KENTUCKY'S AIR

FISCAL YEAR 2024 ANNUAL REPORT

Prepared By

Kentucky Division for Air Quality

TEAM KENTUCKY
ENERGY AND ENVIRONMENT CABINET

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Welcome to the Kentucky Division for Air Quality's FY2024 Annual Report.

This report details the division's accomplishments from July 1, 2023, through June 30, 2024. Due to varying schedules for data quality assurance, some data may be reported for the 2022 or 2023 calendar years.

Our Mission

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

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

Organization

The Division for Air Quality is part of the Kentucky Energy & Environment Cabinet (EEC) and is the third largest division within the Department for Environmental Protection. With a team of 150 environmental professionals working in Frankfort and eight regional offices across the commonwealth, the division oversees air monitoring, permitting, regulation development, air program planning, compliance, facility & complaint inspections, and air quality outreach.

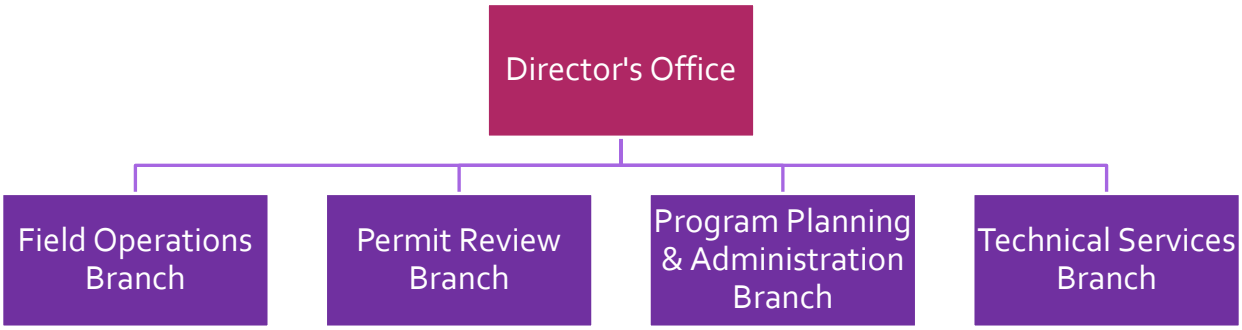

Figure 1: Division for Air Quality organizational chart

FY24 Attainment Status

The Clean Air Act directs the U.S. Environmental Protection Agency to establish National Ambient Air Quality Standards (NAAQS) for six criteria pollutants that are considered harmful to human health and the environment. Based on ambient air monitoring data, EPA designates an area as **attainment** (measured pollutants do not exceed the NAAQS) or **nonattainment** (measured pollutants exceed the NAAQS). During FY24:

- All areas were designated attainment/unclassifiable for PM, CO, NOx, and lead
- Bullitt, Jefferson, & Oldham counties remained designated nonattainment for ozone
- Henderson & Webster counties (partial) remained designated nonattainment for sulfur dioxide

Ozone

Effective Aug. 3, 2018, six Kentucky counties were designated nonattainment for the 2015 ozone standard: all of Bullitt, Jefferson and Oldham counties and the northern portions of Boone, Campbell, and Kenton counties. On Nov. 7, 2022, these six counties and partial counties were bumped up to the designation of "moderate" nonattainment.

- In Sept. 2022, the division submitted requests to EPA to redesignate these areas as attainment. Quality-assured air monitoring data demonstrate all these areas are now meeting the ozone NAAQS.
- On Oct. 4, 2023, EPA published the Final Rule for Northern Kentucky, designating the area as attainment.
- On April 18, 2023, EPA published the proposed redesignation for the Louisville area, but failed to take further action.
- On May 31, 2024, the Division for Air Quality sent EPA a notice of intent to sue for failure to act on the Louisville area submittal.

Sulfur Dioxide

Portions of Henderson and Webster counties were designated nonattainment for the 2010 sulfur dioxide (SO_2) standard, effective March 13, 2021. The division worked on a redesignation request for the area until the monitor picked up several exceedances that put the design value over the SO_2 standard of 75 ppb. As of the end of FY24, the division was working on an attainment plan.

Particulate Matter

On Feb. 7, 2024, the EPA announced a final rule for the $PM_{2.5}$ NAAQS, lowering the primary annual $PM_{2.5}$ standard from 12 µg/m^3 to 9 µg/m^3. At the end of FY24, the division was working to determine which areas meet the standard and make initial attainment/nonattainment recommendations.

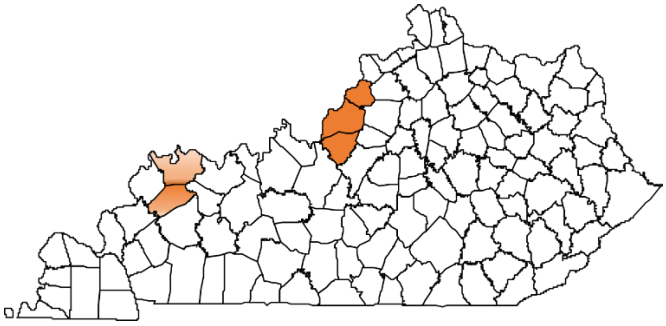

Figure 2: Kentucky Nonattainment Areas During FY24

Air Pollution Complaints

During FY24, **the division received a total of 1,742 air pollution complaints.** Most complaints fell into three categories: open burning, odors, and fugitive emissions. The chart below displays the most common complaints by category with the following data:

- 411 odor complaints, of which 17 resulted in notices of violation (4 percent)
- 779 open burning complaints, of which 211 resulted in notices of violation (27 percent)
- 198 fugitive emissions complaints, of which 20 resulted in notices of violation (10 percent)

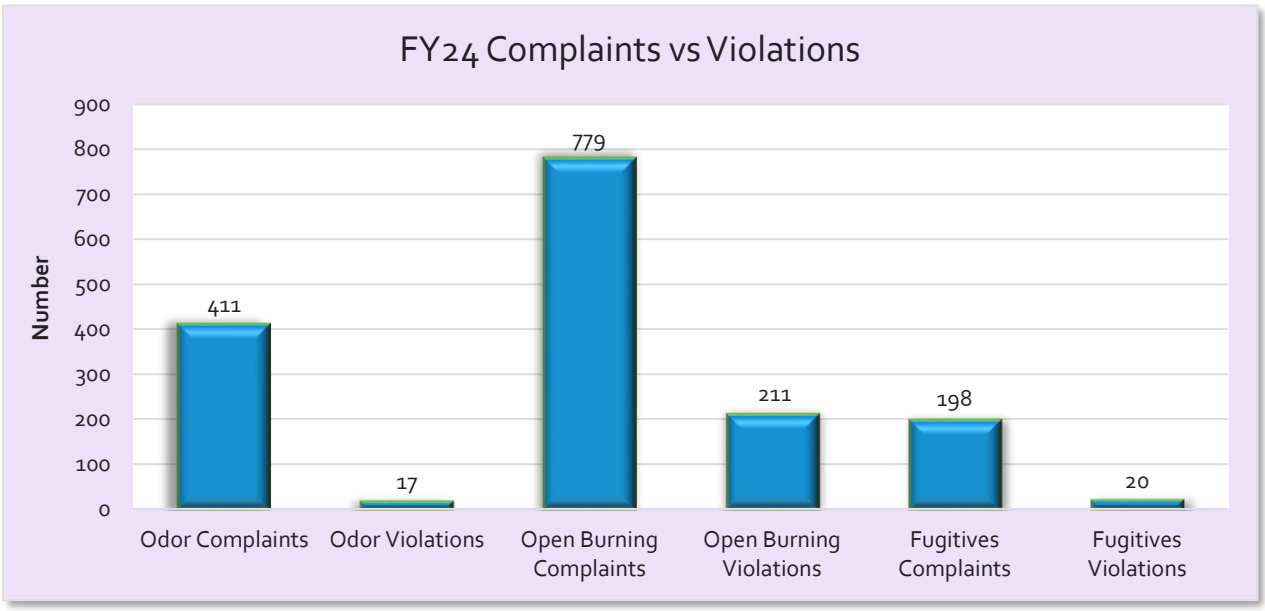

Figure 3: FY24 Complaints vs Violations

Compliance Inspections

- 2,776 compliance inspections
- 88 percent compliance rate

Field Operations Branch staff completed 2,776 compliance inspections of various types at mostly permitted sources (Conditional Major, Title V, & Minor). Eight percent of inspections resulted in documented violations; four percent resulted in notices of violation.

Inspection activities for all permitted facilities include excess emissions reviews, performance test reviews, semi-annual monitoring reviews, engineering inspections, follow-ups, infrared camera inspections, performance test observations, and record reviews.

Inspection activities for major and minor facilities also include annual certification reviews, full compliance evaluations, and partial compliance evaluations.

Asbestos

Compliance with asbestos regulations is overseen by the Field Operations Branch. **During FY24, staff conducted 602 asbestos-related activities**. Asbestos activities include The Asbestos Hazard Emergency Response Act (AHERA) reviews and National Emission Standards for Hazardous Air Pollutants (NESHAP) inspections and investigations from asbestos notifications and complaints.

Calvert City Risk Assessment & Public Meeting

In January 2024, the EPA and DAQ completed an air monitoring study for toxic air pollution near the Calvert City Industrial Complex that focused on volatile organic compounds (VOCs), including ethylene dichloride (EDC). Staff from DAQ's Technical Services Branch and Paducah regional field office oversaw data collection and quality assurance. The final report summarized the study's findings.

The study found elevated levels of VOCs, and EDC was determined to be the chemical with highest risk at each of three monitoring sites. EPA emissions inventory data show 96 percent of EDC emissions in Calvert City are from a single facility.

A public meeting was held on February 13, 2024, to update the public on the air monitoring study, estimated risks, and next steps. The meeting was attended in-person by more than 100 people and was streamed live on Zoom.

Permitting

- 289 air permits issued
- 936 permitting actions (Table 1)
- 13 economic development projects

The Permit Review Branch (PRB) issues air permits for industrial and commercial sources that release pollutants into the air. Air permits include information regarding which pollutants are being released, how much may be released, and what steps the source's owner or operator is required to take to reduce the pollution. Permits also include plans to measure and report air pollutants emitted.

At the close of the fiscal year, the branch had issued 289 permits (initial, renewals, revisions for stationary and portable sources) and had 247 applications in-house. PRB also issued new air permits or permit modifications for 13 economic development-referred projects during FY24. These projects were completed in partnership with the Cabinet for Economic Development.

Type of Permit Action	Number
Major Permit Applications	84
Conditional Major Permit Applications	95
Minor Permit Applications	127
Registrations	586
Administrative Amendments	44

Table 1: Permitting Actions during FY24

Program Funding & Planning

Fiscal Management

The division operates primarily on Title V (pronounced "Title Five") emissions fees and federal grant funds. Funding under the Title V program is mandated by the Clean Air Act through air pollutant emission fees, which are assessed to permitted air pollution sources in the commonwealth that meet

specific criteria. Kentucky statute further authorizes the division to charge fees sufficient to cover the cost of implementing and carrying out the requirements of the air quality program.

During FY24, **87 percent of the division's funding** came from emissions fees under the Title V program. Another **12.1 percent came from federal grant funds**. The remaining funding came from asbestos license application fees, tank truck permits, and proceeds from asset sales.

Emissions Inventory

The Emissions Inventory Section surveys nearly 1,200 facilities per year to determine actual air pollutant emissions for the previous calendar year. Air emission fees are generated based on actual emissions in a calendar year. Sources are surveyed annually and charged a per ton fee for emissions.

Table 2 displays data for the 2022 calendar year. At the time of publication of this report, data for the 2023 calendar year was still being verified. It takes approximately nine months to verify and complete the inventory for the previous year.

Pollutant	Tons Emitted in 2022
Carbon monoxide	57,397
Nitrogen dioxide	48,920
Particulate matter 2.5	6,946
Particulate matter 10	12,028
Sulfur dioxide	51,962
Volatile organic compounds (as an ozone precursor)	60,260

Table 2: 2022 Reported Title V Emissions

How are Emission Fees Calculated?

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 year, the number of tons of emitted pollutants are divided into the projected operating cost to calculate a per ton cost, and each source within the Title V programs is 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. Figure 3 shows the comparison between EPA's presumptive minimum and the actual cost per ton that the division has charged over the last twenty years. As emissions from Kentucky facilities have decreased with time, the per ton fee has necessarily increased.

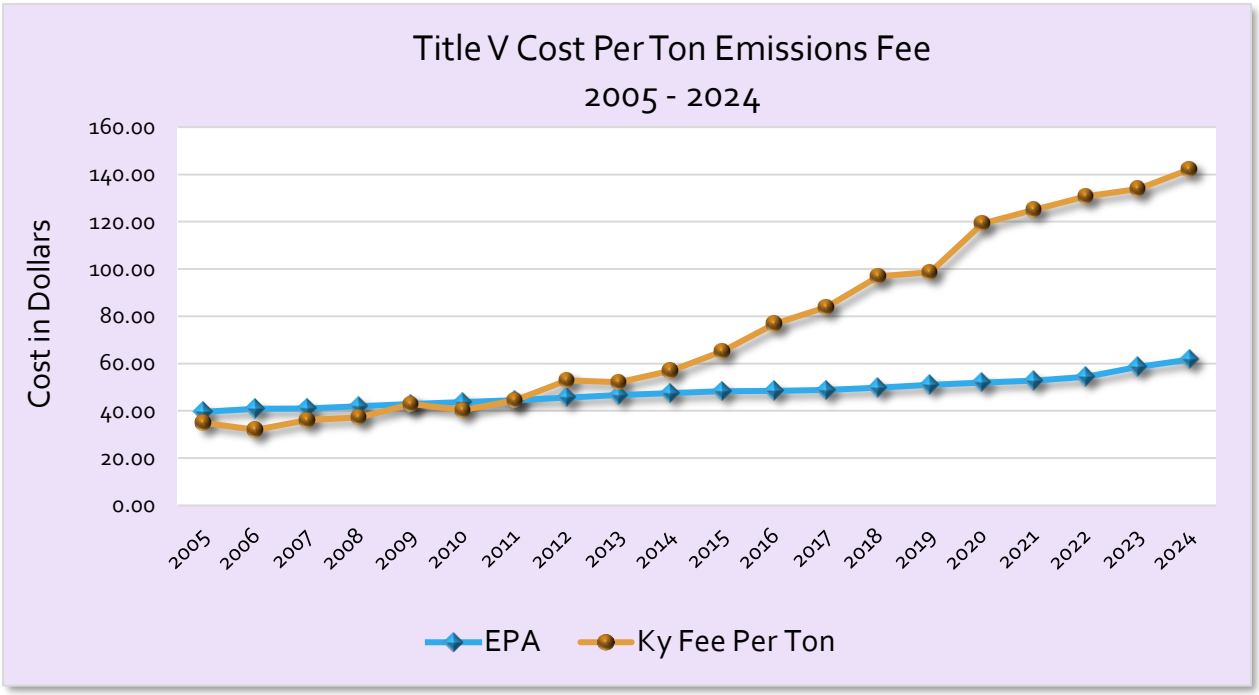

Figure 4: Title V Cost per Ton Emissions Fee, 2005-2024

Kentucky Greenhouse Gas Emissions

Because some gases have a higher warming potential than others, emissions of greenhouse gases are typically expressed in "carbon dioxide equivalent" (CO_2e) to allow their impacts to be directly compared. EPA's Greenhouse Reporting Rule requires reporting of greenhouse gases from sources that emit 25,000 metric tons or more of CO_2e per year in the U.S.

Although the division is not required to report greenhouse gas emissions on behalf of facilities, the Emissions Inventory Section collects this data when available.

Greenhouse Gas	2019 Actual Emissions (tons)	2020 Actual Emissions (tons)	2021 Actual Emissions (tons)	2022 Actual Emissions (tons)
Carbon dioxide	68,860,439	58,911,448	67,589,118	67,798,373
Methane	93,740	109,679	94,983	102,870
Nitrous oxide	2,788	3,156	4,071	3,861
CO2e (metric tonnes)	65,520,542	56,988,254	64,667,792	64,992,066
CO2e (tons)	72,224,035	62,818,800	71,284,038	71,641,490

Table 3: Kentucky Greenhouse Gas Emissions Reported, 2019-2022

Air Dispersion Modeling

Air dispersion modeling is an important tool that supports air program planning and permit review. Air modeling data is used to verify, adjust, or establish limits in permits, justify permit conditions, to support the State Implementation Plan, and to protect public health and air quality.

During FY24, the following assessments and demonstrations were completed:

- **54 air toxics modeling demonstrations** in compliance with 401 KAR 63:020 for affected facility applications that emit hazardous and/or toxic substances
- **3 PSD permit application reviews** in compliance with 401 KAR 51:017 and EPA's Guideline on Air Quality Models, 40 CFR Part 51, Appendix W
- **1 model demonstration** in conjunction with EEC's Emergency Response Team
- **1 Economic Development Project** – PSD evaluated.

Regional Haze

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 Class I areas.

Figure 5: Good and bad visibility days at Mammoth Cave National Park; 144 miles visual range (left) vs 16 miles (right)

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.

Revisions to state plans for Regional Haze are required periodically to ensure progress is being made toward long term goals. Kentucky's draft State Implementation Plan (SIP) revision concentrates on reducing sulfur dioxide (SO_2) emissions from facilities shown to impact Class I areas. As of the publication of this report, the draft SIP revision was in the public comment period with the public hearing scheduled for July 11, 2024.

Regulation Development

During FY24, the Regulation Development Section submitted Kentucky's Section 111(d) Municipal Solid Waste State Plan to EPA and finalized amendments to the following Kentucky Administrative Regulation:

- **401 KAR 51:010,** *Attainment status designations.* This administrative regulation was updated to reflect the counties of Boone, Bullitt, Campbell, Jefferson, Kenton, and Oldham are attainment for the 2015 8-hour Ozone Standard.
- **401 KAR 58:040,** *Requirements for asbestos abatement entities.* This administrative regulation was updated to adopt the warning signage language required by OSHA.
- The section also filed the following administrative regulation:
    - **401 KAR 50:038,** *Air emissions fee.*

State Implementation Plan

During FY24, the Energy and Environment Cabinet submitted two final revisions to **Kentucky's SIP**:

- **August 15, 2023** – Second 10-year Limited Maintenance Plan for the 1997 8-hour ozone NAAQS for Northern Kentucky
- **December 15, 2023** – 2010 SO_2 Data Requirements Rule Annual Report

Clean Diesel Grant

The Kentucky Clean Diesel Grant Program provides financial support for projects that protect human health and improve air quality by reducing harmful emissions from diesel school buses. The division administers this program with funding provided through the federal Diesel Emissions Reduction Act (DERA).

During FY 2024:

- **$430,760 was awarded** to the division through DERA.
- School districts in **five Kentucky counties** were selected to receive funding.
- Funding will replace a total of **eleven** older model, diesel school buses with either new diesel or propane buses.
- The new buses will emit **67 percent less particulate matter and 81 percent less nitrogen oxide** pollution than the older buses they replaced.

Environmental Education Outreach

The Division for Air Quality promotes environmental stewardship and public participation through environmental education programs, resources, and community partnerships. During FY24, the division's Clean Air for Kentucky program provided virtual and in-person outreach to over 3,500 Kentuckians in schools, festivals, teacher workshops and conferences. The division employs one full-time environmental education specialist. Other staff assist with outreach during busy times of the year.

Figure 6: Environmental educator Roberta Burnes talked with students about environmental careers at Western Kentucky University's Earth Day Festival.

Teacher Training

Staff presented four teacher workshops on air quality, climate change, air monitoring, and other environmental topics in partnership with the Kentucky Association for Environmental Education, Division of Water, and the Lexington Fayette Urban County Government's Environmental Academy for teachers.

Earth Day

Air quality staff were busy during the month of April doing air quality outreach to community Earth Day festivals. In just a two-week period, staff attended six different events across the commonwealth reaching more than 1,300 people.

Air Quality Awareness Week

The first week in May is Air Quality Awareness Week (AQAW). To celebrate, the division released several new educational videos as well as daily social media posts. Links to each AQAW video can be found on the division's News and Events web page.

Figure 7: Environmental engineer Johnson Luma explored properties of air with a student at Booker T. Washington STEM Academy (left); Environmental scientist Ashton Quiogue answered questions about open burning at Boone County's Family Nature Day (right).

Kentucky's Air Monitoring Network

During the 2023 monitoring year, KDAQ operated 67 instruments, including 3 meteorological stations, located at 24 ambient air monitoring sites in 23 Kentucky counties. LMAPCD operated an additional 33 instruments, including 5 meteorological stations, in Jefferson County.

When combined with the air monitoring site operated by the National Park Service (NPS) at Mammoth Cave National Park, the total ambient air monitoring network consisted of 105 instruments, including 9 meteorological stations, located at 30 sites across 25 counties of the Commonwealth. While not associated with the division's air monitoring network, the EPA operates two additional CASTNET ozone monitoring stations in Kentucky.

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 point sources of pollution. The site locations are reviewed annually to ensure adequate coverage is being provided and regulatory requirements are being met. See the 2024 Kentucky Ambient Air Monitoring Network Plan for more information.

Ambient Air Monitoring Network Map

2023 Monitoring Year

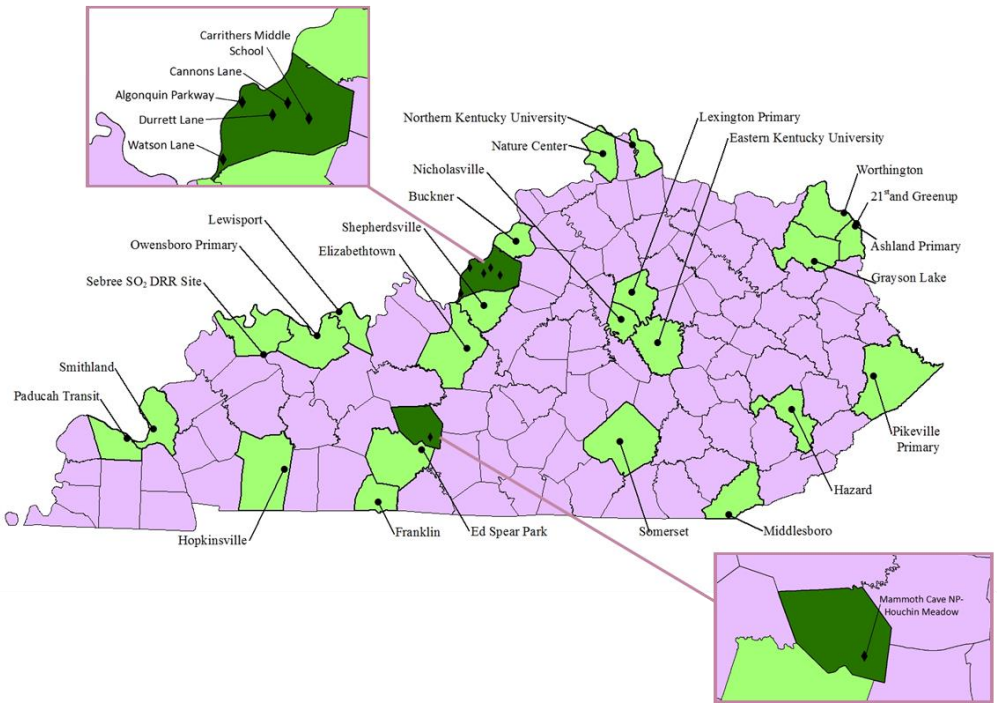

Figure 8: Kentucky's Ambient Air Monitoring Network Map

Air Monitoring Data

This annual report contains quality-assured data collected through calendar year 2023. The data summarizes criteria pollutant averages represented as statewide trends, as well as 2023 design values for each air monitoring site.

What's a Design Value?

A design value is a calculated metric that is used to determine compliance with a particular National Ambient Air Quality Standard (NAAQS). Design values are calculated in accordance with 40 CFR Part 50 and vary from pollutant to pollutant. For example, lead uses a 3-month rolling average and one of the primary NAAQS for nitrogen dioxide uses an annual average.

It is important to note that an exceedance of a particular pollutant is not the same as a violation of the NAAQS for that pollutant. Violations are determined according to the formula for each standard and involve the average of multiple measured values over a specific amount of time. Any data contained in this report is subject to change. The most current quality assured data set can be obtained through a Kentucky Open Records request.

Carbon Monoxide (CO)

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

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

There were no exceedances of the CO standards in 2023. All Kentucky counties are currently in attainment of the standards for carbon monoxide.

Carbon Monoxide Design Values

Site	1-Hour Design Value (ppm)	8-Hour Design Value (ppm)
Mammoth Cave (NPS)	0.7	0.6
Cannons Lane (LMAPCD)	3.2	2.0
Durrett Lane (LMAPCD)	2.5	1.6

Table 4: Carbon monoxide design values for 2023, measured in parts per million

Statewide averages for carbon monoxide (CO) have declined substantially since 1987, primarily due to improved emission controls on motor vehicles. Figure 8 displays the statewide 1-hour and 8-hour averages of the second highest reading of CO from 1993 through 2023, with downward trend lines marked. Note: Trends charts in this report do not demonstrate attainment for any area.

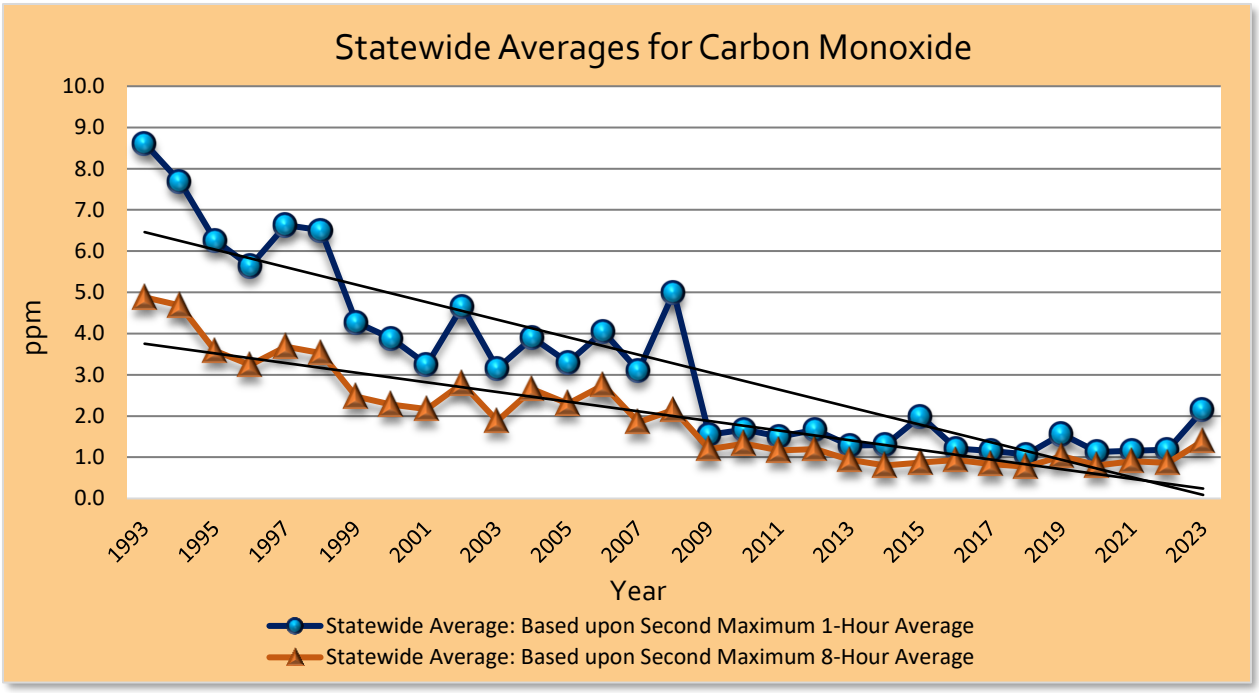

Figure 9: Statewide Averages for carbon monoxide from 1993-2023, measured in parts per million

Lead (Pb)

Primary NAAQS: Rolling 3-month average not to exceed 0.15 micrograms per meter cubed (µg/m^3)
Secondary NAAQS: Same as primary standard

Lead is a soft, blue-gray metal that has historically been used in motor fuels, paint, plumbing and batteries. Since the 1970s when the U.S. EPA mandated the phase out of lead in gasoline, airborne lead concentrations have plummeted. By regulation, lead monitoring is now only required near major sources of lead.

Lead Design Values

Site	1st Max	2nd Max	3rd Max	4th Max	Observations > 0.15	Design Value
EKU	0.03	0.03	0.03	0.03	0	0.03

Table 5: 2023 Top 3-month averages and design values, measured in micrograms per cubic meter

In 2023, the division operated one lead monitoring site at Eastern Kentucky University. There were several exceedances of the lead NAAQS in 2018; all were related to a compliance issue with a single stationary source. The trends chart below displays the three-month rolling averages for lead from October 2013 – December 2023, measured in micrograms per cubic meter (µg/m^3). Data is shown from four discontinued monitoring sites as well as the current site at EKU.

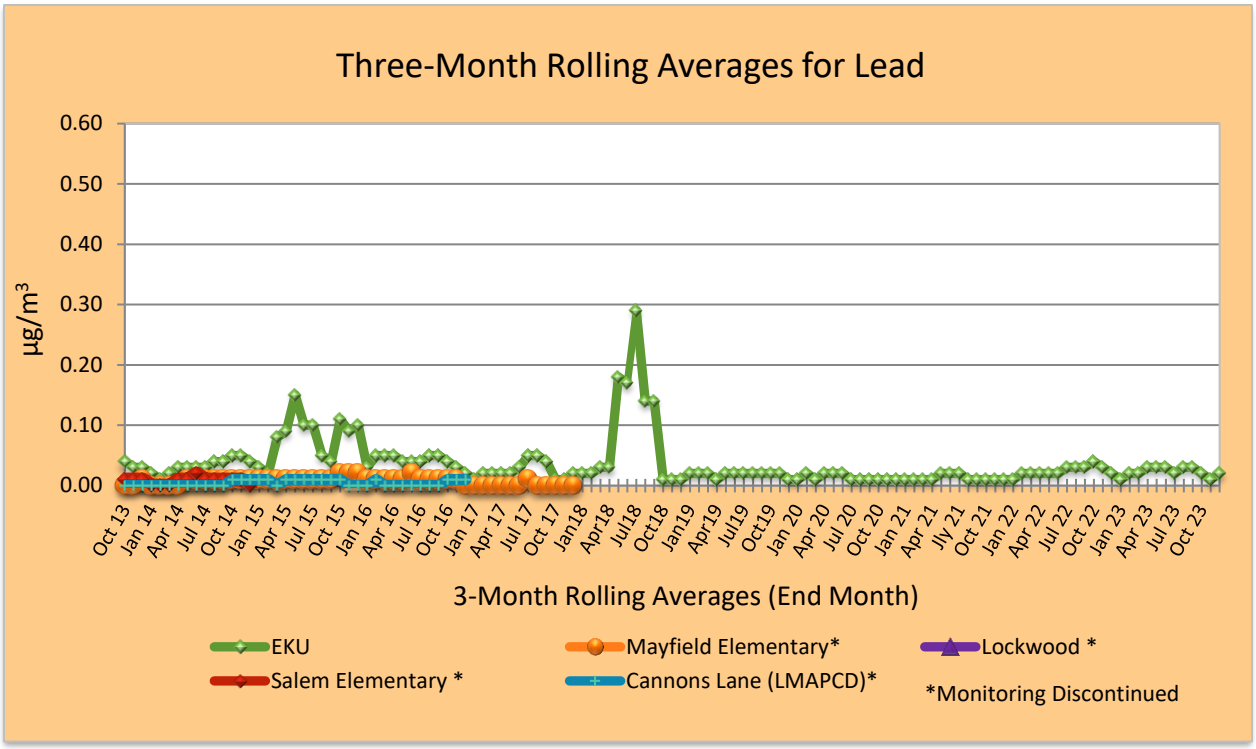

Figure 10: Three-month rolling averages for lead from Oct. 2013-Dec. 2023, measured in micrograms per cubic meter

Nitrogen Dioxide (NO_2)

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

Nitrogen dioxide is a reddish-brown gas that is produced during high-temperature combustion. During combustion, nitrogen and oxygen combine to form a family of highly reactive gases called nitrogen oxides (NOx), which include nitrogen dioxide (NO_2) and nitrogen oxide (NO). Major combustion sources that produce NO_2 include motor vehicles, power plants, incinerators, boilers, and chemical processes. NO_2 is also produced through a photochemical reaction between NO and sunlight.

There have been no recorded exceedances of an NO_2 NAAQS since the inception of sampling in 1970. All Kentucky counties are currently in attainment of the standards for nitrogen dioxide.

Nitrogen Dioxide Design Values

County/Site Name	1-Hour Design Value	Annual Design Value
Boyd	29	5
Campbell	27	5
Daviess	30*	5*
Fayette	40*	6
Cannons Lane (LMAPCD)	40	8
Durrett Lane (LMAPCD)	48	13
McCracken	30*	5

*Table 6: Nitrogen dioxide design values for 2023, measured in parts per billion. * Data does not meet design value validity*

Statewide averages for nitrogen dioxide (NO_2) have declined substantially since the 1990s. Figure 10 displays the statewide 1-hour and annual averages of NO_2 from 1993 through 2023, with downward trend lines marked.

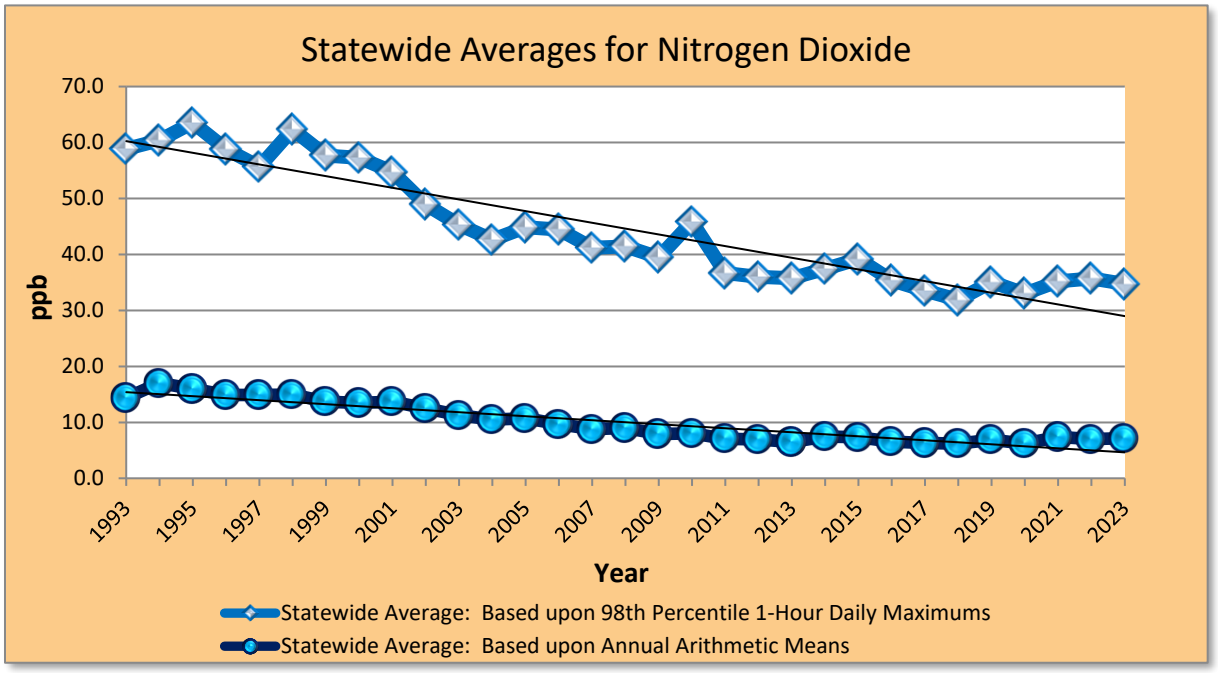

Figure 11: Statewide averages for NO_2 from 1994-2023, measured in parts per billion

Ozone (O_3)

Primary & Secondary NAAQS: 3-year average of the 4th highest daily maximum 8-hr concentration not to exceed 0.070 parts per million.

Ozone is a colorless gas that is not emitted directly into the atmosphere from sources. Instead, ozone forms in the lower atmosphere from a photochemical reaction between volatile organic compounds (VOCs) and nitrogen oxides (NOx) in the presence of sunlight.

Ozone's chemistry makes it more likely to form during warm, sunny weather. Vehicle and factory emissions, open burning, and wildfire smoke are some of the largest sources of NOx and VOCs, which contribute to ozone formation.

In 2023, twenty sites measured 8-hour ozone concentrations greater than 0.070 ppm. The fourth highest daily maximum 8-hour ozone concentration was above the level of the standard at twelve Kentucky sites. A valid 2021-2023 3-year average (design value) was at or below the level of the standard for all Kentucky sites except for the Cannons Lane site in Jefferson County.

Ozone Design Values

County/Site Name	Design Value
Algonquin (LMAPCD)	0.072*
Bell	0.059
Boone	0.068
Boyd	0.061
Bullitt	0.067
Campbell	0.064
Cannons Lane (LMAPCD)	0.072
Carrithers Middle School (LMAPCD)	0.070
Carter	0.058
Christian	0.063
Daviess	0.067*
Edmonson (NPS)	0.064
Fayette	0.066
Greenup	0.058
Hancock	0.068
Hardin	0.065
Jessamine	0.066
Livingston	0.067
McCracken	0.072*
Morgan	0.06
Oldham	0.065
Perry	0.057
Pike	0.057
Pulaski	0.060
Simpson	0.066
Warren	0.063
Washington	0.063
Watson Lane (LMAPCD)	0.068

*Table 7: Ozone design values for 2023, measured in parts per million (LMAPCD = Louisville Metro Air Pollution Control District) *Data does not meet DV validity*

Figure 11 on the following page displays the statewide averages of ozone from 1993-2023, measured in parts per million. Though statewide ozone averages have varied from year to year, the overall trend is downward.

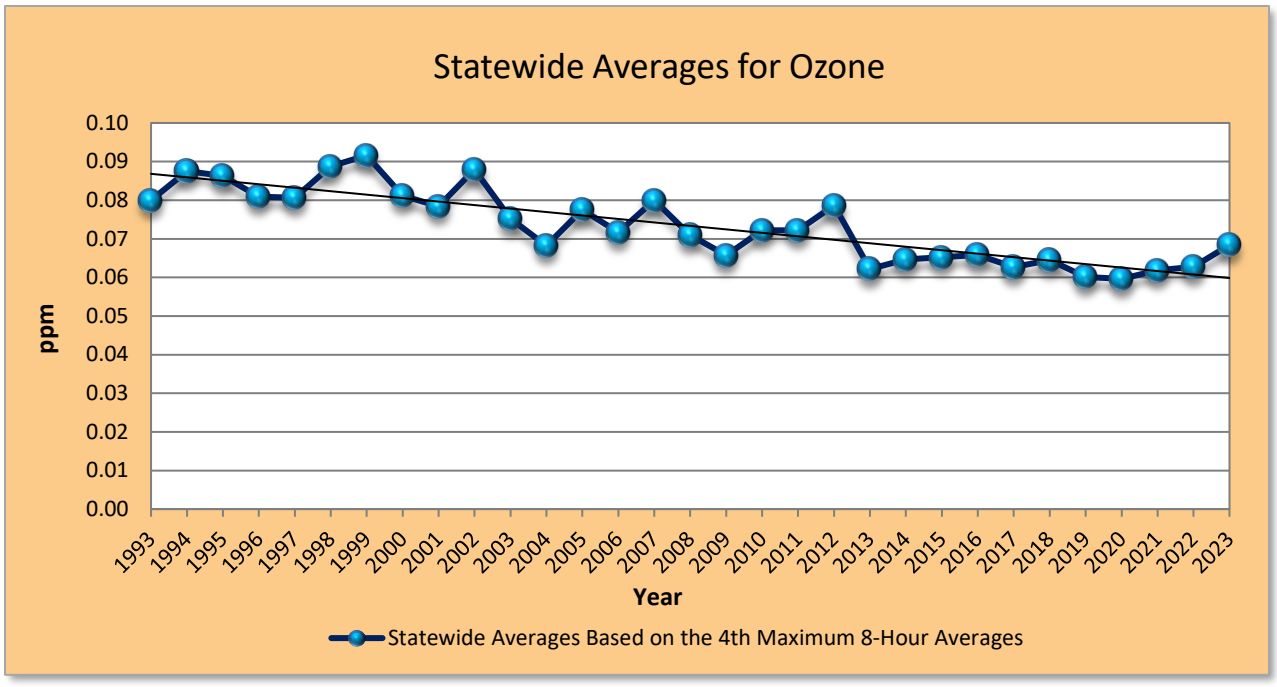

Figure 12: Statewide averages for ozone from 1993-2023, measured in parts per million

Fine Particulate Matter ($PM_{2.5}$)

Primary NAAQS: 3-year average of the annual weighted mean not to exceed 9.0 micrograms per meter cubed (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

Fine particulate matter ($PM_{2.5}$) is a mixture of solid particles and liquid droplets that are 2.5 microns or smaller in size. Sources include power plants, wood burning, industrial processes, and combustion. Fine particulates are also formed in the atmosphere when gases such as sulfur dioxide, nitrogen oxides and VOCs are transformed through chemical reactions.

There were no exceedances of the three-year 24-hour standard. However, the three-year annual standard was lowered from 12.0 to 9.0 µg/m^3 on February 7, 2024. Kentucky has three sites that exceeded the new annual standard during the 2021 - 2023 averaging period. Those sites are Middlesboro (Bell County), Watson Lane (Jefferson County), and Durrett Lane (Jefferson County).

Like many states, Kentucky mainly uses T640/T640x PM mass monitors for measuring $PM_{2.5}$ in the ambient air. These monitors had been identified in peer-reviewed literature as reporting a generally high bias (i.e. reading "high") relative to other monitors. To correct for this bias, a data alignment was developed by the manufacturer and implemented in 2023. Due to the importance of data for regulatory, scientific, and public use, EPA retroactively applied a data alignment equation to all hourly data from T640/T640x air monitors from 2017 onward. For more information, see EPA's Update of PM2.5 data document.

Fine Particulate Matter Design Values

County	Annual Design Value	24-Hour Design Value
Bell	9.1	22
Boyd	7.5	21
Campbell	7.6	20
Carter	6.3	18
Christian	8.6	22
Daviess	8.8*	24*
Fayette	7.8	22
Hardin	7.8	22
Algonquin Parkway (LMAPCD)	8.8	24
Cannons Lane (LMAPCD)	8.4	24
Carrithers Middle School (LMAPCD)	8.8	26
Durrett Lane (LMAPCD)	9.5	26
Watson Lane (LMAPCD)	9.3	25
McCracken	8.5*	22*
Perry	8	22
Pike	6.8	19
Pulaski	7.5	20
Warren	7.4	22

*Table 8: Fine particulate matter ($PM_{2.5}$) design values for 2023, measured in micrograms per cubic meter($\mu g/m^3$) (LMAPCD = Louisville Metro Air Pollution Control District). * Data does not meet DV validity*

Figure 12 displays the statewide annual and 24-hour averages of fine particulate matter from 2001, when monitoring first began for $PM_{2.5}$, to 2023, measured in micrograms per cubic meter. The uptick of $PM_{2.5}$ levels in 2023 was partially influenced by several Canadian wildfire smoke events.

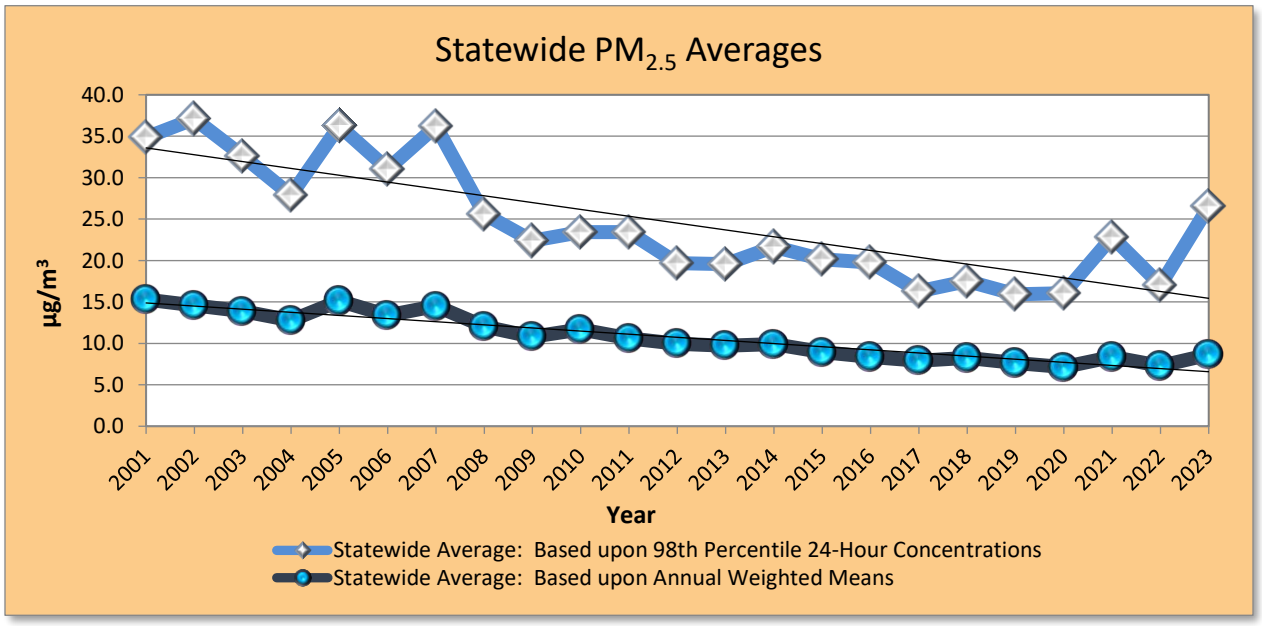

Figure 13: Statewide $PM_{2.5}$ averages from 2001-2023, measured in micrograms per cubic meter

Course Particulate Matter (PM_{10})

Primary NAAQS: Expected number of days with a maximum 24-hour concentration greater than 150 micrograms per meter cubed (µg/m³) must be less than or equal to one, on average over three years.
Secondary NAAQS: Same as Primary Standard

Coarse particulate matter of 10 microns or less in diameter is known as PM_{10}. Common sources of PM_{10} are prescribed fires, construction activities, agricultural practices, metal recycling, and smokestacks.

There were no exceedances of the annual PM_{10} standard in 2023. The last exceedance of the standard occurred on March 22, 2012, at the Ashland site, which is located next to a metals recycler. All Kentucky counties are currently in attainment for the PM_{10} standards.

Coarse Particulate Matter Design Values

Monitoring Site	1st Max	2nd Max	3rd Max	4th Max	Estimated Exceedance (Design Value)
Boyd	68	65	51	47	0
Carter	47	37	25	22	0
Fayette	34	28	26	26	0
Algonquin Parkway (LMAPCD)	118	63	61	61	0
Cannons Lane (LMAPCD)	114	96	58	57	0

Table 9: PM_{10} maximum 24-hour concentrations and design values for 2023, measured in micrograms per cubic meter

PM_{10} levels experienced an uptick in 2021-2023; nevertheless, all readings remained well below the NAAQS level of 150 µg/m³. Figure 12 displays the statewide average of the annual maximum 24-hour concentration for PM_{10} from 2003-2023, measured in µg/m³ (micrograms per cubic meter). The average is calculated using the first maximum PM_{10} measurement at each monitoring location.

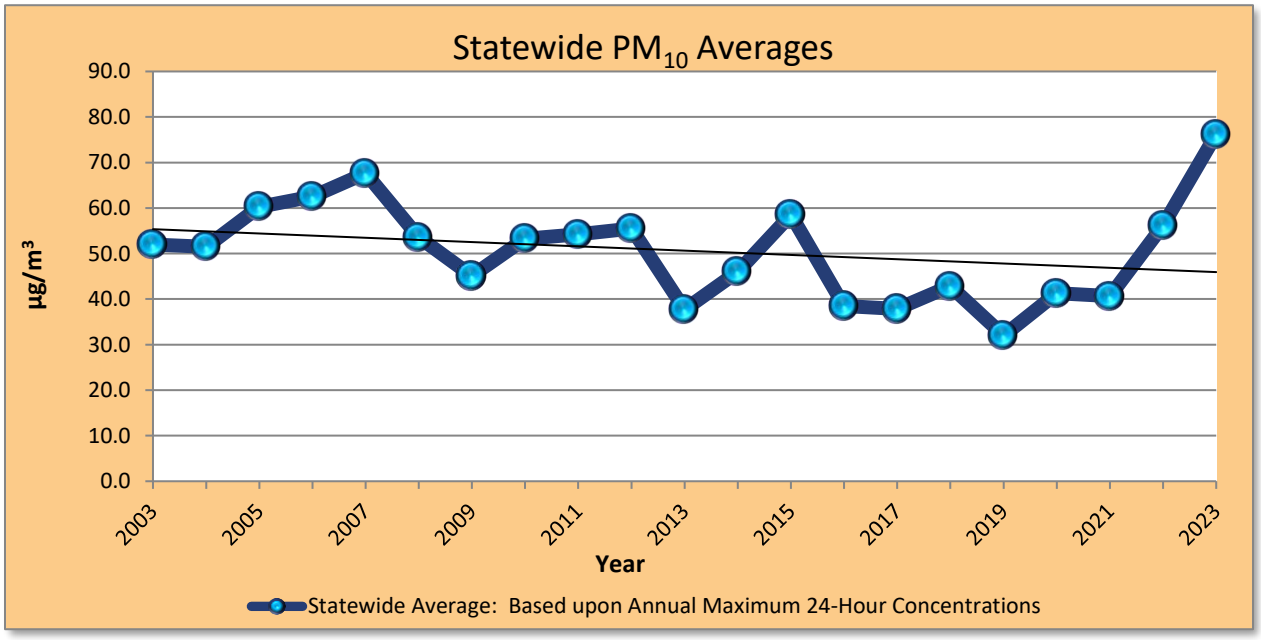

Table 14: Statewide PM_{10} averages from 2003-2023, measured in micrograms per cubic meter

Sulfur Dioxide (SO_2)

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

Sulfur dioxide (SO2) is a colorless gas that has a pungent odor at concentrations exceeding 0.5 ppm. SO_2 is produced during the combustion of sulfur-containing fuels, ore smelting, petroleum processing, and the manufacturing of sulfuric acid. Nationwide, coal-fired power plants are the largest sources of SO_2.

During 2023, one site recorded 11 exceedances of the daily one-hour standard of 75 ppb. That site, located near Sebree, Kentucky, was established to characterize maximum hourly sulfur dioxide concentrations for specific stationary sources. No other exceedances were recorded in the state.

Sulfur Dioxide Design Values

County	Design Value
Boyd	5
Campbell	8
Daviess	7*
Edmondson (NPS)	2*
Fayette	4
Greenup	7
Henderson	78
Algonquin (LMAPCD)	5*
Cannons Lane (LMAPCD)	8
Watson Lane (LMAPCD)	12
Jessamine	5
McCracken	10*

*Table 10: Sulfur dioxide (SO_2) design values for 2023, measured in parts per billion. NPS=National Park Service; LMAPCD=Louisville Metro Air Pollution Control District; Data marked with * do not meet design value criteria.*

The dramatic decline of sulfur dioxide levels is one of Kentucky's biggest air quality success stories. Emission controls on coal-fired power plants, as well as the trading allowances in the federal Acid Rain Program, have directly contributed to the decline in ambient SO_2 concentrations across the region. Figure 13 on the following page displays the statewide average for SO_2 from 1993-2023, measured in parts-per-billion (ppb).

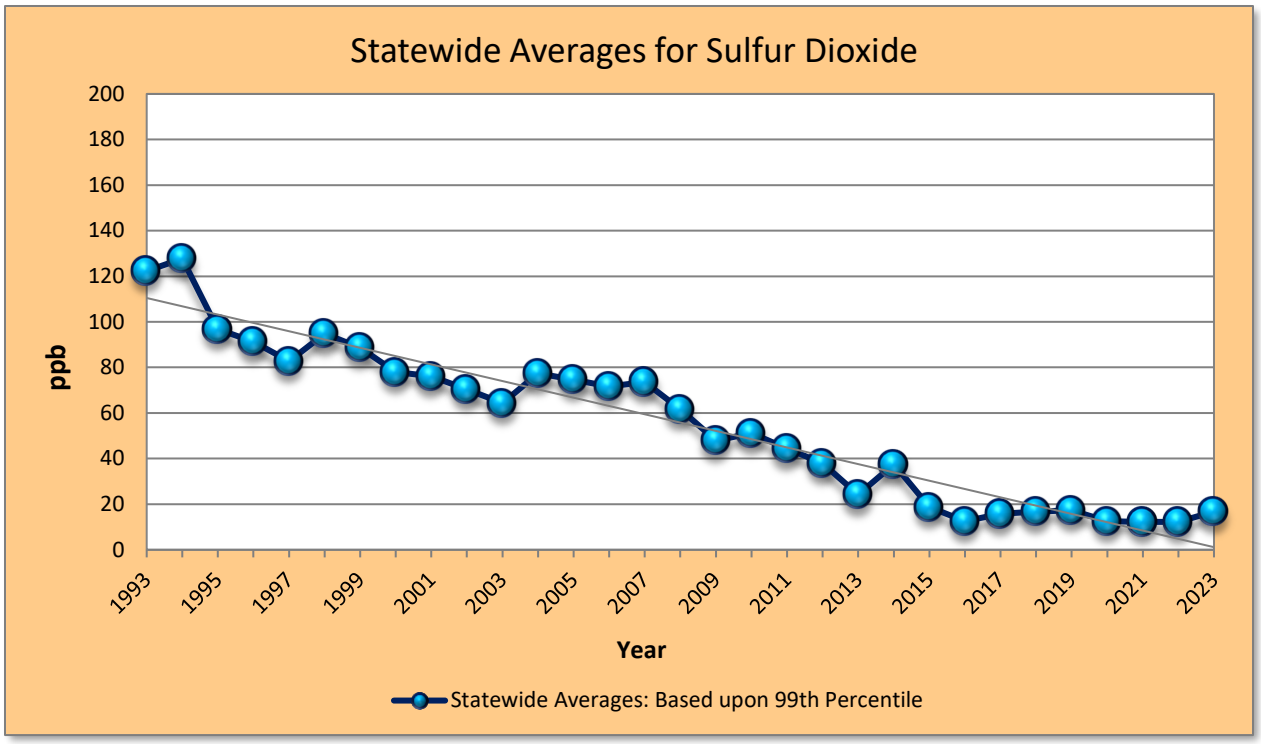

Table 15: Statewide SO_2 averages from 1993-2023, measured in parts per billion

APPENDIX A: The National Ambient Air Quality Standards

The Clean Air Act requires EPA to set standards for six criteria air pollutants to protect public health (Primary Standard) and welfare (Secondary Standard). "Welfare" includes damage to plants and animals, impairment of visibility, and property damage.

Carbon Monoxide	**Primary Standard**	**Secondary Standard**
8-Hour Average	9 ppm	None
1-Hour Average	35 ppm	None
Lead	**Primary Standard**	**Secondary Standard**
Rolling Three-Month Average	0.15 μ/m^3	Same as Primary
Nitrogen Dioxide	**Primary Standard**	**Secondary Standard**
Annual Average	53 ppb	Same as Primary
1-Hour Average	100 ppb	None
Particulate Matter (PM_{10})	**Primary Standard**	**Secondary Standard**
Annual Average	150 μ/m^3	15 μ/m^3
Particulate Matter ($PM_{2.5}$)	**Primary Standard**	**Secondary Standard**
Annual Average	9 μ/m^3	15 μ/m^3
24-Hour Average	35 μ/m^3	Same as Primary
Ozone	**Primary Standard**	**Secondary Standard**
8-Hour Average	0.070 ppm	Same as Primary
Sulfur Dioxide	**Primary Standard**	**Secondary Standard**
1-Hour Average	75 ppb	None
8-Hour Average	None	0.5 ppm

Figure 16: The National Ambient Air Quality Standards