Kentucky Ambient Air Quality Annual Report

2003

Commonwealth of Kentucky
Environmental & Public Protection Cabinet
Department for Environmental Protection
Division for Air Quality
803 Schenkel Lane
Frankfort, Kentucky 40601

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FOREWORD

The Kentucky Ambient Air Quality Annual Report is produced by the Technical Services Branch of the Kentucky Division for Air Quality. This report presents the summary statistical results of monitoring conducted in the calendar year 2003 to measure the outdoor concentrations of air pollutants in the Commonwealth.

The primary source of data for this report is the Air Quality Surveillance Network operated by the Kentucky Division for Air Quality. The report also contains monitoring data collected by the Louisville Metro Air Pollution Control District, the National Parks Service and some industries.

Network Design and Operation

The state has operated an air quality monitoring network since July 1967. The 2003 network included 101 monitors in 33 counties (this total includes monitors operated by the Louisville Metro Air Pollution Control District and the National Parks Service at Mammoth Cave).

The monitoring station locations are selected with U.S. Environmental Protection Agency guidance and, in general, are established near high population areas or air pollution sources. Each year the site locations are reviewed to ensure that adequate coverage is being provided.

Many staff hours are devoted to the operation of the monitoring network. Division staff routinely visit the sites to calibrate and maintain the monitoring equipment, collect samples, and verify and document data from the continuous monitors.

Because it is imperative that the air monitoring data be accurate and precise, the Division for Air Quality has an extensive quality assurance program. Staff members audit every air monitor quarterly to ensure that each is operating properly. This audit includes monitors operated by the Louisville Metro Air Pollution Control District, the National Park Service and industrial networks.

Monitoring data is used in several ways. The data is used to demonstrate compliance with and/or progress made toward meeting ambient air quality standards and to identify pollution trends. The data is also used to evaluate public health impacts and the possible need to initiate emergency control procedures.

The public has access to the information through this annual report and, on a daily basis, through the Air Quality Index (AQI) message on our website: www.air.ky.gov/AQIndex.htm or toll free at: 1-800-AIR-IN-KY. This is a 24-hour report on Kentucky's air quality. During the summer months, the public can also access daily ozone level reports through EPA's AIRNOW website at www.epa.gov/airnow.

Report Organization

This report contains sections on each criteria pollutant with the monitoring data contained in a table arranged alphabetically by county. Wet deposition, toxics and industrial data are presented in separate sections.

The report has been composed and arranged in an attempt to make it "user friendly." Included in the report are: a National Ambient Air Quality Standards table; a table listing monitors by county; maps indicating monitor locations; pollutant trends graphs; and a division directory.

If you have suggestions or questions concerning this report, please contact Jerry Sudduth, Technical Services Branch, Division for Air Quality, 803 Schenkel Lane, Frankfort, KY 40601.

Ambient Air Quality Standards

POLLUTANT	MAXIMUM CONCENTRATION	
	PRIMARY STANDARD	SECONDARY STANDARD
Carbon monoxide		
8 hour average	9 ppm (1)	9 ppm (1)
1 hour average	35 ppm (1)	35 ppm (1)
Sulfur oxides		
24 hour average	0.14 ppm (1)	--
annual average	0.03 ppm	--
3 hour average	--	0.50 ppm (1)
Nitrogen dioxide		
Annual average	0.05 ppm	0.05 ppm
Lead		
Calendar Quarter average	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$
Ozone		
1 hour average	0.12 ppm (4)	0.12 ppm (4)
8 hour average	0.08 ppm (5)	0.08 ppm (5)
Particulate Matter (measured as PM_{10})		
24 hour average	150 $\mu g/m^3$ (3)	150 $\mu g/m^3$ (3)
annual average	50 $\mu g/m^3$ (2)	50 $\mu g/m^3$ (2)
Particulate Matter (measured as $PM_{2.5}$)		
24 hour average	65 $\mu g/m^3$ (6)	65 $\mu g/m^3$ (6)
annual average	15 $\mu g/m^3$ (7)	15 $\mu g/m^3$ (7)

The federal Clean Air Act, as amended by the U.S. Congress in 1970, 1977 and 1990, directs the U.S. Environmental Protection Agency (EPA) to establish NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS) defining maximum allowable ambient (outdoor) concentrations for criteria pollutants. The term "criteria pollutants" derives from the requirement that EPA must set criteria or standards for each.

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 health and welfare. Welfare covers 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 ($\mu g/m^3$) and parts of pollutants per million (ppm) parts of air.

Footnotes:

(1) This average is not to be exceeded more than once per year.
(2) The standard is attained when the expected annual arithmetic mean concentration is less than or equal to 50 $\mu g/m^3$.
(3) The standard is attained when the expected number of days per calendar year with a twenty-four (24) hour average concentration above 150 $\mu g/m^3$ is equal to or less than one (1).
(4) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm (235 $\mu g/m^3$) is equal to or less than one (1).
(5) The standard is attained when the 3-year average of the annual fourth-highest daily maximum 8-hr average ozone concentration is less than or equal to 0.08 ppm.
(6) The standard is attained when the 3-year average of the annual 98th percentile is less than or equal to 65 $\mu g/m^3$.
(7) The standard is attained when the 3-year average of annual means is less than or equal to 15 $\mu g/m^3$.

2003 Kentucky Air Monitoring Network Sites by County

County	$PM_{2.5}$	PM_{10}	SO_2	NO_2	CO	O_3	Pb	AcidRn	WS/WD
Bell	1	1				1			1
Boone						1			
Boyd	1	2	1	1	1	1			1
Bullitt	1	1		1		1			1
Campbell	1	1	1	1		1			
Carter	1					1		1	1
Christian	1								
Daviess	1	2	1	1		1			1
Edmonson[1]						1		1	
Fayette	2	1	1	1	1	2			
Franklin	1								
Graves						1			1
Greenup			1			1			
Hancock			1			1			
Hardin	1	1				1			
Harlan		1							
Henderson	1	1	1			1			
Jefferson[2]	4	2	2	1	2	3			
Jessamine						1			1
Kenton	1					1			1
Laurel	1	1							
Livingston			1			1			1
McCracken	1	2	1	1		1			
McLean						1			1
Madison	1	1							

2003 Kentucky Air Monitoring Network Sites by County

County	$PM_{2.5}$	PM_{10}	SO_2	NO_2	CO	O_3	Pb	Acid Rn	WS/WD
Marshall		1							
Oldham						1			
Perry	1	1				1			1
Pike	1	1				1			
Pulaski		1				1			
Scott						1			
Simpson						1			1
Warren	1	1	1	1		1			
Total	23	22	12	8	4	30	0	2	12

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

2003 Industrial Air Monitoring Network Sites by County

County	$PM_{2.5}$	PM_{10}	SO_2	NO_2	CO	O_3	Pb	Acid Rn	WS/WD
Christian						1			
Gallatin		1							
Henderson			2						
Mason		1	1						
Scott						1			
Trigg						1			
Webster			1						
Wayne,WV			3	1		1			
Total	0	2	7	1	0	4	0	0	0

Carbon Monoxide

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 that includes highway and non-road vehicles such as construction equipment. Other sources include industrial processes and coal, kerosene and wood burning stoves in homes.

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.

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 it. 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. In 2003 the Division for Air Quality and the Louisville Metro Air Pollution Control District operated four CO monitors in Kentucky.

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:	Same as primary standard.

There were no exceedances of the CO standards in 2003. The last exceedance of a standard occurred on January 7, 1998 at Ashland site 21-019-0014 when an 8-hour average of 11.7 ppm was recorded. All Kentucky counties are currently in attainment of the standards for carbon monoxide.

Statewide and regional carbon monoxide levels have declined substantially since 1980, primarily due to improved emission controls on motor vehicles (see Figure 1).

A statistical summary of carbon monoxide data collected in 2003 follows on page 8.

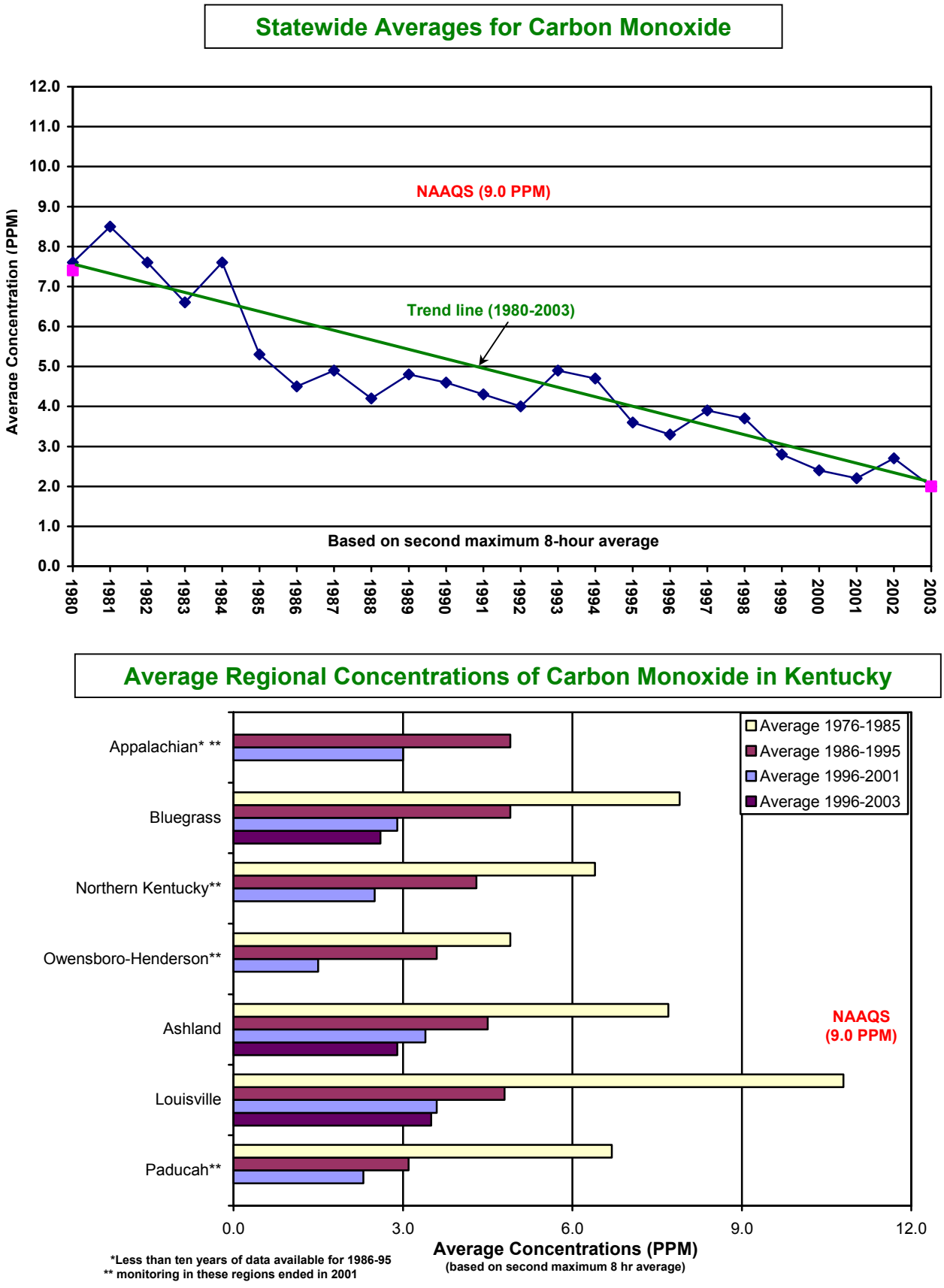
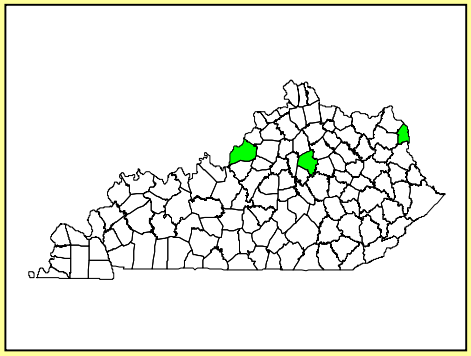


Figure 1. Carbon Monoxide trends

Criteria Pollutant Summary Report - 2003

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



National Ambient Air Quality Standards (NAAQS)

Primary NAAQS: 1-Hour Average 35 PPM
8-Hour Average 9 PPM
Secondary NAAQS: Same as Primary Standard

County	Site	AIRS-ID	# Obs	1-Hr Averages			8-Hr Averages		
				1st max	2nd max	Obs> 35.0	1st max	2nd max	Obs > 9.0
Boyd	2924 Holt Street Ashland	21-019-0017	4209	3.4	2.1	0	1.6	1.2	0
Fayette	650 Newtown Pike Lexington	21-067-0012	4256	2.4	2.1	0	1.3	.9	0
Jefferson [1]	3510 Goldsmith Lane Louisville	21-111-0046	8686	3.1	2.8	0	2.6	2.1	0
Jefferson [1]	1735 Bardstown Road Louisville	21-111-1019	8482	5.8	5.6	0	3.6	3.3	0

[1] Carbon monoxide monitors located in Jefferson County are operated by the Louisville Metro Air Pollution Control District.

Sulfur Dioxide

Sulfur dioxide (SO_2) is a colorless gas that has a pungent odor at concentrations exceeding 0.5 ppm. Sulfur dioxide 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 sulfur dioxide. Other industrial sources include petroleum refineries and paper mills.

The primary health effect of sulfur dioxide is that it aggravates pre-existing respiratory, cardiovascular and pulmonary diseases. Asthmatics, children and the elderly are especially susceptible to the effects of sulfur dioxide pollution. Sulfur dioxide can also damage the foliage of trees and agricultural crops. It can also combine with moisture in the atmosphere to form sulfuric acid (H_2SO_4), which is a component of acid precipitation that causes acidification of soil and water and the erosion of building surfaces.

Sulfur dioxide is measured continuously by analyzers that use the ultraviolet (UV) fluorescence method. Fluorescent analyzers irradiate an ambient air sample with ultraviolet light. Sulfur dioxide molecules absorb a portion of this energy, then re-emit the energy at a characteristic wavelength of light. The light energy emitted by the sulfur dioxide molecules is proportional to the concentration of sulfur dioxide 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 by telemetry for entry into an automated data storage system. In 2003 the Division for Air Quality and the Louisville Metro Air Pollution Control District operated twelve SO_2 monitors in Kentucky.

Primary NAAQS:	Annual Arithmetic Mean not to exceed 0.03 ppm. 24-hour concentrations not to exceed 0.14 ppm more than once per year.
Secondary NAAQS:	3-hour concentrations not to exceed 0.50 ppm more than once per year.

There were no exceedances of any of the sulfur dioxide standards in 2003. The last exceedance of a sulfur dioxide standard occurred in November 1981 when the monitor at Louisville site 21-111-0032 recorded a 24-hour average of 0.159 ppm. Statewide and regional sulfur dioxide levels have declining trends over the past twenty years due at least in part to successful efforts of power plants to curb SO_2 emissions (see Figure 2).

A statistical summary of sulfur dioxide data collected in 2003 follows on page 11.

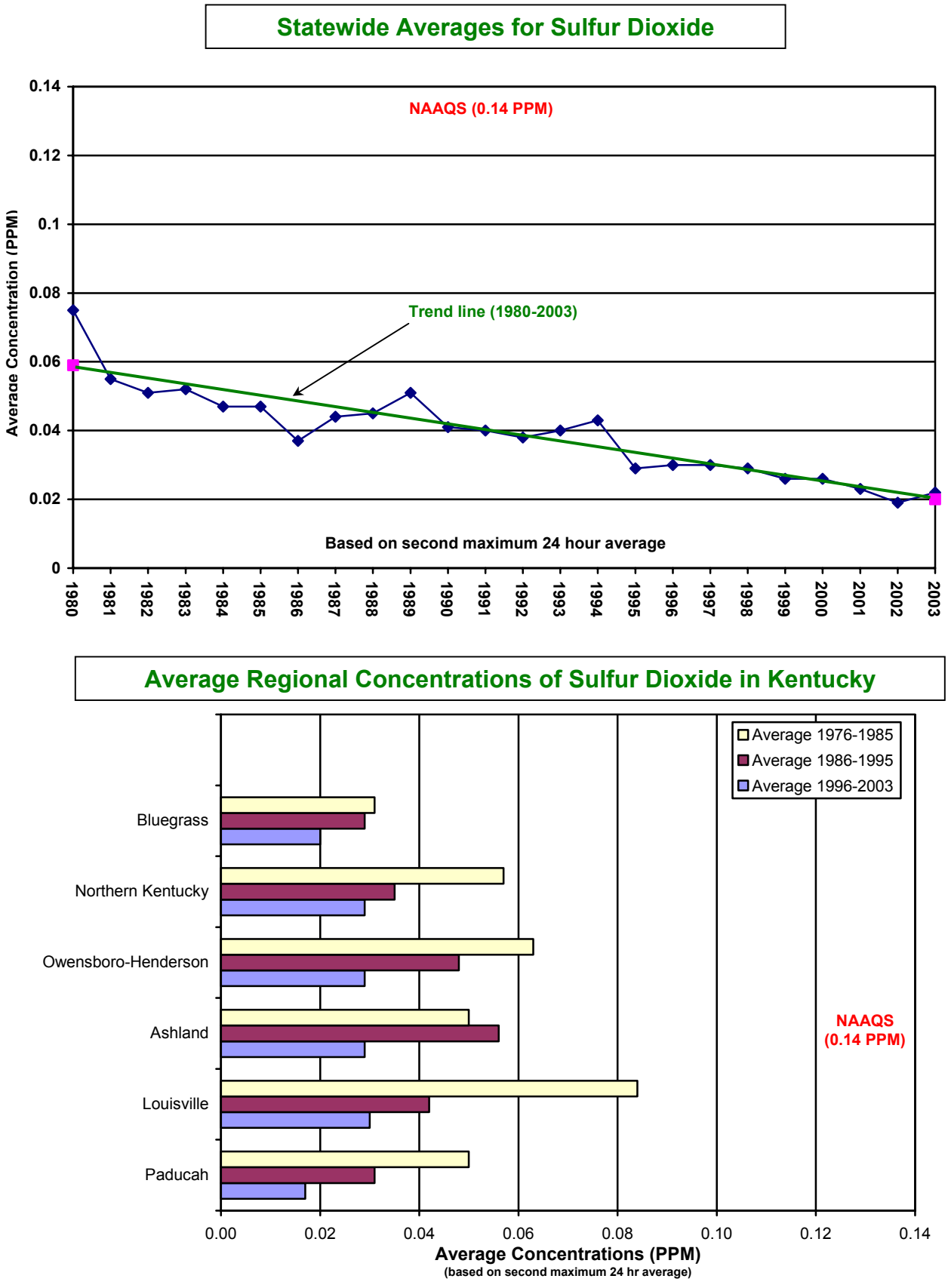
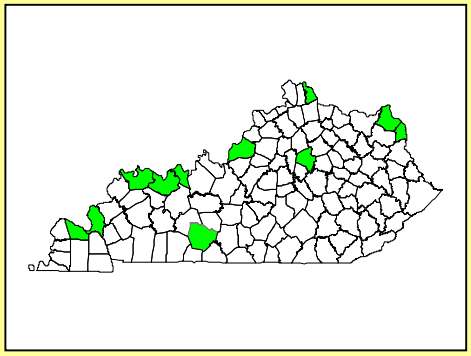


Figure 2. Sulfur Dioxide trends

Criteria Pollutant Summary Report - 2003

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



National Ambient Air Quality Standards (NAAQS)

Primary NAAQS:	Annual Arithmetic Mean	0.03 PPM
	24-Hour Average	0.14 PPM
Secondary NAAQS:	3-Hour Average	0.50 PPM

County	Site	AIRS-ID	# Obs	Annual Mean	24-Hr Average			3-Hr Average		
					1st max	2nd max	Obs> .14	1st max	2nd max	Obs> .50
Boyd	2924 Holt Street Ashland	21-019-0017	8616	.004	.034	.023	0	.091	.063	0
Campbell	700 Alexandria Pike Fort Thomas	21-037-0003	8418	.005	.027	.026	0	.077	.075	0
Daviess	US 60 and Pleasant Valley Rd, Owensboro	21-059-0005	8679	.004	.029	.027	0	.074	.065	0
Fayette	650 Newtown Pike Lexington	21-067-0012	8569	.004	.017	.016	0	.036	.034	0
Greenup	Scott & Center Streets Worthington	21-089-0007	8614	.004	.036	.026	0	.084	.065	0
Hancock	2nd & Caroline Avenue Lewisport	21-091-0012	8654	.004	.026	.026	0	.066	.059	0
Henderson	Baskett Fire Dept Baskett	21-101-0014	7073	.003	.034	.022	0	.096	.094	0
Jefferson[1]	7201 Watson Lane Louisville	21-111-0051	8707	.005	.027	.023	0	.087	.085	0
Jefferson[1]	4201 Algonquin Pkwy Louisville	21-111-1041	8714	.005	.030	.030	0	.115	.105	0
Livingston	763 Bloodworth Road off KY 453	21-139-0004	8604	.003	.023	.022	0	.065	.044	0
McCracken	2901 Powell Street Paducah	21-145-1024	8639	.003	.019	.014	0	.023	.022	0
Warren	Oakland Elementary School, Oakland	21-227-0008	8452	.002	.012	.011	0	.022	.019	0

[1] Sulfur dioxide monitors located in Jefferson County are operated by the Louisville Metro Air Pollution Control District.

Nitrogen Dioxide

Nitrogen dioxide is a reddish brown gas that is produced during the high temperature combustion of fossil fuels. 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 nitrogen dioxide 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 nitrogen dioxide include motor vehicles, power plants, incinerators, industrial boilers and some chemical processes.

The primary health effect of nitrogen dioxide is as a lung irritant, which can cause an increase in respiratory rate, a decrease in lung function and can increase the susceptibility of the respiratory system to infection. Nitrogen dioxide can also be considered detrimental to human health due to its association in the formation of ozone and the resulting health effects caused by that pollutant. Nitrogen dioxide is also a contributor to the formation of acid precipitation, which can damage plant and aquatic life and cause the deterioration of stone and masonry-type buildings and statues.

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 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 stream is reacted 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. That stream is then reacted with ozone, which will provide 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 NO value obtained by the first stream from the NO_x value obtained in the second stream, a NO_2 value is obtained. Data from the analyzer is transmitted by telemetry for entry into an automated data storage system. In 2003 the Division for Air Quality and the Louisville Metro Air Pollution Control District operated eight nitrogen dioxide monitors in Kentucky.

Primary NAAQS:	Annual Arithmetic Mean not to exceed 0.05 ppm.
Secondary NAAQS:	Same as primary standard.

There were no exceedances of the NO_2 standard in 2003 and there have been no recorded exceedances of the NAAQS since the inception of sampling in 1970. Statewide and regional nitrogen dioxide levels show steady downward trends primarily due to the use of pollution control devices on motor vehicles, power plants and industrial boilers (see Figure 3).

A statistical summary of nitrogen dioxide data collected in 2003 follows on page 14.

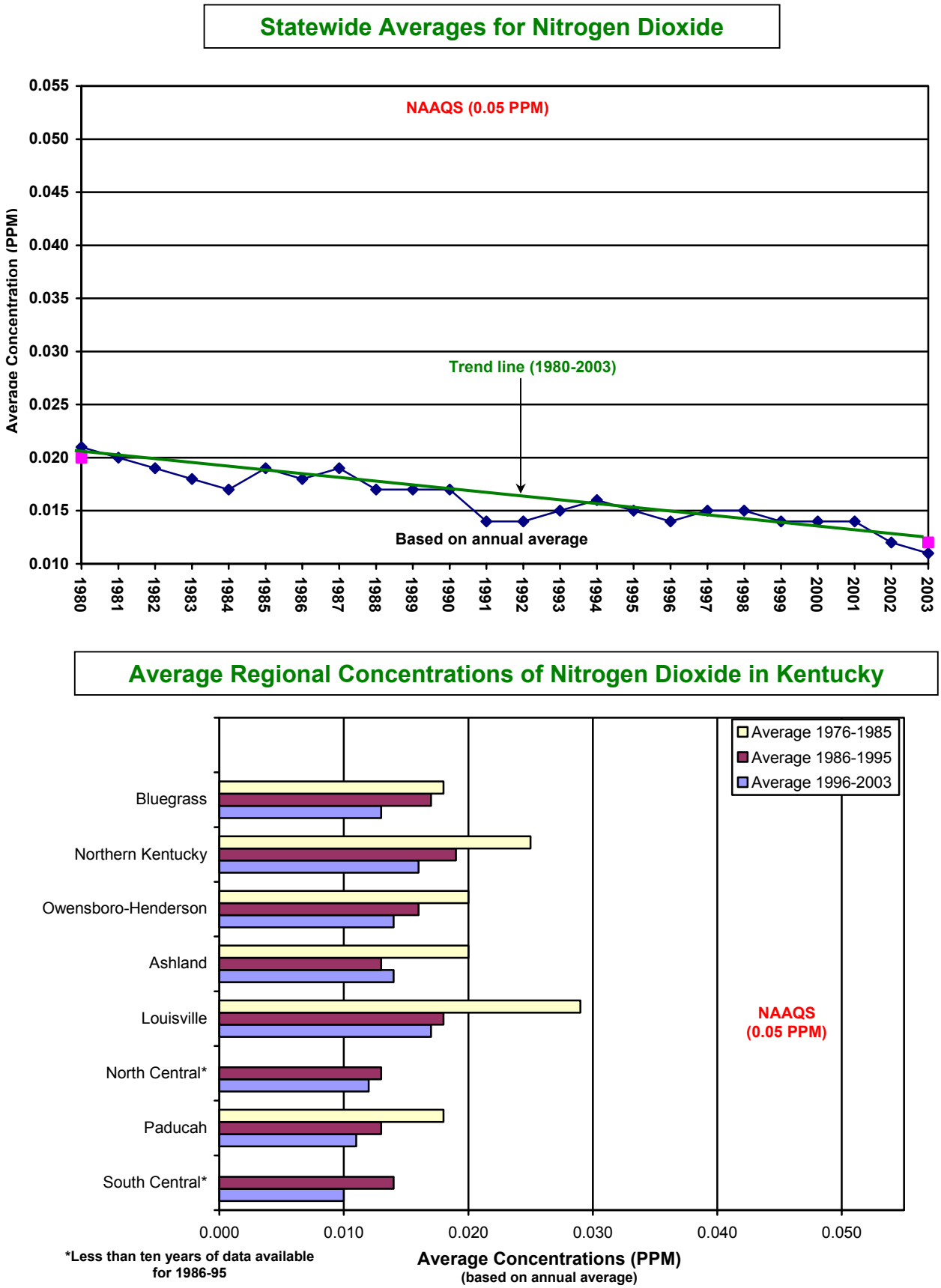


Figure 3. Nitrogen Dioxide trends

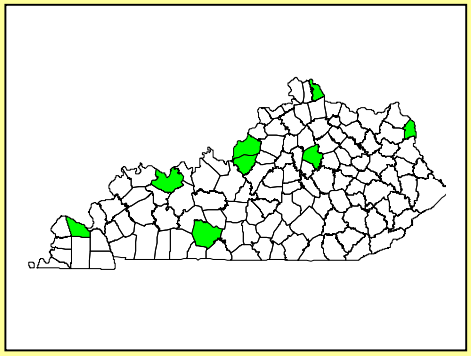
Criteria Pollutant Summary Report - 2003

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

National Ambient Air Quality Standards (NAAQS)

Primary NAAQS: Annual Arithmetic Mean 0.05 PPM

Secondary NAAQS: Same as Primary Standard



County	Site	AIRS-ID	# Obs	Mean	1-Hr Average	
					1st max	2nd max
Boyd	2924 Holt Street Ashland	21-019-0017	8085	.010	.088	.059
Bullitt	2nd & Carpenter Streets Shepherdsville	21-029-0006	7716	.010	.050	.046
Campbell	700 Alexandria Pike Fort Thomas	21-037-0003	7891	.011	.055	.046
Daviess	US 60 and Pleasant Valley Road Owensboro	21-059-0005	8246	.010	.053	.047
Fayette	650 Newtown Pike Lexington	21-067-0012	8068	.012	.057	.056
Jefferson[1]	1918 Mellwood Avenue Louisville	21-111-1021	8690	.018	.059	.056
McCracken	2901 Powell Street Paducah	21-145-1024	8161	.009	.059	.059
Warren	Oakland Elementary School Oakland	21-227-0008	7858	.010	.057	.053

[1] Nitrogen dioxide monitors located in Jefferson County are operated by the Louisville Metro Air Pollution Control District.

Ozone

Ozone is a colorless gas that is not emitted directly into the atmosphere from sources but forms in the atmosphere from a photochemical reaction between volatile organic compounds and nitrogen oxides in the presence of sunlight. Sources of volatile organic compounds include motor vehicle exhaust, dry cleaning and paint solvents and evaporation of gasoline from storage and transfer facilities. Sources of nitrogen oxides include emissions from motor vehicles, boilers, incinerators and power plants.

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 or ground level ozone causes irritation of the respiratory system and is particularly harmful to those persons with asthma and circulatory problems. Ozone can also cause damage to crops and increase the deterioration of rubber, paints and fabrics.

Ozone is monitored during the period from March 1 thru October 31 each year when meteorological conditions are most conducive to the formation of ozone. During this period, ozone is monitored continuously by analyzers that operate using the ultraviolet photometry method of analysis. In this method, ambient air is drawn into a sample cell and a beam of ultraviolet light is passed thru it. 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 is transmitted by telemetry for entry into an automated data storage system. In 2003 the Division for Air Quality, the National Park Service at Mammoth Cave and the Louisville Metro Air Pollution Control District operated thirty ozone monitors in Kentucky.

Primary NAAQS:	Maximum one-hour average concentration of 0.12 ppm. Average number of expected exceedances per year not to exceed 1.0 over the last three years. Maximum 8-hour average concentration of 0.08 ppm (based on a three-year average of the annual fourth highest daily maximum 8-hour averages).
Secondary NAAQS:	Same as primary standard.

Although the one-hour ozone standard is written with two decimal places, actual monitoring data is recorded to three decimal places and must be rounded to two places for comparison to the standard. Therefore the standard is exceeded when a daily one-hour average is greater than or equal to 0.125 ppm. Additionally the one-hour ozone standard is based on "expected exceedances" rather than actual recorded exceedances. This takes into account periods of missing data caused by monitor malfunction, maintenance and repairs. A formula has been developed to estimate the "expected number of exceedances" that would have occurred if 100% of all possible data values had been

collected. The expected number of exceedances calculated for each monitor is used to determine attainment of the one hour standard. The standard is attained when the expected number of exceedances for a monitor is less than or equal to 1.0 averaged over the last three calendar years. During the period 2001-2003, no monitor had an average expected number of exceedances greater than 1.0 (see one-hour ozone multi-year expected exceedances on pages 20-21).

In November 1997 the U.S. EPA adopted an eight-hour ozone standard based on scientific and medical research, which indicated that extended exposure to lower levels of ozone may be as harmful as short-term exposure to elevated levels. The eight-hour standard is set at 0.08 ppm and is exceeded when an average level of ozone over an eight hour period is 0.085 ppm or greater. The standard is attained if the fourth highest daily 8-hour average for each of the three most recent years are averaged and that average is less than 0.085 ppm. Eight-hour multi-year averages for 2001-2003 can be found on pages 22-23. In 2003 there were 25 exceedances of the 8-hour standard. Only preliminary attainment designations have been made based on eight-hour readings.

There has been a general decline in ozone levels over the past twenty-five years based on one-hour data as seen in Figure 4. This downward trend is the result of emission controls on vehicles, such as catalytic converters, and controls on industrial sources of VOC's and nitrogen oxides.

A statistical summary of one-hour and eight-hour ozone data collected in 2003 follows on pages 18-19.

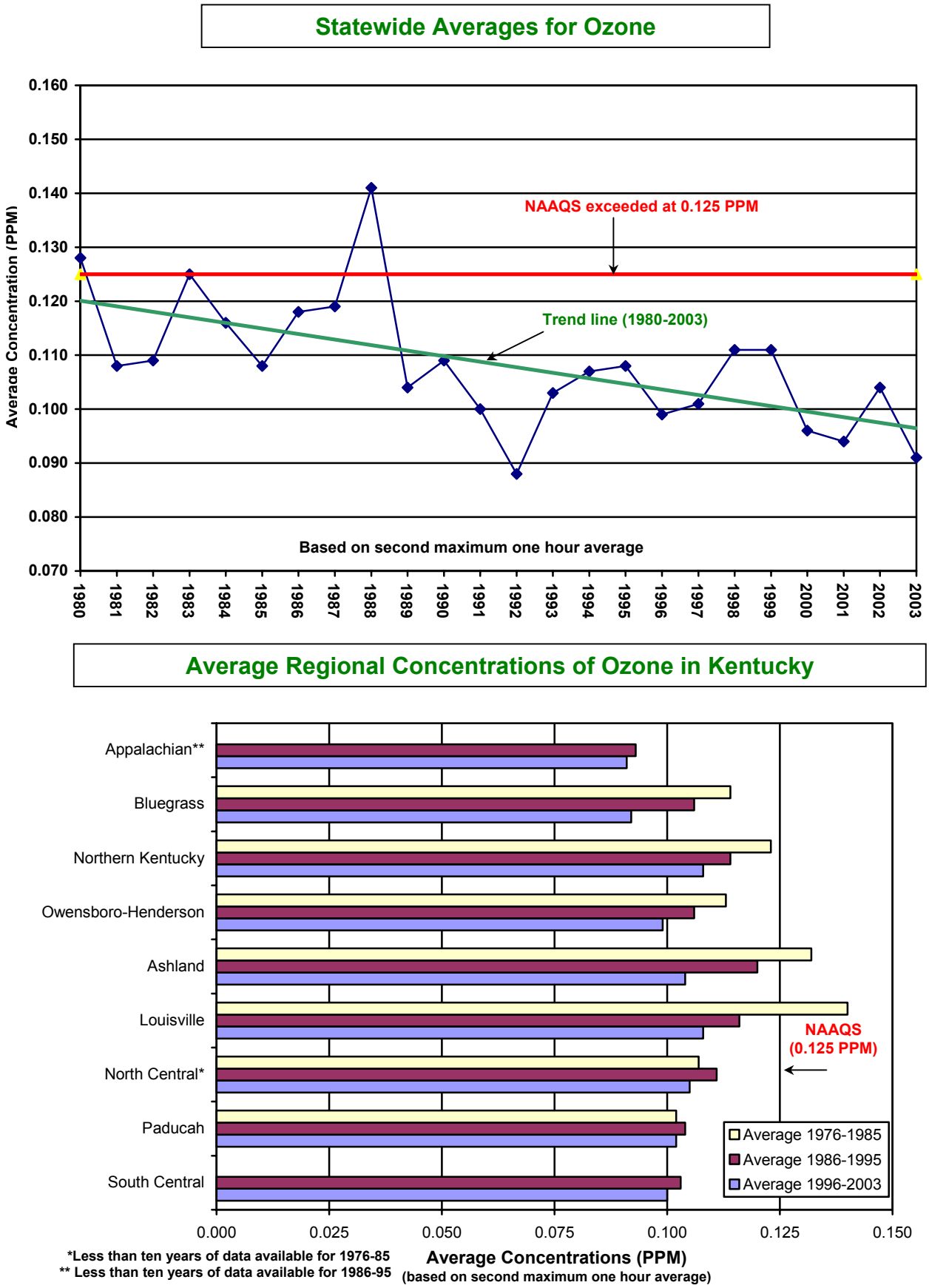


Figure 4. Ozone trends

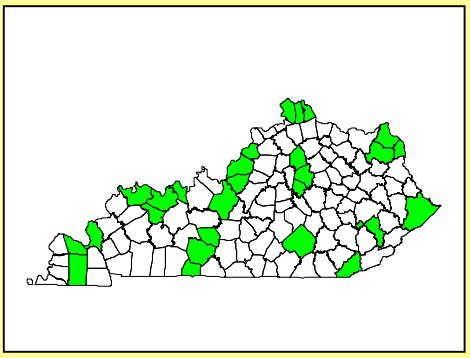
Criteria Pollutant Summary Report - 2003

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

National Ambient Air Quality Standards (NAAQS)

Primary NAAQS: 1-Hour (1 per year/3 years) 0.12 PPM
8-hour (3 year avg of 4th max.) 0.08 PPM

Secondary NAAQS: Same as Primary Standard



County	Site	AIRS-ID	# Obs	1-Hr Average			8-Hr Average				
				Obs> 0.124	1st max	2nd max	Obs> 0.084	1st max	2nd max	3rd max	4th max
Bell	34th & Dorchester Middlesboro	21-013-0002	5858	0	.102	.090	0	.084	.082	.081	.078
Boone	KY 338 & Rabbit Hash Rd, Eastbend	21-015-0003	5682	0	.109	.100	1	.089	.084	.079	.078
Boyd	2924 Holt Street Ashland	21-019-0017	5803	0	.113	.113	6	.106	.099	.088	.088
Bullitt	2nd & Carpenter St Shepherdsville	21-029-0006	5830	0	.090	.086	0	.076	.073	.072	.072
Campbell	700 Alexandria Pike Fort Thomas	21-037-0003	5803	0	.111	.099	4	.093	.091	.087	.085
Carter	Camp Webb Grayson Lake	21-043-0500	5848	0	.100	.087	1	.093	.081	.079	.073
Daviess	US 60 and Pleasant Valley, Owensboro	21-059-0005	5858	0	.090	.085	0	.076	.071	.071	.069
Edmonson[1]	Alfred Cook Road Mammoth Cave	21-061-0501	8270	0	.099	.097	1	.090	.084	.079	.076
Fayette	Iron Works Pike Lexington	21-067-0001	5847	0	.091	.085	1	.085	.081	.074	.074
Fayette	650 Newtown Pike Lexington	21-067-0012	5810	0	.083	.082	0	.077	.072	.071	.070
Graves	Byerly Farm on KY 1949, Symsonia	21-083-0003	5872	0	.104	.092	1	.087	.076	.074	.073
Greenup	Scott & Center St Worthington	21-089-0007	5851	0	.099	.094	1	.094	.084	.080	.078
Hancock	2nd & Caroline Lewisport	21-091-0012	5792	0	.094	.091	0	.080	.078	.077	.077
Hardin	801 North Miles St Elizabethtown	21-093-0006	5850	0	.096	.086	0	.083	.077	.074	.073
Henderson	Baskett Fire Dept. Baskett	21-101-0014	5748	0	.090	.090	0	.083	.079	.079	.078
Jefferson[2]	7601 Bardstown Rd Louisville	21-111-0027	5859	0	.118	.093	1	.096	.082	.076	.072
Jefferson[2]	7201 Watson Lane Louisville	21-111-0051	5861	0	.097	.095	0	.084	.081	.079	.075
Jefferson[2]	1918 Mellwood Ave Louisville	21-111-1021	5869	0	.095	.094	0	.081	.079	.074	.073

Ozone Summary Report Continued

County	Site	AIRS-ID	# Obs	1-Hr Average			8-Hr Average				
				Obs> 0.124	1st max	2nd max	Obs> 0.084	1st max	2nd max	3rd max	4th max
Jessamine	KYDOT, Etter Drive Nicholasville	21-113-0001	5833	0	.099	.088	1	.090	.082	.072	.071
Kenton	1401 Dixie Highway Covington	21-117-0007	5809	0	.104	.098	2	.094	.086	.084	.079
Livingston	KYDOT 811 US 60E Smithland	21-139-0003	5810	0	.101	.096	1	.087	.082	.081	.080
McCracken	2901 Powell Street Paducah	21-145-1024	5791	0	.101	.094	1	.085	.077	.076	.076
McLean	3962 KY 815 Guffie	21-149-0001	5809	0	.100	.091	1	.087	.077	.076	.075
Oldham	DOT Garage, 3995 Morgan Rd, Buckner	21-185-0004	5853	0	.106	.102	2	.088	.085	.082	.082
Perry	Perry Co Horse Park Hazard	21-193-0003	5824	0	.096	.084	0	.084	.079	.076	.075
Pike	101 North Mayo Trail, Pikeville	21-195-0002	5779	0	.087	.083	0	.076	.075	.065	.064
Pulaski	Clifty Street Somerset	21-199-0003	5860	0	.085	.084	0	.077	.077	.076	.075
Scott	Fire Station, KY 32 Sadieville	21-209-0001	5850	0	.079	.076	0	.070	.067	.065	.065
Simpson	KYDOT, HWY 1008 Franklin	21-213-0004	5854	0	.097	.094	0	.084	.083	.079	.077
Warren	Oakland Elementary School, Oakland	21-227-0008	5784	0	.093	.093	0	.079	.079	.077	.076

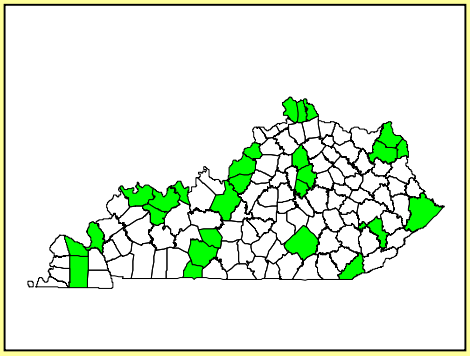
[1] Monitor operated by the National Park Service at Mammoth Cave.
[2] Ozone monitors located in Jefferson County are operated by the Louisville Metro Air Pollution Control District.

Criteria Pollutant Multi-year Summary Report - 2003
3-Year Average of One-hour Expected Exceedances

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

National Ambient Air Quality Standards (NAAQS)

Primary NAAQS: 1-Hour (1 per year/3 years) 0.12 PPM
8-Hour (3-year avg of 4th max.) 0.08 PPM
Secondary NAAQS: Same as Primary Standard



County	Site	AIRS-ID	2001		2002		2003		3 year expected avg
			Actual	Expect	Actual	Expect	Actual	Expect	
Bell	34th & Dorchester Middlesboro	21-013-0002	0	0	0	0	0	0	0.0
Boone	KY 338 & Rabbit Hash Road, Eastbend	21-015-0003	0	0	0	0	0	0	0.0
Boyd	2924 Holt Street Ashland	21-019-0017	*	*	2	2.0	0	0	*
Bullitt	2nd & Carpenter Streets Shepherdsville	21-029-0006	1	1.0	1	1.0	0	0	0.7
Campbell	700 Alexandria Pike Fort Thomas	21-037-0003	0	0	0	0	0	0	0.0
Carter	Camp Webb Grayson Lake	21-043-0500	0	0	0	0	0	0	0.0
Daviess	US 60 & Pleasant Valley Road, Owensboro	21-059-0005	0	0	0	0	0	0	0.0
Edmonson[1]	Alfred Cook Road Mammoth Cave	21-061-0501	0	0	0	0	0	0	0.0
Fayette	Iron Works Pike Lexington	21-067-0001	0	0	0	0	0	0	0.0
Fayette	650 Newtown Pike Lexington	21-067-0012	0	0	0	0	0	0	0.0
Graves	Byerly Farm, KY 1949 Symsonia	21-083-0003	0	0	0	0	0	0	0.0
Greenup	Scott & Center Streets Worthington	21-089-0007	0	0	0	0	0	0	0.0
Hancock	2nd & Caroline Streets Lewisport	21-091-0012	0	0	0	0	0	0	0.0
Hardin	801 North Miles Street Elizabethtown	21-093-0006	0	0	0	0	0	0	0.0
Henderson	Baskett Fire Dept Baskett	21-101-0014	0	0	0	0	0	0	0.0
Jefferson[2]	7601 Bardstown Road Louisville	21-111-0027	0	0	0	0	0	0	0.0
Jefferson[2]	7201 Watson Lane Louisville	21-111-0051	0	0	0	0	0	0	0.0
Jefferson[2]	1918 Mellwood Ave Louisville	21-111-1021	0	0	0	0	0	0	0.0

Ozone 3 Year 1-Hour Averages Continued

County	Site	AIRS-ID	2001		2002		2003		3 year expected Avg
			Actual	Expect	Actual	Expect	Actual	Expect	
Jessamine	KYDOT, Etter Drive Nicholasville	21-113-0001	0	0	0	0	0	0	0.0
Kenton	1401 Dixie Highway Covington	21-117-0007	0	0	0	0	0	0	0.0
Livingston	KYDOT, 811 US 60 East Smithland	21-139-0003	0	0	0	0	0	0	0.0
McCracken	2901 Powell Street Paducah	21-145-1024	0	0	0	0	0	0	0.0
McLean	3962 KY 815 Guffie	21-149-0001	0	0	0	0	0	0	0.0
Oldham	DOT Garage, 3995 Morgan Rd, Buckner	21-185-0004	0	0	0	0	0	0	0.0
Perry	Perry County Horse Park Hazard	21-193-0003	0	0	0	0	0	0	0.0
Pike	101 North Mayo Trail Pikeville	21-195-0002	0	0	0	0	0	0	0.0
Pulaski	Clifty Street Somerset	21-199-0003	0	0	0	0	0	0	0.0
Scott	Fire Station on KY 32 Sadieville	21-209-0001	0	0	0	0	0	0	0.0
Simpson	KYDOT, HWY 1008 Franklin	21-213-0004	0	0	0	0	0	0	0.0
Warren	Oakland Elementary Sch Oakland	21-227-0008	0	0	0	0	0	0	0.0

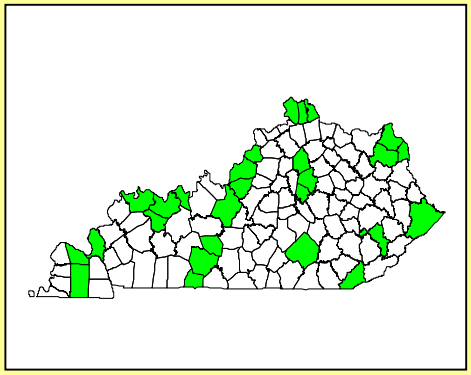
[1] Monitor operated by the National Park Service at Mammoth Cave.
[2] Ozone monitors located in Jefferson County are operated by the Louisville Metro Air Pollution Control District.

Criteria Pollutant Multi-year Summary Report - 2003
8-Hour 4th Maximum 3 Year Average

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

National Ambient Air Quality Standards (NAAQS)

Primary NAAQS: 1-Hour (1 per year/3 year) 0.12 PPM
8-Hour (3-year avg of 4th max.) 0.08 PPM
Secondary NAAQS: Same as Primary Standard



County	Site	AIRS-ID	2001 4th max	2002 4th max	2003 4th max	3 year Avg. 4th max
Bell	34th & Dorchester Middlesboro	21-013-0002	.077	.091	.078	.082
Boone	KY 338 & Rabbit Hash Road Eastbend	21-015-0003	.083	.094	.078	.085
Boyd	2924 Holt Street Ashland	21-019-0017	.085	.102	.088	.091
Bullitt	2nd & Carpenter Streets Shepherdsville	21-029-0006	.082	.091	.072	.081
Campbell	700 Alexandria Pike Fort Thomas	21-037-0003	.088	.102	.085	.091
Carter	Camp Webb Grayson Lake	21-043-0500	.076	.086	.073	.078
Daviess	US 60 & Pleasant Valley Rd Owensboro	21-059-0005	.073	.086	.069	.076
Edmonson[1]	Alfred Cook Road Mammoth Cave	21-061-0501	.080	.085	.076	.080
Fayette	Iron Works Pike Lexington	21-067-0001	.066	.081	.074	.073
Fayette	650 Newtown Pike Lexington	21-067-0012	.078	.080	.070	.076
Graves	Byerly Farm on KY 1949 Symsonia	21-083-0003	.073	.092	.073	.079
Greenup	Scott & Center Streets Worthington	21-089-0007	.088	.084	.078	.083
Hancock	2nd & Caroline Streets Lewisport	21-091-0012	.077	.093	.077	.082
Hardin	801 North Miles Street Elizabethtown	21-093-0006	.080	.084	.073	.079
Henderson	Baskett Fire Dept Baskett	21-101-0014	.074	.087	.078	.079
Jefferson[2]	7601 Bardstown Road Louisville	21-111-0027	.081	.085	.072	.079
Jefferson[2]	7201 Watson Lane Louisville	21-111-0051	.081	.096	.075	.084
Jefferson[2]	1918 Mellwood Avenue Louisville	21-111-1021	.077	.088	.073	.079

Ozone 3 Year 8-Hour Continued

County	Site	AIRS-ID	2001 4th Max	2002 4th Max	2003 4th Max	3 year Avg. 4th max
Jessamine	KYDOT, Etter Drive Nicholasville	21-113-0001	.076	.085	.071	.077
Kenton	1401 Dixie Highway Covington	21-117-0007	.082	.096	.079	.085
Livingston	KYDOT, 811 US 60 East Smithland	21-139-0003	.084	.090	.080	.084
McCracken	2901 Powell Street Paducah	21-145-1024	.077	.086	.076	.079
McLean	3962 KY 815 Guffie	21-149-0001	.078	.095	.075	.082
Oldham	DOT Garage, 3995 Morgan Road, Buckner	21-185-0004	.086	.091	.082	.086
Perry	Perry County Horse Park Hazard	21-193-0003	.072	.083	.075	.076
Pike	101 North Mayo Trail Pikeville	21-195-0002	.075	.082	.064	.073
Pulaski	Clifty Street Somerset	21-199-0003	.077	.081	.075	.077
Scott	Fire Station on KY 32 Sadieville	21-209-0001	.066	.076	.065	.069
Simpson	KYDOT, HWY 1008 Franklin	21-213-0004	.085	.081	.077	.081
Warren	Oakland Elementary School Oakland	21-227-0008	.081	.090	.076	.082

[1] Monitor operated by the National Park Service at Mammoth Cave.
[2] Ozone monitors located in Jefferson County are operated by the Louisville Metro Air Pollution Control District.

Particulate Matter - (PM_{10} / $PM_{2.5}$)

Particulate matter is a broad classification of non-gaseous pollutants that consists of very fine solid particles and liquid droplets or aerosols. Particulates are produced from many sources, including utility plants, wood burning stoves, leaf burning, vehicle exhaust, incinerators, rock quarries, coal processing, smelting, construction, farming and roadways. Common forms of particulates include fly ash, soot, soil, minerals, fibers, metals, oil aerosols and tire rubber.

The primary health effects of particulates are that they aggravate respiratory and cardiovascular disease and in large amounts 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 and may damage vegetation by interfering with plant photosynthesis due to the formation of a film on leaves reducing exposure to sunlight. Particulate pollution can also produce haze, which diminishes visibility and the amount of sunlight reaching the earth.

Particulate matter is categorized according to particle diameter due to the health impacts caused by particles of differing sizes. Particles that are greater than fifty microns (50μm) in diameter rapidly settle out of the air due to gravity and pose a limited health risk. Particles that are less than fifty microns in diameter remain suspended in the air for longer periods and are classified as Total Suspended Particulates (TSP). The larger of these particles (between 10 and 50 microns) rarely penetrate deeply into the human respiratory system but are trapped and removed by the body's natural defenses. Early research on the effects of smaller or "fine particulate matter" indicated that particles ten microns in diameter or less posed the greatest risk to human health. Particulate matter ten microns or less in diameter is referred to as PM_{10} and is a subset of fine particles within the TSP category. Particles in the PM_{10} range are small enough to evade the body's natural defense systems and penetrate into the lungs, where tissue is damaged and the immune system is weakened.

Primary NAAQS: Annual Arithmetic Mean not to exceed 50 $\mu g/m^3$ (based on a three-year avg).

Maximum 24-hour concentration of 150 $\mu g/m^3$. Average number of expected exceedances per year not to exceed 1.0 over last three years.

Secondary NAAQS: Same as primary standard.

As a result of the research on fine particulate matter, the U. S. EPA adopted a PM_{10} standard on July 1, 1987 replacing the previous TSP standard. In 2003, the Division for Air Quality and the Louisville Metro Air Pollution Control District operated a combined network of twenty-two PM_{10} samplers in Kentucky. Most PM_{10} samplers are the intermittent type that operate for twenty-four hours every sixth day. These samplers operate by drawing a measured volume of air thru 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 ten 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 eight continuously operating PM_{10} samplers that provide results daily. These samplers determine sample weights electronically and transmit results by telemetry for entry into an automated data storage system.

There were no exceedances of the PM_{10} standards in 2003. The last PM_{10} exceedance occurred on January 7, 2000 at Louisville site 21-111-0043 where a 24-hour sample of 152 $\mu g/m^3$ was collected. The only other exceedances of a PM_{10} standard occurred on August 27, 1990 in Ashland where a 24-hour value of 182 $\mu g/m^3$ was collected. All Kentucky counties are currently in attainment with the PM_{10} standards. Statewide and regional PM_{10} levels have shown declining trends as seen in Figure 5.

A statistical summary of PM_{10} data collected during 2003 follows on pages 27-28.

$PM_{2.5}$

Medical and scientific research on the health effects of particulate matter continued after the adoption of the PM_{10} standard. As a result of further research it was determined that very fine particles in the 2.5 micron size range have a more adverse effect on human health. In response to these findings the EPA adopted a $PM_{2.5}$ standard, which became effective September 16, 1997.

$PM_{2.5}$ is monitored by intermittent and continuous type samplers that collect samples over a 24-hour run cycle. While most samplers operate every third day some operate every sixth day and some every day. $PM_{2.5}$ sample collection and analysis methods are similar to those for PM_{10}. Sample results are entered into an electronic data storage system. In 2003, the Division for Air Quality and the Louisville Metro Air Pollution Control District operated a network of twenty-three samplers.

Primary NAAQS: Annual Arithmetic Mean not to exceed 15 $\mu g/m^3$ (based on a three-year avg).

24-hour concentration not to exceed 65 $\mu g/m^3$. (based on a three-year average of the annual 98th percentiles).

Secondary NAAQS: Same as primary standard.

There were no exceedances of the 24-hour standard in 2003. Five samplers exceeded the annual standard with four of those occurring in Jefferson County and the fifth in Fayette County. Multi-year annual averages for 2001-2003 can be found on pages 31-32. Only preliminary $PM_{2.5}$ attainment designations have been made at this time.

A statistical summary of 2003 $PM_{2.5}$ data appears on page 29-30.

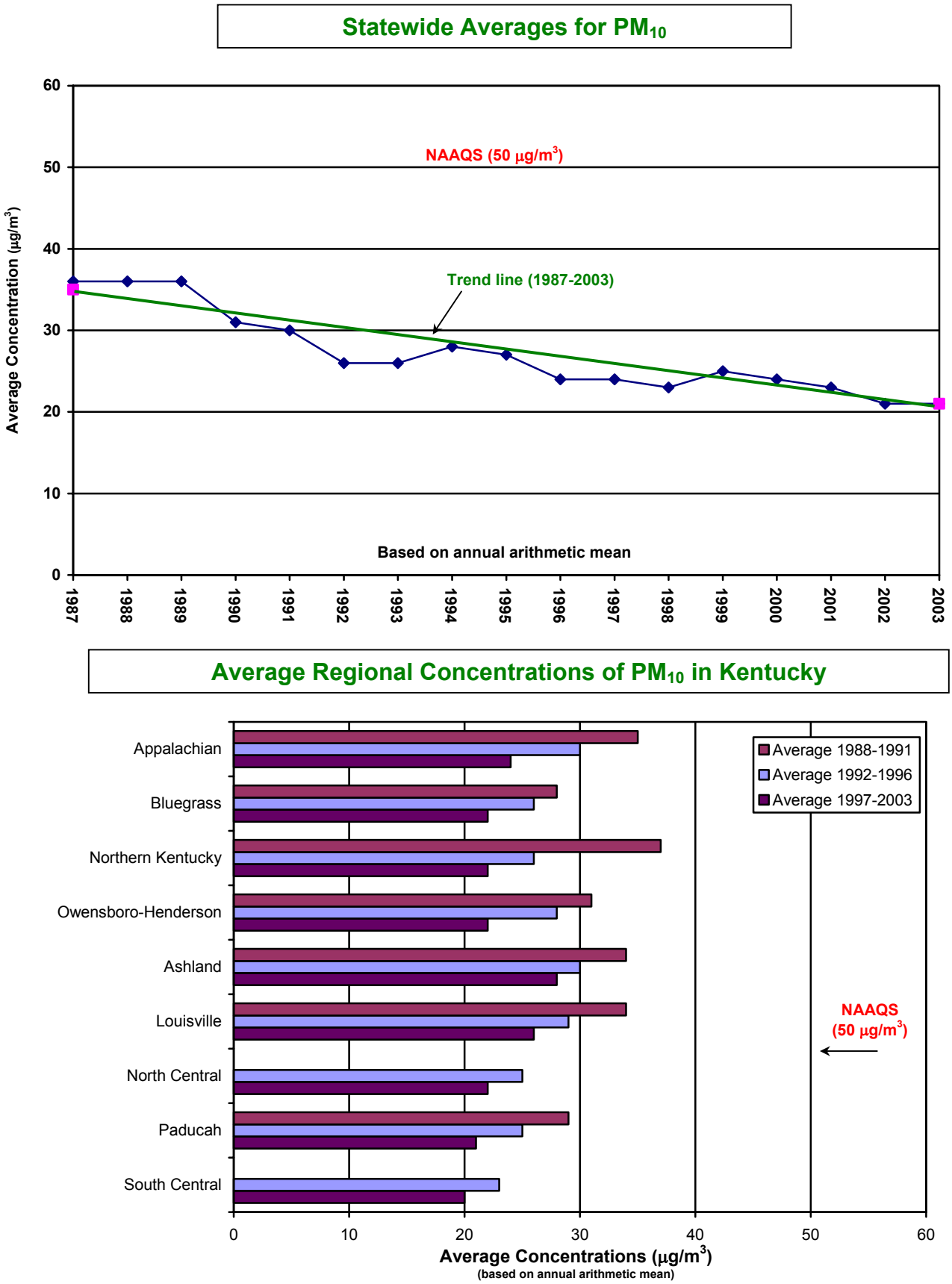


Figure 5. PM_{10} trends

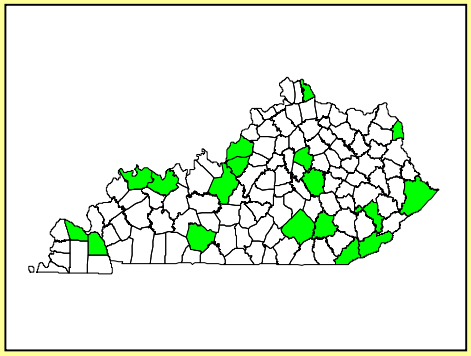
Criteria Pollutant Summary Report - 2003

Pollutant: **Particulate Matter PM_{10}**
Method: Gravimetric
Data Interval: 24-Hour
Units: Micro-grams per cubic meter ($\mu g/m^3$)

National Ambient Air Quality Standards (NAAQS)

Primary NAAQS: Annual Arith Mean (3yr avg) 50 $\mu g/m^3$
24-hour average 150 $\mu g/m^3$

Secondary NAAQS: Same as Primary Standard



County	Site	AIRS-ID	# Obs	Mean	24-hour Average				
					Obs >150	1st max	2nd max	3rd max	4th max
Bell	34th & Dorchester Middlesboro	21-013-0002	61	22	0	55	42	40	36
Boyd	122 22nd Street Ashland	21-019-0002	61	31	0	56	56	54	54
Boyd	2802 Louisa Street Catlettsburg	21-019-2001	61	25	0	51	49	49	44
Bullitt	2nd & Carpenter Street Shepherdsville	21-029-0006	60	22	0	49	46	41	40
Campbell	700 Alexandria Pike Fort Thomas	21-037-0003	197	20	0	55	51	50	49
Daviess	US 60 and Pleasant Valley Rd, Owensboro	21-059-0005	351	19	0	49	47	47	43
Daviess	KY Wesleyan College Owensboro	21-059-0014	56	20	0	45	43	34	34
Fayette	533 South Limestone Lexington	21-067-0014	55	23	0	51	43	42	37
Hardin	801 North Miles Street Elizabethtown	21-093-0006	61	19	0	44	43	42	33
Harlan	110 First Street Harlan	21-095-0003	61	22	0	52	42	36	36
Henderson	Baskett Fire Dept Baskett	21-101-0014	256	21	0	61	50	47	47
Jefferson[1]	37th & Southern Ave Louisville	21-111-0043	305	25	0	76	75	68	60
Jefferson[1]	1032 Beecher Avenue Louisville	21-111-0044	350	24	0	75	65	59	58
Laurel	London-Corbin Airport London	21-125-0004	58	18	0	44	41	35	35
McCracken	342 Lone Oak Road Paducah	21-145-1004	57	19	0	44	38	36	36
McCracken	2901 Powell Street Paducah	21-145-1024	352	20	0	57	54	47	46
Madison	Mayfield School Richmond	21-151-0003	57	20	0	44	42	37	36
Marshall	24 Main Street Calvert City	21-157-0010	59	21	0	43	42	39	35

PM_{10} Summary Report Continued

County	Site	AIRS-ID	# Obs	Mean	24-hour Average				
					Obs >150	1st max	2nd max	3rd max	4th max
Perry	Perry Co. Horse Park Hazard	21-193-0003	59	23	0	50	47	43	42
Pike	101 North Mayo Trail Pikeville	21-195-0002	329	19	0	49	48	47	46
Pulaski	Clifty Street Somerset	21-199-0003	59	19	0	45	44	39	38
Warren	Oakland Ele. School Oakland	21-227-0008	345	17	0	50	48	46	44

[1] PM_{10} samplers located in Jefferson County are operated by the Louisville Metro Air Pollution Control District.

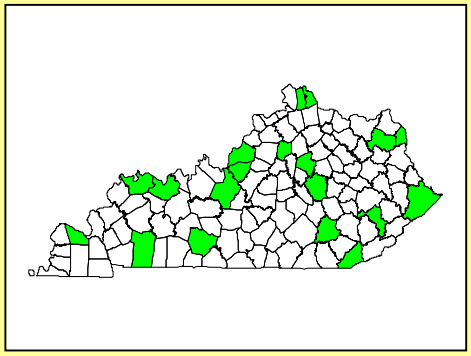
Criteria Pollutant Summary Report - 2003

Pollutant: **Particulate Matter $PM_{2.5}$**
Method: Gravimetric
Data Interval: 24-Hour
Units: Micro-grams per cubic meter ($\mu g/m^3$)

National Ambient Air Quality Standards (NAAQS)

Primary NAAQS: Annual Arithmetic Mean (3yr avg) 15$\mu g/m^3$
24-hour (3yr avg of 98th percentile) 65$\mu g/m^3$

Secondary NAAQS: Same as Primary Standard



County	Site	AIRS-ID	# Obs	Mean	24-Hour Average				
					Obs >65	1st max	2nd max	3rd max	4th max
Bell	34th & Dorchester Middlesboro	21-013-0002	58	14.2	0	42.2	32.7	22.3	21.4
Boyd	2924 Holt Street Ashland	21-019-0017	110	13.9	0	37.7	37.4	33.8	30.7
Bullitt	2nd & Carpenter Street Shepherdsville	21-029-0006	115	14.4	0	40.7	38.9	34.8	31.2
Campbell	700 Alexandria Pike Fort Thomas	21-037-0003	112	13.4	0	32.6	29.7	28.1	27.8
Carter	Camp Webb Grayson Lake	21-043-0500	111	11.4	0	31.3	29.7	26.7	26.3
Christian	10800 Pilot Rock Road Hopkinsville	21-047-0006	103	13.9	0	39.0	38.3	36.8	34.5
Daviess	KY Wesleyan College Owensboro	21-059-0014	98	14.6	0	45.5	36.5	34.8	34.4
Fayette	650 Newtown Pike Lexington	21-067-0012	109	13.8	0	28.9	28.6	28.3	28.0
Fayette	533 South Limestone Lexington	21-067-0014	104	15.0	0	43.6	30.0	29.1	28.6
Franklin	803 Schenkel Lane Frankfort	21-073-0006	116	13.1	0	36.4	31.2	30.3	28.5
Hardin	801 North Miles Street Elizabethtown	21-093-0006	104	13.4	0	39.9	34.5	32.4	26.7
Henderson	Basket Fire Dept Baskett	21-101-0014	107	13.8	0	47.5	35.8	32.5	31.4
Jefferson[1]	37th & Southern Avenue Louisville	21-111-0043	335	16.0	0	44.0	43.2	42.6	40.9
Jefferson[1]	1032 Beecher Avenue Louisville	21-111-0044	316	15.4	0	53.5	44.8	42.3	41.5
Jefferson[1]	850 Barret Avenue Louisville	21-111-0048	108	15.5	0	43.0	42.1	35.5	32.5
Jefferson[1]	7201 Watson Lane Louisville	21-111-0051	57	14.9	0	37.3	33.0	31.1	29.8
Kenton	1401 Dixie Highway Covington	21-117-0007	107	14.3	0	31.9	31.9	30.8	29.6
Laurel	London-Corbin Airport London	21-125-0004	55	12.1	0	28.3	24.5	23.1	21.8

$PM_{2.5}$ Summary Report Continued

County	Site	AIRS-ID	# Obs	Mean	24-hour Average				
					Obs >65	1st max	2nd max	3rd max	4th max
McCracken	342 Lone Oak Road Paducah	21-145-1004	102	13.8	0	43.6	36.3	31.0	29.3
Madison	Mayfield School Richmond	21-151-0003	112	12.9	0	31.3	31.2	28.1	26.3
Perry	Perry Co Horse Park Hazard	21-193-0003	57	13.3	0	37.3	28.3	22.5	22.5
Pike	101 North Mayo Trail Pikeville	21-195-0002	114	13.1	0	62.2	43.0	30.5	29.5
Warren	Kereiakes Park Bowling Green	21-227-0007	107	13.3	0	36.2	32.7	30.2	29.1

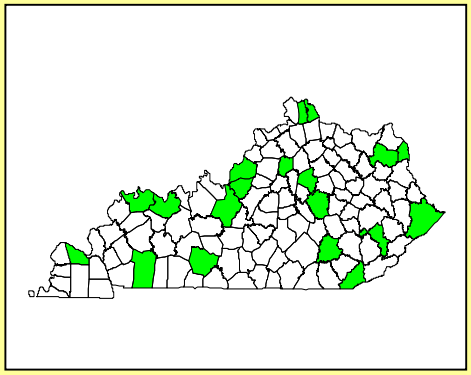
[1] $PM_{2.5}$ samplers located in Jefferson County are operated by the Louisville Metro Air Pollution Control District.

Criteria Pollutant Multi-year Summary Report - 2003
Annual Arithmetic Mean 3-Year Average

Pollutant: **Particulate Matter $PM_{2.5}$**
Method: Gravimetric
Data Interval: 24-Hour
Units: Micro-grams per cubic meter ($\mu g/m^3$)

National Ambient Air Quality Standards (NAAQS)

Primary NAAQS: Annual Arithmetic Mean (3 yr avg) 15$\mu g/m^3$
24-hour (3-yr avg of 98th percentile) 65$\mu g/m^3$
Secondary NAAQS: Same as Primary Standard



County	Site	AIRS-ID	2001 mean	2002 mean	2003 mean	3 year Avg.
Bell	34th & Dorchester Middlesboro	21-013-0002	15.1	14.3	14.2	14.5
Boyd	2924 Holt Street Ashland	21-019-0017	15.3	15.5	13.9	14.9
Bullitt	2nd & Carpenter Streets Shepherdsville	21-029-0006	15.6	14.7	14.4	14.9
Campbell	700 Alexandria Pike Fort Thomas	21-037-0003	13.4	14.8	13.4	13.9
Carter	Camp Webb Grayson Lake	21-043-0500	12.4	12.4	11.4	12.1
Christian	10800 Pilot Rock Road Hopkinsville	21-047-0006	13.5	13.1	13.9	13.5
Daviess	KY Wesleyan College Owensboro	21-059-0014	15.2	14.6	14.6	14.8
Fayette	650 Newtown Pike Lexington	21-067-0012	15.7	15.1	13.8	14.9
Fayette	533 South Limestone Lexington	21-067-0014	16.2	15.6	15.0	15.6
Franklin	803 Schenkel Lane Frankfort	21-073-0006	13.9	13.7	13.1	13.6
Hardin	801 North Miles Street Elizabethtown	21-093-0006	14.6	14.0	13.4	14.0
Henderson	Baskett Fire Dept Baskett	21-101-0014	14.2	14.2	13.8	14.1*
Jefferson[1]	37th & Southern Avenue Louisville	21-111-0043	18.7	17.2	16.2	17.3**
Jefferson[1]	1032 Beecher Avenue Louisville	21-111-0044	17.7	17.5	15.6	16.9
Jefferson[1]	850 Barrett Avenue Louisville	21-111-0048	16.9	16.4	15.7	16.3
Jefferson[1]	7201 Watson Lane Louisville	21-111-0051	16.3	15.7	15.3	15.7
Kenton	1401 Dixie Highway Covington	21-117-0007	15.3	15.1	14.3	14.9
Laurel	London-Corbin Airport London	21-125-0004	-	13.0	12.1	-

$PM_{2.5}$ Annual Arithmetic Mean 3 Year Average Continued

County	Site	AIRS-ID	2001 4th Max	2002 4th Max	2003 4th Max	3 year Avg. 4th max
McCracken	342 Lone Oak Road Paducah	21-145-1004	14.1	12.6	13.8	13.5
Madison	Mayfield School Richmond	21-151-0003	13.9	13.5	12.9	13.4
Perry	Perry County Horse Park Hazard	21-193-0003	14.3	13.0	13.3	13.5
Pike	101 North Mayo Trail Pikeville	21-195-0002	14.5	13.6	13.1	13.7
Warren	Kereiakes Park Bowling Green	21-227-0007	14.8	13.3	13.3	13.8

* This average includes data for 2001-2002 from site 21-101-0006 where this sampler was located prior to being moved to site 21-101-0014 in 2003.

** This average includes data for 2001 from site 21-111-1041 where this sampler was located prior to being moved to site 21-111-0043 in 2002.

[1] $PM_{2.5}$ samplers located in Jefferson County are operated by the Louisville Metro Air Pollution Control District.

Industrial Data

Various industries within the Commonwealth of Kentucky operate air monitoring networks and subsequently report the data from these networks to the Division for Air Quality. Monitoring activity designed to measure the background levels of selected pollutants prior to construction of a proposed source or the expansion of an existing source is termed PSD (Prevention of Significant Deterioration of air quality) monitoring. This type of network is normally set up to operate for approximately one year. Monitoring designed to measure the impact of new or expanded sources on the air quality of an area is termed post-construction monitoring. A third type of monitoring is termed compliance monitoring and is usually set up around existing sources to demonstrate compliance with permit conditions and ambient air standards.

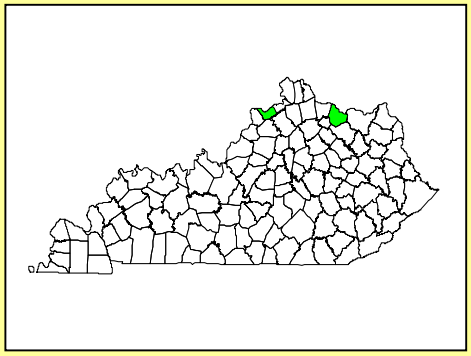
Regardless of the type of monitoring undertaken by these industrial networks, all must meet the following requirements.

- The Division must receive and approve a copy of the monitoring plan for each network prior to commencement of monitoring.
- A member of the Technical Services Branch of the Division for Air Quality must inspect the monitoring site(s) before monitoring begins to ensure that applicable siting criteria are met.
- Operators of networks with CO, SO_2, and NO_2 monitors must use gaseous standards that are traceable to National Institute of Standards and Technology (NIST) gaseous Standard Reference Materials (SRM) to generate test concentrations.
- Test concentrations of O_3 must be obtained in accordance with the UV photometric calibration procedure specified in 40 CFR Part 50, Appendix D, or by means of a certified ozone transfer standard.
- Flow measurements must be made with a flow measuring device that is referenced to an authoritative volume or other standard.
- All samplers and monitors used for monitoring criteria pollutants must be approved as EPA reference or equivalent methods.
- All monitors are audited once each calendar quarter by a member of the Division's Quality Assurance Section.
- Air monitoring reports from these networks are due at the Division for Air Quality no later than 90 days after the end of each calendar quarter. These air monitoring reports are to consist of the raw data from each network (usually on a 3.5" diskette), a missing data report (explaining any gaps in the data), monitor calibrations, results from the biweekly precision checks carried out on each automated analyzer, audit reports, and copies of sections of the strip charts (only when requested).

The data from each network is reviewed for completeness and accuracy and to determine if there are any exceedances of any primary or secondary pollutant standards. A letter of receipt is sent to the operator of each network when their data has been received and reviewed. If corrections are deemed necessary, the network operator is notified so the corrections can be made and the data resubmitted.

A statistical summary of industrial data collected in 2003 follows on pages 34-37.

Industrial - Criteria Pollutant Summary Report - 2003
Sites Operated by Industry



Pollutant: **Particulate Matter PM_{10}**
Method: Gravimetric
Data Interval: 24-Hour
Units: Micro-grams per cubic meter ($\mu g/m^3$)

National Ambient Air Quality Standards (NAAQS)

Primary NAAQS: Annual Arith Mean (3yr avg) 50 $\mu g/m^3$
24-hour average 150 $\mu g/m^3$
Secondary NAAQS: Same as Primary Standard

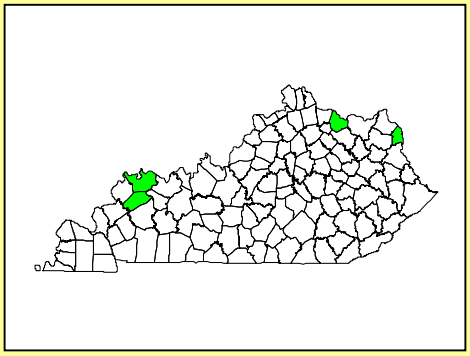
County	Site	Facility-ID	# Obs	Annual Mean	Obs >150	1st max	2nd max	3rd max	4th max
Carroll	US Highway 42 Ghent	North American Stainless	59	29	0	100	89	53	51
Mason	KY 576 Maysville	East Kentucky Power	61	14	0	43	34	32	30

Industrial - Criteria Pollutant Summary Report - 2003
Sites Operated by Industry

Pollutant: **Sulfur Dioxide**
Method: Ultra-Violet Fluorescence
Data Interval: Hourly
Units: Parts-per-million (PPM)

National Ambient Air Quality Standards (NAAQS)

Primary NAAQS:	Annual Arithmetic Mean	0.03 PPM
	24-Hour Average	0.14 PPM
Secondary NAAQS:	3-Hour Average	0.50 PPM



County	Site	Facility-ID	# Obs	Annual Mean	24-Hr Average			3-Hr Average		
					1st max	2nd max	Obs >.14	1st max	2nd max	Obs >.50
Henderson	US 41 & KY 2096 Sebree	Western KY Electric	8242	.003	.038	.031	0	.132	.075	0
Henderson	KY 2097 Sebree	Western KY Electric	8336	.006	.075	.071	0	.325	.283	0
Mason	KY 576 Maysville	East Kentucky Power	8297	.003	.028	.025	0	.128	.085	0
Webster	Bell Gibson Road	Western KY Electric	8130	.006	.168	.122	1	.349	.288	0
Wayne, WV	Spring Brook Dr Kenova, WV	Ashland-Marathon	8658	.008	.045	.042	0	.073	.065	0
Wayne, WV	Route 52 Neal, WV	Ashland-Marathon	8624	.009	.062	.032	0	.116	.112	0
Wayne, WV	Big Sandy Road Neal, WV	Ashland-Marathon	8656	.008	.063	.039	0	.157	.105	0

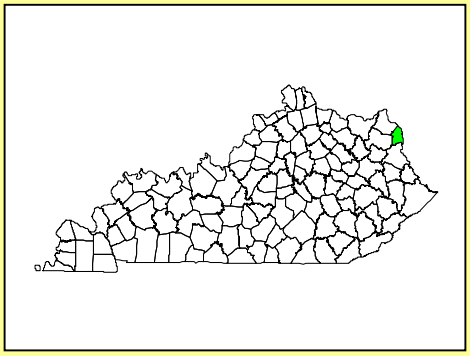
Industrial - Criteria Pollutant Summary Report - 2003
Sites Operated by Industry

Pollutant: **Nitrogen Dioxide**
Method: Instrumental/Chemiluminescence
Data Interval: Hourly
Units: Parts-per-million (PPM)

National Ambient Air Quality Standards (NAAQS)

Primary NAAQS: Annual Arithmetic Mean 0.05 PPM

Secondary NAAQS: Same as Primary Standard



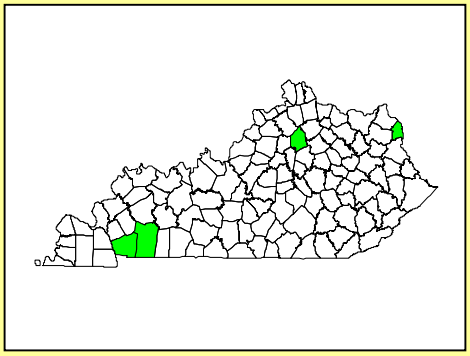
County	Site	Facility-ID	# Obs	Annual Mean	1-Hr Average	
					1st max	2nd max
Wayne, WV	Spring Brook Drive, Kenova, WV	Ashland-Marathon	8511	.014	.092	.091

Industrial - Criteria Pollutant Summary Report - 2003
Sites Operated by Industry

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

National Ambient Air Quality Standards (NAAQS)

Primary NAAQS: 1-Hour (1 per year/3 years) 0.12 PPM
8-Hour (3 year avg of 4th max.) 0.08 PPM
Secondary NAAQS: Same as Primary Standard



County	Site	Facility-ID	# Obs	1-Hr Average			8-hour Average				
				Obs >0.12	1st max	2nd max	Obs >0.08	1st max	2nd max	3rd max	4th max
Christian	10800 Pilot Rock Rd Hopkinsville	TVA	5834	0	.095	.094	2	.086	.085	.083	.080
Scott	4673 Muddy Ford Rd Oxford	Toyota	5405	0	.087	.087	0	.082	.080	.080	.078
Trigg	Mulberry Flat Road Land Between Lakes	TVA	5542	0	.095	.087	0	.080	.073	.073	.070
Wayne, WV	Spring Brook Drive Kenova, WV	Ashland-Marathon	8699	0	.111	.102	3	.104	.085	.085	.081

National Air Toxics Trends Network

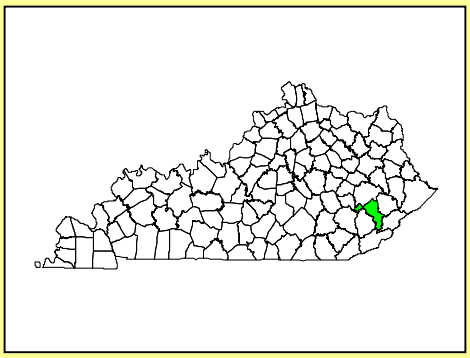
In 2003 the EPA designated the Division for Air Quality's Hazard air monitoring site part of the National Air Toxics Trends Network. This network, along with its urban counterparts, were established to provide toxics trends data on a national basis. Data generated by these monitors are needed to understand the behavior of air toxics in the atmosphere and to develop control strategies.

Toxic air pollutants include substances known or suspected to cause neurological, immunological, reproductive and respiratory disorders, as well as known or suspected human carcinogens. The EPA has identified twenty-three hazardous air pollutants that are to be monitored in the National Air Toxics Trends study. These pollutants can be subdivided into three monitoring groups: carbonyls, metals and volatile organic compounds (VOC's). These compounds are sampled using carbonyl samplers with DNPH cartridges, high-volume PM_{10} samplers and passivated SUMMA canisters. These samplers operate for 24-hours on every sixth day after which the samples are collected and sent to the Division for Environmental Services laboratory in Frankfort for analysis. The results of the laboratory analysis are sent to the Division for Air Quality where they are entered in the AQS data storage and retrieval system.

A statistical summary of the data collected in 2003 follows on page 39.

Rural Trends Toxics Network - 2003

Agency: Kentucky Division For Air Quality
Site ID: 21-193-0003
County: Perry
Location: Hazard



Parameter	# of Samples	Units	1st max	2nd max	3rd max	4th max	Median Value
1,3-Butadiene	52	ppb	ND	ND	ND	ND	-
Benzene	52	ppb	2.69	1.61	1.31	1.28	0.62
Acrylonitrile	52	ppb	ND	ND	ND	ND	-
Carbon tetrachloride	52	ppb	ND	ND	ND	ND	-
Chloroform	52	ppb	ND	ND	ND	ND	-
cis-1,3 Dichloropropene	48	ppb	ND	ND	ND	ND	-
1,2-Dibromomethane	52	ppb	ND	ND	ND	ND	-
1,2-Dichloroethane	48	ppb	.085	ND	ND	ND	-
1,3-Dichloropropene	52	ppb	ND	ND	ND	ND	-
1,2-Dichloropropane	52	ppb	ND	ND	ND	ND	-
Methylene chloride	30	ppb	0.99	0.52	0.42	0.26	0.255
Tetrachloroethene	48	ppb	0.85	0.54	0.48	0.36	0.27
1,1,2,2 Tetrachloroethane	48	ppb	ND	ND	ND	ND	-
Trichloroethene	48	ppb	0.11	0.07	ND	ND	0.09
Vinyl chloride	52	ppb	ND	ND	ND	ND	-
Formaldehyde	21	ppb	3.0	2.8	2.5	1.9	1.25
Acetaldehyde	21	ppb	0.8	0.7	0.7	0.7	0.54
Arsenic	57	ng/m^3	8.87	4.66	4.57	3.58	1.68
Beryllium	57	ng/m^3	ND	ND	ND	ND	-
Cadmium	57	ng/m^3	1.18	1.12	1.04	0.95	0.35
Chromium	57	ng/m^3	6.67	4.65	4.36	3.43	1.48
Lead	57	ng/m^3	32.9	16.3	15.7	12.8	4.88
Manganese	57	ng/m^3	15.1	13.6	12.3	11.9	5.35
Nickel	57	ng/m^3	9.44	3.08	2.89	2.56	1.26

ND – Pollutant not detected at the lowest detection limit of the analyzing instrument

Wet Deposition

Wet deposition (sometimes referred to as "acid rain") is a classification of pollutants that are precipitation borne. Snow, sleet, hail, rain or fog can combine with pollutants in the atmosphere and fall to earth as harmful acidic compounds. Acidified rainwater may contain combinations of sulfuric and nitric acids that form when water vapor and sulfur dioxide and nitrogen oxides react. Major sources of sulfur dioxide include power plants, paper and wood pulp processing plants and facilities with coal fired boilers. Nitrogen oxides are produced primarily from the combustion of fossil fuels in the engines of cars, trucks and other vehicles and from power plant emissions.

Aquatic life appears to be most sensitive to the effects of acidic precipitation. Small changes in the pH levels of lakes and streams may prevent some fish species and other aquatic life forms from reproducing. Many insects cannot survive in acidic waters and therefore birds and mammals that depend on insects for food may suffer abnormally high mortality rates. Acidic precipitation can also alter soil chemistry and nutrient availability, in turn weakening trees and shrubs and causing them to be more vulnerable to insects, diseases and fungus infestations. Acid precipitation may also damage agricultural crops and has been blamed for deterioration of monuments and building surfaces.

Wet deposition monitoring stations operate on a weekly sampling schedule. Cumulative precipitation events occurring during a seven day period are collected in one container to represent a one-week sample. An automatic wet/dry precipitation collector is used to collect the sample. The sampler consists of two collection containers. The "wet" container is fitted with a clean plastic sample bag for collection of precipitation. The "dry" container, designed for dry particulate collection is not presently utilized for sample collection. The sampler employs a moisture sensor, which activates an electrically driven movable container lid that covers the wet container during dry periods and then moves to cover the dry container when precipitation occurs. At the end of each weekly sampling period, the wet container is removed and replaced with a new, clean container for the next sampling period. After the sample is removed, field measurements of pH and conductivity are made and recorded. The remaining sample is then shipped to Frankfort where laboratory analysis is conducted to determine levels for pH, conductivity, acidity, sulfates, nitrates, phosphates, ammonia and metal ions. In 2003, the Division for Air Quality operated one acid rain site at Grayson Lake State Park. The National Park Service at Mammoth Cave also operated a wet deposition sampler in 2003 and data from that sampler are included.

Annual pH averages for both sites have shown modest upward trends since 1985 meaning that rainfall is gradually becoming less acidic (see Figure 6). This improvement is due at least in part to successful efforts of power plants to curb sulfur dioxide and nitrogen dioxide emissions.

A statistical summary of wet deposition data collected in 2003 follows on pages 42-43.

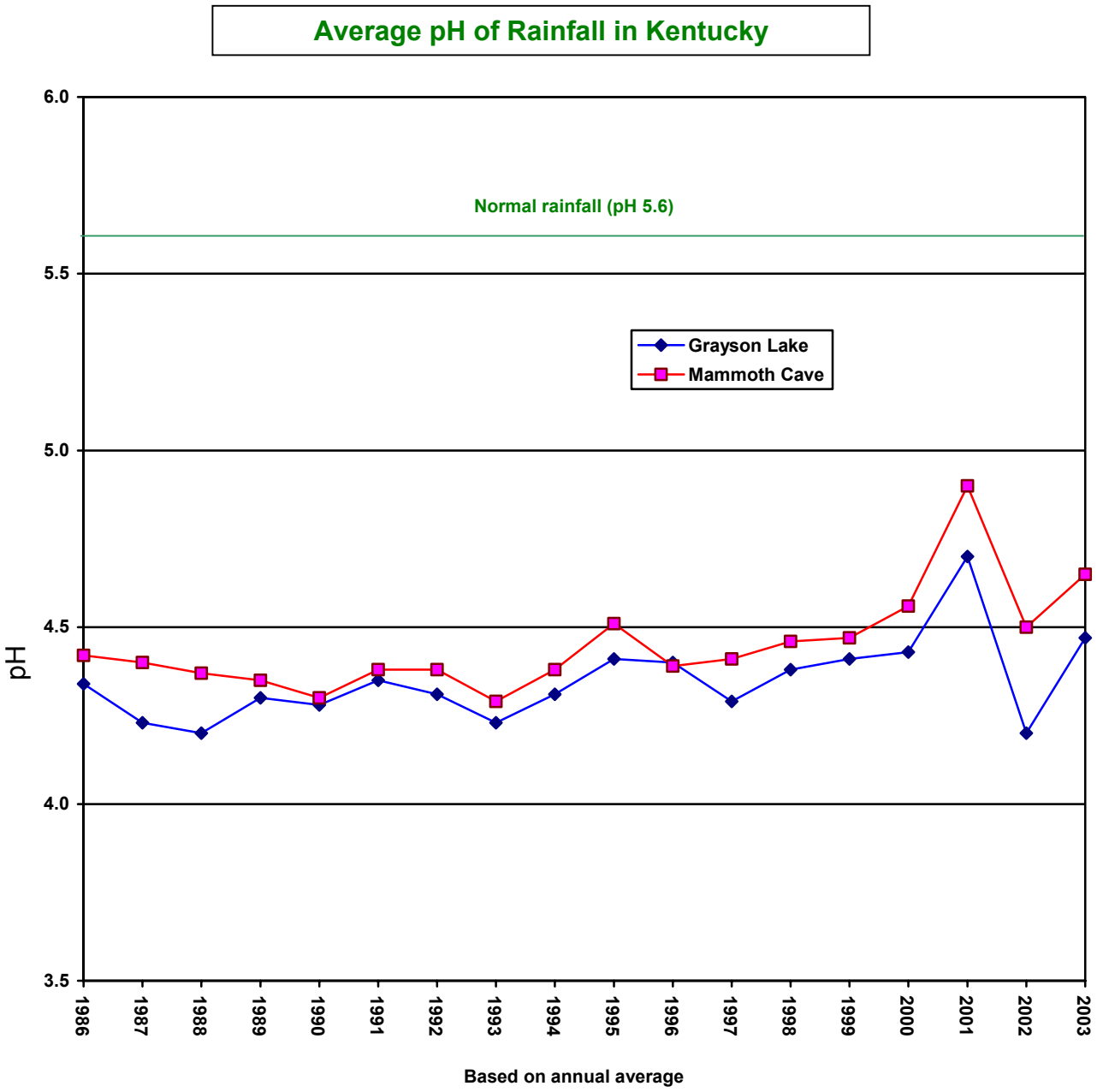


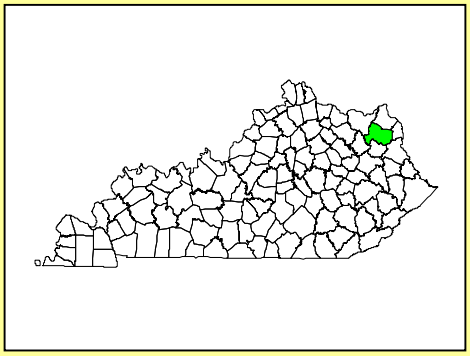
Figure 6. pH trends

Acid Rain Pollutants Summary Report - 2003

Agency: Kentucky Division for Air Quality

Site ID: 21-043-0500
County: Carter
Location: Grayson Lake
Camp Webb

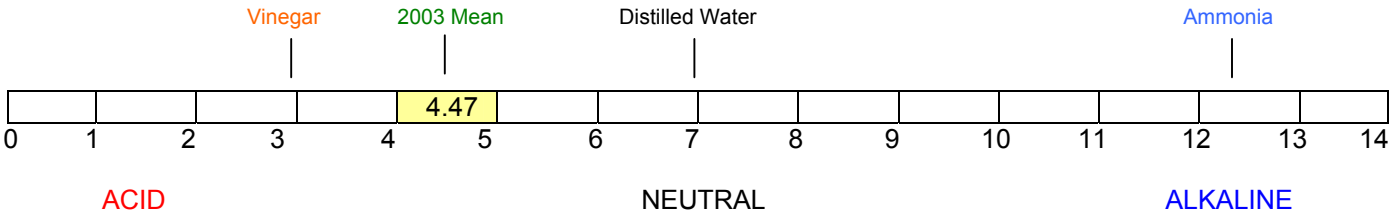
Method: Wet/Dry Collector
Laboratory Analytical



Parameter	Units	# Obs	Arithmetic Mean	1st Max	2nd Max	3rd Max	4th Max
Acidity	Mg/L	49	4.5	14.1	8.8	7.2	6.9
Ammonia	Mg/L	45	0.27	0.85	0.71	0.68	0.54
Calcium	Mg/L	25	0.63	2.32	1.43	1.33	1.33
Chloride	Mg/L	31	0.18	0.76	0.63	0.47	0.41
Conductivity	µmho	47	18.3	43.6	38.4	38.0	37.4
Magnesium	Mg/L	16	0.13	0.44	0.24	0.23	0.18
Nitrate	Mg/L	47	1.33	4.96	3.77	3.44	3.34
Potassium	Mg/L	22	0.37	0.57	0.54	0.54	0.5
Sodium	Mg/L	9	0.4	2.16	0.24	0.21	0.19
Sulfate	Mg/L	48	1.62	6.01	3.88	3.63	2.98

pH is measured on a scale ranging from zero to fourteen where neutral substances such as distilled water are around seven on the scale. The more acidic substances such as vinegar would be on the lower end of the scale while alkaline substances such as ammonia would be on the upper end of the scale. The chart below indicates where the pH measurements for 2003 at Grayson Lake fall on this scale.

pH Scale

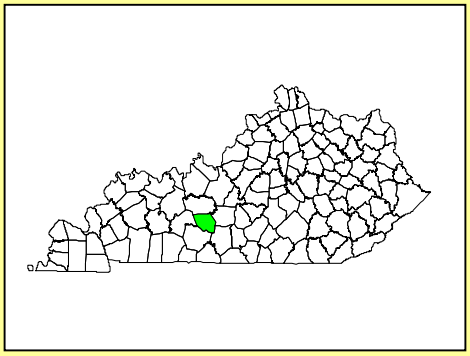


Acid Rain Pollutants Summary Report - 2003

Agency: National Parks Service

Site Id: 21-061-0501
County: Edmonson
Location: Mammoth Cave National Park
Alfred Cook Road

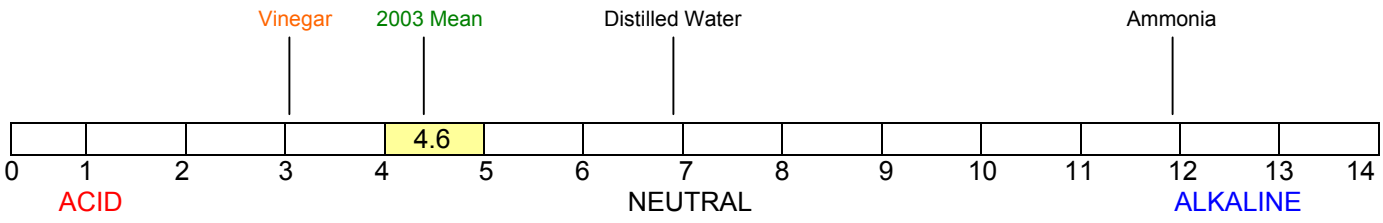
Method: Wet/Dry Collector
Laboratory Analytical



Parameter	Units	# Obs	Arithmetic Mean	1st Max	2nd Max	3rd Max	4th Max
Acidity	Mg/L	-	-	-	-	-	-
Ammonia	Mg/L	50	0.4	1.3	1.2	1.1	0.8
Calcium	Mg/L	49	0.2	1.3	0.9	0.6	0.6
Chloride	Mg/L	50	0.1	0.4	0.3	0.3	0.3
Conductivity	μmho	50	20.2	90.6	61.0	53.2	41.7
Magnesium	Mg/L	49	0.02	0.9	0.8	0.7	0.7
Nitrate	Mg/L	50	1.6	5.4	4.8	4.4	3.6
Potassium	Mg/L	50	0.04	0.6	0.1	0.1	0.1
Sodium	Mg/L	50	0.1	0.3	0.2	0.2	0.2
Sulfate	Mg/L	50	2.0	7.9	6.0	5.3	5.1

pH is measured on a scale ranging from zero to fourteen where neutral substances such as distilled water are around seven on the scale. The more acidic substances such as vinegar would be on the lower end of the scale while alkaline substances such as ammonia would be on the upper end of the scale. The chart below indicates where the pH measurements for 2003 at Mammoth Cave fall on this scale.

pH Scale



Speciation Charts

The promulgation of the new $PM_{2.5}$ Standards may require all future areas not meeting the Standards to reduce emissions of fine particulates and their precursors. Efficient air quality management requires knowing which sources contribute to the problem and estimating how much. However, determining $PM_{2.5}$ source contributions is very complicated due to the fact that often half or more of the $PM_{2.5}$ mass is composed 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, 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:

- Helping to implement 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 effect to $PM_{2.5}$ constituents
- Understanding the effect of atmospheric constituents on visibility impairment
- Using the speciated particulate data to aid in monitoring network design and siting adjustment.

The approach to be used for chemical speciation involves both sampling and analysis components. The target group 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 analytes, each series of analytes requires sample collection on the appropriate media and utilization of the appropriate analytical techniques. Listed below are the target analytes and the analytical techniques used:

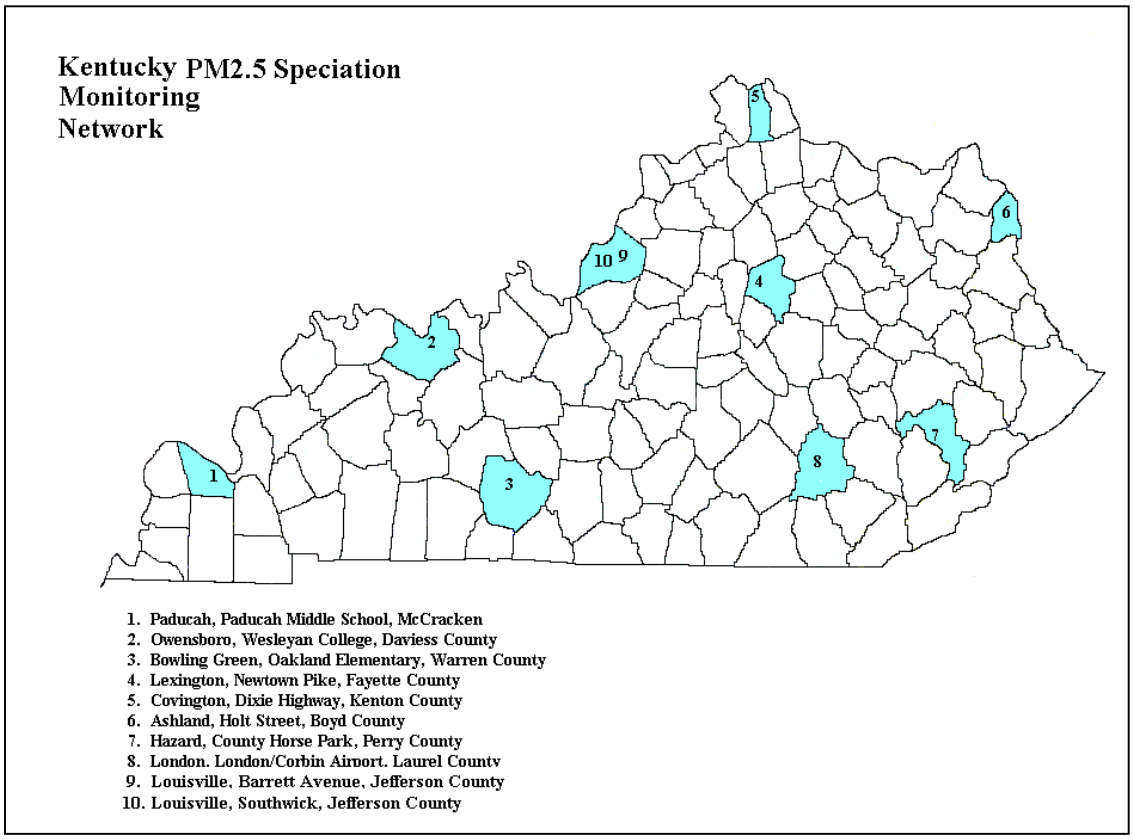
- Trace elements — X-ray fluorescence and particle induced X-ray emission
- Anion and cations — Ion chromatography
- Carbon — Controlled-combustion/thermal optical

Once analysis is complete, the analytes are grouped into the target chemical species listed below. These species in turn can be linked to source categories that ultimately can be used to assist in understanding $PM_{2.5}$ and developing control strategies needed to reduce ambient levels.

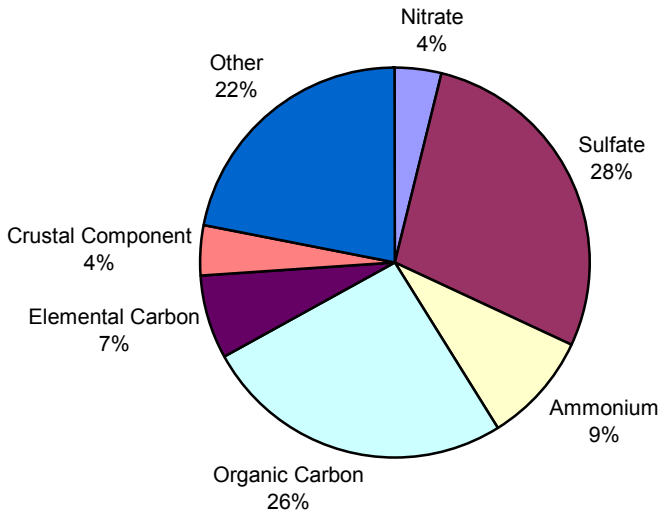
- Nitrate (total)
- Sulfate
- Ammonium
- Organic Carbon
- Elemental Carbon
- Crustal Component (trace elements, fine soil)
- Other ($PM_{2.5}$ mass unaccounted for by analytical methods)

In 2003 the Kentucky Division for Air Quality operated a network of eight Speciation Trends Network sites and the Louisville Metro Air Pollution Control District operated two. The sites are strategically located to address different types of land use ranging from heavy industrial,

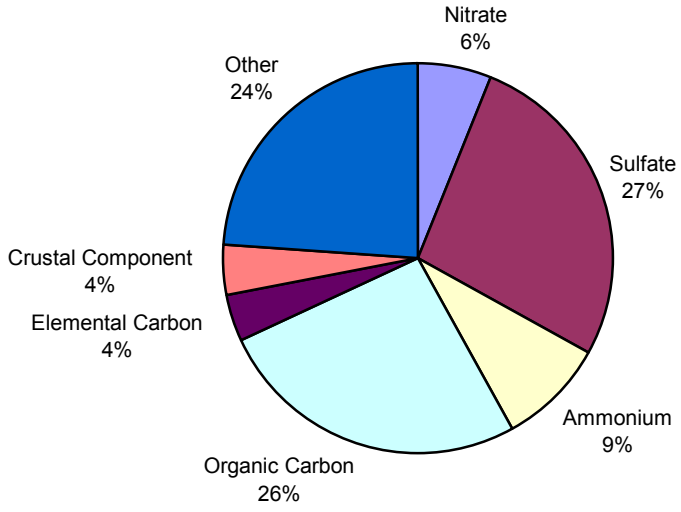
urban, and rural. The charts on pages 46-49 provide a visual representation of speciation data collected at each site during 2003.



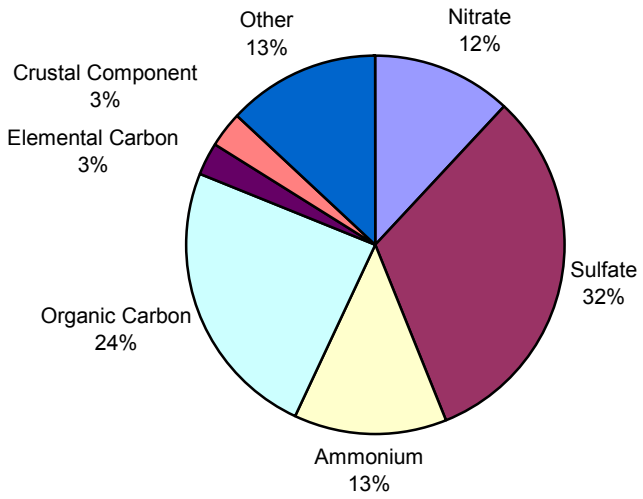
Hazard – Perry County Horse Park
AIRS Code 211930003 POC 5 (ROUTINE)
Date(s): 1/3/03 – 12/29/03
Average Concentration ($\mu g/m^3$)



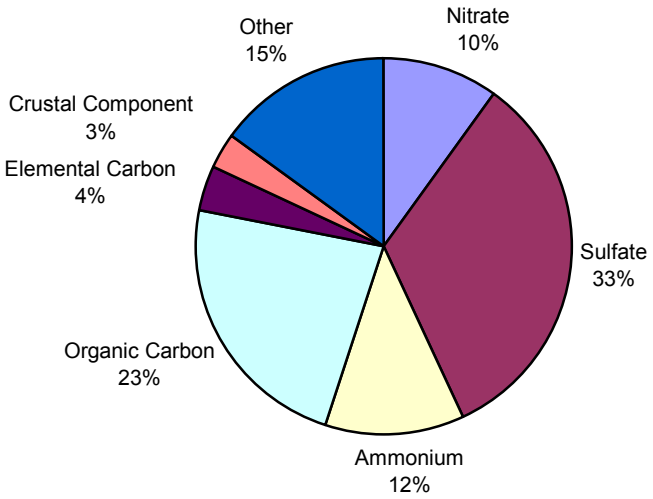
London Laurel County
AIRS Code 211250004 POC 5 (ROUTINE)
Date(s): 1/3/03 – 12/29/03
Average Concentration ($\mu g/m^3$)



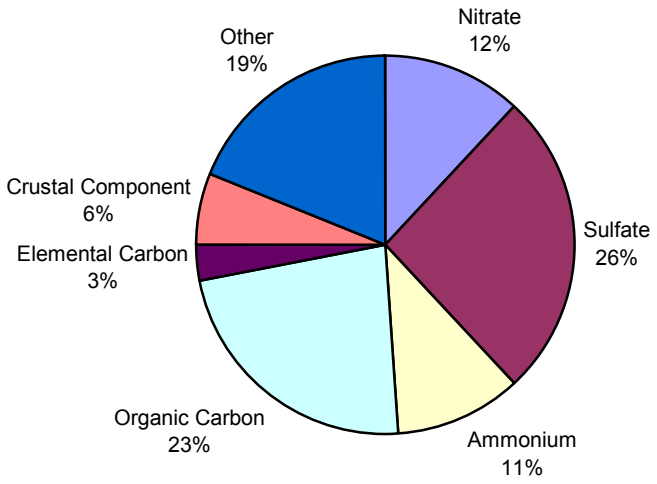
Lexington Health Department
AIRS Code 210670012 POC 5 (ROUTINE)
Date(s): 1/3/03 – 12/11/03
Average Concentration (μg/m^3)



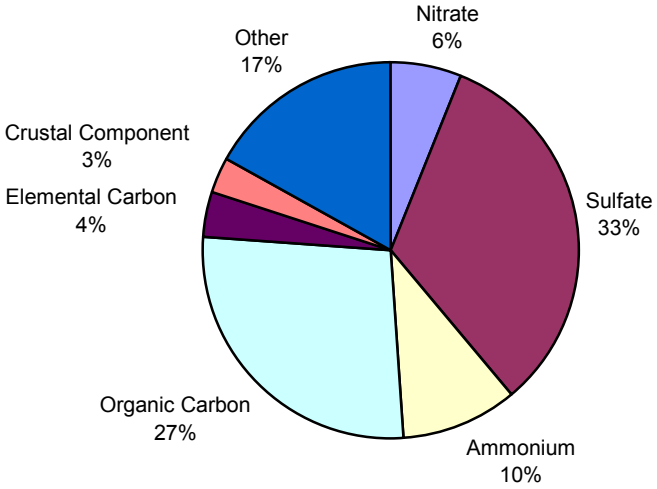
Covington – University College
AIRS Code 211170007 POC 5 (ROUTINE)
Date(s): 1/3/03 – 12/11/03
Average Concentration (μg/m^3)



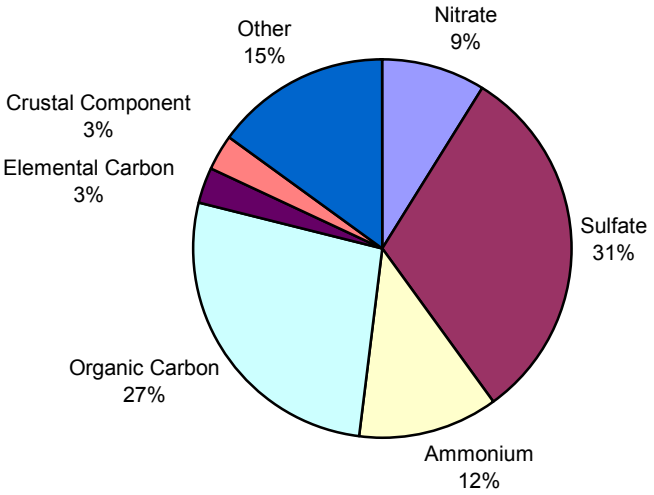
Owensboro - KY Wesleyan College
AIRS Code 210590014 POC 5 (ROUTINE)
Date(s): 1/3/03 – 12/29/03
Average Concentration ($\mu g/m^3$)



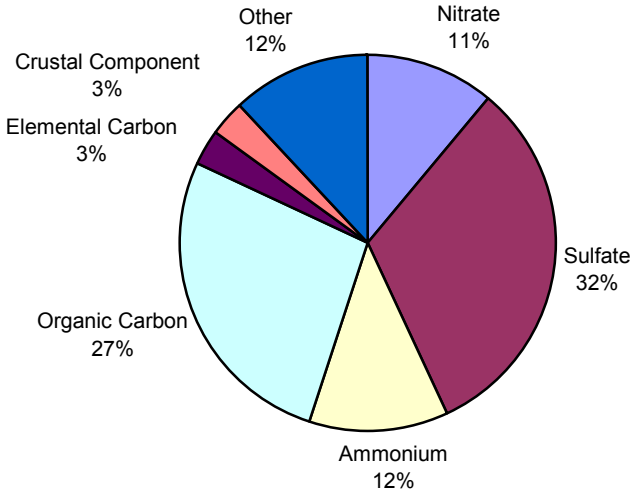
Ashland Health Department
AIRS Code 210190017 POC 5 (ROUTINE)
Date(s): 1/3/03 – 12/11/03
Average Concentration ($\mu g/m^3$)



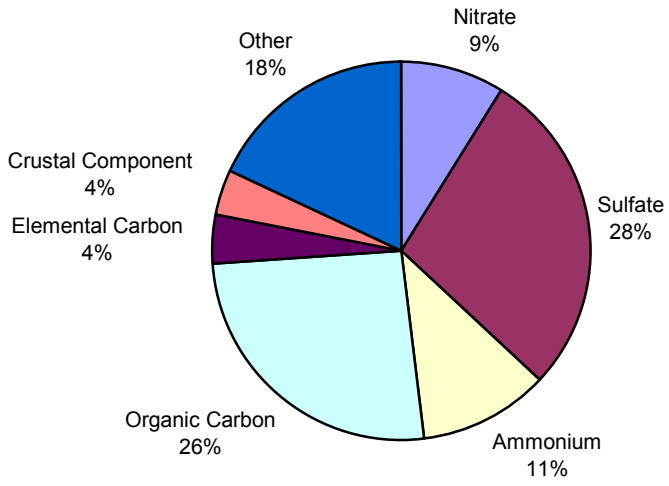
Paducah Middle School
AIRS Code 211451004 POC 5 (ROUTINE)
Date(s): 1/3/03 – 12/29/03
Average Concentration ($\mu g/m^3$)



Bowling Green – Kereiakes Park
AIRS Code 212270007 POC 5 (ROUTINE)
Date(s): 1/3/03 – 12/29/03
Average Concentration ($\mu g/m^3$)



Southwick Community Center
AIRS Code 211110043 POC 5 (ROUTINE)
Date(s): 1/3/03 – 12/29/03
Average Concentration ($\mu g/m^3$)



LMAPCD (Barret)
AIRS Code 212270007 POC 5 (ROUTINE)
Date(s): 1/3/03 – 12/29/03
Average Concentration ($\mu g/m^3$)