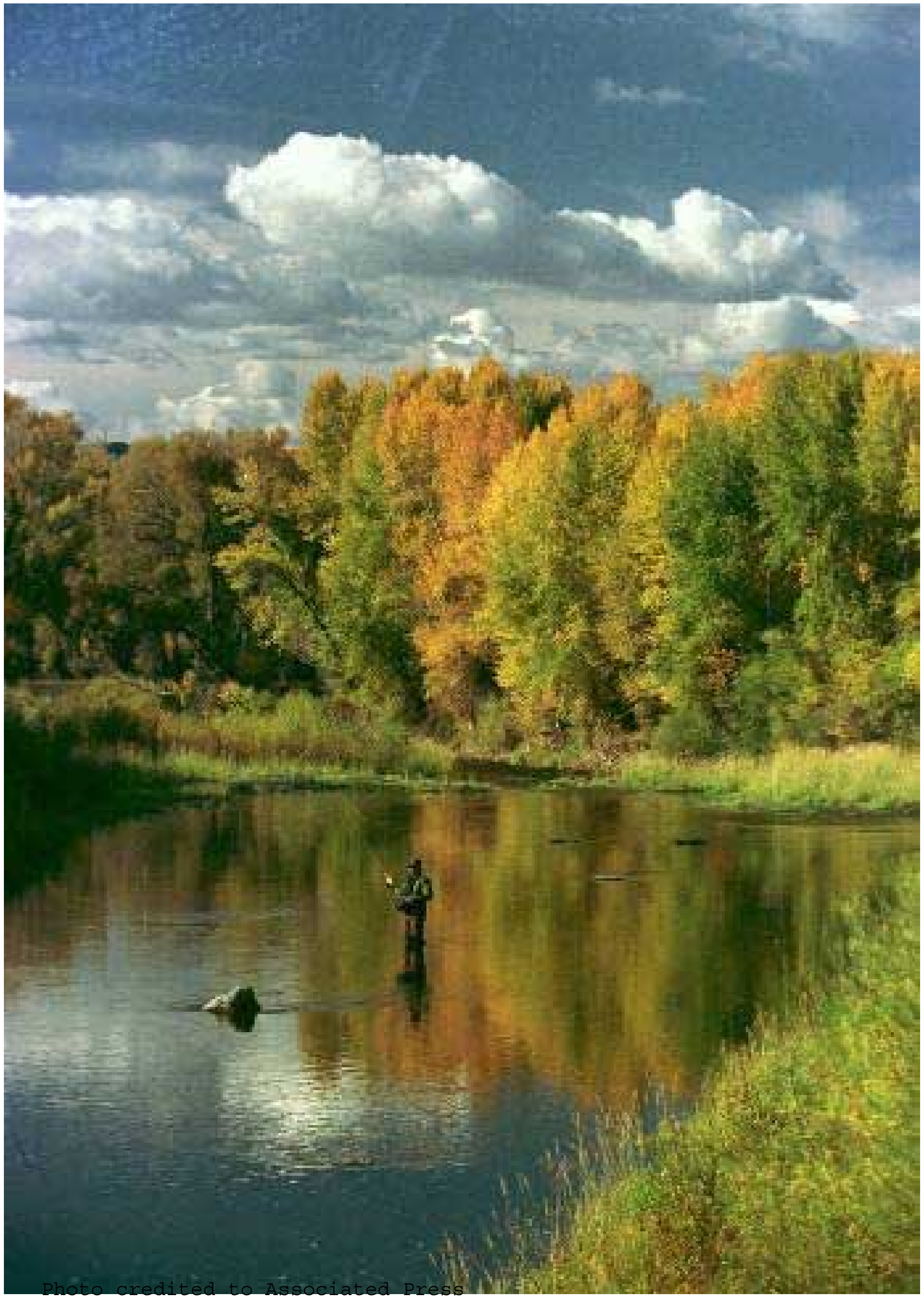

Photo credited to Associated Press

AIR QUALITY

ANNUAL REPORT 1999

Fairfax County Health Department
Environmental Monitoring & Trends Analysis
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F O R E W O R D

This is a technical report summarizing the data collected by the Environmental Monitoring and Trends Analysis staff from the air quality monitoring network in Fairfax County during the calendar year 1999. The report design is intended to meet the needs of concerned County citizens and organizations and public and private administrators whose decisions must reflect air quality considerations. Air quality summary reports have been issued annually since 1973. Persons requiring additional technical information should contact Environmental Monitoring and Trends Analysis staff to see if more detailed information is available.

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AMBIENT AIR QUALITY AND METEOROLOGY

A. OVERVIEW

The Environmental Monitoring and Trends Analysis section of the Fairfax County Health Department is authorized by the Fairfax County Code, Chapter 103, in cooperation with Federal and State agencies, to conduct an air monitoring program. The primary purpose of the air monitoring program is to measure the levels of air quality to ensure the protection of human health, welfare and safety, and to the greatest degree feasible, prevent injury to plant and animal life and property. The ambient air monitoring stations are sited in such a manner as to indicate residential, health based pollution concentrations. The objective of this monitoring network is to track ambient air pollutant levels to indicate compliance or non-compliance with Federal standards, to observe effects on pollutant levels from regulatory controls on sources, to develop data for trend analysis, and to provide data for the air quality index and forecasts.

The air quality monitoring program consists of monitoring for the Environmental Protection Agency (EPA) criteria pollutants, ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), lead (Pb), and particulate matter (PM_{10}). In addition, other non-criteria pollutants, total suspended particulates (TSP), nitric oxide (NO), and meteorological parameters, wind direction, wind speed, temperature, and rainfall are monitored.

The pollutant monitoring network maintained and operated by Fairfax County Health Department Environmental Monitoring and Trends Analysis staff consists of the following:

4 Continuous monitoring stations for gaseous pollutants
6 High volume particulate/lead samplers
5 Fractional particulate samplers of 10 micrometers (PM_{10})
1 Acid deposition station
5 Meteorological stations

The data are reduced to both monthly and annual terms and are shown in both tabular and graphical forms to reveal seasonal and short-term changes that would be obscured by longer term averaging. Comparisons with applicable standards are emphasized. The Air Quality Annual Report is supplemented with two appendices. Appendix A contains a trend analysis and a set of graphs showing multi-year trends for several air pollutants and several independent factors. Appendix B provides a table and a map of the monitoring stations, which includes the location and descriptive information of each of the stations.

Data reduction is done in-house, and the data are placed in a computer database for use in assessing current air quality, identifying air quality trends, and analyzing periods of elevated concentrations. Pollutant data are sent to the United States Environmental Protection Agency (EPA) for incorporation into the Aerometric Information Retrieval System (AIRS) database, and the Virginia Department of Environmental Quality (VDEQ).

The National Ambient Air Quality Standards (NAAQS), as defined in Title 40 of the Code of Federal Regulations Part 50, provide a basis for evaluating air quality in Fairfax County. The primary standards define the levels of air quality necessary to protect the public health with an adequate margin of safety. The secondary standards define levels of air quality necessary to prevent any degradation or harm to the total environment.

For this report, gaseous pollutant concentrations are expressed in parts per million (ppm); particulate matter and lead concentrations are expressed in micrograms per cubic meter ($\mu g/m^3$).

B. QUALITY ASSURANCE PROGRAM

The Environmental Monitoring and Trends Analysis section maintains a quality assurance/control program based on requirements stated in Title 40 of the Code of Federal Regulations, Part 58, Appendix A. This quality assurance (QA) program is used to assure that the monitoring data is of the highest quality and to minimize the loss of data due to instrument malfunctions or out of range operating conditions. A database of the precision, accuracy and audit results are maintained on a microcomputer using software developed by EPA, and are submitted on a quarterly basis to the EPA and VDEQ. The Environmental Monitoring and Trends Analysis section also participates in the EPA National Performance Audit program and the Ambient Air Monitoring Systems Audit program.

C. CRITERIA POLLUTANTS

1. Ozone (O_3)

Ozone is not emitted directly from pollution sources (i.e. smokestacks, tailpipes), but is formed by a complex series of reactions among nitrogen oxides (NO_x) and volatile organic compounds (VOCs) under the influence of solar ultraviolet radiation (sunlight). Two significant sources are the incomplete combustion of gasoline from motor vehicles and other volatile organic compound emissions from stationary sources such as factories, printers, dry cleaners, and paint shops. Ozone is shorter lived than its precursors, which may build up and redistribute geographically over an extended period of calm wind conditions (air stagnation). Therefore, ozone concentrations show a very strong diurnal (daily) and seasonal cyclical character, with the height of the cycles controlled almost entirely by meteorological conditions.

The 1-hour National Ambient Air Quality Standard (NAAQS) for ozone is defined in terms of the daily maximum hourly average. The primary and secondary standards for ozone are 0.12 ppm hourly average concentration. The standard is attained when over the most recent three calendar years, the average number of exceedant days is not greater than one. An exceedant day is one during which one or more observed hourly concentrations exceeds 0.12 ppm.

The United States Environmental Protection Agency (EPA) promulgated new national ambient air quality standards for ozone on July 19, 1997. The new primary standard provides increased protection to the public, especially children and at-risk populations. The secondary standard provides protection on vegetation. EPA replaced the current 1-hour NAAQS with an 8-hour standard at a level of 0.08 parts per million (ppm). On May 14, 1999 the U.S. Court of Appeals for the D.C. Circuit issued an opinion regarding these new standards. The Court left the new standards in place with the determination that these new standards cannot be enforced. EPA and the Department of Justice, on January 28, 2000, have filed a petition seeking Supreme Court review of the decision.

Ozone is an irritant to the respiratory system, mucous membranes and eyes. Exposure to ozone causes short term effects such as shortness of breath, eye and respiratory irritation as well as pulmonary function impairment. Chronic effects of repeated exposure can result in degeneration of the lung, acceleration of the natural aging process of the lung, and an increase in the body's susceptibility to disease. Individuals with existing respiratory impairments such as asthmatics have increased sensitivity to the effects of ozone. Healthy adults engaged in moderate physical activity are susceptible to the effects of ozone, as are children. In addition to health effects, ozone can have an adverse effect on many plants, weaken certain fabrics and rubber, and fade dyes.

Table 1: Ozone 1-hour

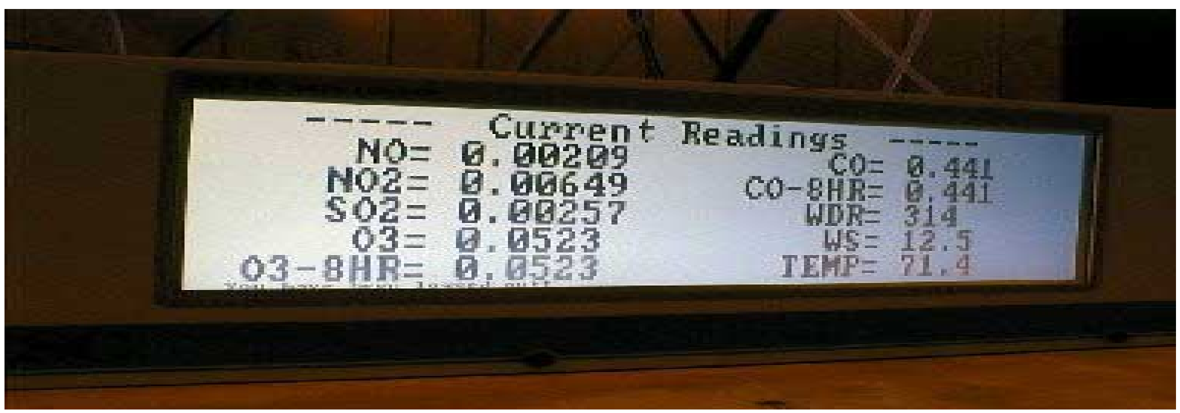
	SEVEN CORNERS	MOUNT VERNON[2]	CUB RUN	LEWINSVILLE	FRANCONIA[1,2]
Highest daily max 1-hr conc., ppm	0.134	0.130	0.118	0.125	0.128
2nd highest daily max 1-hr conc., ppm	0.113	0.121	0.114	0.114	0.120
99th percentile conc., ppm of all 1-hr measurements	0.087	0.100	0.083	0.083	0.099
Number of 1-hr measurements	8390	4839	8670	8524	5059
Number of hours above 0.12 ppm	3	3	0	1	1
Number of exceedant days, 1999	1	1	0	1	1
Average no. of exceedant days, 1997-1999	1	1	0.7	0.3	N/A

1. A VADEQ monitoring station; ozone monitoring commenced July 1998.
2. These stations are operational only during the ozone season from April through October.

Table 2: Ozone 8-hour

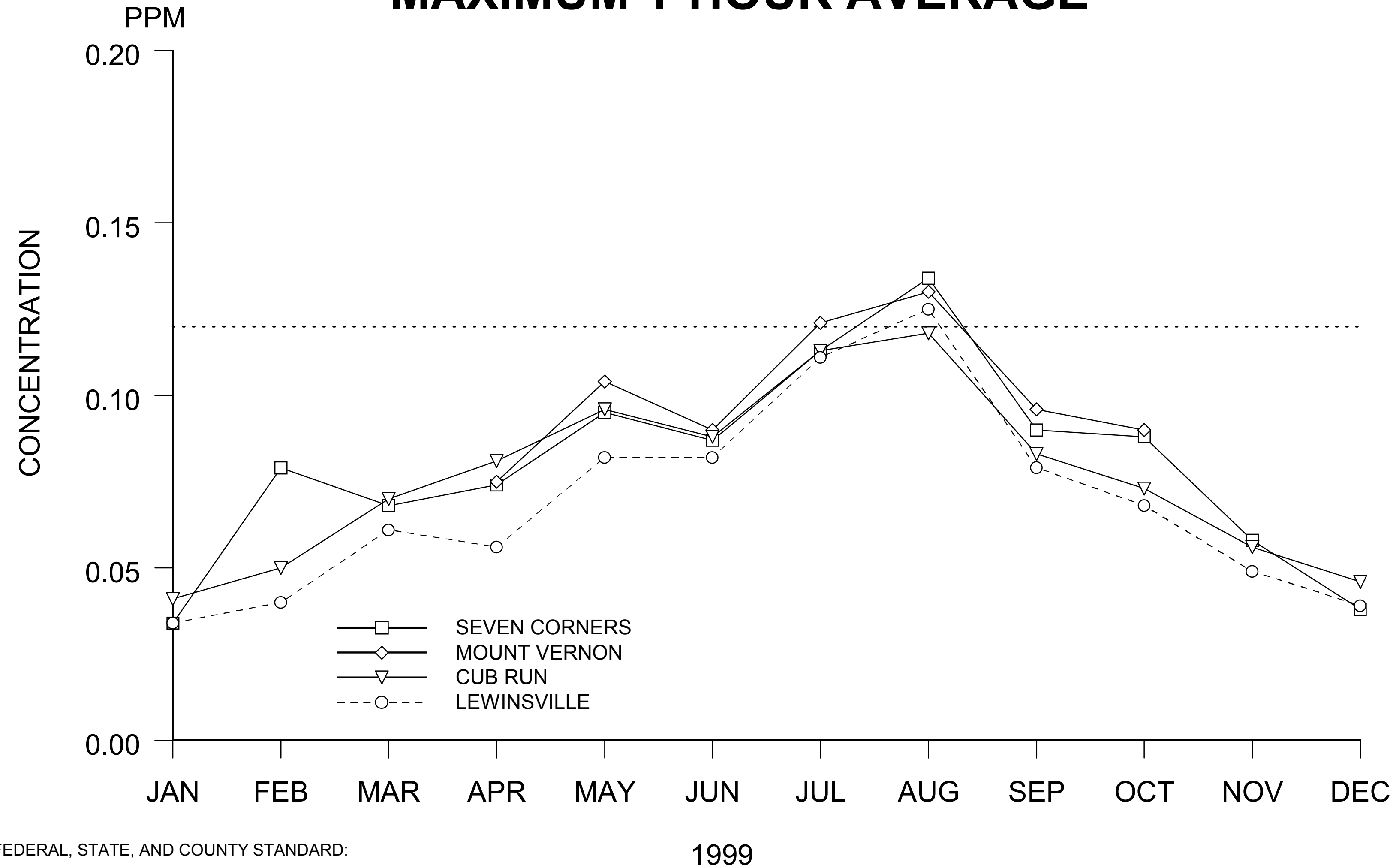
	SEVEN CORNERS	MOUNT VERNON[2]	CUB RUN	LEWINSVILLE	FRANCONIA[1,2]
Highest daily max 8-hr conc., ppm	0.115	0.112	0.106	0.105	0.106
4th highest daily max 8-hr conc., ppm	0.094	0.101	0.093	0.088	0.099
99th percentile 8-hr conc., ppm	0.078	0.077	0.089	0.075	0.090
Number of days with 8-hr conc. greater than 0.08 ppm, 1999	9	16	6	6	19
Average of 4th highest 8-hr conc., ppm, 1997-1999	0.094	0.097	0.092	0.086	N/A

Mount Vernon air monitoring station-
ozone analyzer at left



ESC 8816 data logger

OZONE
MAXIMUM 1-HOUR AVERAGE



FEDERAL, STATE, AND COUNTY STANDARD:

PRIMARY: 0.12 PPM MAXIMUM 1-HOUR CONCENTRATION.

SECONDARY: SAME AS PRIMARY

2. Carbon Monoxide (CO)

Carbon monoxide is a colorless, odorless gas produced by incomplete combustion of carbon compounds in fuels. The primary source of carbon monoxide is motor vehicle exhaust, although other fuel combustion processes such as wood burning stoves, incinerators and industrial sources may be important. Diurnal and seasonal patterns of carbon monoxide concentrations can be detected which correspond to human activities and meteorological factors. Concentrations are generally higher in vicinities of heavy vehicular traffic and fall off rapidly as the distance from a roadway increases. Elevated levels of CO are a winter time phenomena due to inefficient fuel combustion and weather conditions that hamper dispersion. CO is also known to be a participant in the photochemical reactions of ozone formation.

The NAAQS for CO specifies upper limits for one-hour and eight-hour averages. The primary and secondary standards for the 1-hr level are 35 ppm and the 8-hr level is 9 ppm, neither is to be exceeded more than once per year. The 8-hr standard is generally more restrictive.

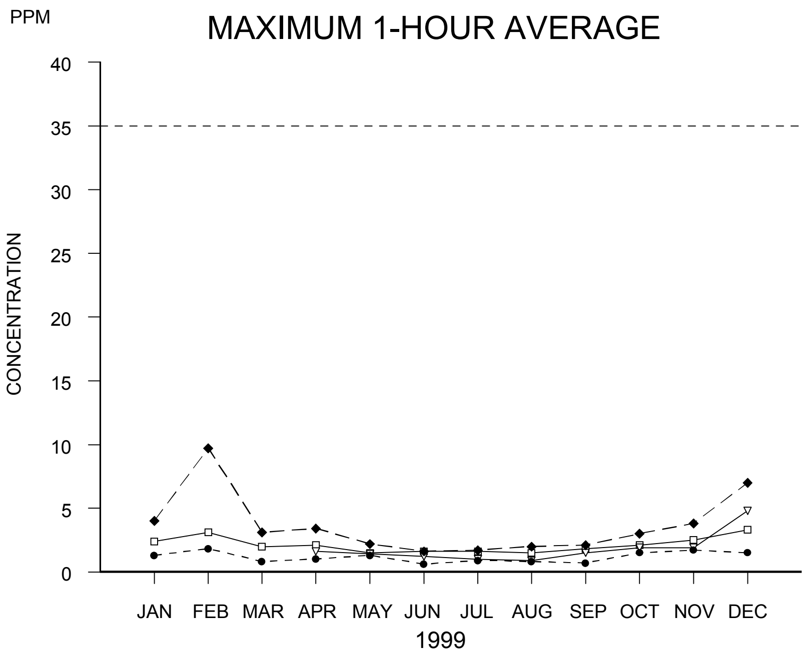
Carbon monoxide exposure through inhalation enters the blood stream and reacts chemically with hemoglobin, thereby reducing delivery of oxygen to the body's tissues and organs. The heart and central nervous system are dependent on oxygen utilization; therefore, these are the organ systems most affected by CO exposure. The effects of CO can worsen the conditions of people with chronic heart disease. Other groups more susceptible to the effects of CO are individuals with anemia, pregnant women, infants, elderly people, and fetuses. Low levels of CO exposure may produce symptoms of headache, dizziness, impairment of visual perception, mental function and manual dexterity. High levels may be fatal; however, high exposure levels are unlikely in ambient conditions.

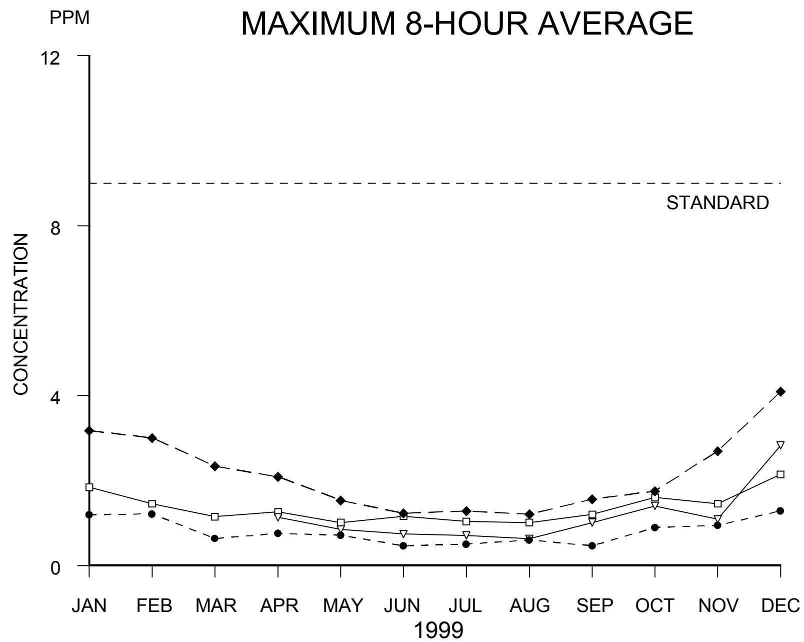
Table 3: Carbon Monoxide

	FRANCONIA	SEVEN CORNERS	CUB RUN	LEWINSVILLE
Annual arithmetic mean, ppm	0.41	0.70	0.33	0.80
Maximum 8-hr conc., ppm	2.83	2.14	1.28	4.09
2nd highest 8-hr conc., ppm	1.40	2.09	1.21	3.68
Maximum 1-hr conc., ppm	4.8	3.3	1.8	9.7
2nd highest 1-hr conc., ppm	3.4	3.2	1.7	7.0
99th percentile 1-hr conc., ppm	1.2	1.8	1.0	2.5
Number of 1-hr measurements	6328	8477	8371	7505
Number of 8-hr conc. above 9 ppm	0	0	0	0

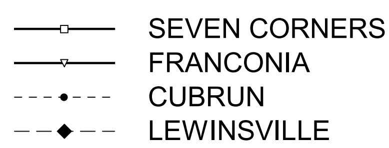
Carbon monoxide analyzer

CARBON MONOXIDE





*No data available for Franconia for Jan - March



FEDERAL,STATE, AND COUNTY STANDARDS:

PRIMARY: 1) 35 PPM MAXIMUM 1-HOUR CONCENTRATION,
NOT TO BE EXCEEDED MORE THAN ONCE PER YEAR.

2) 9 PPM MAXIMUM 8-HOUR CONCENTRATION,
NOT TO BE EXCEEDED MORE THAN ONCE PER YEAR.

SECONDARY: SAME AS PRIMARY.

3. Sulfur Dioxide (SO_2)

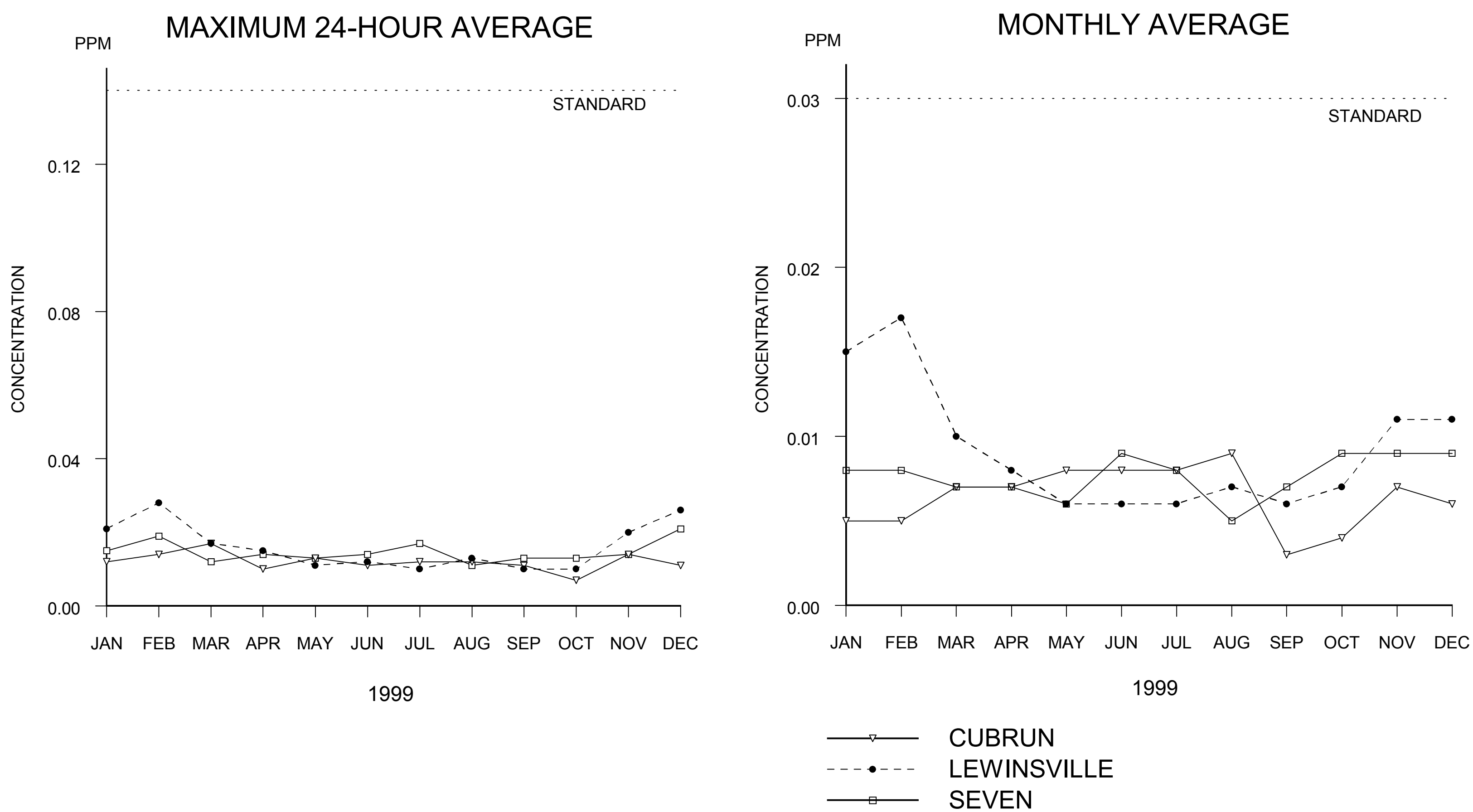
Sulfur dioxide is formed by the combustion of sulfur containing fossil fuels. SO_2 is produced primarily from coal and oil combustion sources such as electric utilities, steel mills, refineries, pulp and paper mills and nonferrous smelters. Sulfur dioxide is an irritant to the nose, throat, lungs, and eyes. Health effects of SO_2 exposure are highly correlated with particulate pollution. High concentrations may affect breathing and aggravate existing respiratory and cardiovascular disease. Subgroups of the population that are especially susceptible to the effects of SO_2 include asthmatics, individuals with bronchitis or emphysema, children and the elderly. Sulfur dioxide is a primary contributor to acid deposition, through atmospheric chemical conversions, causing acidification of water systems, and damage to trees, crops, buildings and statues.

The NAAQS for sulfur dioxide are defined in terms of the annual arithmetic mean concentration, the maximum 24-hour concentration and the maximum 3-hour concentration. The primary standards are expressed in terms of the annual arithmetic mean, set at 0.03 ppm, and the maximum 24-hour concentration, set at 0.14 ppm, which are not to be exceeded more than once per year. The secondary standard is expressed in terms of maximum 3-hour concentration, which is set at 0.5 ppm and is not to be exceeded more than once per year.

Table 4: Sulfur Dioxide

	SEVEN CORNERS	CUB RUN	LEWINSVILLE
Annual arithmetic mean, ppm	0.008	0.006	0.009
Maximum 24-hr conc., ppm	0.021	0.017	0.028
2^{nd} highest 24-hr conc., ppm	0.019	0.015	0.026
Maximum 3-hr conc., ppm	0.047	0.031	0.048
2^{nd} highest 3-hr conc.,ppm	0.040	0.031	0.046
99^{th} percentile 1-hr conc., ppm	0.026	0.021	0.027
Number of 1-hr measurements	8582	8441	8614
Number of 24-hr averages above 0.14 ppm	0	0	0

SULFUR DIOXIDE



PRIMARY: 1) 0.03 PPM ANNUAUAL ARITHMETIC MEAN.

2) 0.14 PPM MAXIMUM 24-HOUR CONCENTRATION.

SECONDARY: 0.5 PPM MAXIMUM 3-HOUR CONCENTRATION,

NOT TO BE EXCEEDED MORE THAN ONCE PER YEAR.

4. Oxides of Nitrogen (NO & NO_2)

Oxides of nitrogen are formed by high temperature combustion in both mobile and stationary sources such as electric utility and industrial boilers. Nitric oxide is produced in abundance by these sources and under the influence of sunlight it reacts with certain organic compounds to both generate and destroy ozone and NO_2. The NO concentration is highly variable and strongly seasonal in character (high in winter). The NO_2 concentration is more stable and shows little seasonal influence.

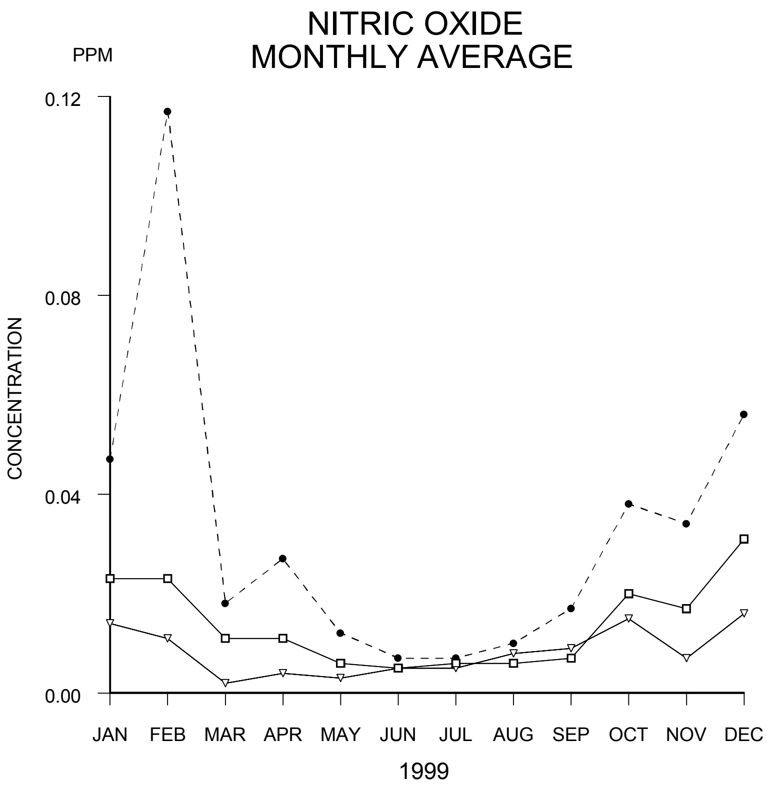
Nitrogen dioxide is a highly reactive oxidant and has a greater toxic potential than NO. Exposure to ambient concentrations of NO_2 may cause changes in airway responsiveness, lower resistance to respiratory infections, and reduce pulmonary function. Subgroups of the population that are especially susceptible to the effects of NO_2 exposure include asthmatics, persons with existing respiratory illness, i.e. emphysema and chronic bronchitis, and children. Studies are not definitive for health effects in healthy individuals. Nitrogen oxides injure vegetation, cause fabrics and dyes to deteriorate, and contribute to metal corrosion. They are important participants in photochemical reactions of ozone formation and acid deposition.

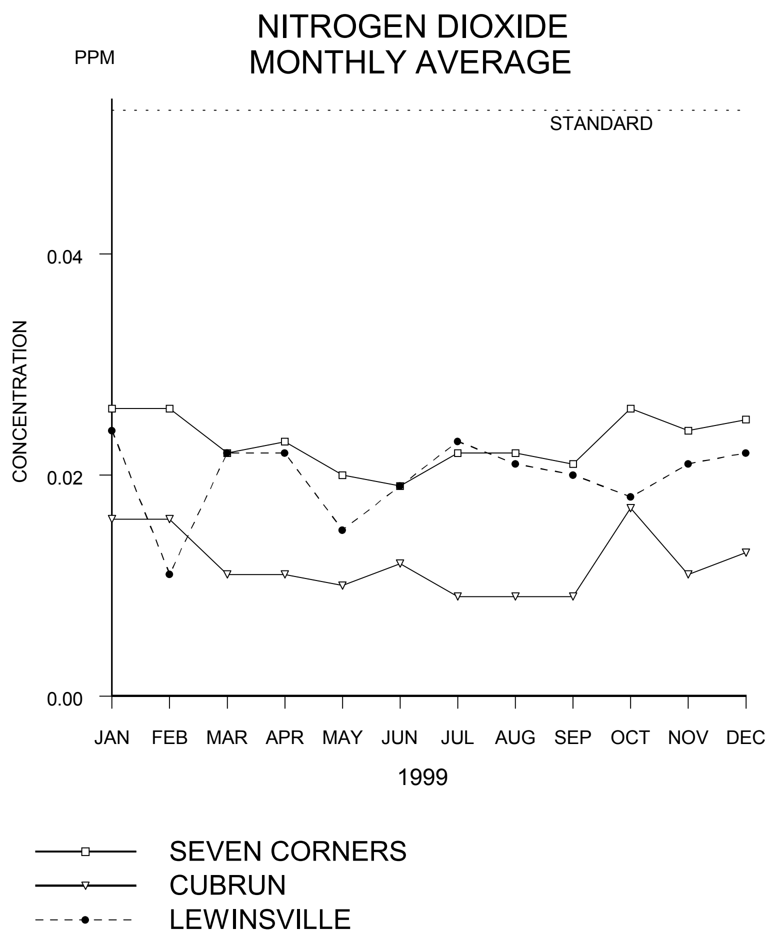
The NAAQS for nitrogen dioxide are defined in terms of the annual arithmetic mean concentration. The primary and secondary standards are 0.053 ppm. No NAAQS have been established for nitric oxide.

Table 5: Oxides of Nitrogen

	SEVEN CORNERS	CUB RUN	LEWINSVILLE
NITRIC OXIDE (NO)			
Annual arithmetic mean, ppm	0.014	0.008	0.032
99^{th} percentile 1-hr conc., ppm	0.109	0.081	0.270
Number of 1-hr measurements	8524	8080	7706
NITROGEN DIOXIDE (NO_2)			
Annual arithmetic mean, ppm	0.023	0.012	0.020
99^{th} percentile 1-hr conc., ppm	0.053	0.039	0.056
Number of 1-hr measurements	8525	8081	7706

OXIDES OF NITROGEN





FEDERAL, STATE, AND COUNTY STANDARDS:

NITROGEN DIOXIDE:

PRIMARY: 0.053 PPM ANNUAL ARITHMETIC MEAN.

SECONDARY: SAME AS PRIMARY

NITRIC OXIDE: NO STANDARD ESTABLISHED.

5. Particulate Matter

Particulate matter consists of dust, smoke, and other solid or liquid particles small enough to suspend readily in the air. The particles range in size from very fine (a fraction of a micrometer) to the very coarse (about 1000 micrometers). The chemical and physical properties of particulate matter can vary greatly with time, region, meteorology, and type of source. Particulate matter has been associated with increased respiratory symptoms and illnesses in children and adults, and at very high levels has been shown to produce mortality in the elderly and ill.

The Environmental Protection Agency (EPA) revised the NAAQS for particulate matter on July 18, 1997. EPA added standards for particulate matter 2.5 micrometers and below ($PM_{2.5}$) and revised the form of the 24-hour standard for particulate matter 10 micrometers and below (PM_{10}). $PM_{2.5}$ standards are intended to protect against exposures to fine fraction particle pollution and the PM_{10} standards are intended to protect against coarse fraction particles. On May 14, 1999 the U.S. Court of Appeals for the D.C. Circuit issued an opinion regarding these new standards. The Court vacated the revised PM_{10} standard and ruled that the old PM_{10} standard still apply. The Court ruled that the new $PM_{2.5}$ should remain in place, however, this standard could be vacated if "the presence of this standard threatens a more imminent harm". The "harm" refers to the burden on sources complying with the regulations. EPA and the Department of Justice, on January 28, 2000, have filed a petition seeking Supreme Court review of the decision.

Fairfax County has retained the standard for total suspended particulate (TSP), which is used to evaluate nuisance impacts that cause damage, annoyance, or unreasonable interference with the enjoyment of life and property.

a. Total Suspended Particulate (TSP)

The TSP measure is the weight of material in a unit volume of air, without regard to the size of the particles. The TSP sampler collects particulate matter up to a nominal size (aerodynamic diameter) of 25 to 45 micrometers. Each sample is collected during a 24-hour period, midnight to midnight. A maximum of 61 samples were scheduled for each station during 1999.

County primary and secondary standards are 60 $\mu g/m^3$ for annual geometric mean and 150 $\mu g/m^3$ for maximum 24-hour concentration, the 24-hour concentration is not to be exceeded more than once per year.

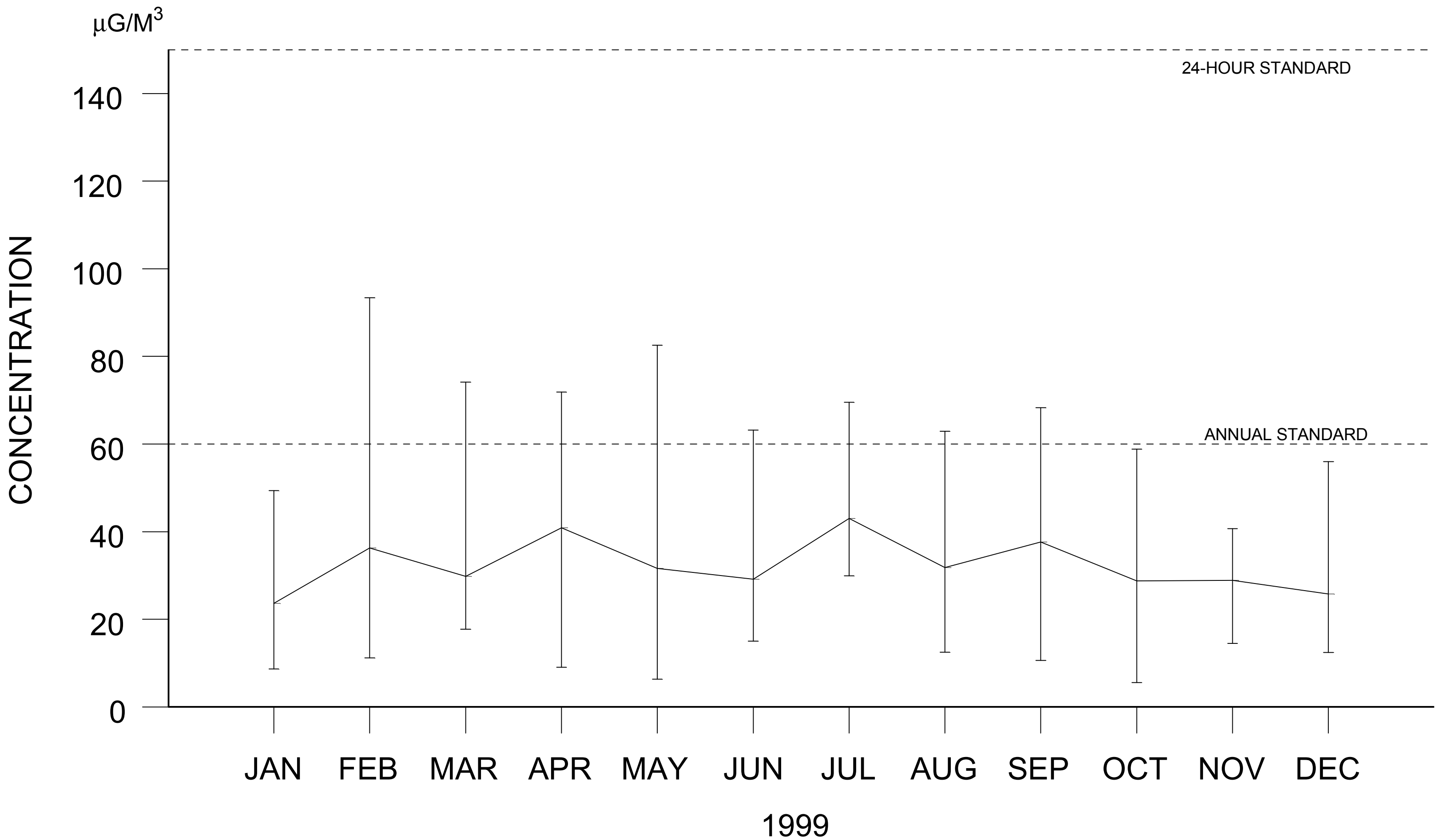
Table 6: Total Suspended Particulates

	CLERMONT	THOMAS EDISON	GUNSTON	I95	OCCOQUAN HILL	SPRINGFIELD	ALL STATIONS
Number of samples	56	54	56	56	58	57	337
Annual geometric mean, µg/m3	29.6	33.9	27.9	47.1	39.9	40.2	35.8
Maximum 24-hr sample, µg/m3	79.8	78.7	71.6	107.7	88.2	86.1	107.7
2nd highest 24-hr sample, µg/m3	75.5	77.8	60.3	106.8	80.9	85.4	106.8

Table 7: Total Suspended Particulates
Monthly Geometric Mean, $\mu g/m^3$

	CLERMONT	THOMAS EDISON	GUNSTON	I-95	OCCOQUAN HILL	SPRINGFIELD	ALL STATIONS
January	14.9	19.8	19.8	32.6	28.6	32.1	23.6
February	26.8	28.2	23.9	51.5	31.2	37.8	32.1
March	24.0	31.7	19.0	32.9	38.0	22.4	27.2
April	41.3	43.0	34.9	52.8	48.6	43.2	43.6
May	49.6	57.6	43.8	71.2	58.3	66.6	57.1
June	32.7	38.4	33.4	57.6	41.0	48.5	41.1
July	37.4	45.5	33.4	49.8	44.6	45.9	42.4
August	38.1	N/A*	37.8	64.6	57.3	50.6	48.6
September	32.0	29.9	25.9	41.2	34.2	35.8	32.8
October	30.9	35.4	28.1	53.3	38.2	43.6	37.4
November	25.4	30.2	20.9	46.5	36.8	37.8	31.8
December	13.6	22.7	20.7	33.4	27.9	27.6	23.4

TOTAL SUSPENDED PARTICULATES MONTHLY GEOMETRIC MEAN WITH MAXIMUM / MINIMUM 24-HOUR SAMPLES



COMPOSITE AVERAGE

COUNTY STANDARDS:

60 µG/M³ ANNUAL GEOMETRIC MEAN.

150 µG/M³ MAXIMUM 24-HOUR CONCENTRATION, NOT TO BE EXCEEDED MORE THAN ONCE PER YEAR.

b. Particulate Matter 10 Micrometers (PM_{10})

The PM_{10} measurement is a size specific indicator of particulate matter in the ambient air. The PM_{10} sampler collects particulates with an aerodynamic diameter less than or equal to a nominal 10 micrometers. The PM_{10} measure is the weight of this size specific material in a unit volume of air.

The NAAQS are defined in terms of the 24-hour average concentration and the annual arithmetic mean. The primary standard for 24-hour average concentration is 150 $\mu g/m^3$. The standard is attained when the 3-year average of the 99th percentile of the monitored concentrations at the highest monitor in an area is less than or equal to 150 $\mu g/m^3$. The primary standard for annual arithmetic mean is 50 $\mu g/m^3$. The standard is attained when the 3-year average of the annual arithmetic PM_{10} concentrations at each monitor within an area is less than or equal to 50 $\mu g/m^3$.

TSP samplers at Gunston monitoring site

PM_{10} samplers at Mount Vernon monitoring site

Table 8: Particulate Matter 10 Micrometers

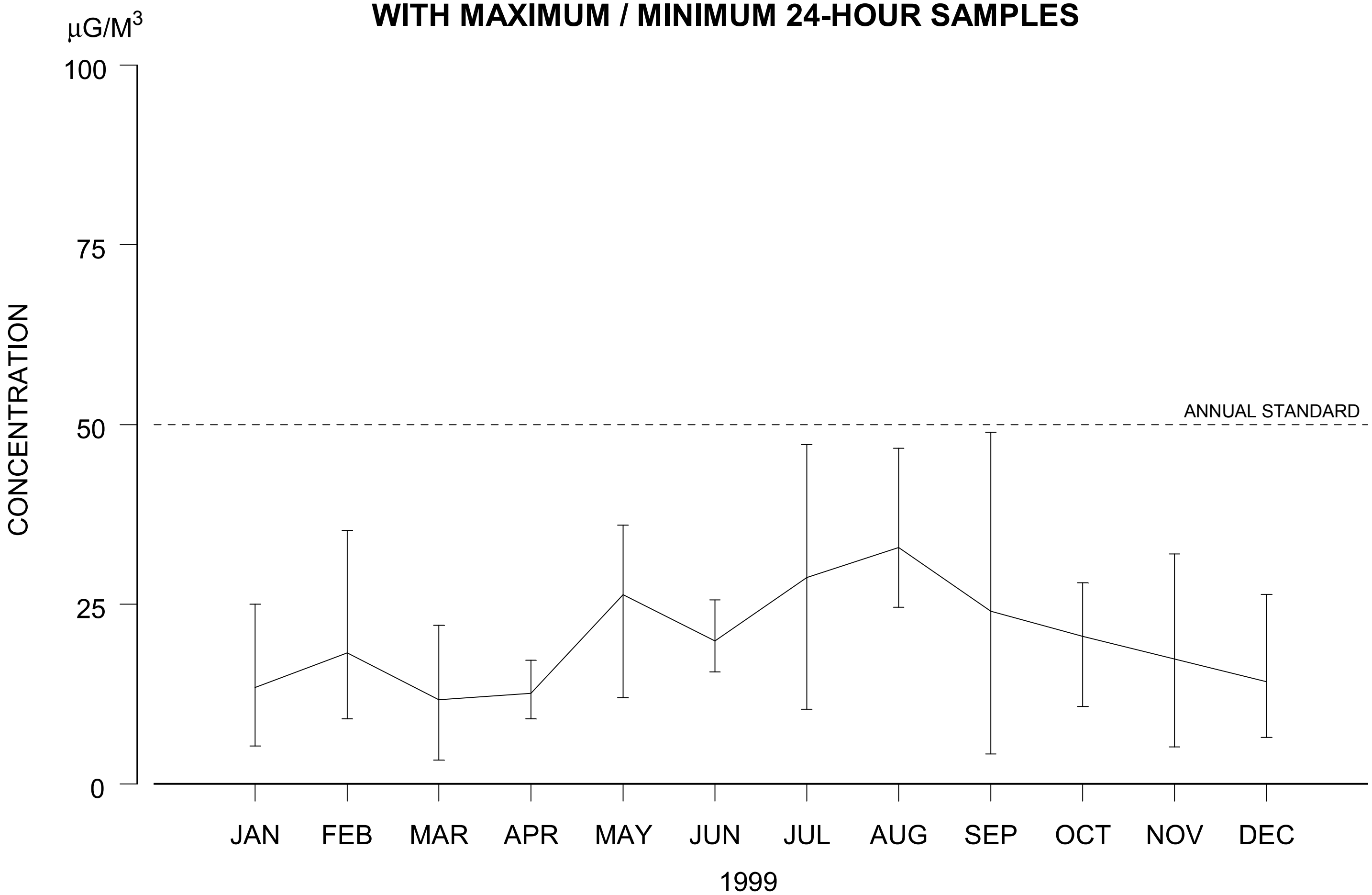
	CUB RUN	LUCK	MOUNT VERNON	OCCOQUAN HILL	SPRINGFIELD	ALL STATIONS
Number of samples	51	52	55	56	56	270
Annual arithmetic mean, $\mu g/m^3$	18.84	19.47	19.92	20.21	20.41	19.80
Maximum 24-hr sample, $\mu g/m^3$	48.3	48.9	47.2	44.4	42.2	48.9
99^{th} percentile of 24-hr samples, $\mu g/m^3$	48.3	48.9	47.2	44.4	42.2	47.2
24-hr samples above 150 $\mu g/m^3$	0	0	0	0	0	0

Table 9: Particulate Matter 10 Micrometers
Monthly Arithmetic Mean, $\mu g/m^3$

	CUB RUN	LUCK	MOUNT VERNON	OCCOQUAN HILL	SPRINGFIELD	ALL STATIONS
January	9.55	11.2	17.7	14.6	14.2	13.4
February	14.9	18.2	18.3	17.2	22.7	18.2
March	11.3	13.7	11.5	10.8	11.2	11.7
April	11.9	12.8	13.2	12.7	12.5	12.6
May	25.2	25.9	24.7	25.2	30.7	26.3
June	21.6	18.3	19.5	20.8	19.2	19.9
July	28.2	26.5	28.9	30.0	30.1	29.7
August	33.1	34.0	31.9	34.2	31.3	32.9
September	24.4	25.1	22.7	24.9	23.2	24.1
October	15.9	20.6	22.4	21.9	21.8	20.5
November	18.3	16.2	17.9	17.1	17.7	17.4
December	12.2	12.1	15.8	14.7	16.4	14.2

PARTICULATE MATTER PM_{10} MONTHLY ARITHMETIC MEAN

WITH MAXIMUM / MINIMUM 24-HOUR SAMPLES



COMPOSITE AVERAGE

PRIMARY: 50 $\mu G/M^3$ ANNUAL ARITHMETIC MEAN, 3-YEAR AVERAGE OF ANNUAL VALUES MUST BE LESS THAN OR EQUAL TO 50 $\mu G/M^3$.

150 $\mu G/M^3$ 24-HOUR CONCENTRATION, 3-YEAR AVERAGE OF THE 99 th PERCENTILE OF THE MONITORED CONCENTRATIONS AT THE HIGHEST MONITOR IN AN AREA MUST BE LESS THAN OR EQUAL TO 150 $\mu G/M^3$.

SECONDARY: SAME AS PRIMARY.

c. Particulate Matter 2.5 Micrometers ($PM_{2.5}$)

The $PM_{2.5}$ measurement is a size specific indicator of particulate matter in the ambient air. The $PM_{2.5}$ sampler collects particulates with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers. The $PM_{2.5}$ measurement is the weight of this size specific material in a unit volume of air.

The new primary annual $PM_{2.5}$ standard is set at 15 $\mu g/m^3$, annual arithmetic mean. The annual standard is attained when the 3-year average of the annual arithmetic mean $PM_{2.5}$ concentrations is less than or equal to 15 $\mu g/m^3$ from single or multiple community-oriented monitors. The new primary 24-hour $PM_{2.5}$ standard is set at 65 $\mu g/m^3$. The 24-hour $PM_{2.5}$ standard is attained when the 3-year average of the 98th percentile of the 24-hour $PM_{2.5}$ at each population-oriented monitor within an area is less than or equal to 65 $\mu g/m^3$.

The $PM_{2.5}$ monitoring network has been put in place in Fairfax County and quality assurance procedures for the samplers developed by EPA and the Virginia Department of Environmental Quality (VADEQ) have been implemented. Sampling for $PM_{2.5}$ started in January 1999.

The following Table 10 contains data that was collected in 1999. Some of the data is missing due to challenges encountered in the sampling, collection, and analysis procedures.

Table 10: Particulate Matter 2.5 Micrometers
Monthly Arithmetic Mean, $\mu g/m^3$

	FRANCONIA	LEWINSVILLE	SEVEN CORNERS
January	12.9*	16.5*	14.9*
February	14.2	17.4*	17.1*
March	8.8	8.5	7.4*
April	11.0	11.5	10.2
May	12.4	14.4*	13.8
June	14.4	16.1	15.4
July	21.7	21.5	21.5
August	19.7	19.8	20.6
September	14.8	16.2	*
October	7.4*	*	5.2*
November	10.6*	14.8*	15.4*
December	11.3	9.9*	11.9*
Number of Observations	240	80	86
Maximum Value	35.1	40.3	39.2
Annual Mean	13.7	15.3	13.4

*Less than 75% of data collected for valid EPA average; and /or missing values.

6. Lead (Pb)

Lead is emitted into the atmosphere by certain industries such as smelters and battery manufacturers. Airborne lead is associated with particles ranging between 0.1 and 5.0 micrometers in diameter. Particle size and shape are important factors in determining the deposition and suspension of lead in the atmosphere and the retention and absorption of lead into the human lung.

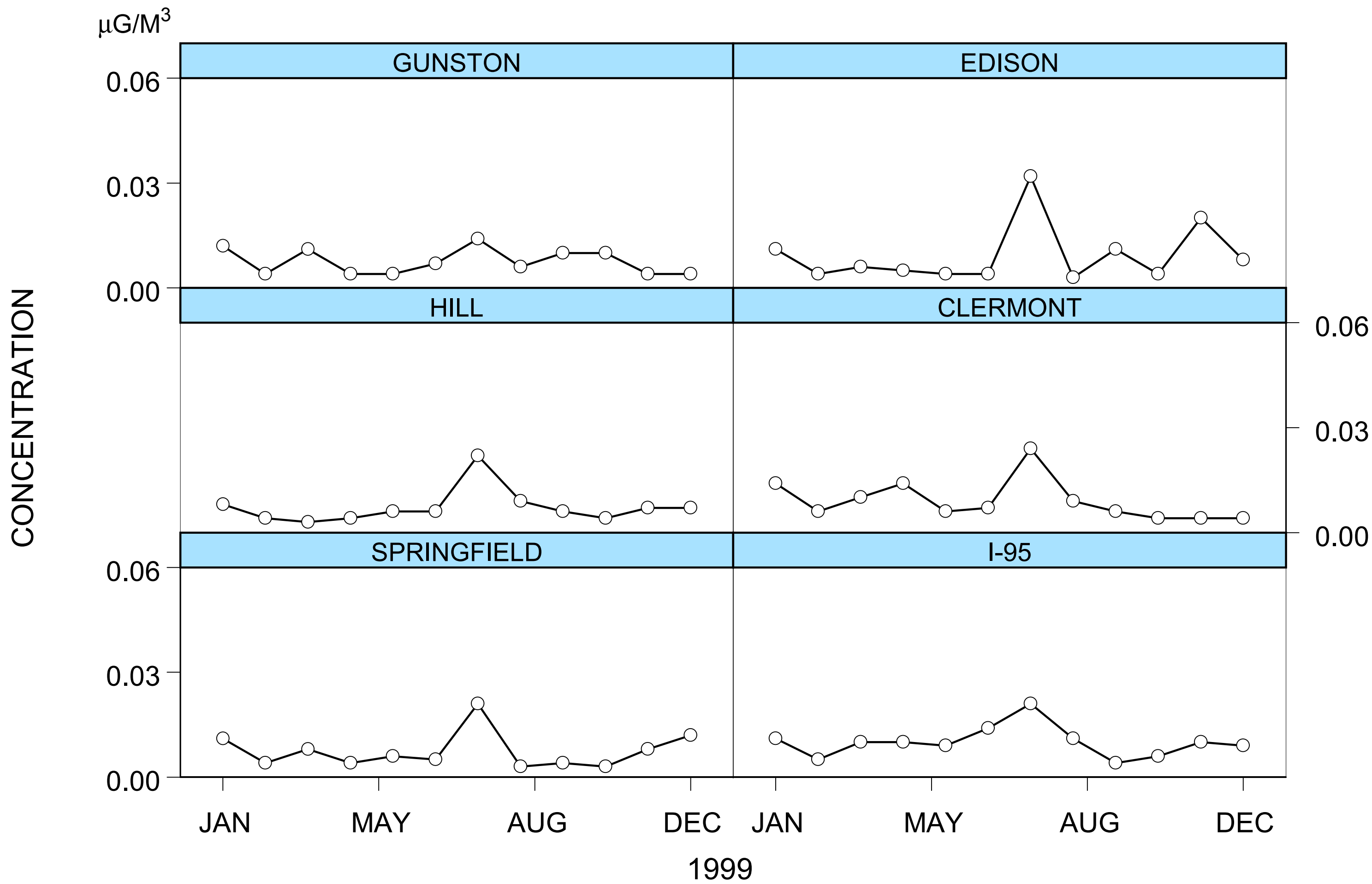
Lead interferes with the blood forming system, the nervous system, the renal system, vitamin D metabolism, and can affect the normal functions of the reproductive and cardiovascular systems. Certain subgroups of the population are more susceptible to the effects of lead. Low levels of lead absorption by young children can cause permanent mental retardation. Lead has also been associated with high blood pressure in adults.

The NAAQS for lead are defined in terms of the quarterly arithmetic mean. The primary and secondary standards for lead are 1.5 $\mu g/m^3$ quarterly arithmetic mean.

Table 11: Lead

	CLERMONT	GUNSTON	I-95	OQQOQUAN HILL	SPRINGFIELD	THOMAS EDISON
Number of 24-hr measurements	56	56	56	58	57	54
Maximum 24-hr sample, $\mu g/m^3$	0.074	0.038	0.040	0.062	0.065	0.080
Maximum monthly average, $\mu g/m^3$	0.024	0.014	0.020	0.022	0.021	0.032
Maximum quarterly average, $\mu g/m^3$	0.013	0.010	0.011	0.012	0.009	0.017
2^{nd} highest quarterly average, $\mu g/m^3$	0.009	0.009	0.011	0.006	0.008	0.009

LEAD MONTHLY MEAN



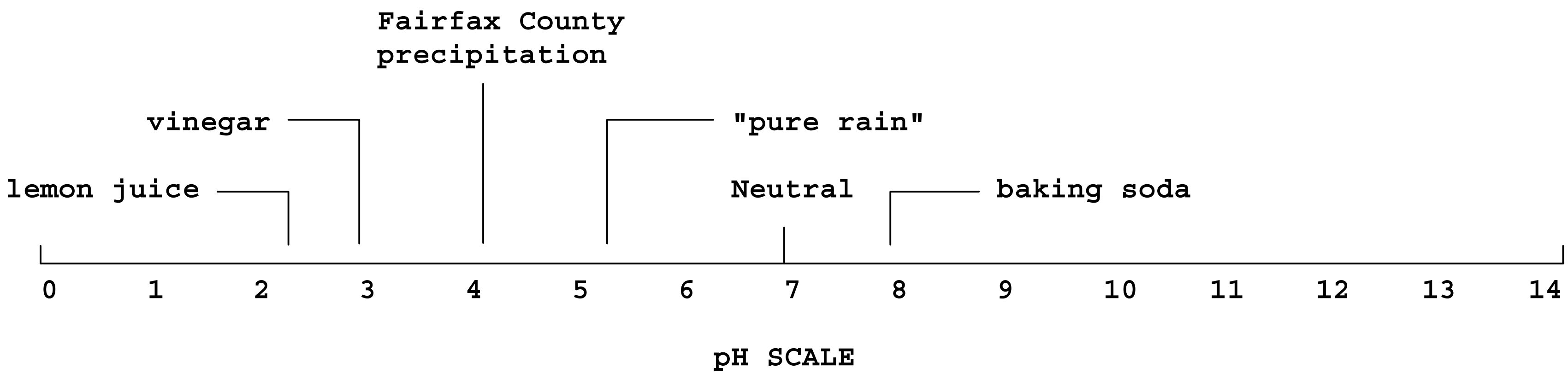
FEDERAL, STATE, AND COUNTY STANDARDS:

PRIMARY: 1.5 µG/M^3 MAXIMUM ARITHMETIC MEAN PER CALENDAR QUARTER.

SECONDARY: SAME AS PRIMARY

D. Acid Deposition

Acidic precipitation is a phenomenon resulting primarily from the reaction of sulfur oxides and nitrogen oxides which in combination with atmospheric oxygen and moisture form sulfuric and nitric acids. These acids can then be deposited by wet deposition (rain, snow, ice, and fog). Rain and snow are the two primary mechanisms of deposition. In the absence of moisture intermediate products, sulfates, nitrates, and other aerosols are formed and deposited in dry form. The amount of acidity in precipitation can be determined by measuring the pH of a sample. pH is based on a logarithmic scale. A pH of 7.0 is neutral, less than 7.0 is acidic, and greater than 7.0 is basic. Since the scale is logarithmic, a pH change from 7.0 to 6.0 is a ten-fold increase in acidity.



In sensitive areas of the country, acidic precipitation has caused acidification of freshwater ecosystems such that aquatic life can no longer survive. Acidic precipitation is also suspected to be a corrosive which can damage statuary, stone structures, and automobile finishes. Direct effects upon humans have not been established.

Rain and snow samples are collected from our monitoring station at Occoquan, Virginia on a weekly basis. The samples are returned to our laboratory in Fairfax and are analyzed for pH and conductivity. The Virginia Department of Environmental Quality conducts further analysis on our samples for cations and anions, and determines the anion-cation balance.

No standards have been established but "pure rain" should have a pH in the range of 5.2 to 5.6 due to its mixing with atmospheric carbon dioxide and other natural atmospheric constituents.

Table 12: Acid Deposition Occoquan Hill Site
Monthly Volumetric Weighted Average

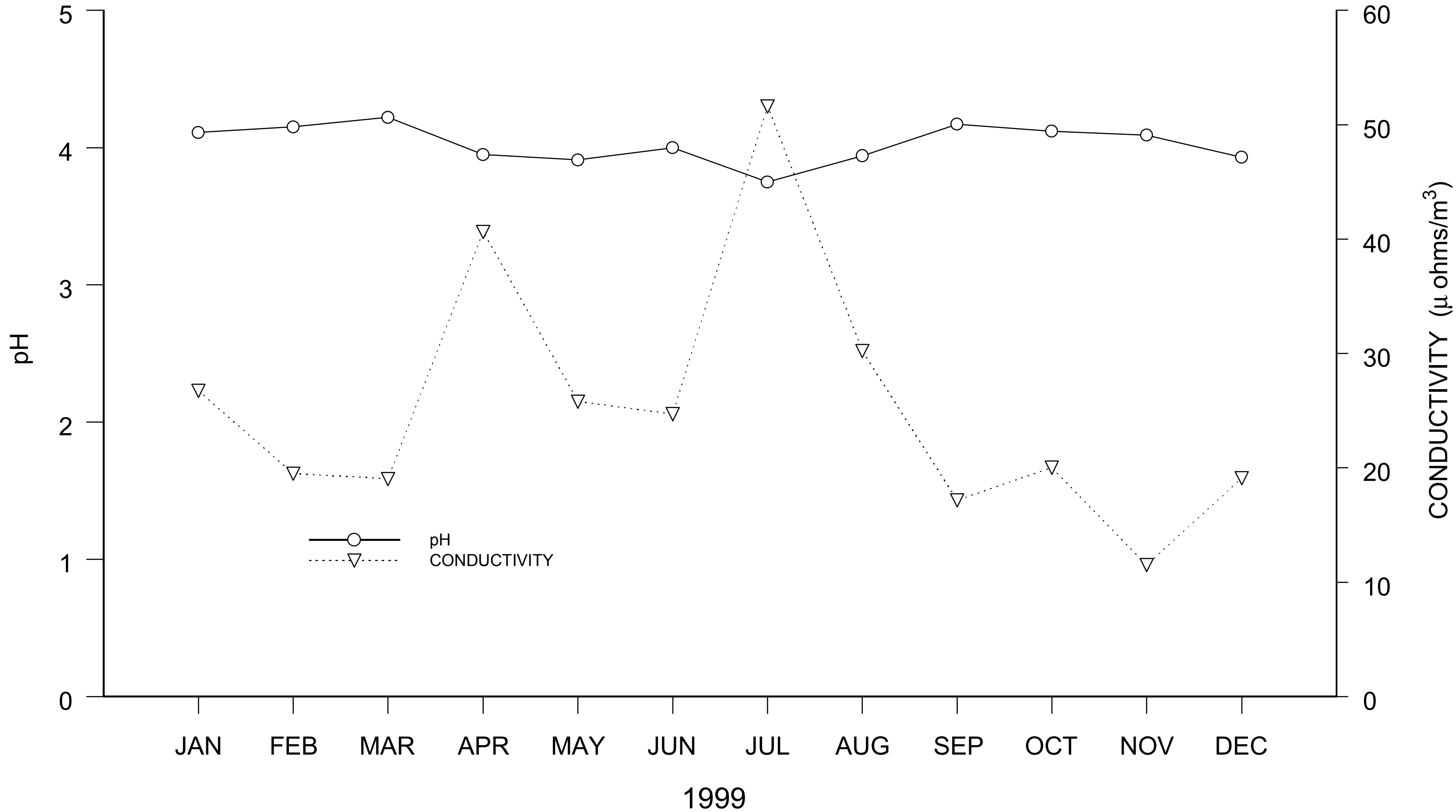
	pH*	CONDUCTIVITY* (μMHO)	TOTAL RAINFALL
January	4.11	26.74	5.55
February	4.15	19.49	2.44
March	4.22	19.02	4.10
April	3.95	40.62	1.69
May	3.91	25.79	1.73
June	4.00	24.70	1.64
July	3.75	51.59	2.23
August	3.94	30.20	5.01
September	4.17	17.14	8.44
October	4.12	20.01	2.08
November	4.09	11.49	1.90
December	3.93	19.08	2.13

Table 13: Acid Deposition Occoquan Hill Site
Quarterly And Annual Volumetric Weighted Average

	pH*	CONDUCTIVITY* (μMHO)
First Quarter	4.16	23.09
Second Quarter	3.94	31.22
Third Quarter	4.03	26.31
Fourth Quarter	4.06	20.02
Annual 1999	4.07	25.29

* Volume weighted average indicates what the level would be if all samples had been mixed together.

ACID DEPOSITION
OCCOQUAN HILL



ph and Conductivity monthly values are volume weighted averages.

Acid rain sampler at Occoquan Hill monitoring site

E. Regional Air Quality

1. Air Quality Index

The U.S. Environmental Protection Agency (EPA) requires the use of an Air Quality Index (AQI) for reporting air quality levels to the general public. The AQI is a system which condenses five air pollutant concentration values (PM_{10}, SO_2, CO, O_3, and NO_2) into a single number as an indicator of air quality. The index values are then grouped into air quality descriptor categories as shown in Table 14. The EPA adopted changes to this index, formerly named the Pollutant Standards Index (PSI), which became effective October 4, 1999. Some of the changes to this index are the addition of another descriptor category for "unhealthy for sensitive groups", new breakpoints for the ozone sub-index in terms of 8-hour, and reporting this index in a color format to the public.

Table 14: Air Quality Index

Index Value	Descriptor Category	Color
0-50	Good	Green
51-100	Moderate	Yellow
101-150	Unhealthy for sensitive groups	Orange
151-200	Unhealthy	Red
201-300	Very unhealthy	Purple
301-500	Hazardous	Maroon

The Metropolitan Washington Council of Governments (C.O.G.) is responsible for reporting daily air quality levels to the public in this region. C.O.G. collects air quality data from selected monitoring stations on a daily basis, calculates a maximum index value and forecasts the air quality levels for the following day, and reports this by color format to the media for dissemination to the public. During regional air pollution advisories, C.O.G. collects hourly air quality data from these monitoring stations throughout the region as a basis for continuing or canceling the advisory. When the index exceeds or will probably exceed 100, and when specific weather conditions exist, a Health Advisory may be issued by C.O.G. This Health Advisory is directed towards sensitive populations such as the elderly and those with respiratory disorders. There were seven Code Red observations and 21 Code Orange observations issued during 1999.

2. Regional Ozone Exceedances

The Washington DC, Maryland, and Virginia air quality control region is classified as a serious nonattainment area for ozone. This region had until 1999 to attain the 1-hour ozone NAAQS, but did not achieve it. Washington, D.C., Maryland, and Virginia have petitioned EPA for an extension until 2005.

An exceedant day is a day when an ozone monitoring site exceeds the NAAQS of 0.12 ppm for at least one hour. There were seven ozone exceedant days in the air quality control region in 1999. Fairfax County had one ozone exceedant day in 1999. It is shown in Table 15 below.

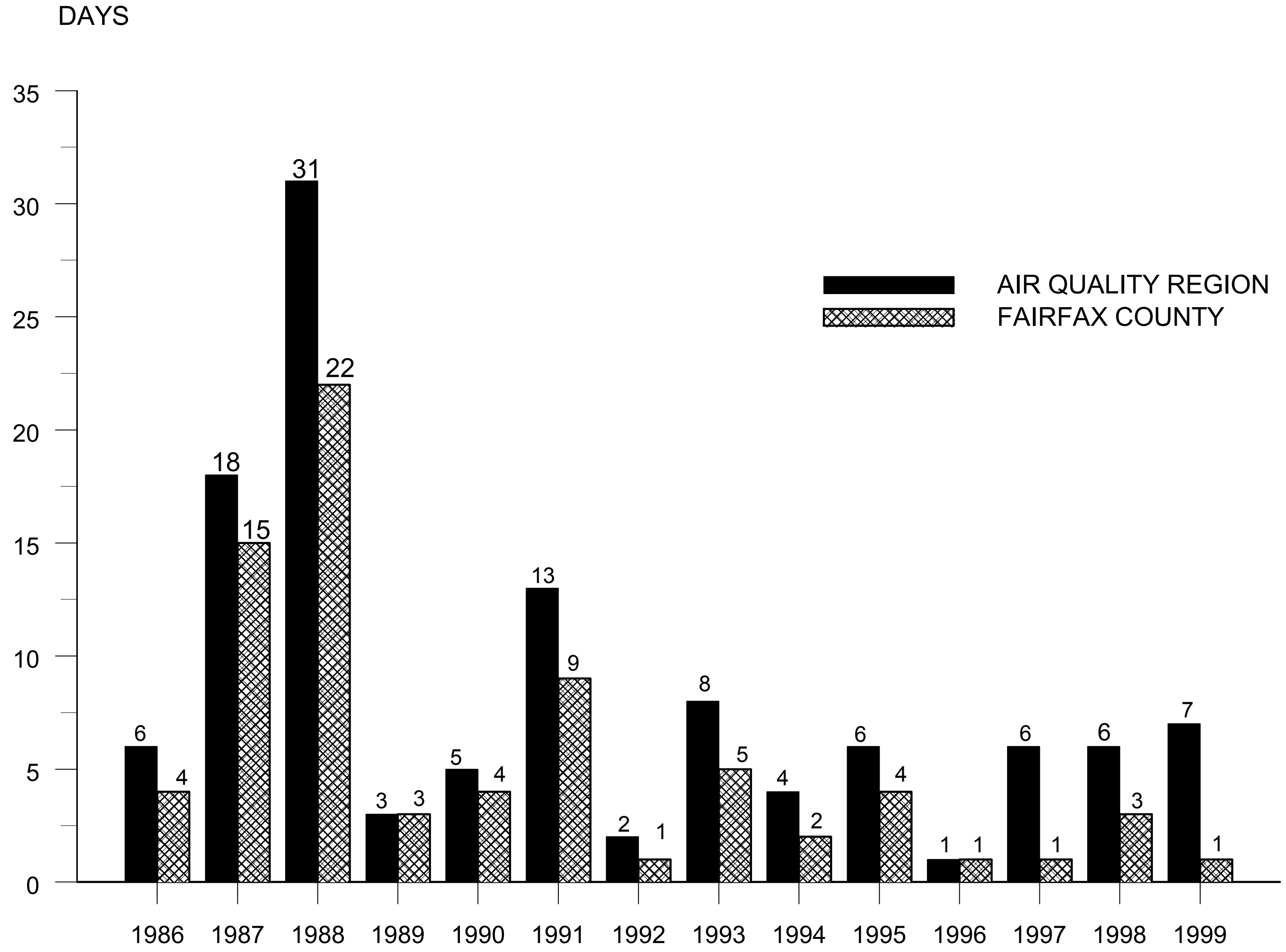
TABLE 15: REGIONAL OZONE EXCEEDANCES

DATE	LOCATION	MAXIMUM 1 HOUR OZONE (PPM)
June 7	Charles Co., MD	0.130
July 9	Greenbelt, MD	0.130
July 16	Frederick Co., MD	0.128
	Rockville, MD	0.128
July 18	Arlington, VA	0.135
	McMillan, D.C.	0.135
July 23	Charles Co., MD	0.130
July 31	Greenbelt, MD	0.141
	McMillan, D.C.	0.129
	City of Alexandria, VA	0.129
	Suitland, MD	0.127
	River Terrace, D.C.	0.126
August 12	*Seven Corners, Fairfax, VA	0.134
	*Lewinsville, McLean, VA	0.125
	*Mount Vernon, VA	0.130
	Greenbelt, MD	0.128
	Arlington, VA	0.130
	Stafford Co., VA	0.128
	Franconia, Fairfax Co., VA	0.128

*Fairfax County Monitoring Station

The following graph is a comparison of the number of ozone exceedant days observed in the air quality control region (including Fairfax County) with those observed just in Fairfax County.

OZONE EXCEEDANT DAYS



F. METEOROLOGY

1. Overview

Pertinent and representative localized meteorological data are an essential and ongoing integral part of the County's air quality monitoring program. Continuous and accurate observations of local conditions relating to temperature, wind flow (speed and direction) and precipitation are fundamental elements used in the day to day evaluation and understanding of air quality conditions and assessment of long-term trends within the County.

The County's meteorological observing equipment has evolved from simple battery powered, mechanical recorder devices requiring manual reduction of data to more modern electronic sensors and data average devices capable of real-time call up and output of instantaneous values or hourly and daily averages of temperature, wind and precipitation. Paramount along with these improvements, the meteorological sensors have always been employed in close proximity with the continuous air quality monitors to assure the most representative data practical.

Some meteorological data produced by other agencies at nearby locations are acquired and used by the agency. Data from Dulles and Washington National Airports and Davison Army Airfield (Ft. Belvoir), although tailored for aviation support, are particularly useful in establishing long term averages, for quality control work, and to compliment agency data. Therefore, some of the pertinent airport data are tabulated and displayed in this report.

County and agency computers, data loggers, and other electronic devices are exploited in the acquisition, reduction and processing of meteorological data. For this report, the data, unless otherwise described, is processed, tabulated and displayed in a manner similar to that done for the air quality pollutant data. In addition, data for this and all prior years are archived in electronic format and is readily available for interested County and other governmental agencies, contractors, and Fairfax County citizens.

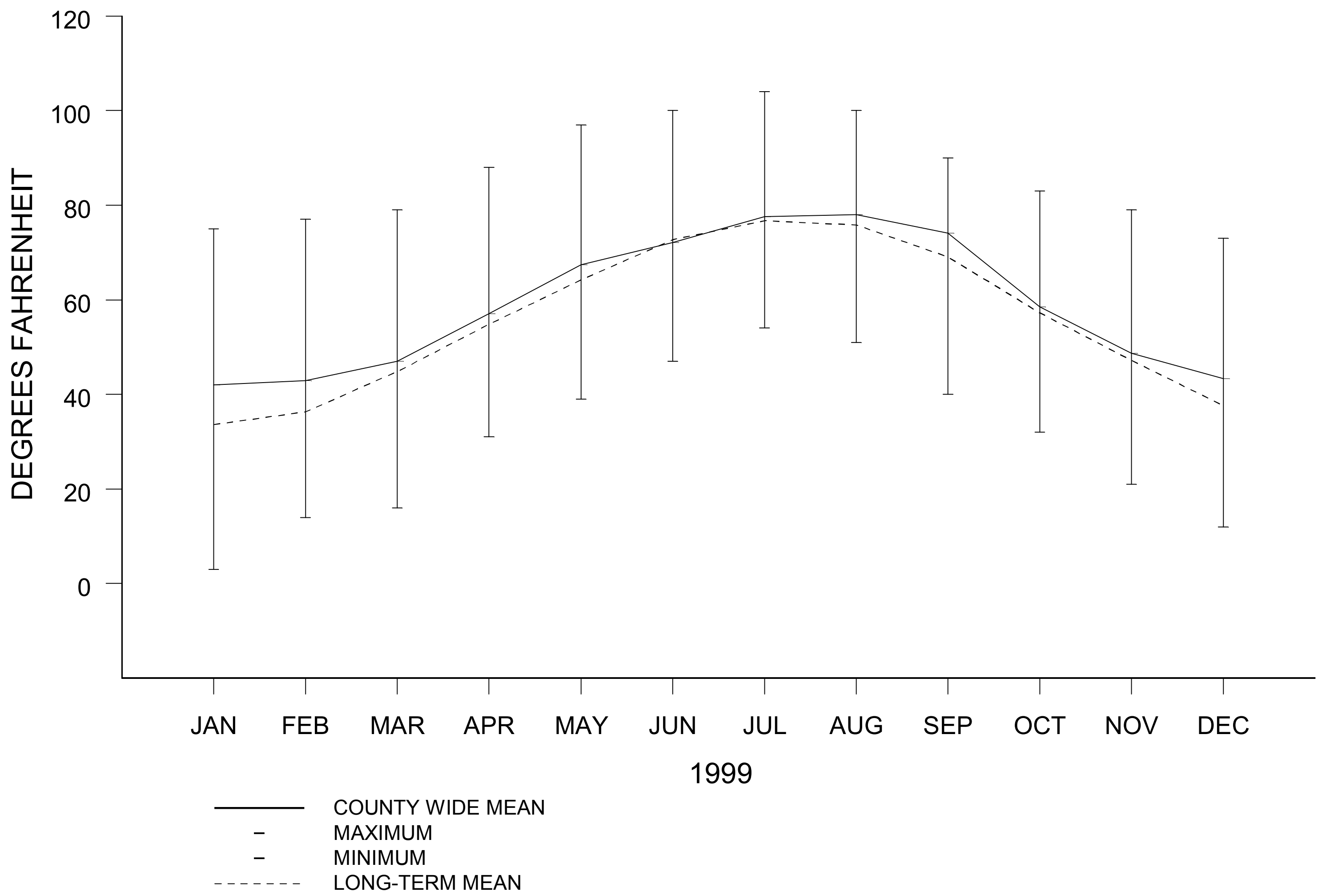
2. Temperature

The annual average maximum or minimum temperature is obtained by averaging all daily maximum or minimum temperatures. The annual mean value is the average of all hourly average temperature observations, and is independent of any recorded or calculated maximum or minimum.

Table 16: Temperature

	Annual Average Daily Maximum °F	Annual Mean Temperature °F	Annual Average Daily Minimum °F
	Maximum	Mean	Minimum
COUNTY STATIONS			
Seven Corners	65.0	56.7	48.3
Lewinsville	67.8	58.4	48.7
Mount Vernon	68.9	57.8	47.4
Occoquan Hill	67.9	57.9	48.8
Luck Quarry	68.6	56.4	44.6
AIRPORTS			
Dulles	66.7	55.7	43.8
National	67.9	58.8	50.1
Davison	70.6	59.5	48.3

MONTHLY MEAN TEMPERATURE
WITH MAXIMUM AND MINIMUM DAILY EXTREMES



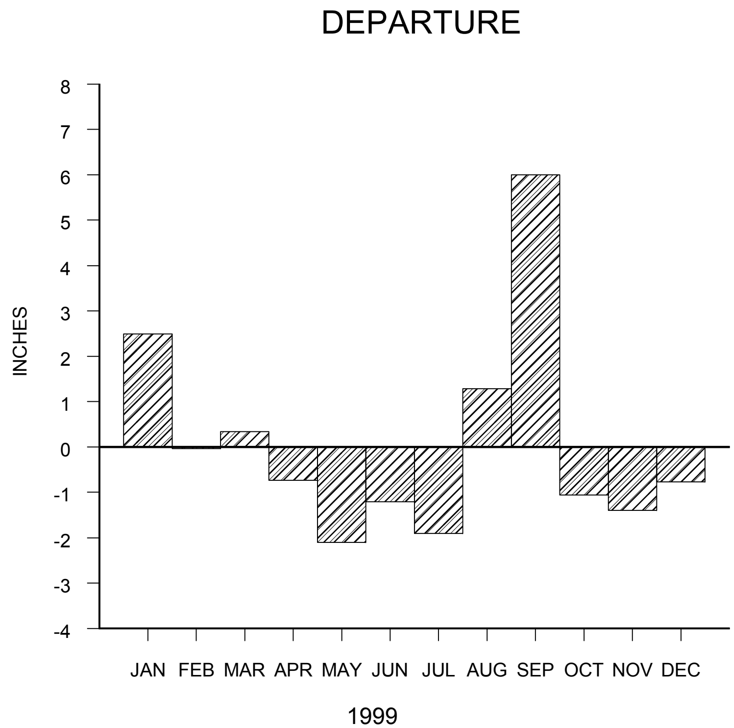
3. Rainfall

Rainfall is stated as the accumulated depth in inches as measured by county and airport rain gauges. January, August, and September were very wet months; 2.49 inches, 1.29 inches, and 6.00 inches above normal, respectively. April, June, July, October, November, and December were dry months, an average of 1.15 inches below normal. Rainfall was slightly above normal (0.94 inches) in 1999.

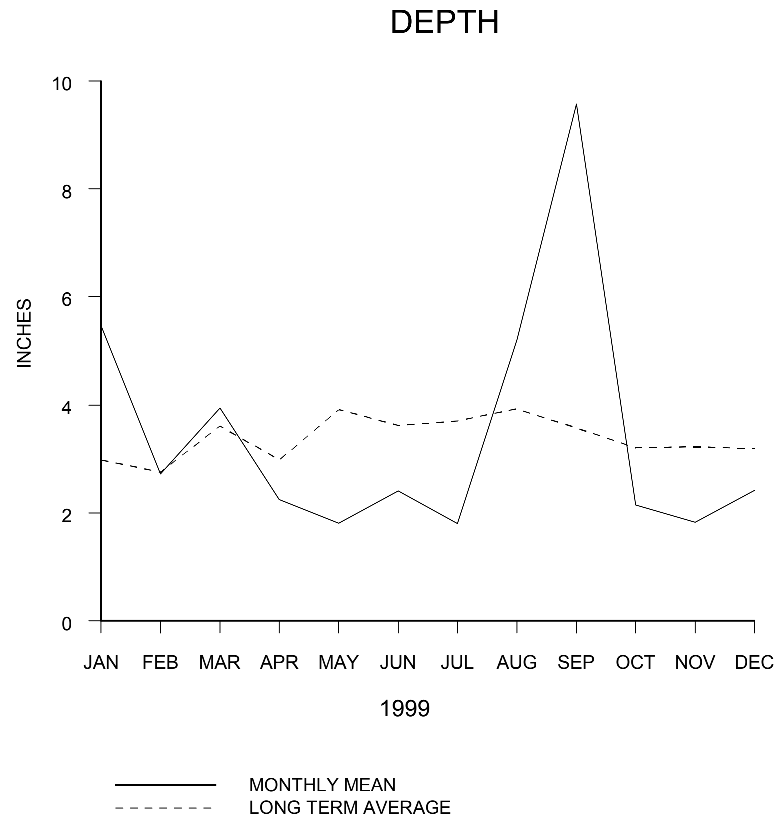
Table 17: Rainfall

	RAINFALL (inches)
COUNTY STATIONS	
Cub Run	45.87
Seven Corners	39.80
Lewinsville	42.71
Mount Vernon	38.28
Occoquan Hill	38.94
Luck Quarry	40.33
AIRPORTS	
Dulles	43.61
National	40.23
Davison	43.07
ANNUAL COUNTYWIDE MEAN	41.58
LONG TERM MEAN FROM THREE AIRPORT SITES	40.64

RAINFALL



DEPARTURE: THE DIFFERENCE BETWEEN THE LONG
TERM 3 AIRPORT AVERAGE AND THE AVERAGE
OF THE OBSERVED AMOUNTS AT ALL STATIONS.



4. Wind

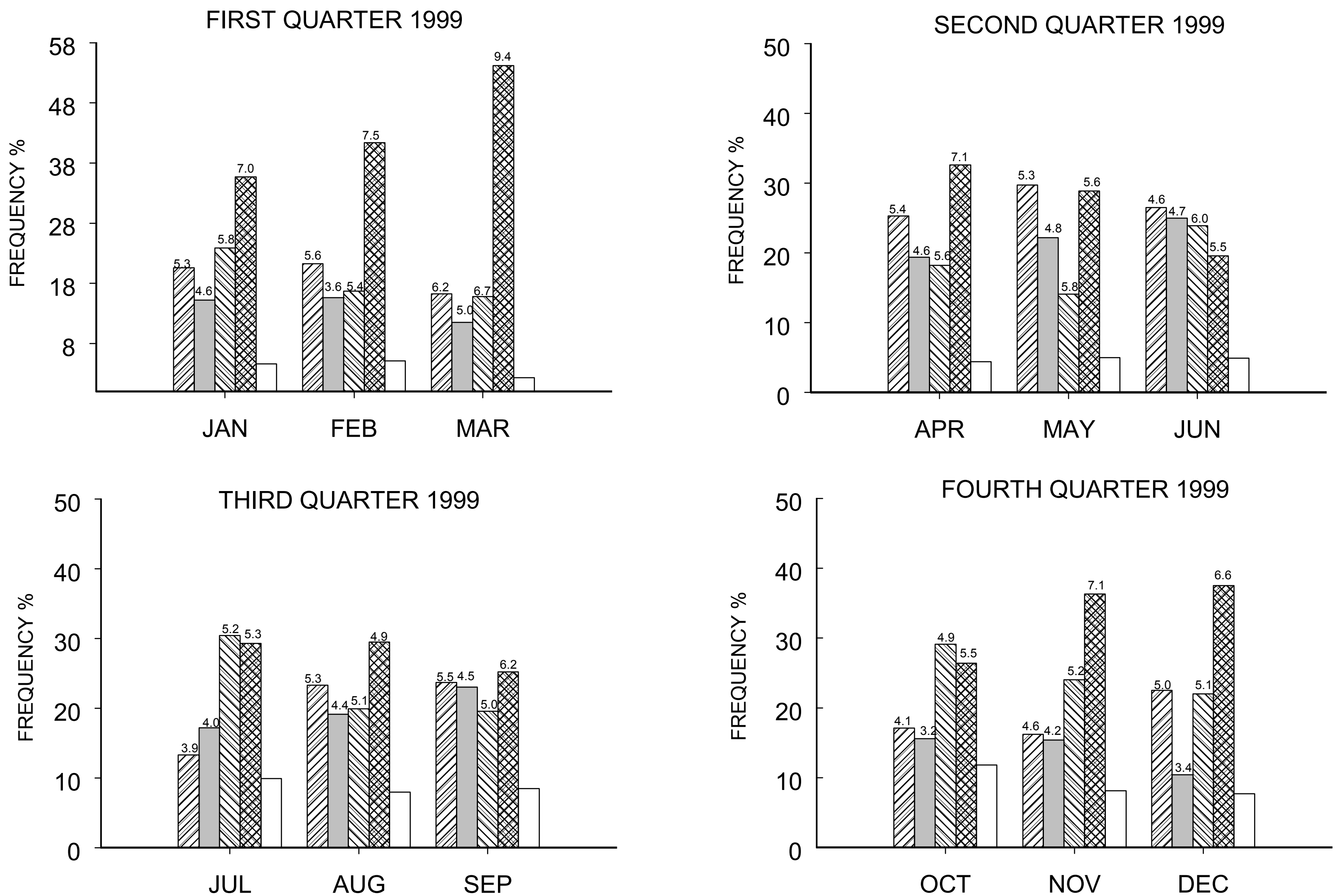
Wind direction observations are grouped by quadrant as follows: All occurrences of wind from 349^o true through 078^o true inclusive are classed as northeast winds; similarly winds from 079^o through 168^o true are southeast; winds from 169^o through 258^o true are southwest; and winds from 259^o through 348^o true are northwest. Frequency is the number of hourly observations in a quadrant stated as a percentage of all wind observations. Similarly, the mean wind speed for a quadrant is the average of all hourly wind speeds whose associated directions fall within the quadrant.

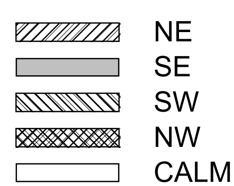
Table 18: Wind Direction and Mean Wind Speed

Table Format: Frequency (percent of time)
Miles per hour

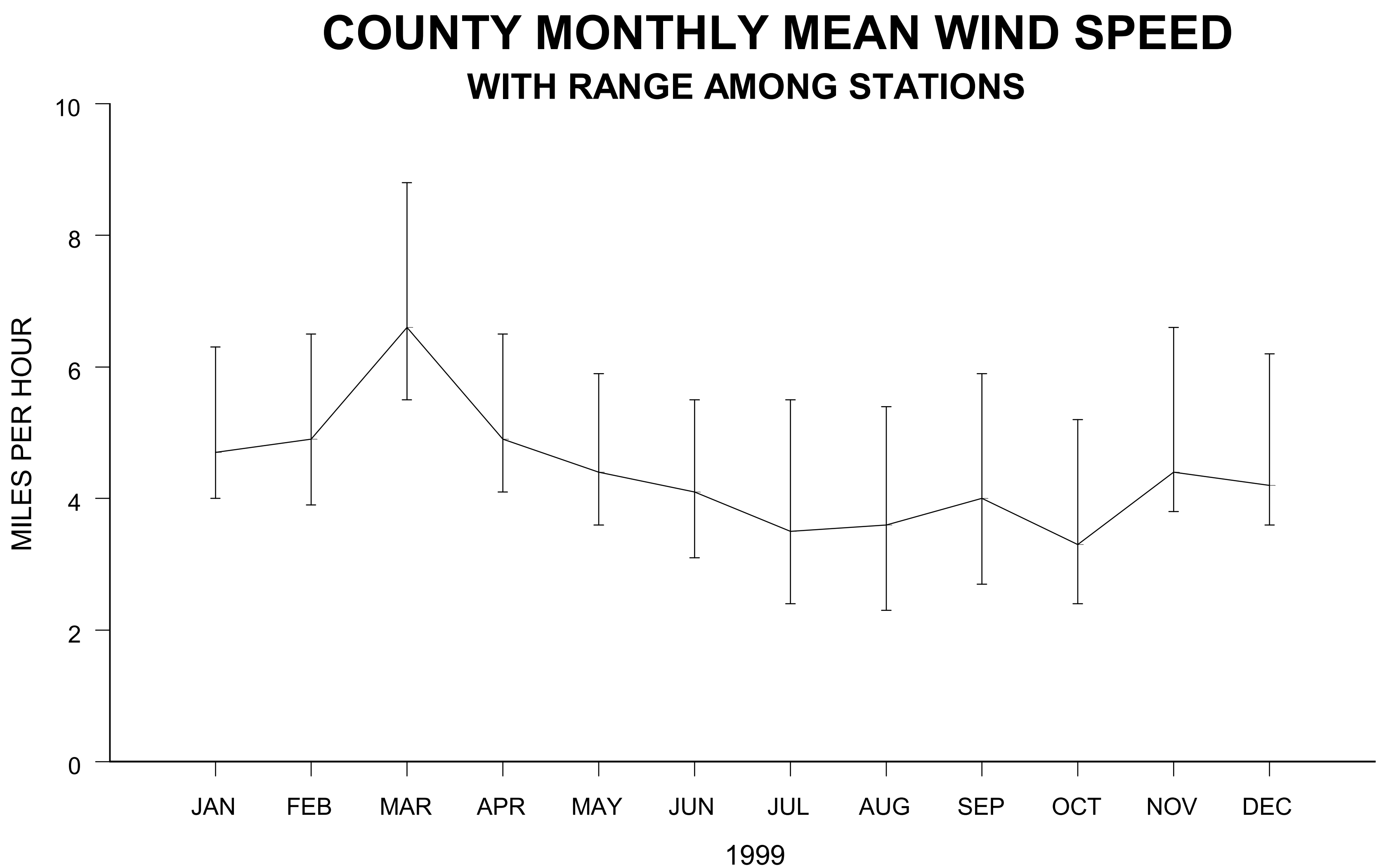
	NORTHEAST	SOUTHEAST	SOUTHWEST	NORTHWEST	CALM
COUNTY STATIONS					
Seven Corners	15.6 4.8	19.3 5.5	27.4 5.5	37.6 7.6	1.5
Lewinsville	23.7 4.0	22.1 3.2	19.6 3.5	34.6 4.0	0.0
Luck Quarry	17.9 3.8	17.1 3.1	21.7 4.3	34.1 4.2	9.2
Mount Vernon	23.9 3.5	20.4 3.4	23.1 4.4	32.6 4.8	0.0
Occoquan Hill	14.7 5.4	16.4 3.3	13.7 4.1	38.2 6.3	17.0
AIRPORTS					
Dulles	23.6 7.7	9.1 6.6	23.0 7.8	25.0 10.1	19.3
National	25.2 9.4	12.8 8.0	29.2 8.8	25.7 11.8	7.1
Davison	25.9 4.3	22.4 4.7	14.4 5.6	36.4 9.4	0.9

WIND SPEED AND DIRECTION





MONTHLY AVERAGE WIND SPEED FOR EACH QUADRANT APPEARS ABOVE ITS RESPECTIVE BAR.


COUNTY MONTHLY MEAN WIND SPEED
WITH RANGE AMONG STATIONS
MILES PER HOUR
10
8
6
4
2
0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1999

APPENDIX A
ANNUAL TREND ANALYSIS AND GRAPHS

In this Section, monitoring data for a number of pollutants are aggregated on an annual basis and plotted against time to indicate long-term trends. A trend is a broad long-term movement in the time sequence of air quality measurements.

Comparable data on several factors known to influence air quality are also plotted for ease of comparison. Some caution in making comparisons is urged however, because the nature and strength of the causal relationships, if any, are somewhat speculative.

A1. PARTICULATE MATTER (PM_{10})

Particulate matter (PM_{10}) is emitted directly by mobile and industrial sources or is formed in the atmosphere by reaction with sulfur dioxide, nitrogen oxides, and volatile organic compounds.

In the Group A graphs, the composite average annual arithmetic mean PM_{10} concentrations are compared with traffic, building activity and rainfall deficit. There has been a significant long-term downward trend in the PM_{10} composite average
(-36.4%) since 1987. The 1-year change between 1998 and 1999 was -1.9 percent. The building activity graph reflects residential projects under construction during January of each year, and is used as an indicator of development activities, i.e. fugitive dust emissions, for the succeeding year. The traffic graph is used as an indicator of vehicle travel growth as measured by vehicle miles traveled. The rainfall deficit graph is a plot of the percentage difference above or below normal. Rainfall deficit is plotted with "below normal rainfall" as a positive percentage for ease of comparison with the PM_{10} graph.

Vehicle travel growth and development activities have the effect of increasing the amount of dust in the air. Pollution emissions from automobiles are declining despite increases in vehicle miles traveled each year. Building activity declined 78.6 percent between 1986 and 1991, and has increased 84.8 percent from 1991 to 1999. PM_{10} levels continued to fall between 1991 and 1999 (26.9%) despite an increase in building activity. PM_{10} trends are highly associated with the trends in sulfur dioxide and nitrogen oxides. PM_{10} levels seem to be affected more by reductions in sulfur dioxide, nitrogen oxides, and volatile organic compound emissions than by increases in building activity or the growth in vehicle travel. Rainfall has the effect of minimizing dust re-entrainment and also cleans dust out of the air. PM_{10} levels, on an annual basis, seem to be unaffected by the amount of rainfall in a given year.

A2. OZONE

Ozone levels tend to be high during the warm months of the year. The official "Ozone Season" for the Metropolitan Washington area begins in April and continues through October of each year. In the top left graph of Group B-1, ozone levels are expressed in terms of the composite average (four sites) of the second highest daily maximum 1-hour concentration. The composite average tends to vary from year to year due to a number of different factors affecting ozone levels, such as changing meteorological conditions and precursor emission changes. The long-term mean of the composite average since 1974 is 0.13 ppm. In 1983 Fairfax County exceeded the standard (0.12 ppm) on 25 days, in 1987 on 15 days, and in 1988 on 22 days. The composite average in 1983 was 15 percent above it's long-term mean, in 1987 it was 8 percent above it's long-term mean, and in 1988 it was 22 percent above it's long-term mean. There were many hot clear days during the ozone seasons of 1983, 1987, and 1988, conditions very conducive to ozone formation.

In 1992, 1996, and 1997 the composite average was 18, 18.5, and 19.2 percent below it's long-term mean. Cooler than normal temperatures persisted during most of these ozone seasons, as well as above normal cloud cover. These cool and/or cloudy conditions are not conducive to ozone formation. Ozone levels during the 1996 and 1997 ozone seasons were the lowest measured since 1974 when monitoring began. Ozone levels during the 1999 ozone season were lower than 1998. The composite average (0.116 ppm) increased 9.4 percent above the 1996 and 1997 levels, and was 10.8 percent below the long-term mean. There has been a downward trend in the composite average, -14.1 percent, since 1979.

The top right graph of Group B-1 depicts the number of "unhealthful" days as defined by the Air Quality Index (AQI). The AQI is the national uniform index system, the use of which in this area is required by Federal regulation. (See section E.1. Air Quality Index for more information). For purposes of this report, an "unhealthful" day is defined as any day when the measurement at any Fairfax County station yields an index value greater than 100. In 1983 Fairfax County experienced 30 "unhealthful" days, in 1987 17 "unhealthful" days, and in 1988 28 "unhealthful" days. The large number of "unhealthful" days during these 3 years was due primarily to the occurrence of meteorological conditions very conducive to ozone formation. There were 2 "unhealthful" days in 1999.

The bottom left graph is a plot of the composite average of the average number of exceedant days (an exceedant day is one during which a site had at least one hourly average greater than the ozone standard). The average number of exceedant days is a 3-year running average and is calculated by dividing the total number of exceedant days in a given year plus those in the two prior years by three. The plotted values are a composite of the average number of exceedant days averaged over all the County ozone sites. In 1988 and 1989 the composite average was 7.0 days, the highest value recorded, and reflects the influence of the high number of exceedant days in 1988 on the 3-year averages. The composite averages in 1997 and 1998 were the lowest observed (.58). In 1999, the composite average of exceedant days was 0.75.

On July 18, 1997 EPA promulgated new national ambient air quality standards (NAAQS) for ozone. EPA changed the averaging time to 8 hours and changed the form of the standard from an expected exceedance form to a concentration-based form. The NAAQS for ozone are met at an ambient monitoring site when the 3-year average of the annual fourth highest daily maximum 8-hour concentration is less than or equal to 0.08 ppm. The new standards became effective on September 16, 1997, and the 1-hour standard will remain in effect until EPA determines that this region has attained the 1-hour standard. As stated earlier in this report, (Section C.1. Ozone), a Court opinion was issued on May 14, 1999 regarding the final ambient air quality standards for ozone. Fairfax County continues to monitor for 1-hour and 8-hour ozone standards.

The graphs in Group B-2 will be used to track ozone trends associated with the new 8-hour standards. The statistics used in the plots are directly related to the form and averaging time of the new 8-hour standards. Trends in the composite average of the fourth highest daily maximum 8-hour concentration are shown in the top left graph of Group B-2. There has been a significant downward trend in the composite average, -6.1 percent, since 1979. The composite average was 0.092 ppm in 1999. The top right graph is a plot of the composite average of the 3-year mean fourth highest maximum daily 8-hour concentration and is used to track compliance with the new 8-hour standard. There has been a significant downward trend in the composite average, - 2.2 percent, since 1979. The 1999 composite average of the 3-year mean was 0.091 ppm.

The bottom left graph is a plot of the composite average of the number of days with maximum 8-hour concentration above the 8-hour standard. It shows the year to year variability in the number days the ozone standard was exceeded. The composite average decreased in 1999 to 9 days. The bottom right graph is a plot of the monthly frequency, in percent, of days above the 8-hour standard using all ozone data from 1974 to 1999. April is the earliest month in which the 1-hour standard has been exceeded, while ozone concentrations above the 8-hour standard have been observed in March. July has the greatest number of days above the 8-hour standard. There have been no exceedances of either the 1-hour standard or the 8-hour standard in October.

The graphs in Group B-3 are plots of the maximum daily 8-hour ozone concentration at each ozone monitoring site during the 1999 ozone season. They show the day to day variation in the maximum daily 8-hour mean and the number of exceedances of the 8-hour standard at each site. Mount Vernon exceeded the 8-hour standard on 16 days, Seven Corners on 9 days, and Cub Run and Lewinsville on 6 days.

Ozone in Fairfax County has improved since 1979. Citizens in the County are exposed to fewer unhealthful ozone days and generally lower ozone concentrations on those days.

A3. INDUSTRIAL AND SPACE HEATING EMISSIONS

Sulfur dioxide and nitrogen dioxide trends are shown in Group C along with trends in existing dwelling units and heating degree-days. These pollutants are produced by fossil-fueled space heating and electrical utility boilers as well as by internal combustion engines. In the top left graph the sulfur dioxide levels are expressed in terms of the composite annual average concentration. The composite average decreased 6.6 percent between 1987 and 1999. The sulfur dioxide composite average has shown a long-term downward trend, - 33.6 percent, since 1979.

In the top right graph the nitrogen dioxide levels are expressed in terms of the composite annual average concentration. The composite average decreased 4.2 percent between 1998 and 1999. The nitrogen dioxide composite average has shown a long-term downward trend, - 27.8 percent, since 1979.

The bottom left graph is a plot of the number of dwelling units in Fairfax County. The growth rate in the housing inventory averaged 4.1 percent between 1985 and 1990. The growth rate has slowed to 1.7 percent per year since 1991.

The bottom right graph is a plot of heating demand. Geographical differences in heating demand are substantial, with approximately 730 degree-days average difference between the highest and lowest county stations. Both the age of a community (fossil or electric fuel) and its location (high or low heating demand) influence its emission response to changes in overall heating demand.

A4. LEAD AND VEHICLE EMISSIONS

Carbon monoxide and nitrogen oxides are produced principally by automotive sources and secondarily by fossil fuel space heating. At one time, the primary source of lead in ambient air in this area was the combustion of leaded fuels by automotive vehicles. Group D shows trends of these pollutants along with the traffic trends.

In the top left graph the carbon monoxide levels are expressed in terms of the composite average of the second highest 8-hour average concentration. There has been a long-term downward trend, - 74.1 percent, in the composite average since 1974. Carbon monoxide levels tend to be high during the colder months of the year, January, February, November, and December. High 8-hour average concentrations frequently occur in the 5pm - 1am and 6pm - 2am time frames, and are associated with emission generated by evening rush hour traffic and strong winter temperature inversions. Fairfax County has never exceeded the 1-hour standard and has not violated (2 exceedances in one year) the 8-hour standard since 1979. The last exceedance of the 8-hour standard was in 1986. Fairfax County is in attainment for the NAAQS for carbon monoxide.

In the top right graph of Group D, lead levels are expressed in terms of the composite average of the maximum quarterly average concentration. There has been a long-term decrease of 96 percent in lead levels since 1981. The 1999 composite average is 1.0 percent of the National Standard of I.5 $\mu g/M^3$. This decrease in the composite average can be attributed to the Environmental Protection Agency's (EPA) program of eliminating lead in gasoline. The EPA lowered the allowable lead content in gasoline by 50 percent on July 1, 1985. A further reduction to 0.1 grams/gal, a 90% reduction from pre-July 1985 levels, was implemented on January 1, 1986. In 1975 unleaded gasoline was introduced, which now accounts for about 99% of gasoline sales.

In the bottom left graph oxides of nitrogen levels are expressed in terms of the composite average of the annual average concentration. The annual average is calculated as the sum of the annual averages of nitrogen dioxide and nitrogen oxide. There has been a downward trend in the composite average, - 36.8 percent, since 1979.

In the bottom right graph the number of vehicle miles traveled in the County each year is plotted. Despite increases in the number of vehicle miles traveled pollutant emissions from motor vehicles have continued to decline. Additional emission control strategies will be needed in the future if declines in motor vehicle emissions are offset by continued growth in the number of vehicle miles traveled.

A5. ACID DEPOSITION

Sulfuric and nitric acids are the two major components of both wet and dry acidic deposition. The top left and top right graphs in Group E show trends in their precursors, sulfur dioxide and nitric oxides. Sulfur dioxide reacts with hydroxyl radicals, hydrogen peroxide and ozone, to produce sulfate ions. Nitric oxide reacts with a number of different pollutants such as hydrocarbons, carbon monoxide, hydroperoxyl radicals, hydroxyl radicals, and ozone to produce nitric acid, particulate nitrate, and peroxyacetyl nitrate (PAN). The bottom left and bottom right graphs show trends in rainfall and volume weighted pH at the Occoquan Hill site. There is evidence of a downward trend in pH at Occoquan Hill; the long-term average is 4.20. The average pH from 1989 to 1996 was 4.27, and from 1997 to 1999 it was 4.00.

A6. WEATHER

Meteorological monitoring was initiated in 1974 for wind direction and wind speed, temperature, and rainfall. Group F shows trends of rainfall, temperature, heating demand, and cooling demand.

The top left graph in Group F illustrates the year to year variability inherent in rainfall. The values used in this graph are obtained as follows: the observed rainfall amounts at all County stations, plus Dulles, National, and Davison airports for each month and for each year are averaged to obtain a composite county average amount, for the year of interest. The long-term average uses the climatological values from the three airports. Annual rainfall in 1999 was 41.58 inches, 0.94 inches above normal. Annual rainfall in 1996 was 55.82 inches, the wettest year since 1974. The driest year was in 1980, 29.94 inches of rainfall, 10.84 inches below normal.

The top right graph is a plot of the annual mean temperature. The warmest annual mean temperature was set in 1998 (59.1°F). The United States average temperature in 1998 was also one of the warmest years on record. The coolest annual mean temperature observed in the County was in 1978 (53.0°F). The annual mean temperature in 1999 was 57.5°F. There has been an upward trend in the annual mean temperature in the County since monitoring was initiated in 1974. Several factors have probably influenced the apparent trend in the annual mean temperature, improvements in the temperature measurement instrumentation, changes in sample site location, and a "heat island" effect. Fairfax County has become increasingly developed over the last twenty years. There are more buildings and streets, which can collect, heat during the day and hold on to it longer at night, increasing the temperature of the surrounding air.

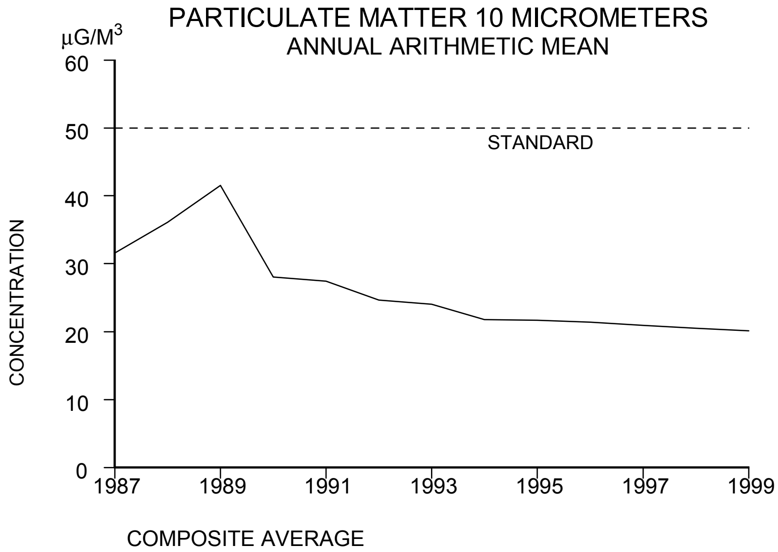
The bottom left graph is a plot of the County average heating demand. Heating degree-days are used as a rough indicator of the heating demand, the amount of fuel consumed in space heating. One heating degree-day is given for each degree the daily mean temperature falls below 65°F. The heating degree-days are totaled over a heating season and averaged over all County monitoring sites. There has been a long-term downward trend in heating demand since 1978.

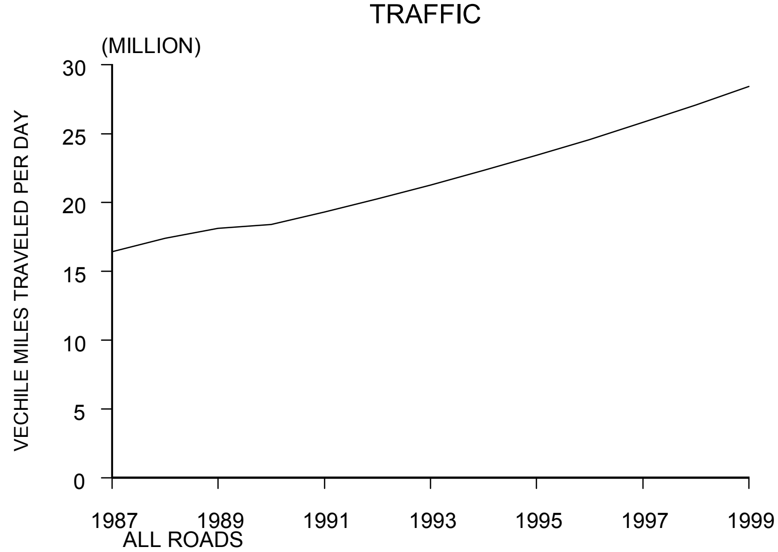
The bottom right graph is a plot of the County average cooling demand. Cooling degree-days are used as a rough estimate of the energy requirements for refrigeration and air conditioning. One cooling degree-day is given for each degree the daily mean temperature rises above 65°F. The cooling degree-days are totaled over the cooling season and averaged over all County monitoring sites. There is no evidence for a trend in the cooling demand.

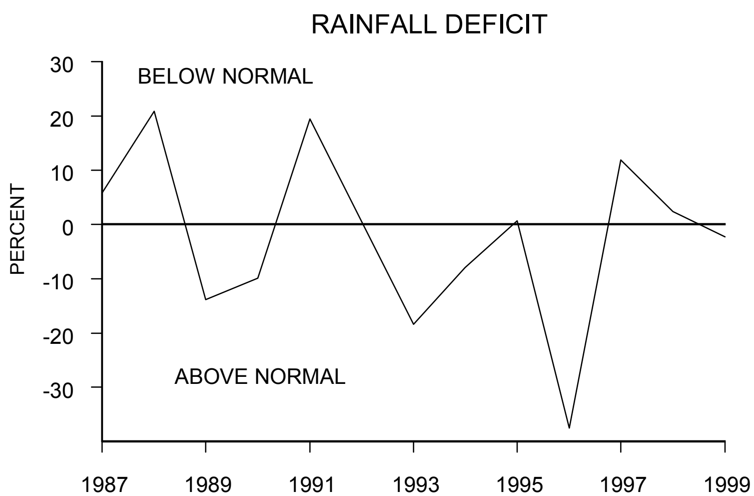
The predominant wind directions in the summer months are from the southwest quadrant. In the winter and late fall the predominant winds are from the northwest quadrant. Higher mean wind speeds are associated with winds from the northwest quadrant.

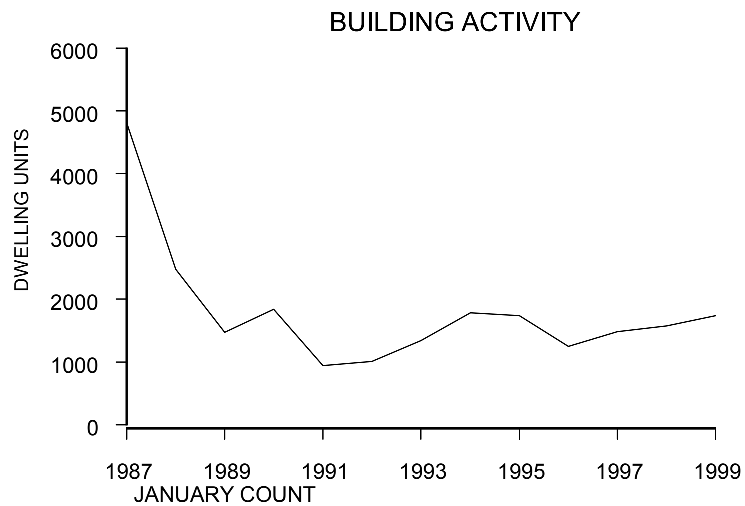
ANNUAL TRENDS

GROUP A



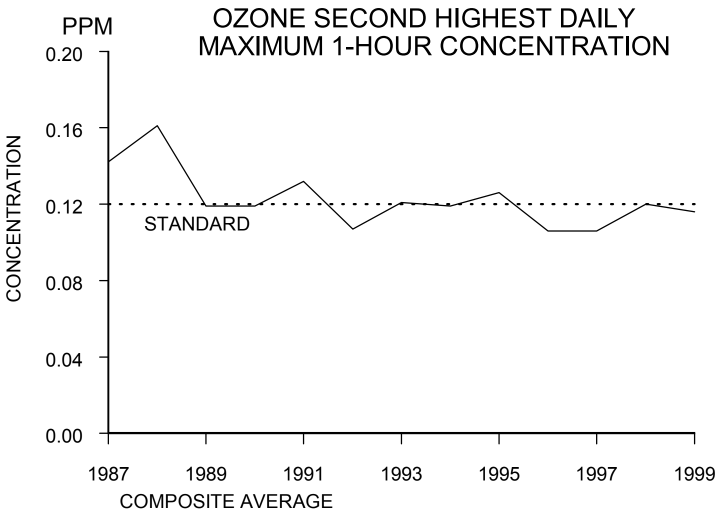


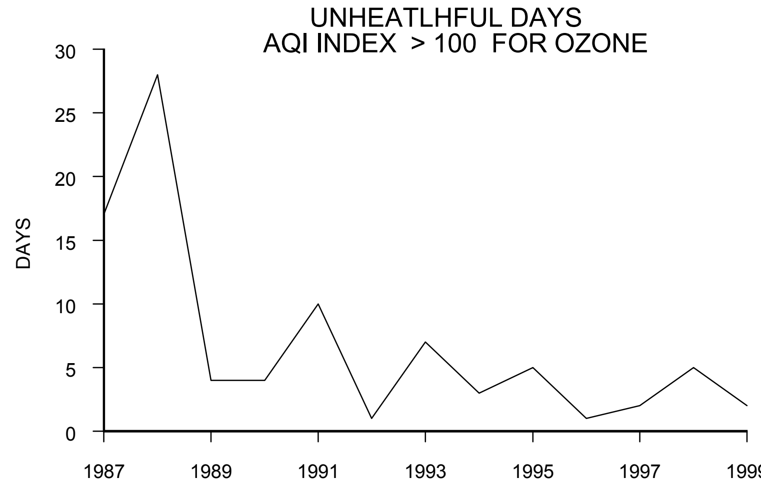


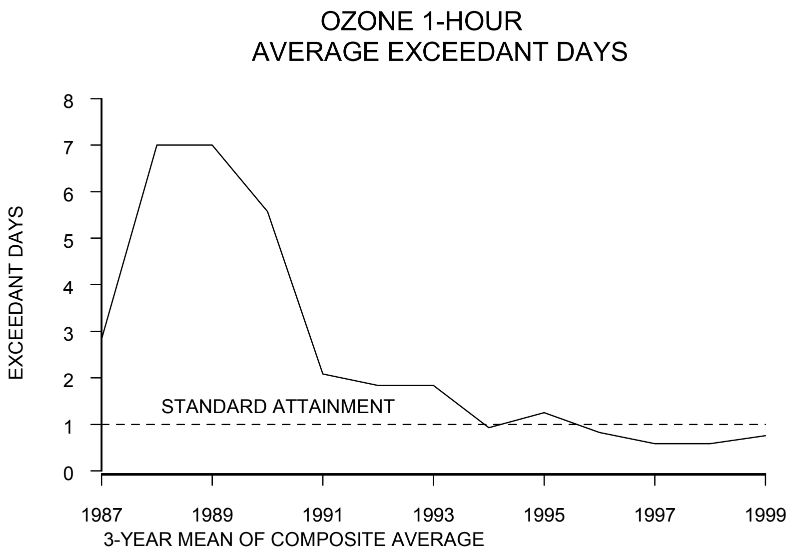


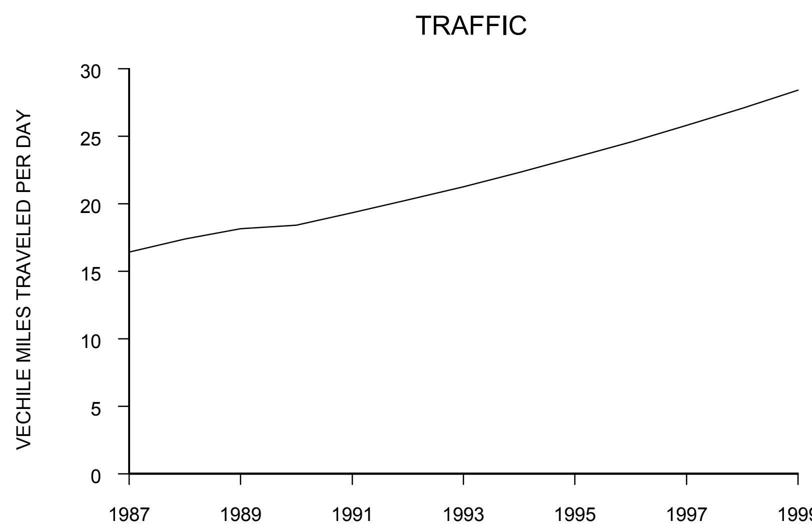
ANNUAL TRENDS

GROUP B-1









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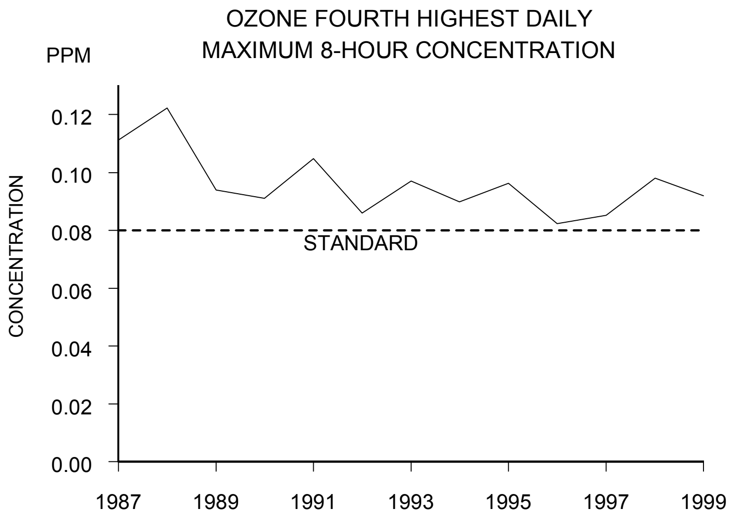
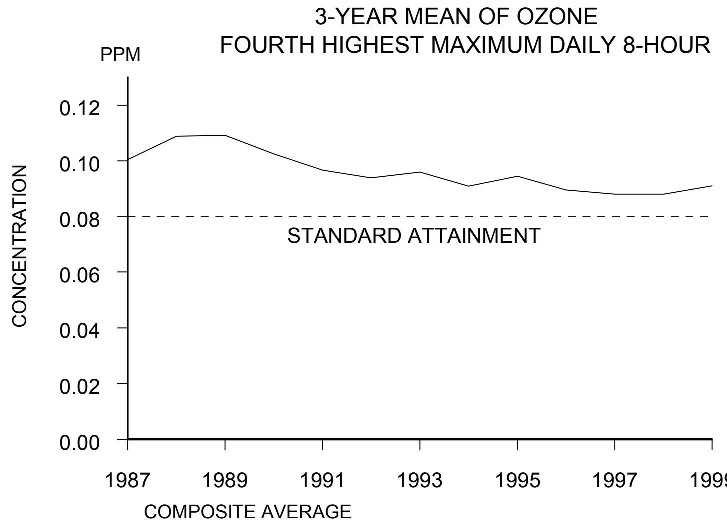
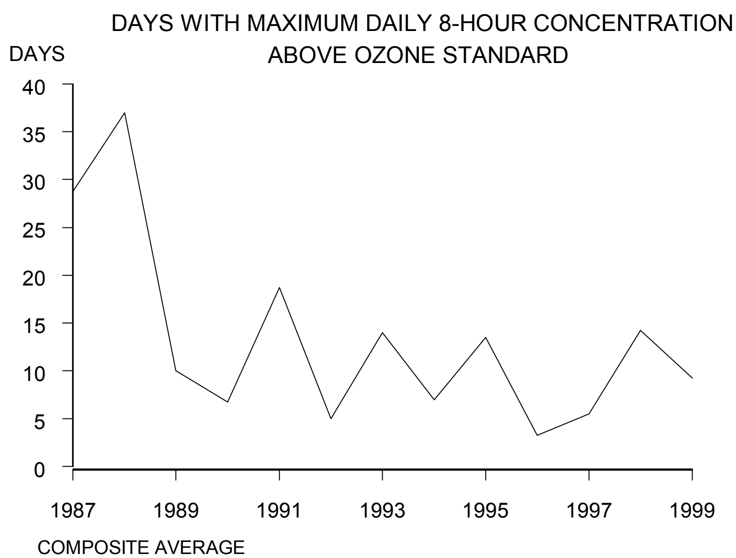
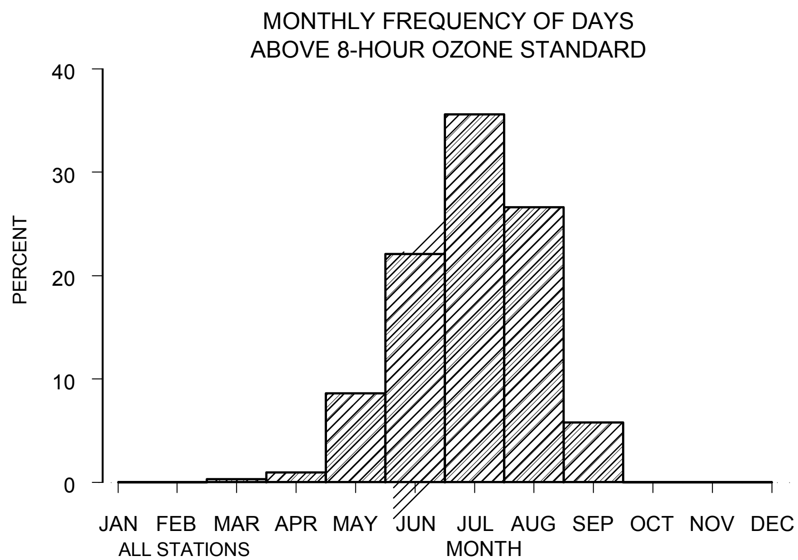




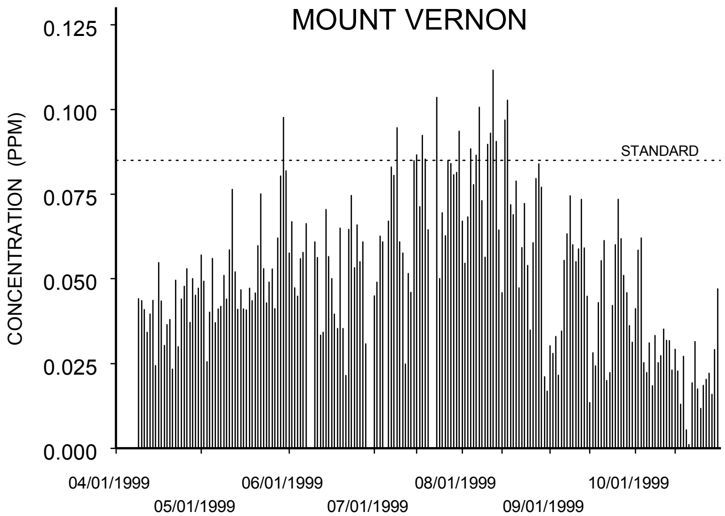


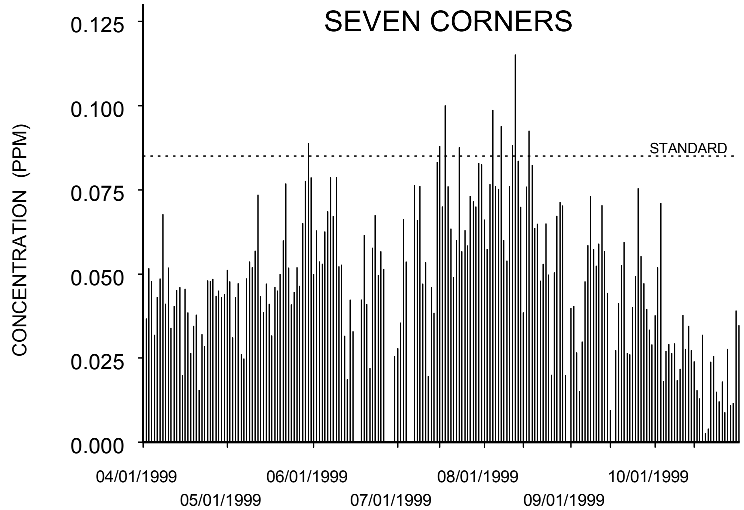


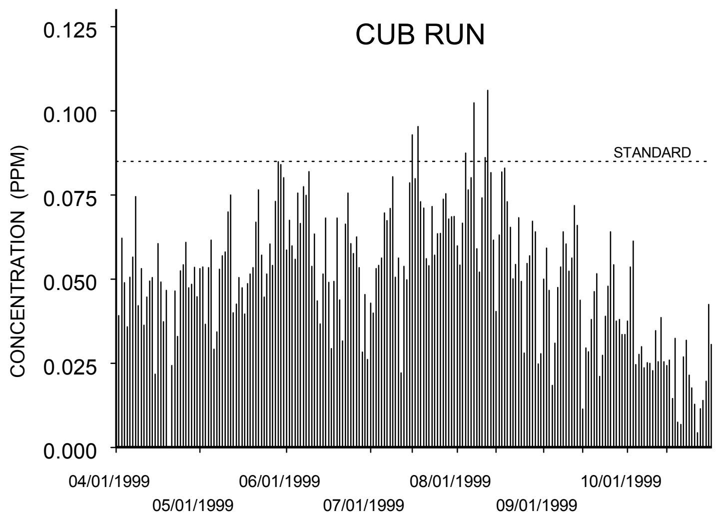
ANNUAL TRENDS

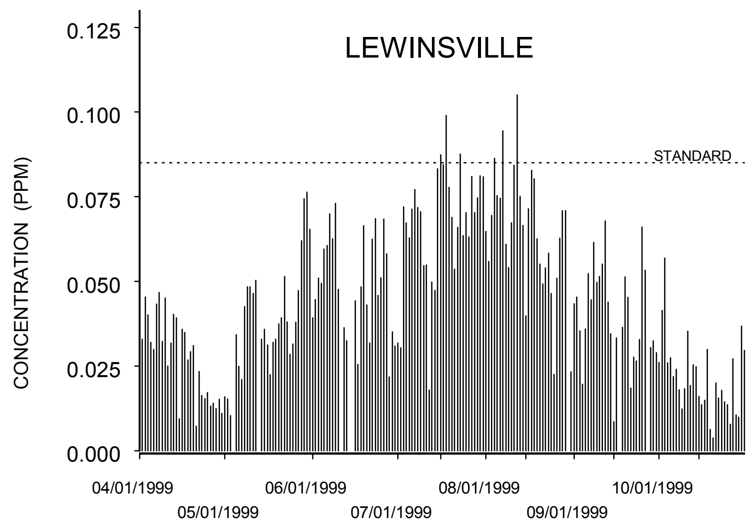
GROUP B-3

MAXIMUM DAILY 8-HOUR OZONE CONCENTRATION



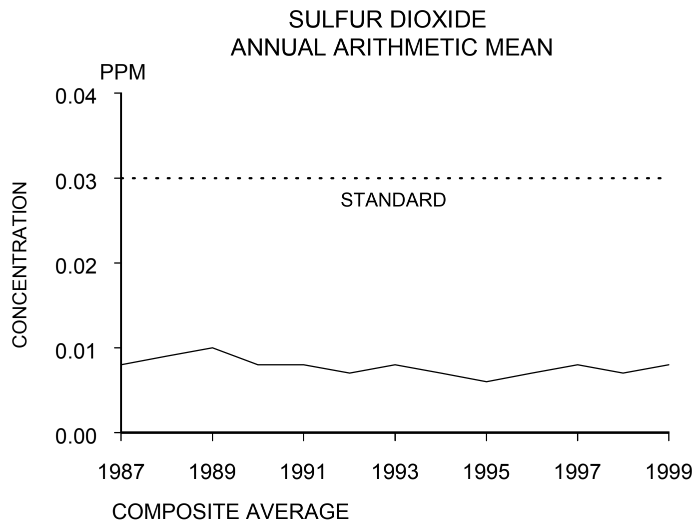


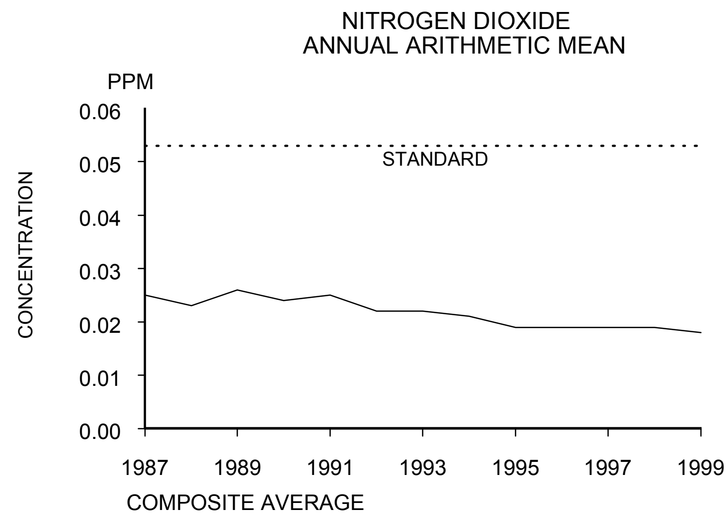


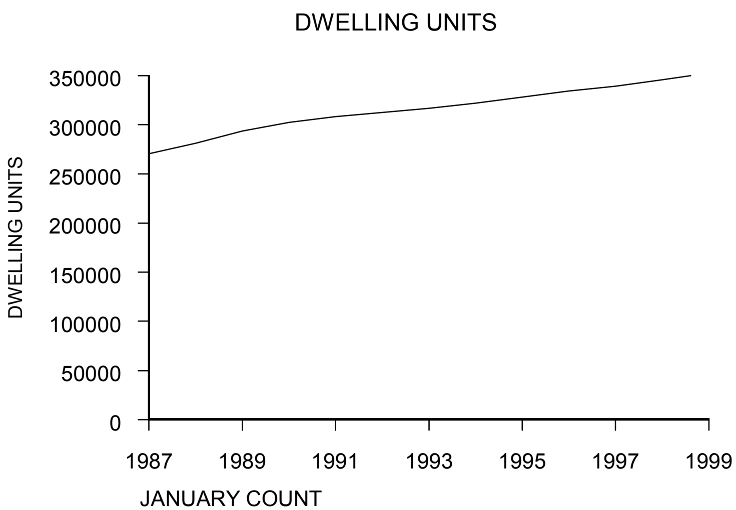


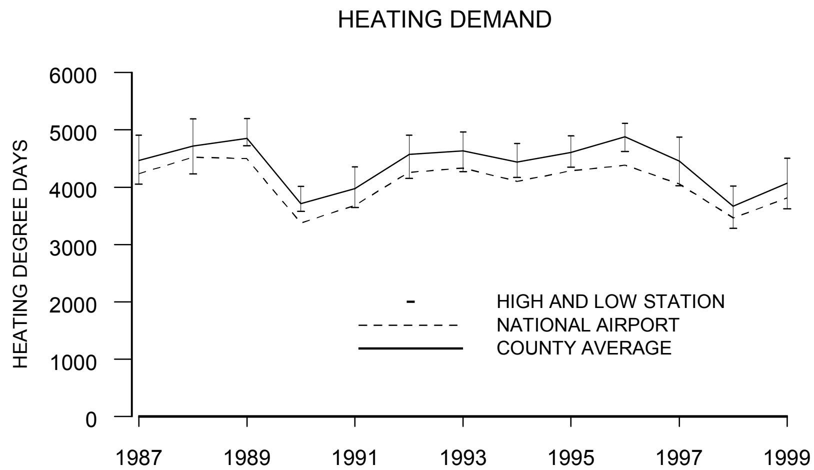
ANNUAL TRENDS

GROUP C









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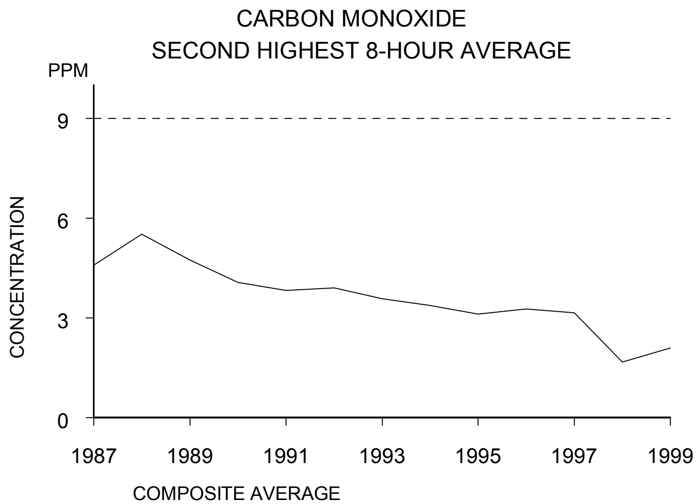

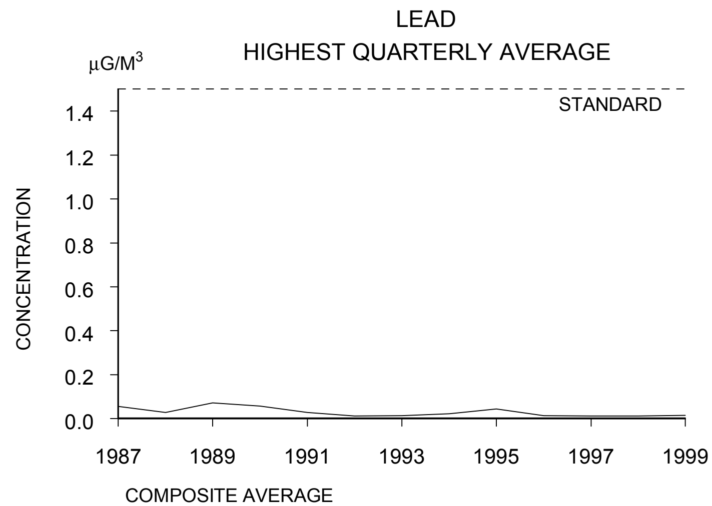

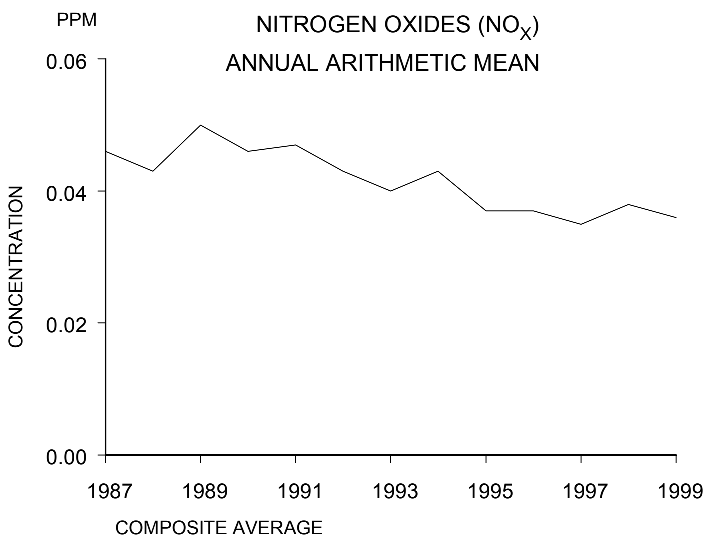

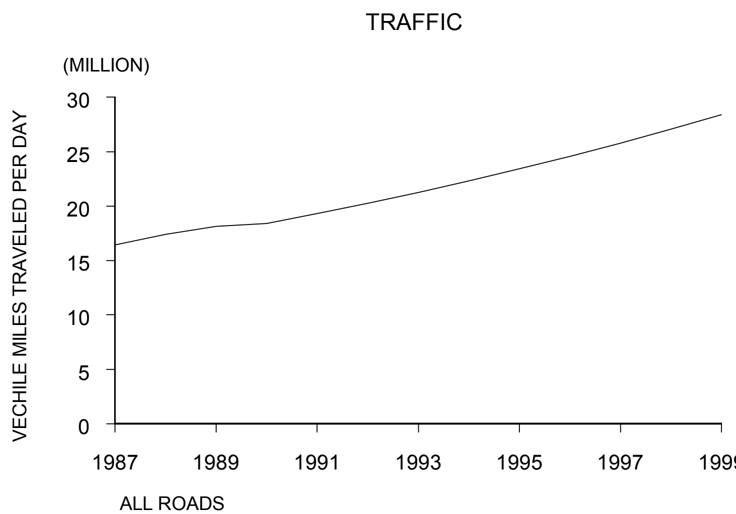

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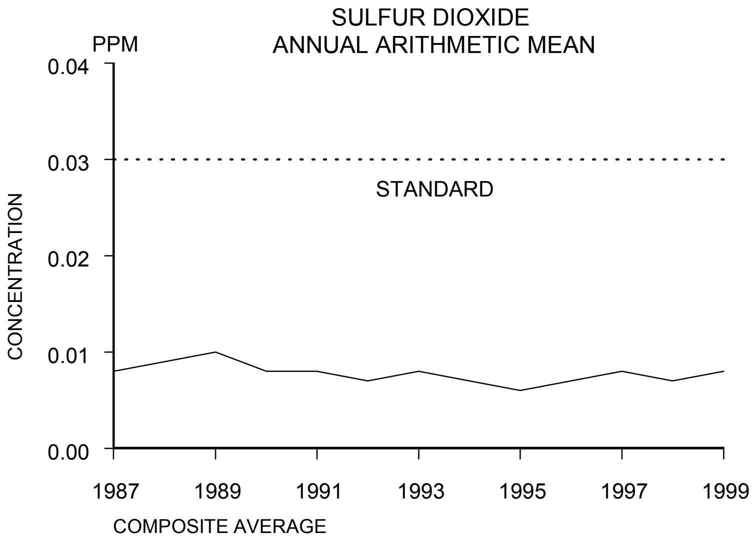

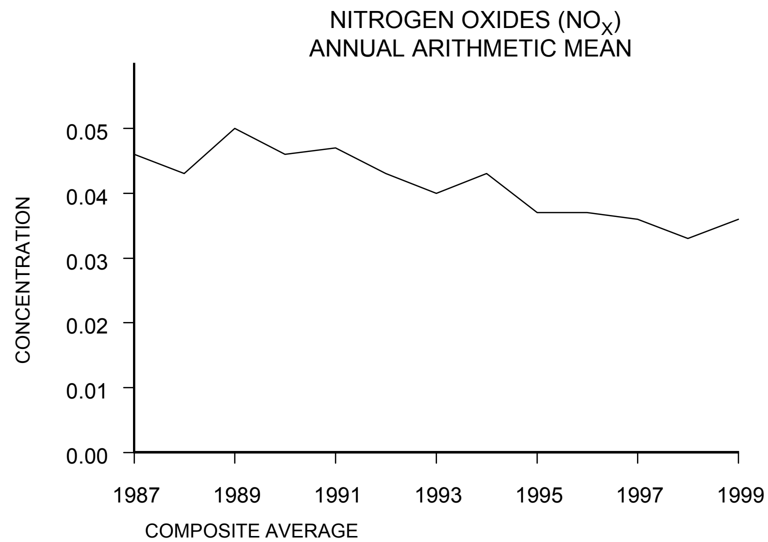

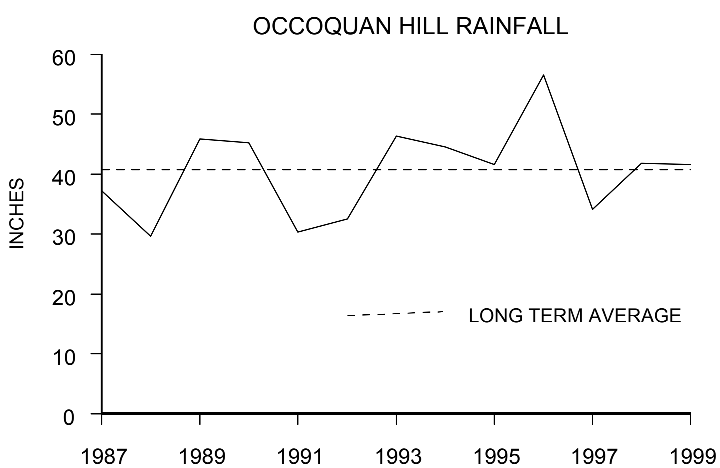

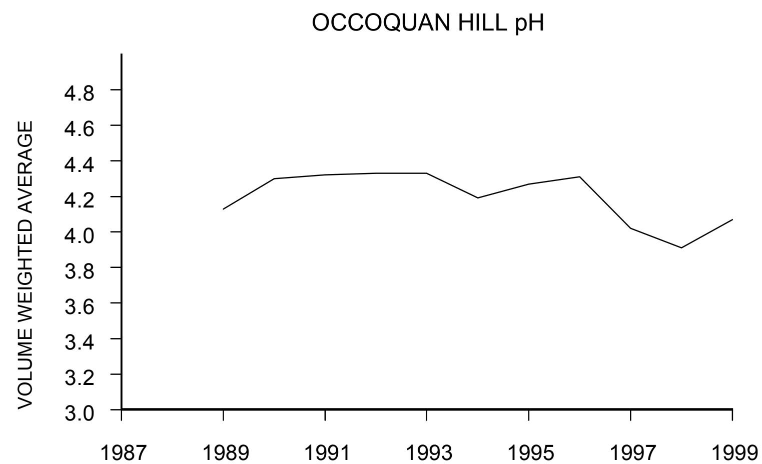

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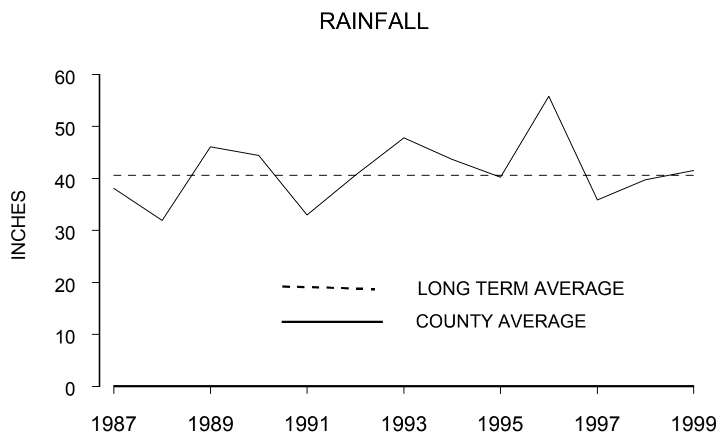
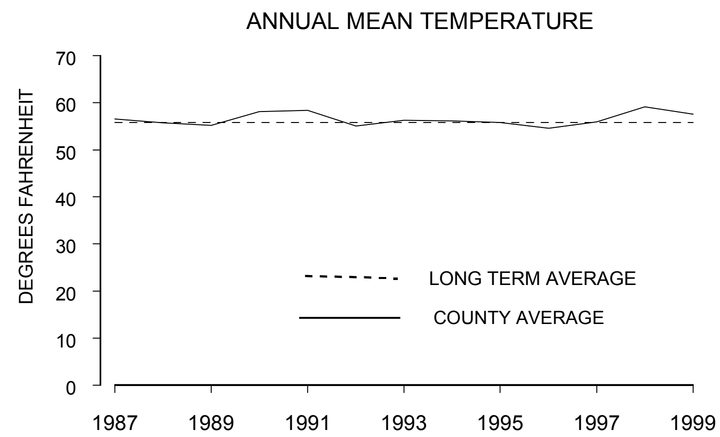
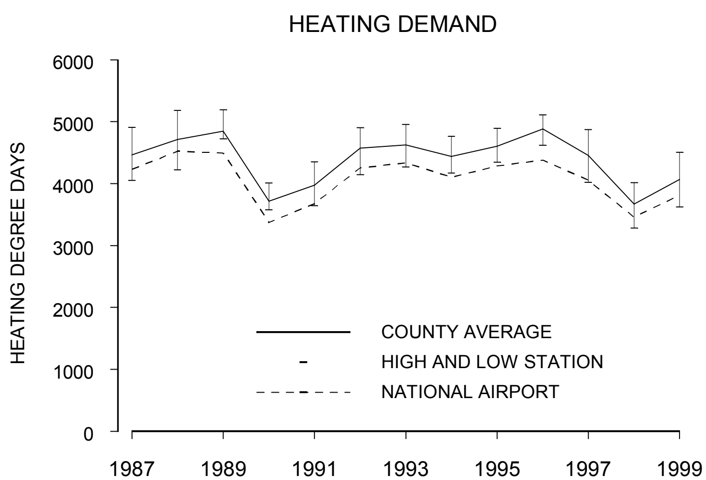
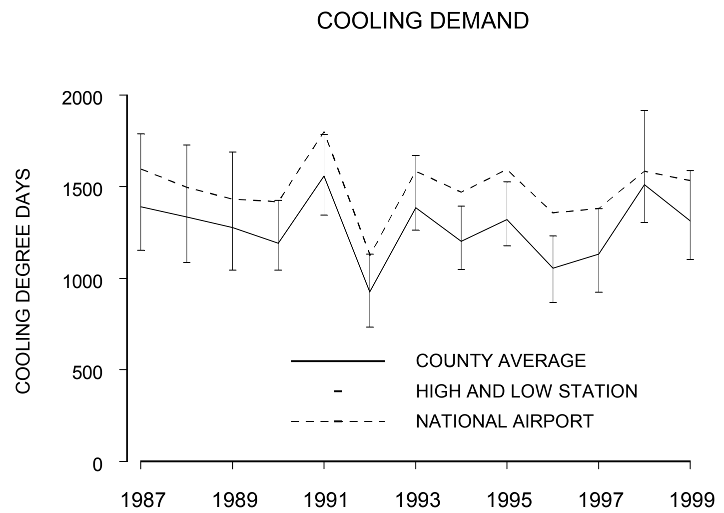
GROUP F









APPENDIX B
MONITORING SITES AND MAP

SITE	ADDRESS	LATITUDE	LONGITUDE	UTM COORDINATES	TAX MAP	AIR POLLUTANT PARAMETERS	METEOROLOGICAL PARAMETERS
CUB RUN AIRS: 51-059-0005	Upper Cub Run Dr. Chantilly	38° 53' 38.3" N	77° 27' 56.3" W	289.177 km E, 4307.697 km N	33-4	CO; O3; NO/NO2; SO2; PM10	None
FRANCONIA AIRS: 51-059-0030	6601 Telegraph Rd. Franconia	38° 46' 22" N	77° 06' 20" W	317.090 km, 4293.450 km N	92-1	O3; O3	None
LEWINSVILLE AIRS: 51-059-5001	1437 Balls Hill Rd. Mclean	38° 55' 56.6" N	77° 11' 54.6" W	309.443 km E, 4311.600 km N	30-1	CO; O3; NO/NO2; SO2; PM2.5	Wind Speed and Direction; Temperature, Precipitation
MOUNT VERNON AIRS: 51-059-0018	2675 Sherwood Hall Ln. Mount Vernon	38° 44' 32" N	77° 04' 37" W	319.488 km E, 4290.214 km N	102-1	O3; PM10	Wind Speed and Direction; Temperature; Precipitation
SEVEN CORNERS AIRS: 51-059-1004	6100 Arlington Blvd. Falls Church	38° 52' 05.4" N	77° 08' 34.91" W	314.073 km E, 4304.095 km N	51-4	CO; O3; NO/NO2; PM2.5	Wind Speed and Direction; Temperature; Precipitation
BUSH HILL*	5927 Westchester St. Alexandria	38° 47' 24" N	77° 07' 25" W	315.46 km E 4295.400 km N	81-4	TSP; Lead	None
CLERMONT*	5720 Clermont Dr. Alexandria	38° 47' 42" N	77° 06' 42" W	316.505 km E, 4295.963 km N	82-1	TSP; Lead	None
GUNSTON* AIRS: 51-059-0021	10100 Gunston Rd. Lorton	38° 41' 03" N	77° 12' 35" W	307.369 km E, 4283.938 km N	113-2	TSP; Lead	None
I-95* AIRS: 51-059-0029	9850 Furnace Rd. Lorton	38° 41' 30.5" N	77° 14' 41.5" W	305.280 km E, 4284.740 km N	113-1	TSP; Lead	None
LUCK* AIRS: 51-059-0123	15500 Lee Hwy. Centreville	38° 49' 16.0" N	77° 27' 05.5" W	284.310 km E, 4300.512 km N	64-1	None	Wind Speed and Direction; Temperature; Precipitation
OCCOQUAN HILL* AIRS: 51-059-0023	9900 Ox Rd. Lorton	38° 41' 23.8" N	77° 15' 34.7 W	303.475 km E, 4284.648 km N	112-2	TSP; PM10; Lead	Wind Speed and Direction; Temperature; Precipitation
SPRINGFIELD AIRS: 51-059-3002	6120 Brandon Ave. Springfield	38° 47' 03" N	77° 10' 57.0" W	310.420 km E, 4294.805 km N	80-4	TSP; PM10; Lead	None
THOMAS EDISON*	5801 Franconia Rd. Alexandria	38° 46' 55" N	77° 08' 00" W	314.500 km E, 4294.56 km N	81-4	TSP; Lead	None

*Special study monitoring site; may not have assigned AIRS number.