



# KENTUCKY'S AIR

KENTUCKY DIVISION FOR AIR QUALITY  
FY2021 ANNUAL REPORT

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**Welcome** to the Kentucky  
Division for Air Quality's FY2021  
Annual Report.

This report details the division's  
accomplishments from July 1, 2020  
through June 30, 2021. Due to varying  
schedules for data quality assurance,  
some data may be reported for the  
2019 or 2020 calendar years.

# From the Director

On behalf of the Division for Air Quality, thank you for taking the time to read our 2021 Annual Report. Within these pages, we report on key measures our dedicated staff have taken to fulfill the division's mission, function, and commitment to protecting human health and the environment.

Fiscal Year 2021 saw Covid-19 infections surge during the winter months, then wane in the spring as Kentuckians started receiving their life-saving vaccines. At the time of writing this report, the highly contagious Delta variant is causing infection rates to rise once again.

Through most of the year, a majority of staff accomplished their work through telecommuting or by rearranging work spaces to allow for social distancing. Despite working remotely, division staff continued to be highly productive. Each of us has learned how to stay connected using online platforms to meet, chat, train, and accomplish our mission of protecting Kentucky's air quality.

The division's essential work includes:

- Operation and maintenance of the air monitoring network and quality assuring air monitoring data by the Technical Services Branch
- Issuing appropriate permits containing all applicable requirements by the Permit Review Branch
- Developing effective regulations and control strategies by our Program Planning Branch
- Evaluating facilities for compliance, responding to air quality complaints, and enforcing emissions limitations by the Field Operations Branch
- Providing education and outreach through our Environmental Education program

Please take a few moments to explore the good work that so many have done in our division over the past year. I hope you find this report to be informative and educational.



*Melissa Duff*  
*Director*

# Our Mission

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

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





## Who We Are

- A team of environmental professionals dedicated to protecting Kentucky's air quality
- 150 funded positions located in Frankfort and throughout the Commonwealth in eight regional offices
- The third largest division within the Department for Environmental Protection

## What We Do

- Air monitoring
- Regulation development
- Issue permits
- Respond to air quality complaints
- Ensure compliance with air quality regulations
- Education & outreach

# Why We Do It

## Protecting Human Health.

Human activities create air pollution. Too much air pollution is harmful to human health. That's why Congress enacted the Clean Air Act, which requires the U.S. Environmental Protection Agency (EPA) to set standards or "limits" for outdoor air pollutants. States, and sometimes local governments, are responsible for meeting those air quality standards.





## Why We Do It

### Protecting the Environment.

Air pollution also harms the environment. Some plants such as milkweed, tulip poplar and soybeans are sensitive to air pollution. Airborne sulfur oxide and nitrogen oxide pollution can cause acid precipitation, which in turn harms forests and aquatic organisms. Air pollution can even damage man-made structures such as buildings and monuments.



# FY2021 Highlights

## A New Normal

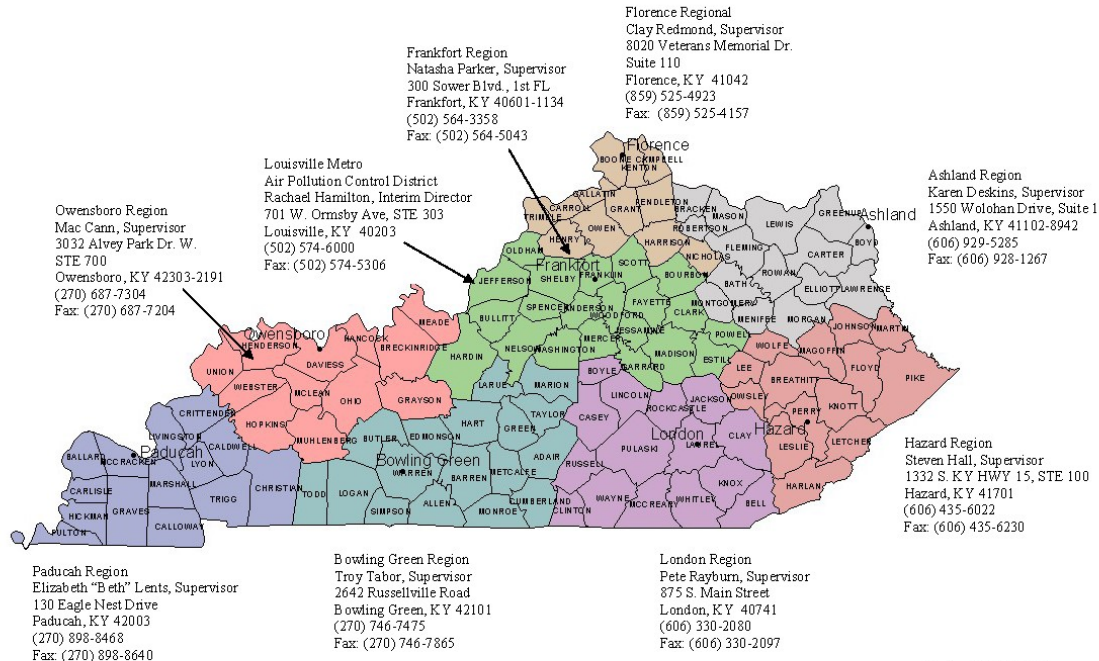
As Covid-19 continued to impact Kentuckians, offices remained closed to the public for most of the fiscal year. Whether working remotely or on-site, DAQ staff continued to accomplish our essential mission of protecting Kentucky's air quality.

### Key accomplishments for the fiscal year include:

- 2,835 compliance inspections performed with an 87 percent compliance rate
- 1,185 air pollution complaints investigated
- 536 permitting actions
- 375 air permits issued
- 12 major economic development projects
- \$294,748 in Clean Diesel grants awarded to four school districts
- 40 outreach programs reached 1,969 people across Kentucky
- Virtual air monitoring station tour viewed by more than 800 people

# Division for Air Quality Regional Office Boundaries

*Environmental Emergency, 24-hour; (502) 564-2380 or (800) 928-2380*



Revised: 08/19/2021

Visit the [Regional Field Offices web page](#) on our website for a complete listing of field office locations and counties served.

# Kentucky's Air Monitoring Network

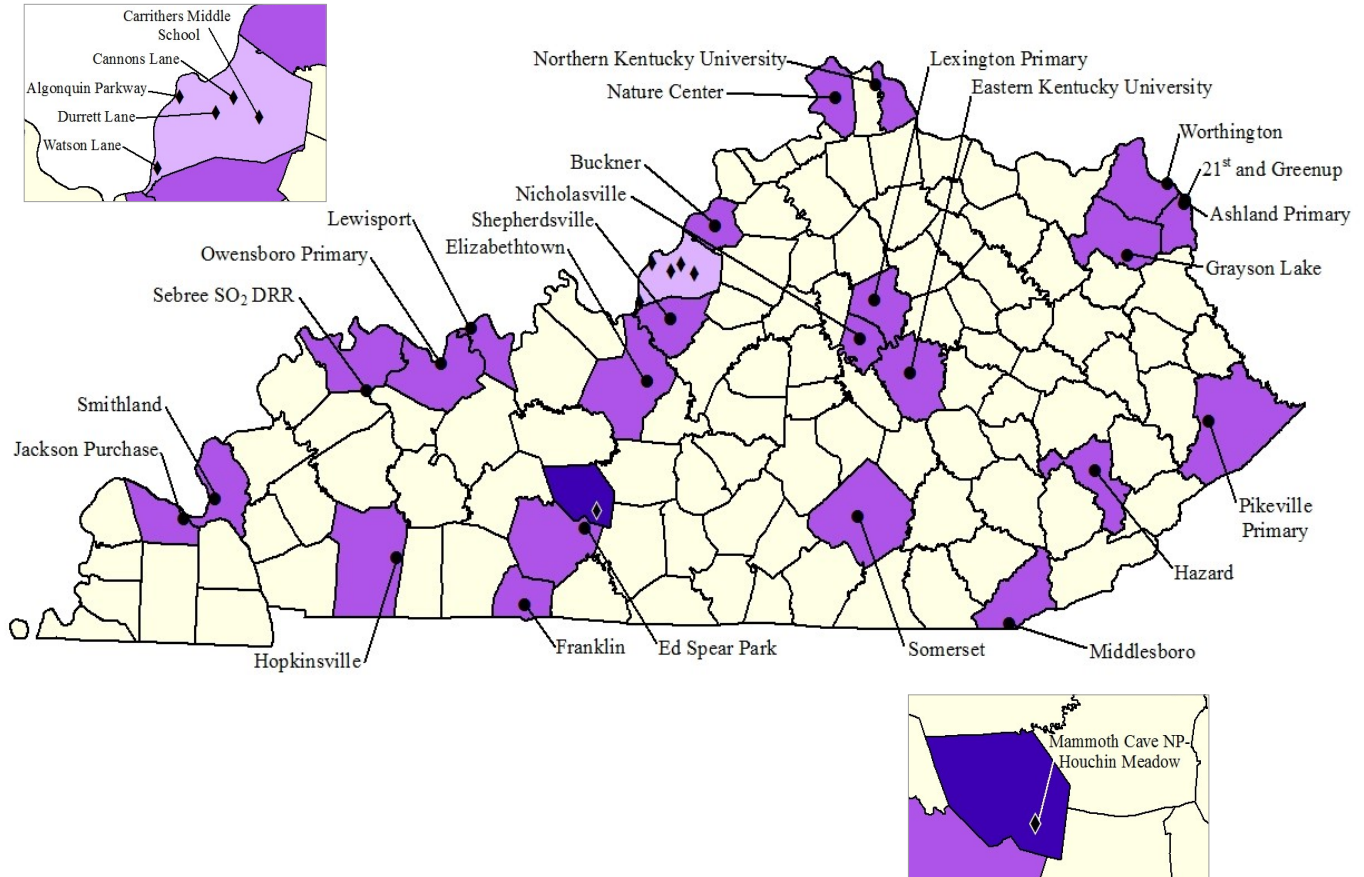
From July 1, 2020 - June 30, 2021, the Kentucky Division for Air Quality operated 76 instruments, including 10 meteorological stations, located at 24 ambient air-monitoring sites in 23 Kentucky counties. The Louisville Metropolitan Air Pollution Control District (LMAPCD) operated an additional 32 instruments, including six meteorological stations, in Jefferson County.

When combined with the air-monitoring site operated at Mammoth Cave National Park, Kentucky's total ambient air monitoring network consisted of 113 instruments, including 17 meteorological stations, located at 31 sites across 25 counties of the Commonwealth. While not associated with the division's air monitoring network, the EPA also operates three 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 [2020 Kentucky Ambient Air Monitoring Network Plan](#) for more information.



# FY21 Ambient Air Monitoring Network Map



## Air Monitoring, Covid, and ... Cicadas

Along with the unprecedented challenges of air monitoring during a pandemic, staff also had to contend with hoards of cicadas during the springtime emergence of Brood X. Every seventeen years, millions of cicadas emerge from the ground across northern Kentucky and surrounding states, creating the largest periodical cicada event in the world. While harmless to humans, the giant insects created quite a nuisance for staff working at the air monitoring station on the campus of Northern Kentucky University (NKU).

NKU's monitoring station is located in a natural area surrounded by mature trees, the roots of which feed the developing cicadas while underground. That meant an especially large emergence of insects around the station, and numerous cicadas would often land on staff as they serviced air monitoring instruments. Cicadas are attracted to the sounds of mowers and weed-eaters, and staff were frequently swarmed as they performed landscape maintenance around the station. Earplugs helped, but nothing could completely drown out the deafening sound of the insects' mating call.



(Left) Dead cicadas can still be seen scattered across the roof of the NKU air monitoring shelter. *Photo: Chris Juilfs*  
(Right) Thousands of cicadas covered the foliage around NKU's air monitoring shelter. *Photo: Chris Juilfs*



# National Ambient Air Quality Standards

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. The **primary standard** is designed to protect public health. The **secondary standard** is designed to protect public welfare. Welfare includes damage to plants and animals, impairment of visibility, and property damage.

## National Ambient Air Quality Standards

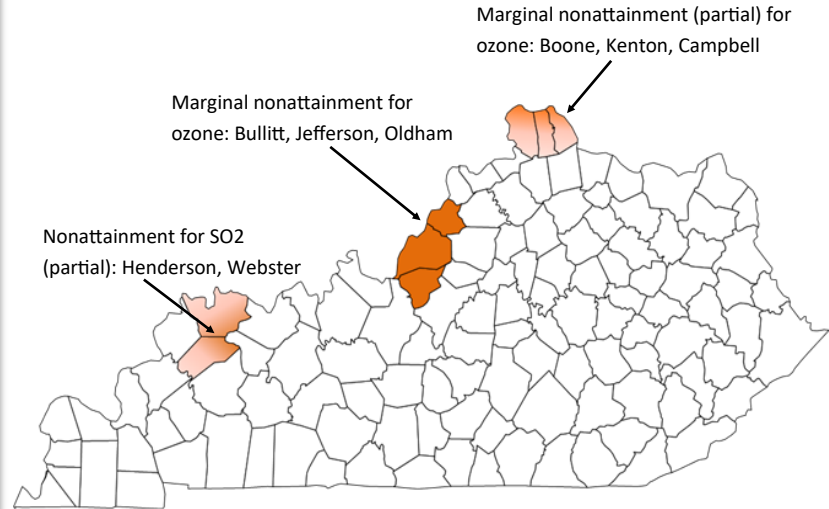
<b>Carbon Monoxide</b>	Primary Standard	Secondary Standard
8-Hour Average	9 ppm	none
1-Hour Average	35 ppm	none
<b>Lead</b>	Primary Standard	Secondary Standard
Rolling 3-Month Average	0.15 $\mu\text{m}^3$	Same as primary
<b>Nitrogen Dioxide</b>	Primary Standard	Secondary Standard
Annual Average	53 ppb	Same as primary
1-Hour Average	100 ppb	none
<b>Particulate Matter (PM<sub>10</sub>)</b>	Primary Standard	Secondary Standard
24-Hour Average	150 $\mu\text{m}^3$	Same as primary
<b>Particulate Matter (PM<sub>2.5</sub>)</b>	Primary Standard	Secondary Standard
Annual Average	12 $\mu\text{m}^3$	15 $\mu\text{m}^3$
24-Hour Average	35 $\mu\text{m}^3$	Same as primary
<b>Ozone</b>	Primary Standard	Secondary Standard
8-Hour Average	0.070 ppm	Same as primary
<b>Sulfur Dioxide</b>	Primary Standard	Secondary Standard
1-Hour Average	75 ppb	none
3-Hour Average	none	0.5 ppm

# Kentucky Nonattainment Areas

Effective August 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. As of the publication of this report, these counties and partial counties are still designated as “marginal” nonattainment.

For the 2010 Sulfur Dioxide standard, EPA took a new approach, making nonattainment designations in four “rounds.” On Oct. 4, 2013, EPA designated a portion of Jefferson County as nonattainment during Round 1. As required by the Clean Air Act, a SIP revision detailing how to bring the area back into attainment with the standard was submitted to EPA and approved. Subsequently, air monitoring data for 2016-2018 demonstrated that the area met the SO<sub>2</sub> standard, and EPA redesignated it to attainment on September 8, 2020.

During the Round 4 designations, portions of two Kentucky counties, Henderson and Webster, were also designated nonattainment for the 2010 SO<sub>2</sub> standard, effective March 13, 2021. Air monitoring data collected from 2017 – 2019 for this area exceeds the standard and the division is required to develop a SIP revision to bring the area back into attainment.



During FY21, the three shaded counties in the middle of the above map were designated marginal nonattainment for the 2015 ozone standard (Bullitt, Jefferson, & Oldham counties). The northern portions of three counties in northern KY were designated marginal nonattainment for the 2015 ozone standard. Portions of the two shaded counties in western KY (Henderson and Webster) were designated nonattainment for SO<sub>2</sub>.

# Understanding the Data

This annual report contains quality-assured data collected during calendar year 2020, as well as statewide trends for each of the criteria pollutants. The data summarizes concentrations and **design values** of pollutants measured in Kentucky during the 2020 calendar year. A design value is a calculated metric that is used to determine compliance with a particular National Ambient Air Quality Standard (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 alternative time intervals for calculation. 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

**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 2020. 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.

## 2020 Carbon Monoxide 1-Hour Averages

Method: Instrumental/Non-Dispersive Infrared Photometry

Data Interval: Hourly

Units: Parts per Million (ppm)

Station	1st Max	2nd Max
Mammoth Cave (NPS)	0.258	0.258
Cannons Lane (LMAPCD)	1.65	1.63
Durrett Lane (LMAPCD)	1.65	1.51

*LMAPCD = Louisville Metro Air Pollution Control District*

*NPS = National Park Service*

# Statewide Averages for Carbon Monoxide

Statewide averages for carbon monoxide (CO) have declined substantially since 1987, primarily due to improved emission controls on motor vehicles.

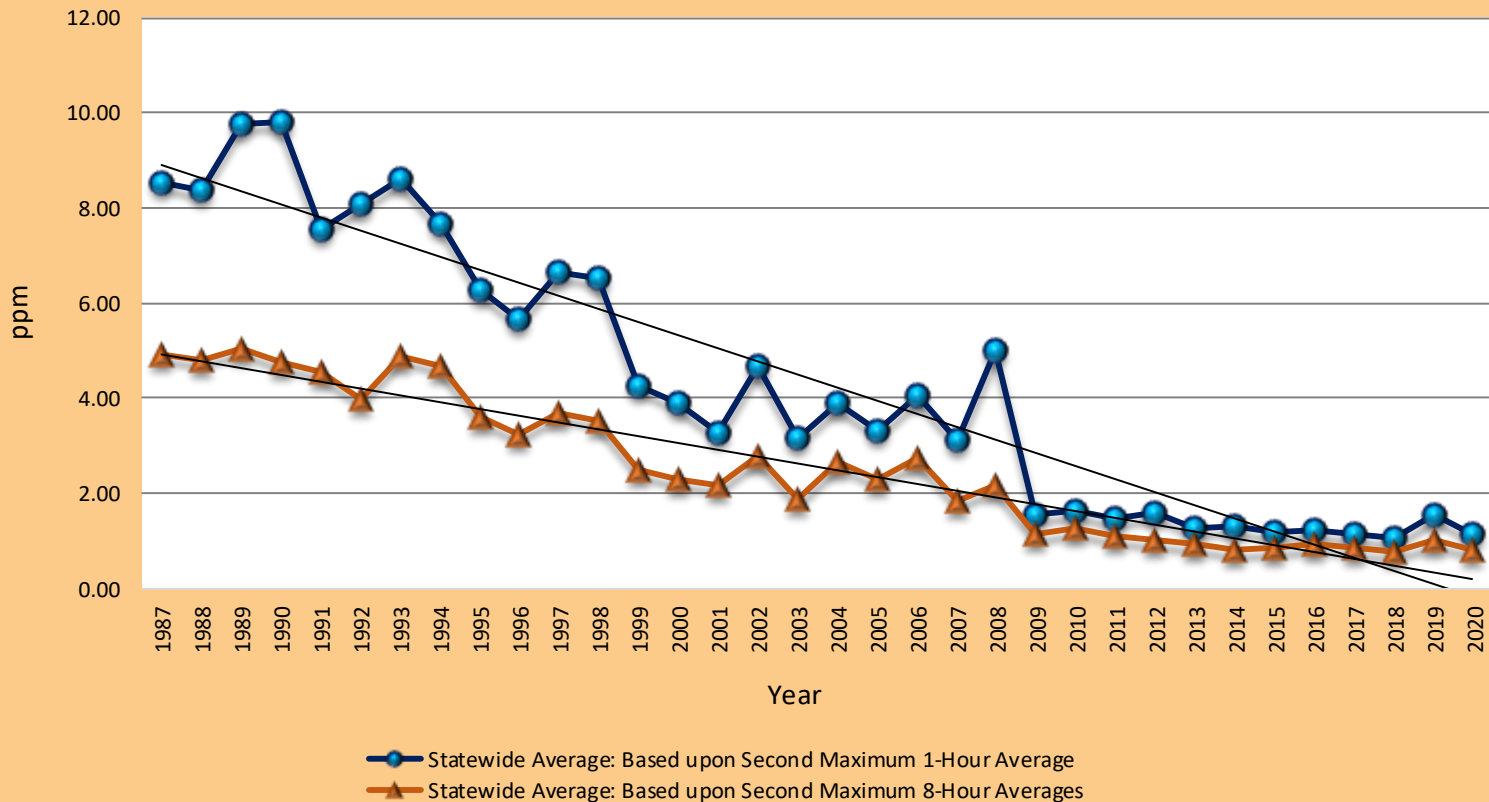
This table presents the statewide 1-hour and 8-hour averages of the second highest reading of CO from 1987 through 2020. For reference, the current 1-hour primary standard for CO is 35 ppm and the current 8-hour primary standard for CO is 9 parts per million (ppm).

These data are graphed on the following page, with the downward trend lines clearly visible.

*Disclaimer:* These charts show generalized pollution trends through time. They do not show trends for specific sites, nor do they demonstrate attainment for any particular area. While individual pollutants may spike in certain years, overall trends show declines in pollution levels.

Year	Statewide Average (ppm) Based upon Second Maximum 1-Hour Averages	Statewide Average (ppm) Based upon Second Maximum 8-Hour Averages	Year	Statewide Average (ppm) Based upon Second Maximum 1-Hour Averages	Statewide Average (ppm) Based upon Second Maximum 8-Hour Averages
1987	8.56	4.93	2004	3.90	2.65
1988	8.39	4.80	2005	3.30	2.30
1989	9.76	5.04	2006	4.05	2.75
1990	9.83	4.77	2007	3.10	1.85
1991	7.57	4.57	2008	5.00	2.15
1992	8.09	3.99	2009	1.55	1.20
1993	8.62	4.88	2010	1.67	1.33
1994	7.69	4.68	2011	1.50	1.17
1995	6.26	3.58	2012	1.66	1.20
1996	5.64	3.24	2013	1.28	0.93
1997	6.63	3.68	2014	1.30	0.80
1998	6.51	3.53	2015	1.16	0.87
1999	4.27	2.47	2016	1.21	0.93
2000	3.88	2.28	2017	1.15	0.83
2001	3.25	2.17	2018	1.07	0.77
2002	4.66	2.79	2019	1.56	1.03
2003	3.15	1.88	2020	1.13	0.80

## Statewide Averages for Carbon Monoxide



# Lead

**Primary NAAQS:** Rolling 3-month average not to exceed 0.15 micrograms per meter squared ( $\mu\text{g}/\text{m}^3$ )

**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.

In 2020, the division operated one lead monitoring site at Eastern Kentucky University. There were several exceedances of the lead NAAQS in 2012 and 2018; all were related to a compliance issue with a single stationary source.

## 2020 Lead Rolling Three-Month Average

Method: High Volume Sampler;

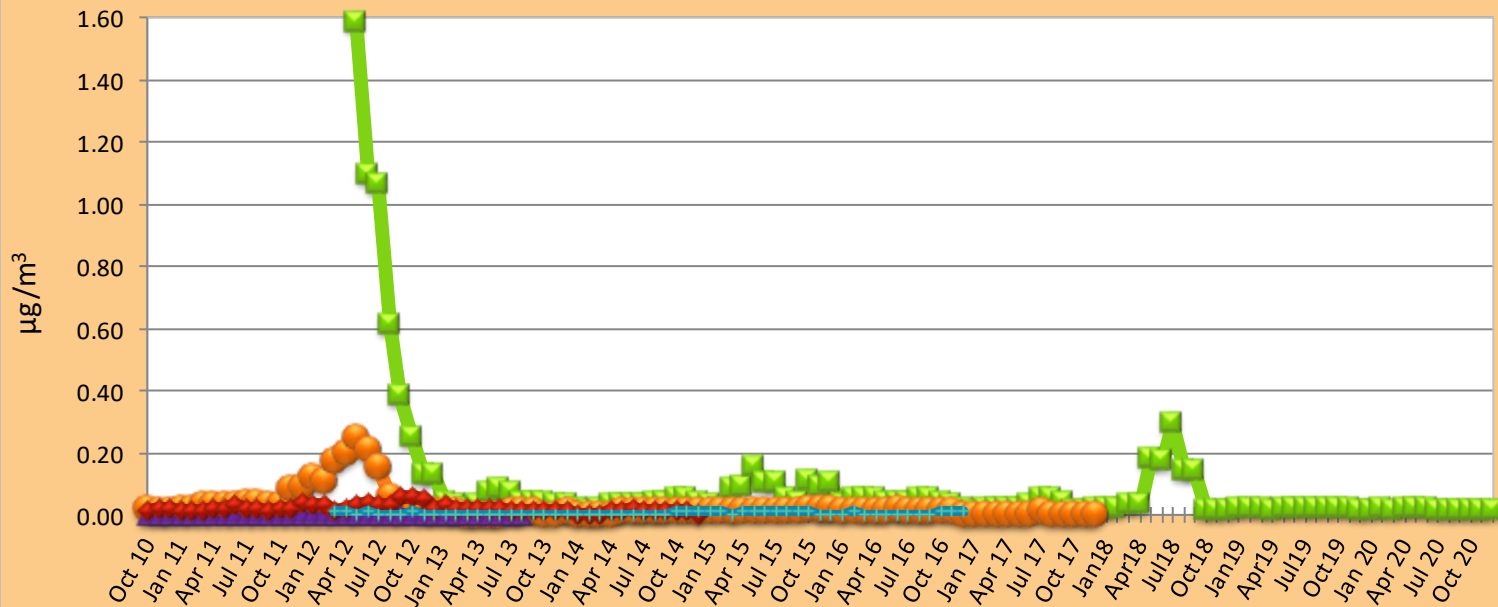
Inductively Coupled Plasma-Mass Spectroscopy

Data Interval: 24-Hour

Units: Micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ )

Site Name	1st Max	2nd Max	3rd Max	4th Max	Observations > 0.15
EKU	0.06	0.06	0.05	0.04	0

# Three-Month Rolling Averages for Lead



3-Month Rolling Averages (End Month)

EKU

Mayfield Elementary\*

Lockwood \*

Salem Elementary \*

Cannons Lane (LMAPCD)\*

\*Monitoring Discontinued

# Nitrogen Dioxide

## Primary NAAQS:

3-year average of the 98th percentile of daily maximum one-hour averages must not exceed 100 ppb

Annual arithmetic mean must not exceed 53 parts per billion (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 (NO<sub>x</sub>), which include nitrogen dioxide (NO<sub>2</sub>) and nitrogen oxide (NO). Major combustion sources that produce NO<sub>2</sub> include motor vehicles, power plants, incinerators, boilers, and chemical processes. NO<sub>2</sub> is also produced through a photochemical reaction between NO and sunlight.

There have been no recorded exceedances of an NO<sub>2</sub> NAAQS since the inception of sampling in 1970. All Kentucky counties are currently in attainment of the standards for nitrogen dioxide.

## 2020 Nitrogen Dioxide Results: Three-Year Average of 98th Percentile of Daily Maximum One-Hour Averages

Method: Chemiluminescence

Data Interval: Hourly

Units: Parts per billion (ppb)

County/Site Name	2018	2019	2020	3-Yr Avg
Boyd	27	27	27	27
Campbell	25	27	28	27
Daviess	28	27	26	27
Fayette	31	42	38	37
Cannons Lane (LMAPCD)	38	41.6	38.4	39
Durrett Lane (LMAPCD)	46.2	48.8	43.7	46
McCracken	28	32	30	30

LMAPCD = Louisville Metro Air Pollution Control District

## Statewide Averages for Nitrogen Dioxide

Statewide averages for nitrogen dioxide (NO<sub>2</sub>) show a steady downward trend over the past three decades, primarily due to the installation and use of pollution control devices on motor vehicles, power plants and industrial boilers.

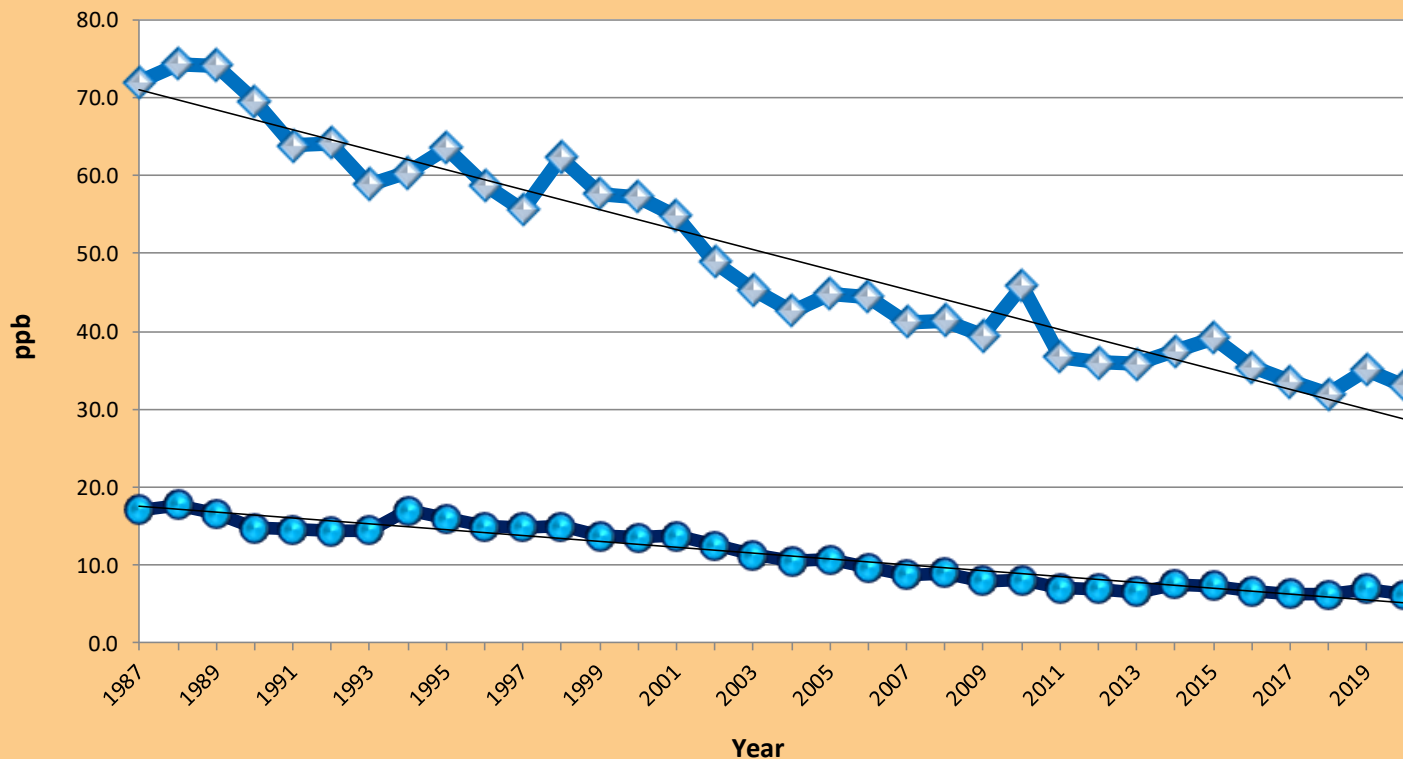
These tables present the statewide averages of NO<sub>2</sub> from 1987 through 2019. The data is represented in two different ways: A statewide average of the annual averages from each monitoring station; and the statewide average of the 98th percentile 1-hour daily maximums. For reference, the annual standard for nitrogen dioxide is 53 ppb and the 1-hour standard is 100 ppb.

The data from these tables are graphed on the following page, with the downward trend lines clearly visible.

Year	Statewide Average (ppb) Based upon Annual Arithmetic Means	Statewide Average (ppb) Based upon 98th Percentile 1-Hour Daily Maximums	Year	Statewide Average (ppb) Based upon Annual Arithmetic Means	Statewide Average (ppb) Based upon 98th Percentile 1-Hour Daily Maximums
1987	17.09	72.00	2004	10.46	42.63
1988	17.72	74.38	2005	10.72	44.88
1989	16.61	74.14	2006	9.67	44.44
1990	14.76	69.57	2007	8.78	41.20
1991	14.50	63.83	2008	9.0	41.43
1992	14.34	64.20	2009	7.92	39.50
1993	14.40	58.85	2010	8.05	45.83
1994	17.02	60.42	2011	7.04	36.68
1995	15.97	63.55	2012	6.94	35.97
1996	14.90	58.82	2013	6.48	35.75
1997	14.88	55.64	2014	7.48	37.44
1998	14.95	62.36	2015	7.35	39.17
1999	13.68	57.64	2016	6.57	35.37
2000	13.48	57.27	2017	6.32	33.55
2001	13.72	54.77	2018	6.20	31.89
2002	12.51	48.92	2019	6.88	35.06
2003	11.30	45.33	2020	6.21	33.01

*Disclaimer:* These charts show generalized pollution trends through time. They do not show trends for specific sites, nor do they demonstrate attainment for any particular area. While individual pollutants may spike in certain years, overall trends show declines in pollution levels.

## Statewide Averages for Nitrogen Dioxide



- ◆ Statewide Average: Based upon 98th Percentile 1-Hour Daily Maximums
- Statewide Average: Based upon Annual Arithmetic Means



# Ozone

**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.

In 2020, six 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 the Cannons Lane (Jefferson County) site. The 2018-2020 3-year average was below the level of the standard for all Kentucky sites expect for Cannons Lane (Jefferson County).

*LMAPCD = Louisville Metro Air Pollution Control District*

*NPS = National Park Service*

*CASTNET = EPA-operated monitor*

## 2020 Ozone Results:

### 3-Yr Average of 4th Highest Daily Maximum 8-Hour Concentration

Method: Ultra-Violet Photometry

Data Interval: Hourly

Units: Parts-per-million (ppm)

County/Site Name	ppm
Bell	0.057
Boone	0.064
Boyd	0.061
Bullitt	0.065
Campbell	0.063
Cannons Lane (LMAPCD)	0.072
Carrithers Middle School (LMAPCD)	0.067
Carter	0.057
Christian	0.058
Daviess	0.064
Edmonson (NPS)	0.059
Fayette	0.060
Greenup	0.056
Hancock	0.063*

\* = Incomplete data set

County/Site Name	ppm
Hardin	0.061
Jessamine	0.060
Livingston	0.063
McCracken	0.063
Morgan (CASTNET)	0.058
Oldham	0.065
Perry	0.058
Pike	0.055
Pulaski	0.057
Simpson	0.059
Trigg (CASTNET)	0.061
Warren	0.058
Washington (CASTNET)	0.060
Watson Lane (LMAPCD)	0.065

## Statewide Averages for Ozone

Statewide averages for ozone (O<sub>3</sub>) have generally declined since 1987. This trend is attributable to emission controls on vehicles and a regional strategy to control NO<sub>x</sub> emissions from large stationary internal combustion engines, large boilers, and turbines used in power plants and other industrial applications.

This table presents the statewide averages of ozone from 1987 through 2019. For reference, the current primary standard for ozone is a 3-year average of the 4th highest daily maximum 8-hr concentration not to exceed 0.070 ppm.

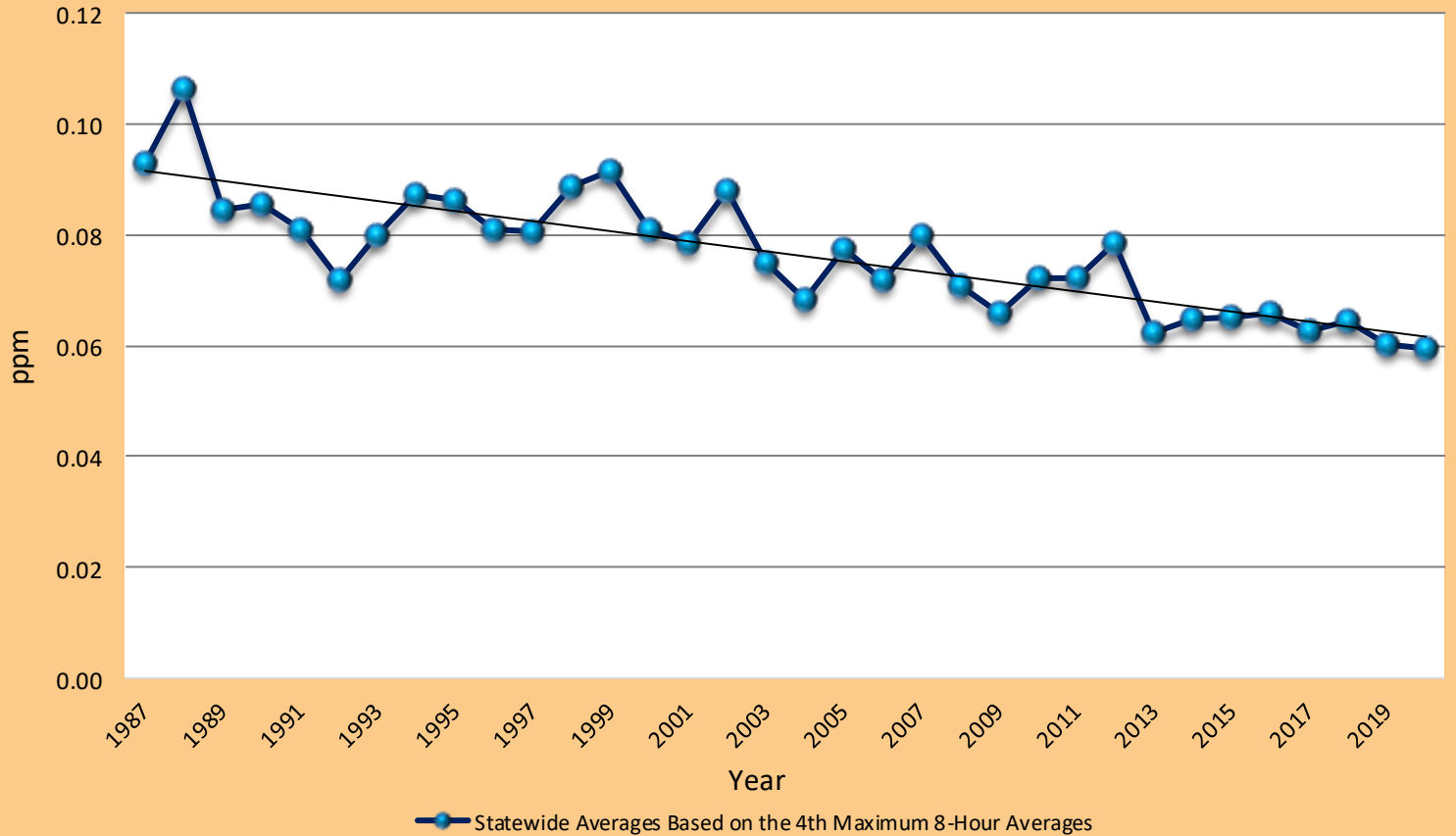
These data are graphed on the following page, with the downward trend line marked.

Year	Statewide Average: Based on Fourth Maximum 8-Hour Averages (ppm)
1987	0.093
1988	0.106
1989	0.084
1990	0.086
1991	0.081
1992	0.072
1993	0.080
1994	0.088
1995	0.086
1996	0.081
1997	0.081
1998	0.089
1999	0.092
2000	0.081
2001	0.078
2002	0.088
2003	0.075
2004	0.068
2005	0.078
2006	0.072

Year	Statewide Average: Based on Fourth Maximum 8-Hour Averages (ppm)
2007	0.080
2008	0.071
2009	0.066
2010	0.072
2011	0.072
2012	0.079
2013	0.062
2014	0.065
2015	0.065
2016	0.066
2017	0.063
2018	0.065
2019	0.060
2020	0.060

*Disclaimer:* These charts show generalized pollution trends through time. They do not show trends for specific sites, nor do they demonstrate attainment for any particular area. While individual pollutants may spike in certain years, overall trends show declines in pollution levels.

# Statewide Averages for Ozone



# Fine Particulate Matter (PM<sub>2.5</sub>)

**Primary NAAQS:** 3-year average of the annual weighted mean not to exceed 12.0 micrograms per meter cubed ( $\mu\text{g}/\text{m}^3$ )  
3-year average of the 98th percentile of 24-hour concentrations not to exceed 35  $\mu\text{g}/\text{m}^3$

**Secondary NAAQS:** 3-year average of the annual weighted mean not to exceed 15.0  $\mu\text{g}/\text{m}^3$   
3-year average of the 98th percentile of 24-hour concentrations not to exceed 35  $\mu\text{g}/\text{m}^3$

Fine particulate matter (PM<sub>2.5</sub>) 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 nor the three-year annual standard during the 2018 - 2020 averaging period. All Kentucky counties are currently in attainment for the PM<sub>2.5</sub> standards.

## 2020 PM<sub>2.5</sub> Results: 3-Yr Avg. of 24-Hour 98th Percentile

Method: Gravimetric

Data Interval: 24-Hour

Units: Micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ )

County/Site Name	$\mu\text{g}/\text{m}^3$
Bell	16
Boyd	15
Campbell	16
Carter	13
Christian	19

County/Site Name	$\mu\text{g}/\text{m}^3$
Daviess	18
Fayette	14*
Hardin	16
Watson Lane (LMAPCD)	22
Cannons Lane (LMAPCD)	20
Durrett Lane (LMAPCD)	23
Carrithers M.S. (LMAPCD)	19*

County/Site Name	$\mu\text{g}/\text{m}^3$
Algonquin Parkway (LMAPCD)	20
McCracken	20
Perry	12
Pike	13
Pulaski	15
Warren	17

LMAPCD = Louisville Metro Air Pollution Control District; \* Incomplete data set

# Statewide Averages for PM<sub>2.5</sub>

This table presents the statewide averages of PM<sub>2.5</sub> from 1999, when monitoring first began for this pollutant, through 2019. The data is presented according to the two primary standards for PM<sub>2.5</sub>:

- The 3-yr average of the annual weighted mean, not to exceed 12.0 µg/m<sup>3</sup>
- 3-year average of the 98th percentile of 24-hour concentrations not to exceed 35 µg/m<sup>3</sup>

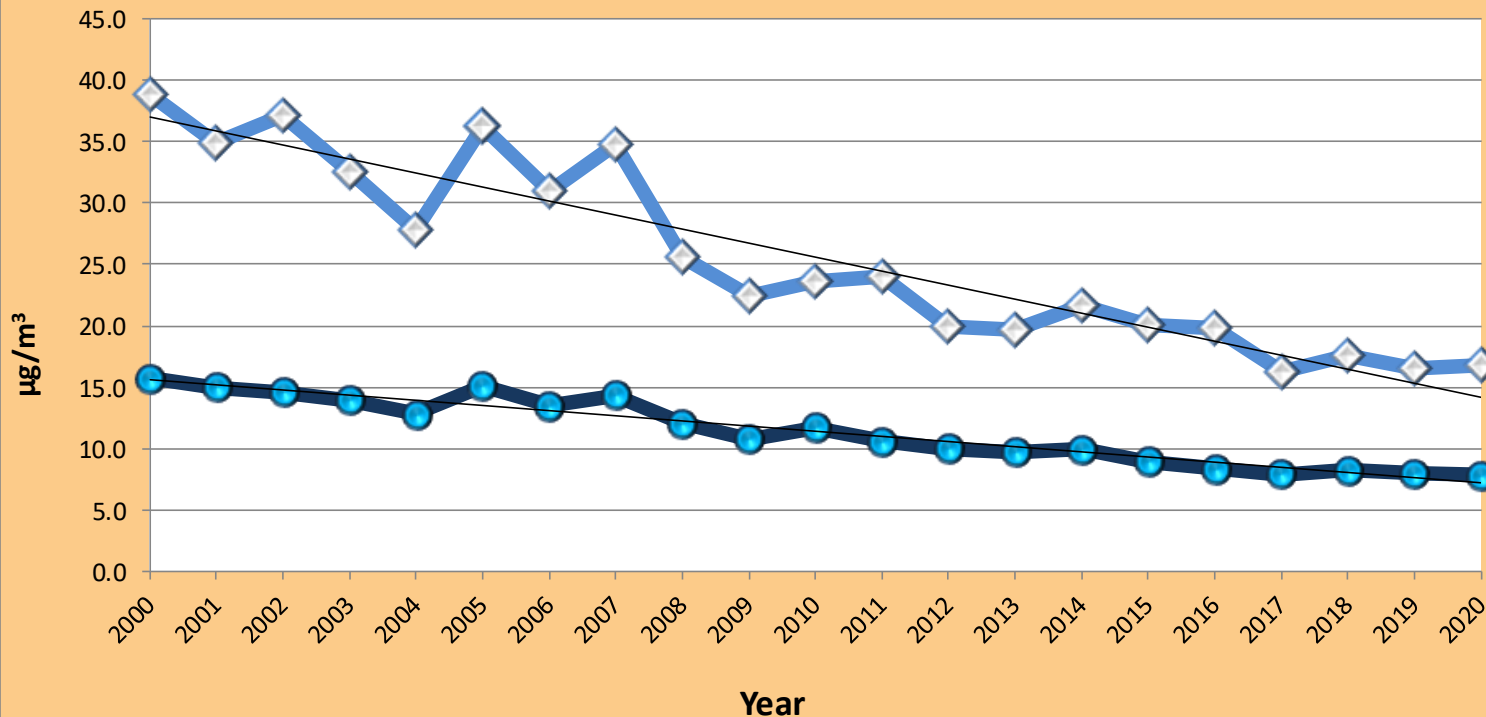
These data are graphed on the following page, with the downward trend lines marked.

Year	Statewide Average: Based upon 98th Per- centile 24-Hour Con- centrations (µg/m <sup>3</sup> )	Statewide Average: Based upon Annual Weighted Means (µg/m <sup>3</sup> )
2000	38.8	15.7
2001	34.9	15.0
2002	37.1	14.6
2003	32.6	13.9
2004	27.9	12.8
2005	36.3	15.1
2006	31.0	13.5
2007	34.8	14.3
2008	25.6	12.0
2009	22.4	10.8
2010	23.6	11.7
2011	24.0	10.6

Year	Statewide Average: Based upon 98th Per- centile 24-Hour Con- centrations (µg/m <sup>3</sup> )	Statewide Average: Based upon Annual Weighted Means (µg/m <sup>3</sup> )
2012	20.0	9.97
2013	19.6	9.7
2014	21.7	9.9
2015	20.1	8.9
2016	19.8	8.4
2017	16.3	7.9
2018	17.5	8.2
2019	16.5	7.9
2020	16.8	7.8

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# Statewide PM<sub>2.5</sub> Averages



◆ Statewide Average: Based upon 98th Percentile 24-Hour Concentrations

● Statewide Average: Based upon Annual Weighted Means

## Particulate Matter (PM<sub>10</sub>)

**Primary NAAQS:** Expected number of days with a maximum 24-hour concentration greater than 150 micrograms per meter cubed ( $\mu\text{g}/\text{m}^3$ ) 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<sub>10</sub>. Common sources of PM<sub>10</sub> are prescribed fires, construction activities, agricultural practices, metal recycling, and smokestacks.

There were no exceedances of the annual PM<sub>10</sub> standard in 2020. 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<sub>10</sub> standards.

### 2020 PM<sub>10</sub> Results: Maximum 24-Hr Concentrations ( $\mu\text{g}/\text{m}^3$ )

Method: Gravimetric

Data Interval: 24-Hour

Units: Micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ )

County/Site Name	1st Max	2nd Max	3rd Max	4th Max
Boyd	45	40	36	35
Carter	19	17	16	15
Fayette	28	21	20	20
Algonquin Parkway (LMAPCD)	64	44	43	40
Cannons Lane (LMAPCD)	60	47	39	34
Livingston*	29	25	20	19
McCracken	32	27	26	24

LMAPCD = Louisville Metro Air Pollution Control District

\* = Incomplete data set; Livingston was discontinued in Sept. 2020

# Statewide Averages for PM<sub>10</sub>

Statewide and regional PM<sub>10</sub> levels show declining trends over the past several decades. This decrease is largely due to the installation of pollution controls on industrial sources for particulate matter.

These tables show the statewide average of the annual maximum 24-hour concentration for PM<sub>10</sub> from 1987 through 2020, measured in µg/m<sup>3</sup>.

These data are graphed on the following page, with the downward trend line marked.

*Disclaimer:* These charts show generalized pollution trends through time. They do not show trends for specific sites, nor do they demonstrate attainment for any particular area. While individual pollutants may spike in certain years, overall trends show declines in pollution levels.

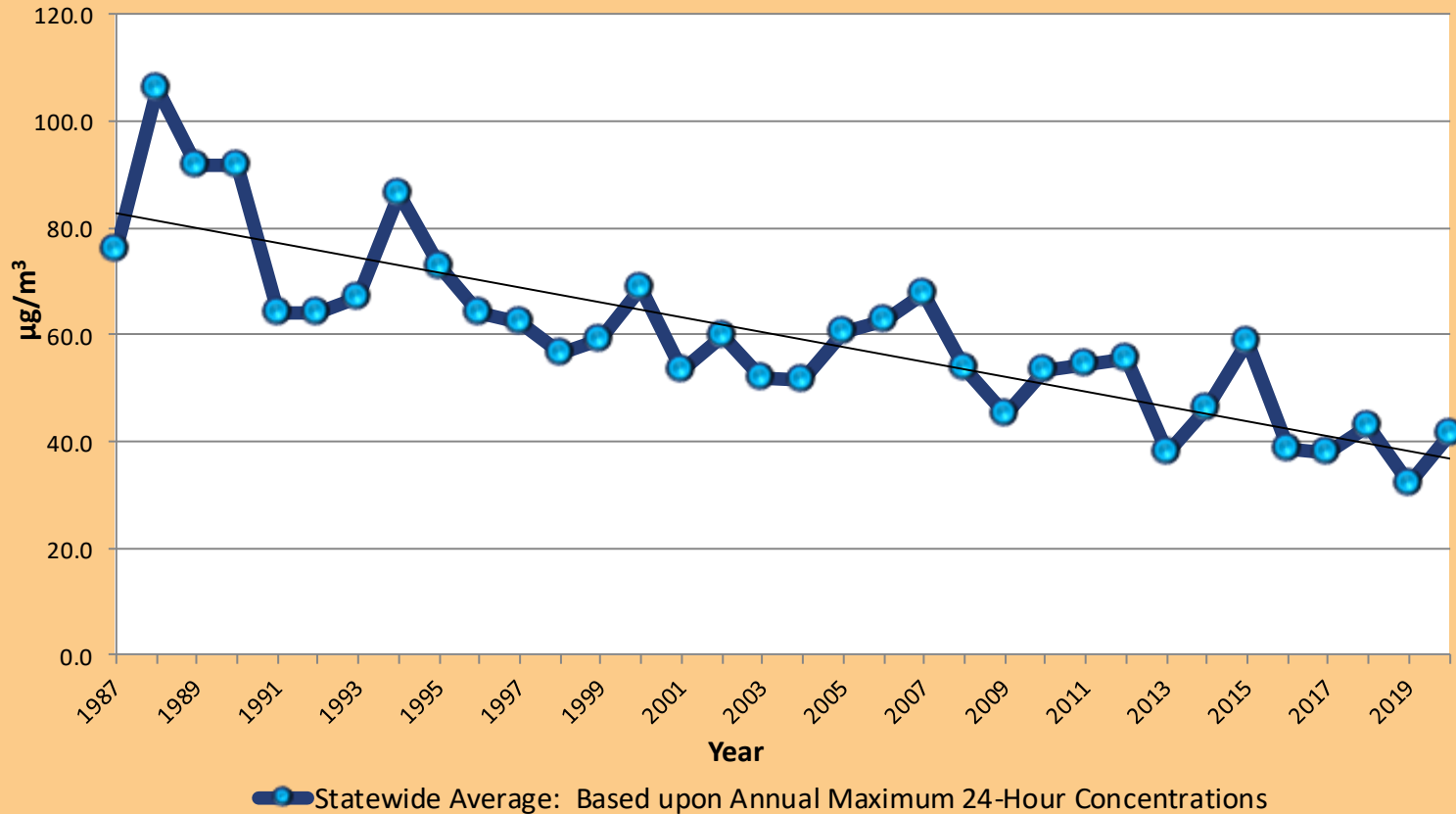
Year	Statewide Avg. Based upon Annual Maximum 24-Hour Concentrations (µg/m <sup>3</sup> )
1987	76.0
1988	105.9
1989	91.7
1990	91.5
1991	64.1
1992	63.9
1993	66.9
1994	86.1
1995	72.7
1996	63.9
1997	62.4
1998	56.4
1999	59.0
2000	68.6
2001	53.4
2002	59.8
2003	52.0
2004	51.5
2005	60.3
2006	66.2
2007	67.7

Year	Statewide Avg. Based upon Annual Maximum 24-Hour Concentrations (µg/m <sup>3</sup> )
2008	53.6
2009	45.1
2010	53.3
2011	54.3
2012	55.5
2013	37.7
2014	46.0
2015	58.5
2016	38.5
2017	37.9
2018	42.9
2019	32.0
2020	41.3





## Statewide PM<sub>10</sub> Averages



## Sulfur Dioxide (SO<sub>2</sub>)

**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 (SO<sub>2</sub>) is a colorless gas that has a pungent odor at concentrations exceeding 0.5 ppm. SO<sub>2</sub> 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<sub>2</sub>.

During 2020, one site recorded 3 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.

### 2020 Sulfur Dioxide Results: 3-Year Average of Annual Daily Maximum 1-Hr Averages (ppb)

Method: Instrumental, Ultra-Violet Fluorescence

Data Interval: Hourly

County	2018	2019	2020	3 Yr Avg
Boyd	8	4	5	6
Campbell	9	8	10	9
Daviess	17	34	12	21
Edmonson (NPS)	5	2	2	3
Fayette	5	4	3	4
Greenup	11	9	6	9
Henderson (Sebree)	102	99	73	91
Watson Lane (LMAPCD)	16	15	15	15
Cannons Lane (LMAPCD)	8	10	9	9
Algonquin Parkway (LMAPCD)	12	6	5	8
Jessamine	3	4	3	3
McCracken	10	13	7	10

Units: Parts-per-billion (ppb)

LMAPCD = Louisville Metro Air Pollution Control District; NPS = National Park Service;

## Statewide Averages for Sulfur Dioxide

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<sub>2</sub> concentrations across the region.

These tables show the statewide average for SO<sub>2</sub> from 1985 through 2020, measured in parts-per-billion (ppb). For reference, the primary standard for SO<sub>2</sub> is the 3-year average of the 99th percentile of the daily maximum 1-hour concentration, not to exceed 75 ppb.

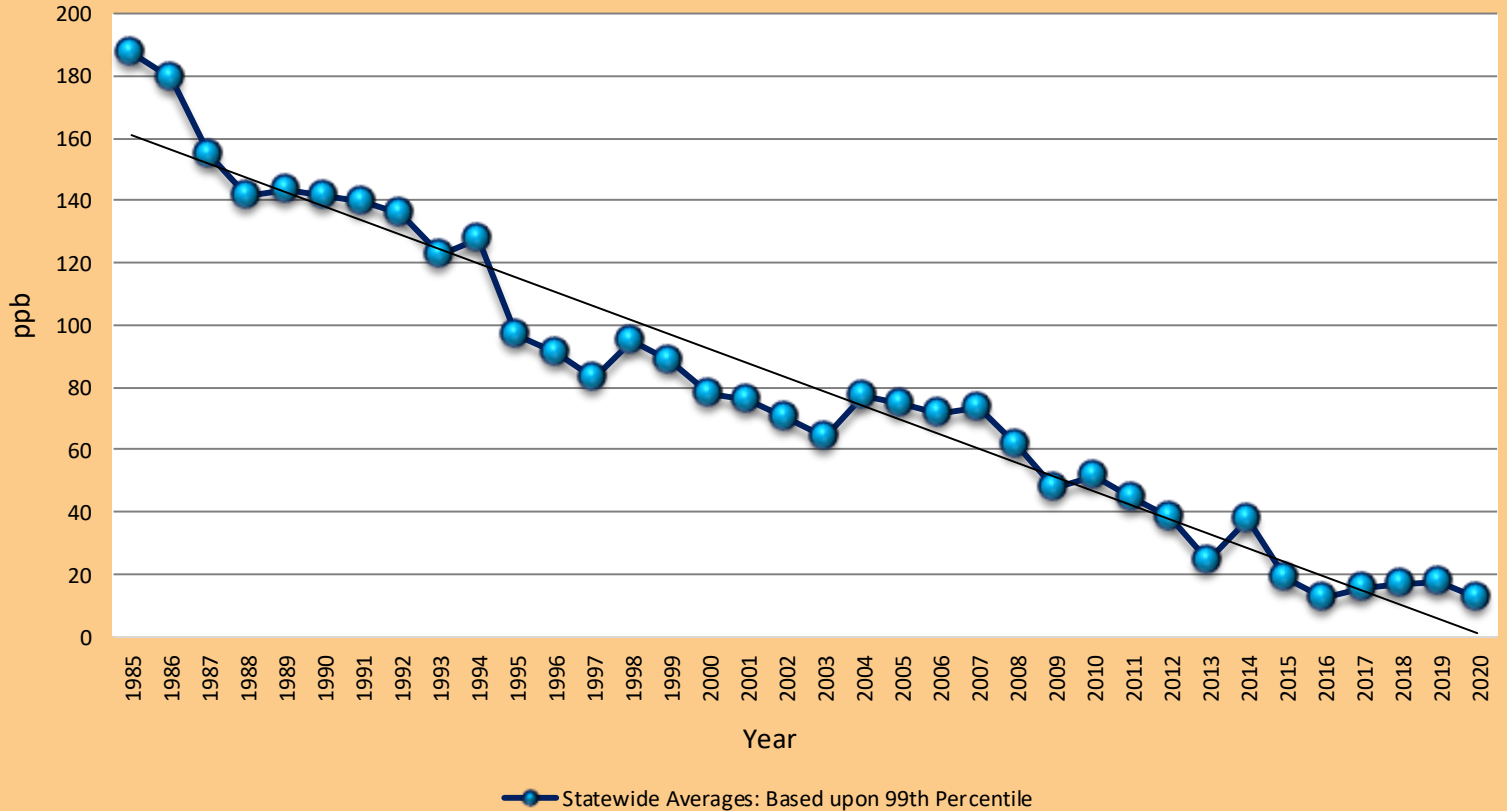
These data are graphed on the following page, with the downward trend line marked.

Year	Statewide Averages: Based upon 99th Percentile (ppb)
1985	187.6
1986	179.4
1987	154.9
1988	141.3
1989	143.3
1990	141.5
1991	139.6
1992	135.8
1993	122.3
1994	127.7
1995	96.8
1996	91.3
1997	82.7
1998	94.8
1999	88.7
2000	77.9
2001	76.1
2002	70.4
2003	64.4
2004	77.3
2005	74.6
2006	71.7

Year	Statewide Averages: Based upon 99th Percentile (ppb)
2007	73.6
2008	61.7
2009	47.9
2010	51.2
2011	44.4
2012	38.0
2013	24.2
2014	37.6
2015	18.7
2016	12.6
2017	15.8
2018	16.8
2019	17.3
2020	12.5

*Disclaimer:* These charts show generalized pollution trends through time. They do not show trends for specific sites, nor do they demonstrate attainment for any particular area. While individual pollutants may spike in certain years, overall trends show declines in pollution levels.

## Statewide Averages for SO<sub>2</sub>

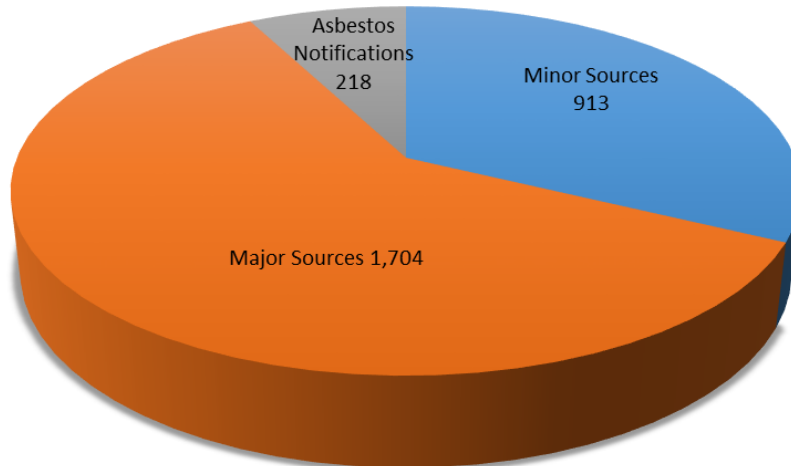


# Inspections

During FY21, Field Operations Branch staff completed **2,835** compliance inspections of various types at mostly permitted sources (major Title V, minor); **87 percent of inspected sources were found to be compliant.**

- Inspection activities for major and minor facilities include annual certification reviews, full compliance evaluation and partial compliance evaluations.
- Asbestos inspection activities include AHERA and NESHAP inspections.
- Inspection activities include excess emissions reviews, performance test reviews, semi-annual monitoring reviews, engineering inspections, follow-ups, infrared camera inspections, performance test observations and record reviews for all permitted facilities.

**FY21 Source Inspection Activities**

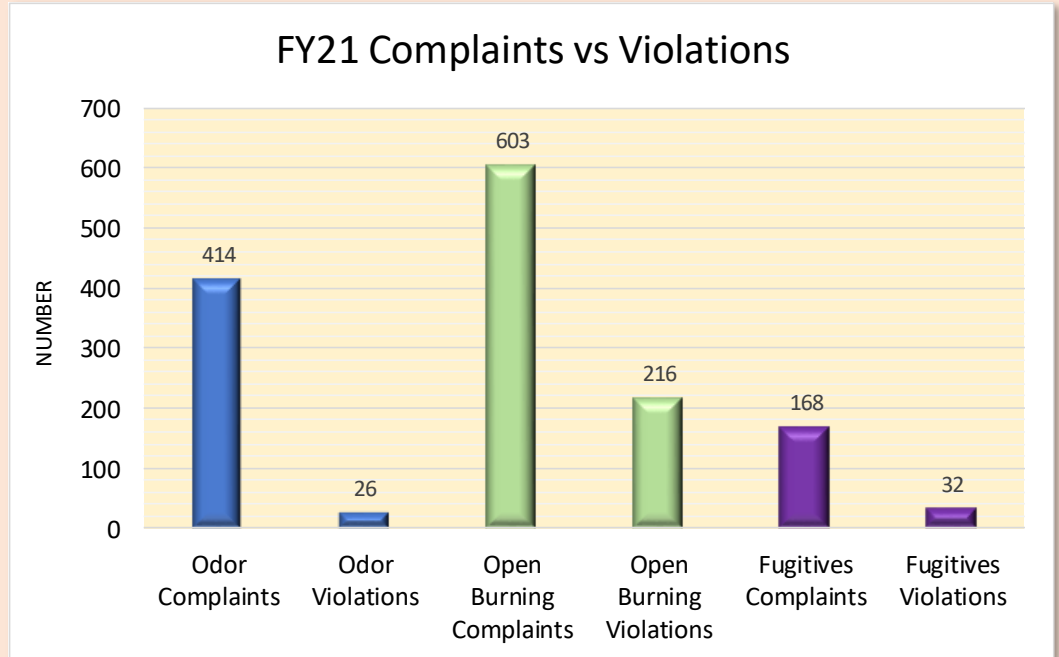


# Air Pollution Complaints

During FY21, the division received a total of **1,185 complaints**. The majority of complaints were about open burning, odors, and fugitive emissions. The breakdown of complaints vs. violations follows:

- 168 complaints were about fugitive emissions, 32 of which resulted in notices of violation (19 percent)
- 414 complaints were about odor, of which 26 resulted in notices of violation (6 percent)
- 603 complaints were about open burning, of which 216 resulted in notices of violation (36 percent)

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



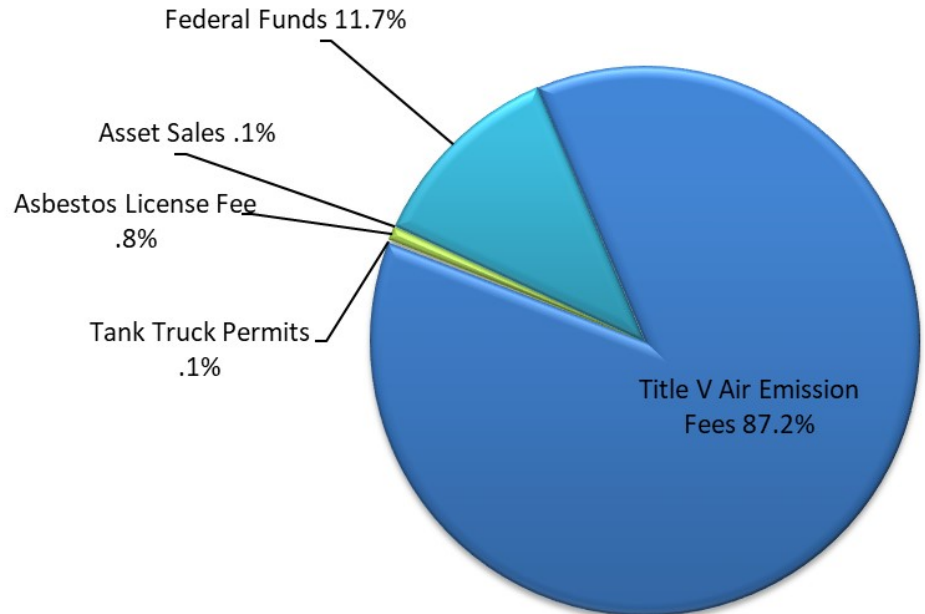
## Program Funding

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

State statute authorizes the division to charge fees sufficient to cover the cost of implementing and carrying out the requirements of the Title V program.

87.2 percent of the division's funding comes from emissions fees under the Title V program. Another 11.7 percent comes from federal grant funds. The remaining funding comes from asbestos license application fees, tank truck permits, and proceeds from asset sales.

## FY 2021 Funding



## Emissions Inventory

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

The table on this page shows data for the 2019 calendar year. At the time of publication of this report, data for the 2020 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 2019
Carbon monoxide	69,259
Nitrogen dioxide	55,912
Particulate matter 2.5	6,031
Particulate matter 10	11,901
Sulfur dioxide	57,504
Volatile organic compounds (as an ozone precursor)	50,429





# 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<sub>2</sub>e) in order 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 tonnes or more of CO<sub>2</sub>e 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.

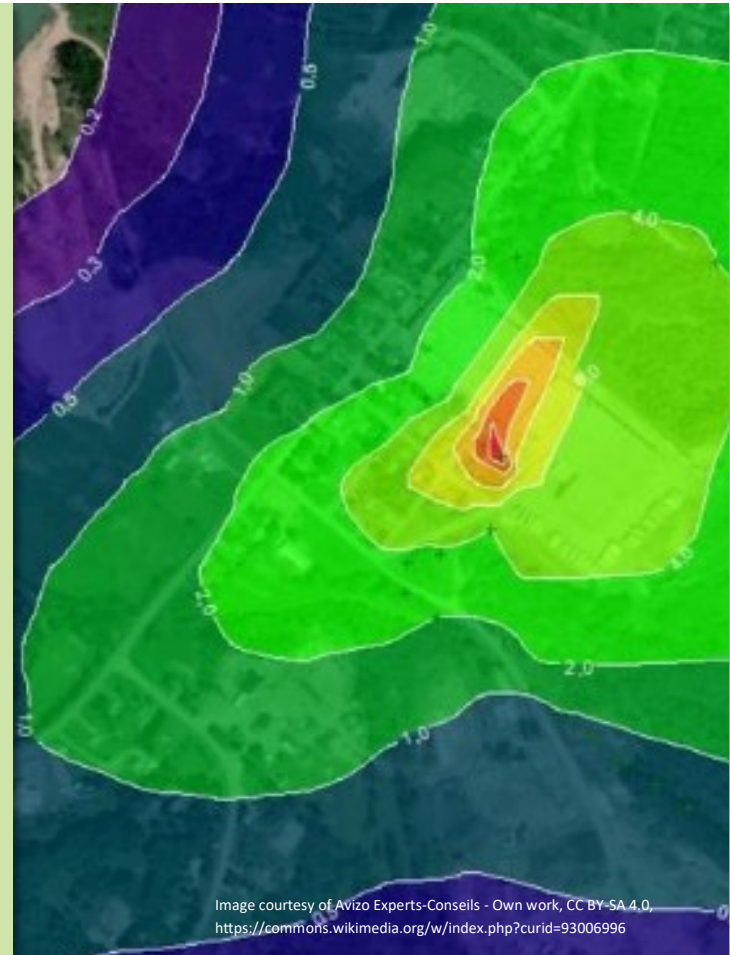
Greenhouse Gas	2015 Actual Emissions (tons)	2016 Actual Emissions (tons)	2017 Actual Emissions (tons)	2018 Actual Emissions (tons)	2019 Actual Emissions (tons)
Carbon dioxide	92,176,908	86,531,345	73,655,105	76,999,573	68,860,439
Methane	88,373	89,313	88,675	89,808	93,740
Nitrous oxide	3,519	3,891	3,190	3,369	2,788
CO <sub>2</sub> e (metric tonnes)	86,712,303	81,703,900	69,838,096	72,943,967	65,520,542
CO <sub>2</sub> e (tons)	95,583,925	90,063,137	76,983,327	80,406,960	72,224,035

# Air Dispersion Modeling

The Air Dispersion Modeling section uses modeling to assist 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 protect public health and air quality.

In FY 2021, the Air Dispersion Modeling section completed the following assessments and demonstrations:

- 36 air toxics modeling demonstrations in compliance with 401 KAR 63:020 for affected facility applications that emit hazardous and/or toxic substances
- 6 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 modeling review in conjunction with the Division of Waste Management's Blue Grass Chemical Agent Destruction Pilot Plant Multi-pathway Human Health Risk Assessment
- 1 SO<sub>2</sub> nonattainment boundary modeling demonstration for Henderson and Webster counties
- 1 MOVES3 (Motor Vehicle Emission Simulator) model demonstration to estimate on-road emissions to support the ozone nonattainment emissions inventory SIP



## Regulation Development

From July 2020 through June 2021, the Regulation Development Section finalized amendments to the following Kentucky Administrative Regulations: 401 KAR 60:005, *40 C.F.R. Part 60 standards of performance for new stationary sources*; 401 KAR 63:002, *40 C.F.R. Part 63 national emission standards for hazardous air pollutants*; and 401 KAR 61:036, *Emission guidelines and compliance times for municipal solid waste landfills*. These administrative regulations were updated to stay current with federal requirements.

## State Implementation Plan

During FY21, the Energy and Environment Cabinet (EEC) submitted five final revisions to [Kentucky's SIP](#):

- August 11, 2020 – SIP revision submitted adopting amended 401 KAR 52:100, *Public, affected states, and US EPA review* into KY SIP.
- October 5, 2020 – 2010 SO<sub>2</sub> Data Requirements Rule Annual Report submitted to EPA.
- October 15, 2020 – Letter submitted requesting approval of certification of the emissions statement and Nonattainment New Source Review program for the 2015 8-hour ozone NAAQS.
- October 15, 2020 – SIP revisions submitted adopting amended 401 KAR 63:010, *Fugitive emissions* into the SIP.
- November 12, 2020 – 2010 1-hour SO<sub>2</sub> NAAQS nonattainment boundary recommendation for the Henderson -Webster area submitted.

## 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 2021, a total of **\$294,748** was awarded to the division through DERA. Out of seven school districts that applied, four were selected to receive funding through the Kentucky Clean Diesel Grant Program. The four school districts will replace a total of twelve older-model, diesel school buses with either new diesel, or propane buses. The new buses will emit 98 percent less particulate matter and 90 percent less nitrogen oxide pollution than the older buses they replaced.



# Air Permitting

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

The Permit Review Branch is divided into several specialized sections:

- Chemical Section - Chemical Plants (Organic and Inorganic), Petroleum Refineries, Coal to Liquids, Bulk Terminals, Brake Manufacturing, Plastic Products and Resins, Paper Mills/Pulp Mills, Electronic Components, Nonwoven Fabrics, Rubber Products, Paperboard Mills, Pharmaceuticals, Paint and Allied Products, Carbon and Graphite Products, and Battery Manufacturers
- Combustion Section - Brick and Tile Manufacturing, Charcoal Manufacturing, Combustion (Boilers), Distilleries, Glass Manufacturing, Incineration, Natural Gas Transmission Stations, Power Plants, Sawmills, Soil Remediation Units, Tobacco Processing Plants, Electric Utilities
- Metallurgy Section - Primary Steel and Aluminum Producers, Mini Steel Mills, Secondary Metal Plants, and Various Surface Treatments Of Metals



- Minerals Section - Asphalt Plants (Portable and Stationary), Cement Storage Operations, Chicken Feed Manufacturing Plants, Coal Preparation Plants (Portable and Stationary), Coal Tipples (Portable and Stationary), Coal Terminals, Concrete Block Plants, Edible Oil Plants, Fertilizer Operations (Including Blending), Flour Mills, Grain Elevators, Lime Manufacturing Plants, Limestone Crushing Operations (Portable and Stationary), Limestone Terminals, Pet Food Manufacturers, Pre-stress Concrete Plants, Ready Mix Concrete Plants, Sandstone Crushing Operations, Sand and Gravel Operations (Portable and Stationary), Slag Coal Operations, Soybean Extraction Plants
- Surface Coating Section - Automobile and Light-Duty Trucks, Beverage Cans, Fabric, Vinyl and Paper, Flat Wood Paneling, Flexible Vinyl and Urethane, Large Appliances, Magnet Wire, Magnetic Tape, Metal Coil, Metal Furniture, Miscellaneous Metal Parts and Products, Plastic Parts for Business Machines, Polymeric Coating, Pressure Sensitive Tape and Labels, Publication Rotogravure and Flexography Printing

## Permitting Actions

During FY21, the Permit Review Branch issued 375 permits. 12 of these were considered major economic development projects completed in partnership with the Cabinet for Economic Development. At the close of FY21, the branch had 243 pending applications in-house.

### FY 2021 Permitting Actions

Type of Permit Action	Number
Major Permit Applications	93
Conditional Major Permit Applications	67
Minor Permit Applications	162
Registrations	160
Administrative Amendments	54

# Environmental Education Outreach

The Division for Air Quality promotes environmental stewardship and public participation through environmental education programs, resources, and community partnerships.

Due to the pandemic, remote instruction was the norm for schools across Kentucky throughout the year. The division's environmental education program continued to provide virtual outreach to schools across the Commonwealth, particularly during Air Quality Awareness Week (AQAW). Virtual educational programs about air quality were also offered through county libraries. Staff presented 40 programs reaching nearly 2,000 people across the Commonwealth.

To celebrate Earth Day and AQAW, the division hosted a Facebook Live event at the air monitoring station in Lexington. The 15-minute live video featured a tour of the station and interviews with DAQ staff about career opportunities, garnering hundreds of views.

The division's Open Burning PowerPoint is a key educational tool to help Kentuckians learn more about outdoor burning and air quality. Education staff updated and recorded the presentation to allow for easier access on the cabinet's YouTube page. A link to the video can be found at <http://bit.ly/OpenBurningKY>.

During fall semester of 2020, the division partnered with University of KY writing and rhetoric professor Dr. Lauren Cagle on an advanced communication class focusing on digital accessibility. Students learned how to make DAQ's PowerPoints, data visualizations, and other public documents more accessible to people with disabilities. The class also produced digital accessibility help guides, which were later utilized in a series of webinars for division staff. DAQ's multi-year partnership with professor Cagle is detailed in an upcoming book, *Technical Communication for Environmental Action*, edited by Sean D. Williams, to be published later in 2021.



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