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.

A. 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.

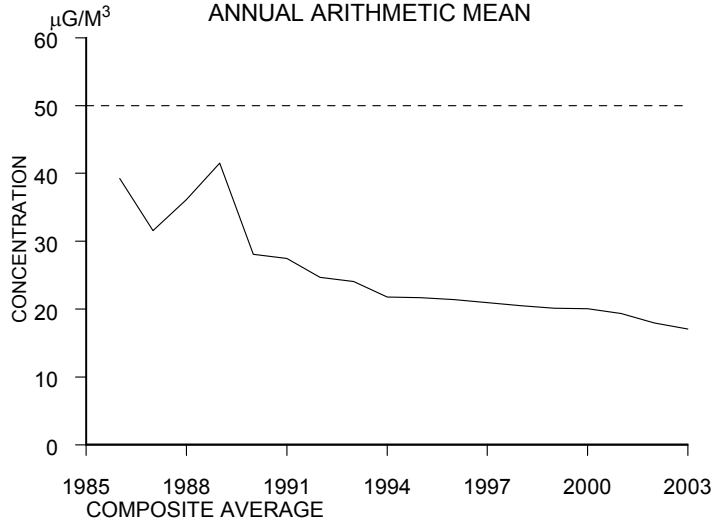
In the Group A graphs, the composite average annual arithmetic mean PM_{10} concentrations are compared with traffic and rainfall deficit. There has been a significant long-term downward trend in the PM_{10} composite average (-56.6%) since 1986. The 1-year change between 2002 and 2003 was –5.2 percent. 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. 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 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.

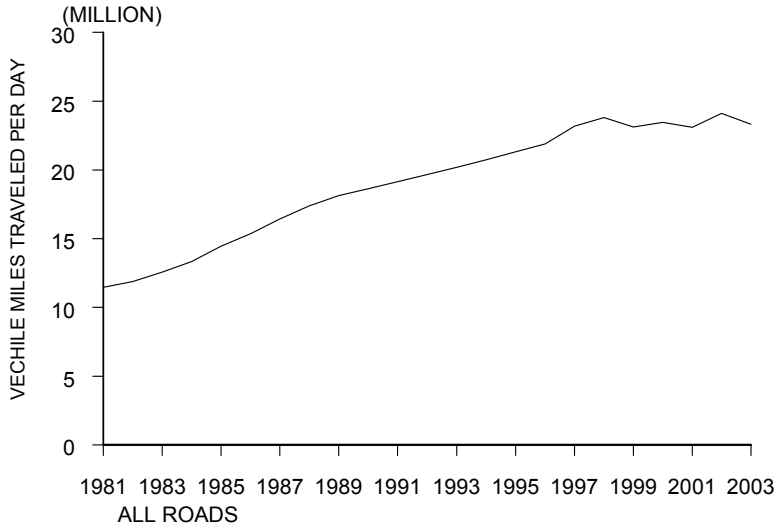
ANNUAL TRENDS

GROUP A

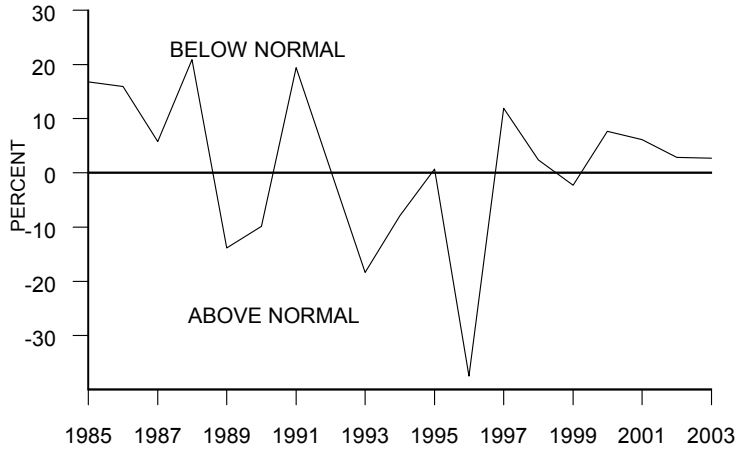
PARTICULATE MATTER 10 MICROMETERS
ANNUAL ARITHMETIC MEAN



TRAFFIC



RAINFALL DEFICIT



B. 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. 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 top graph of Group B-1 depicts the number of "unhealthy" 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 "unhealthy" day is defined as any day when a regional monitor yields an index value greater than 150. In 1983, 1987, and 1988, there were an unusually large number of “unhealthy days” which was due primarily to the occurrence of meteorological conditions very conducive to ozone formation. There were 3 "unhealthy" days in 2003.

The bottom left graph of Group B-1 is a plot of the 3-year running average of a composite average. The composite average is the number of exceedant days averaged across all ozone sites. An exceedant day is one in which a site had at least one hourly concentration greater than the ozone 1-hour standard. The 3-year running average is calculated by dividing the composite average for a given year plus those in the prior two years by three. In 1988 and 1989 the 3-year running average was 7.0 days, the highest value recorded. This reflects the influence of the high number of exceedant days in 1988 on the 3-year averages. The 3-year running average in 2003 was 0.93 days.

As stated earlier in this report, in April 2004 the metropolitan Washington region, including Washington, DC, Maryland, and Virginia was classified by EPA as moderate non-attainment of the 8-hour ozone National Ambient Air Quality Standard (NAAQS). 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 metropolitan Washington region has until June 2007 to submit a State Implementation Plan with effective ozone reduction actions that will lead the region to compliance with the 8-hour ozone standard. The region must demonstrate compliance by June 2010. The 1-hour ozone standard is being phased out in 2004.

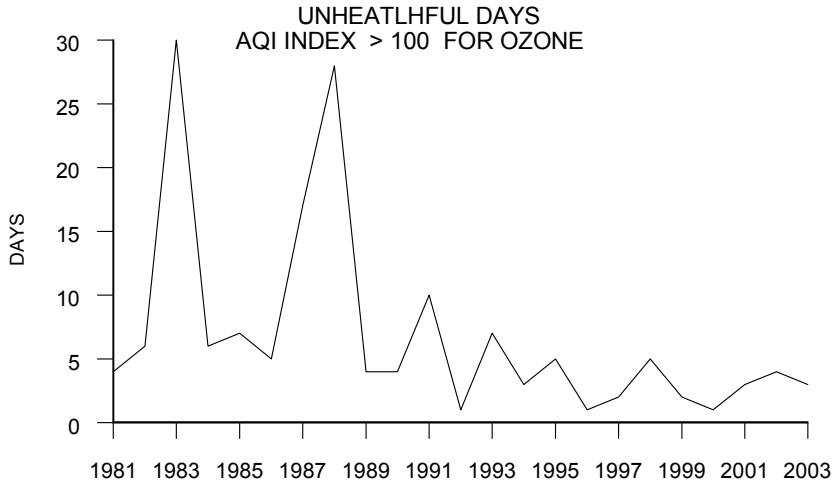
The graphs in Group B-2 will be used to track ozone trends associated with the new 8-hour standards. The statistics used in the plots are directly related to the form and averaging time of the new 8-hour standards. Trends in the composite average of the fourth highest daily maximum 8-hour concentration are shown in the top left graph of Group B-2. There has been a significant downward trend in the composite average, -14.8 percent since 1979. The composite average was 0.084 ppm in 2003. 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 3-year mean composite average, - 8.8 percent, since 1980; however, the 2003 composite average of the 3-year mean was 0.093 ppm, up 1.1 percent from 2002.

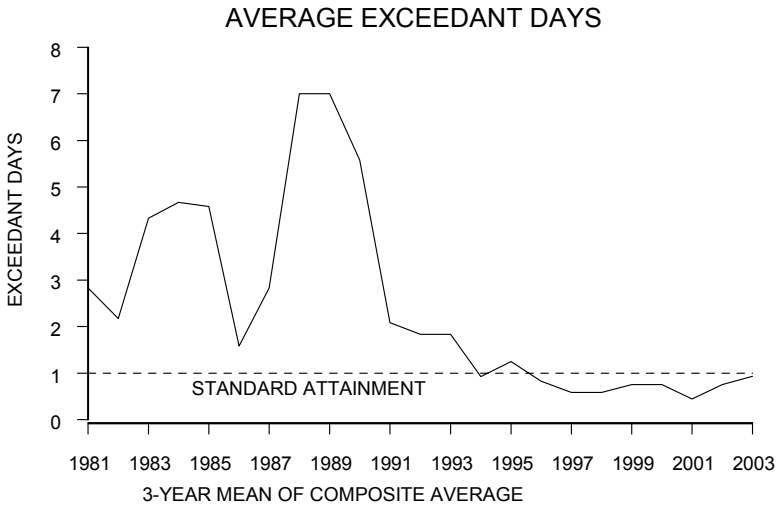
The bottom left graph is a plot of the composite average of the number of days with maximum 8-hour concentration above the 8-hour standard. It shows the year to year variability in the number days the ozone standard was exceeded. The composite average decreased in 2003 to 3.6 days. The bottom right graph is a plot of the monthly frequency, in percent, of days above the 8-hour standard using ozone data from 2003. 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 usually has the most exceedant days and there have never been exceedances of either the 1-hour standard or the 8-hour standard in October. June had the greatest number of days above the 8-hour standard in 2003. Mount Vernon and Franconia exceeded the 8-hour standard on 5 days, Lewinsville and Mason on 3 days and Cub Run on 2 days.

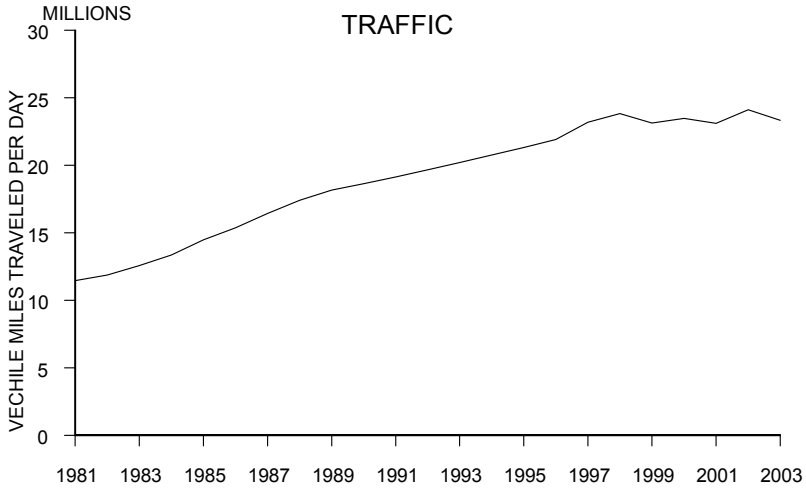
Ozone in Fairfax County has improved since 1980. Citizens in the County are exposed to fewer unhealthy ozone days and generally lower ozone concentrations on those days.

ANNUAL TRENDS

GROUP B-1

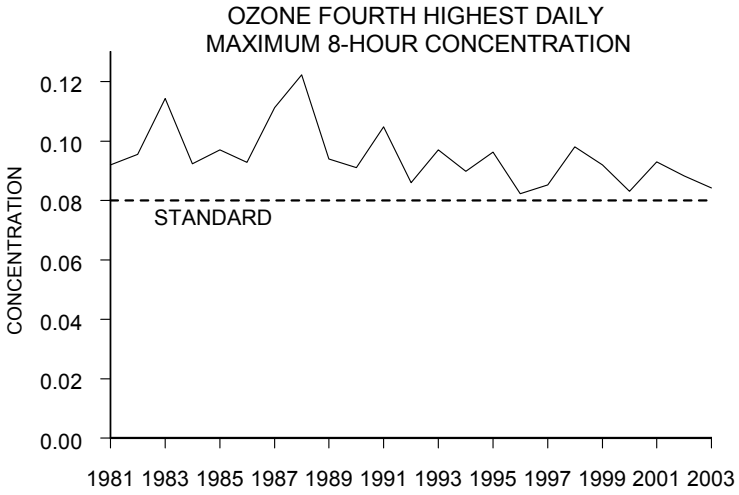


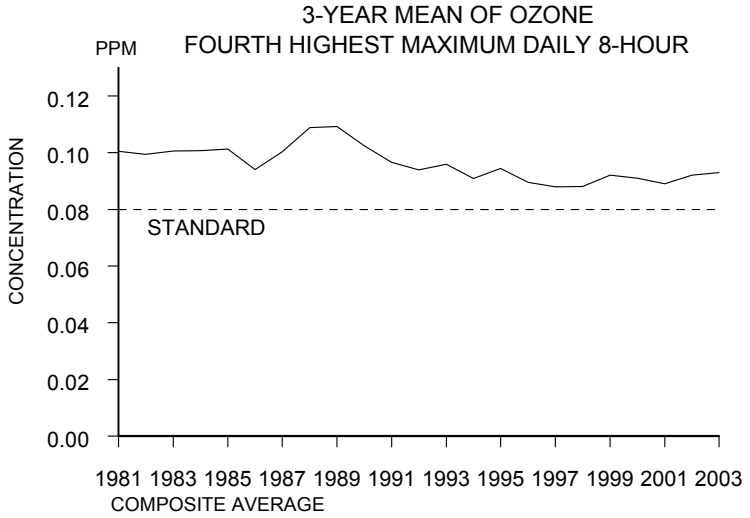


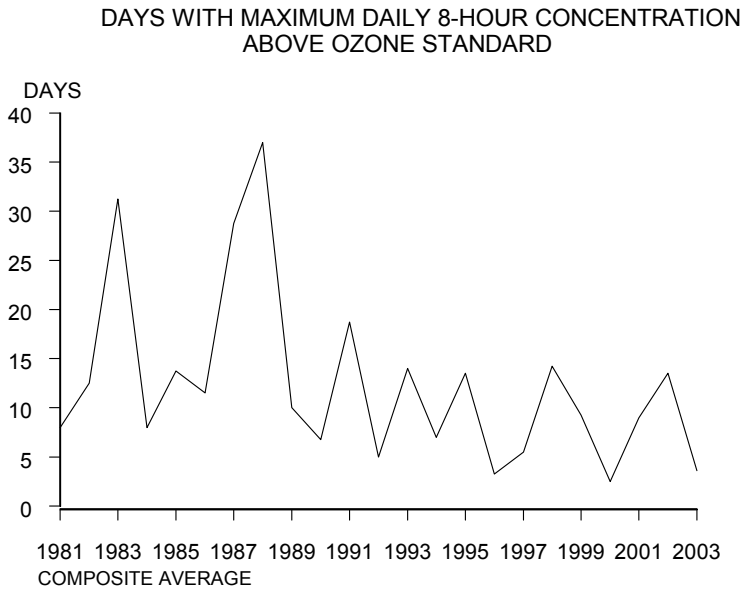


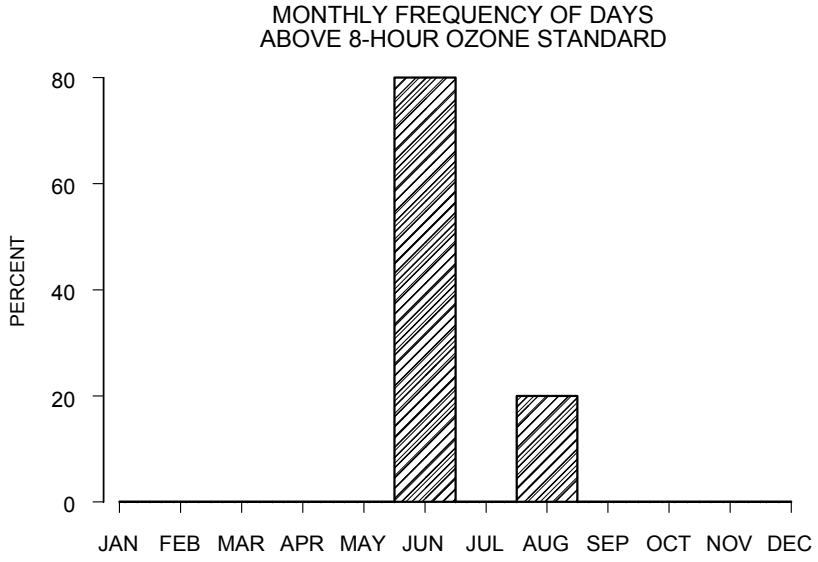
ANNUAL TRENDS

GROUP B-2









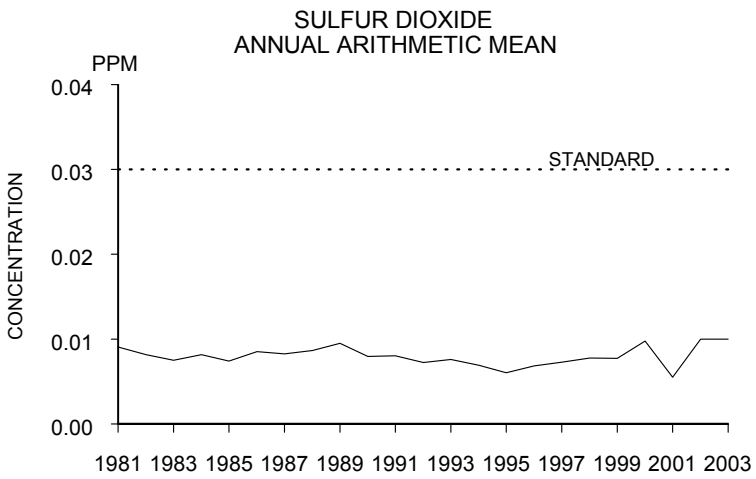
C. INDUSTRIAL AND SPACE HEATING EMISSIONS

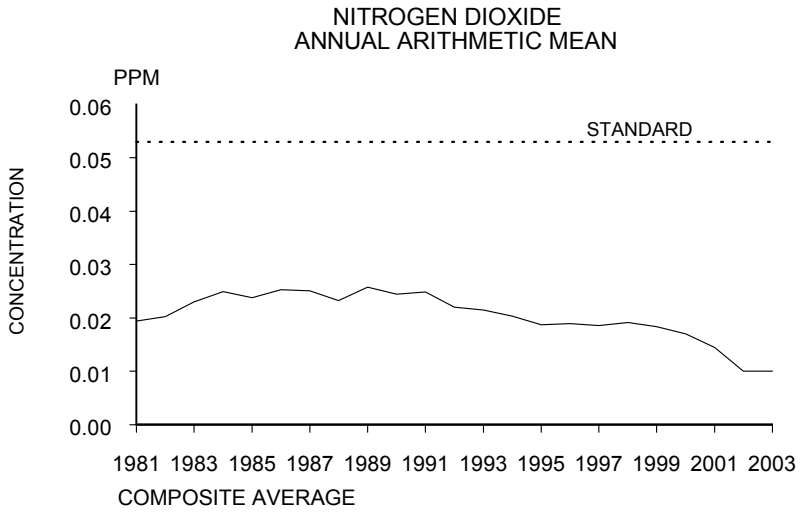
Sulfur dioxide and nitrogen dioxide trends are shown in the set of graphs contained in Group C. These pollutants are produced by fossil-fueled space heating and electrical utility boilers as well as by internal combustion engines. In the left graph the sulfur dioxide levels are expressed in terms of the composite annual average concentration. The sulfur dioxide composite average has shown a long-term downward trend, - 50 percent, since 1974.

In the right graph the nitrogen dioxide levels are expressed in terms of the composite annual average concentration. The nitrogen dioxide composite average has shown a long-term downward trend, - 53.3 percent, since 1974.

ANNUAL TRENDS

GROUP C





D. LEAD AND VEHICLE EMISSIONS

Carbon monoxide is 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.

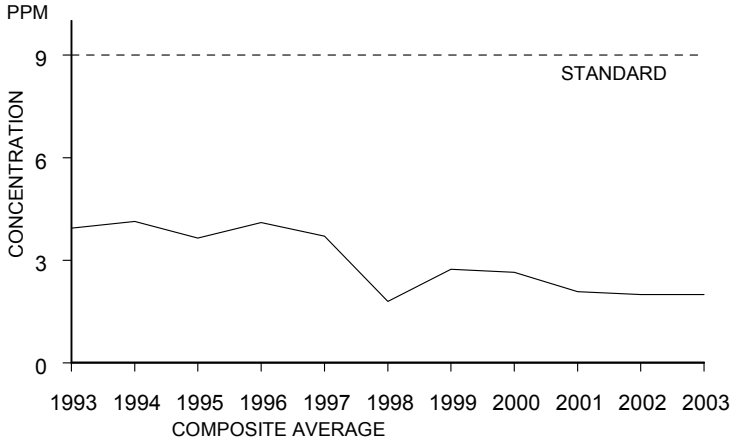
In the left graph the carbon monoxide levels are expressed in terms of the composite average of the highest 8-hour average concentration. There has been a long-term downward trend, -72.4 percent, in the composite average since 1991. Carbon monoxide levels tend to be high during the colder months of the 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 the last exceedance of the 8-hour standard was in 1986. Fairfax County is in attainment for the NAAQS for carbon monoxide. In the 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 –97.6 percent in lead levels since 1981. The 2003 composite average is 0.6 percent of the National Standard of l.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.

ANNUAL TRENDS

GROUP D

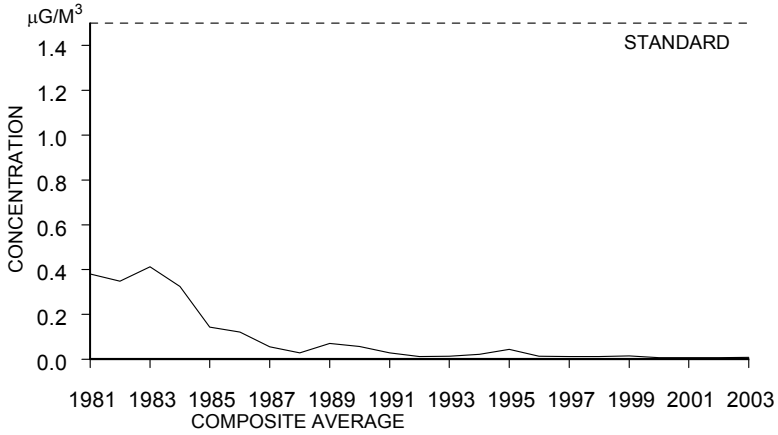
CARBON MONOXIDE

HIGHEST 8-HOUR AVERAGE



LEAD

HIGHEST QUARTERLY AVERAGE



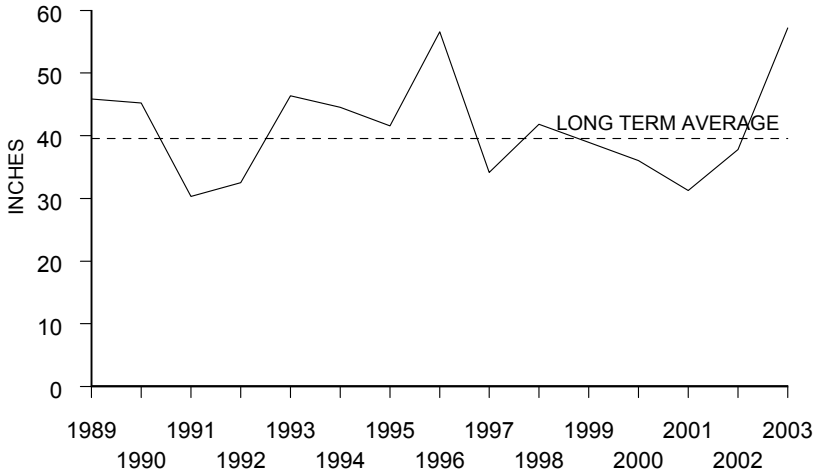
E. ACID DEPOSITION

Sulfuric and nitric acids are the two major components of both wet and dry acidic deposition. 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. The long-term volume weighted pH average is 4.47. There was an increase in acidity of 9 percent from 1996 to 1998, and a decrease in acidity of -15.6 percent from 1998 to 2003. There is no evidence of any trends since sampling began in 1989.

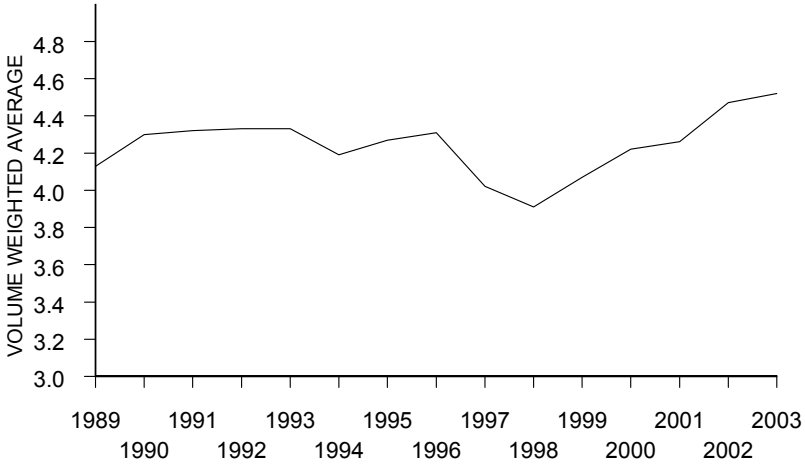
ANNUAL TRENDS

GROUP E

OCCOQUAN HILL RAINFALL



OCCOQUAN HILL pH



F. WEATHER

Meteorological monitoring was initiated in 1974 for temperature, rainfall, and wind. Group F shows trends of rainfall and temperature.

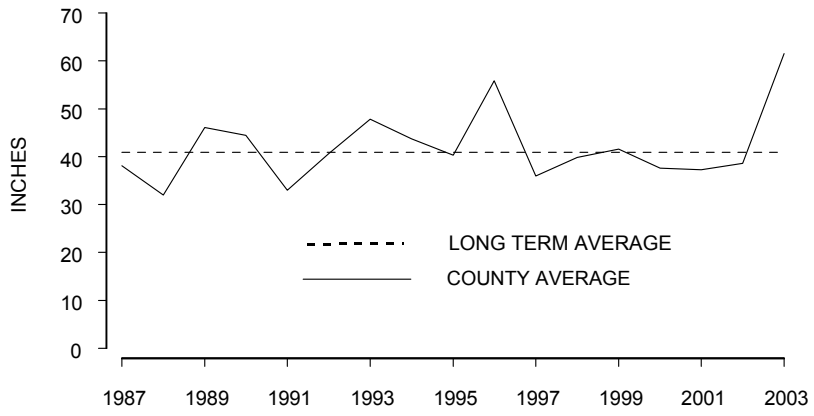
The left graph in Group F illustrates the year to year variability inherent in rainfall. The values used in this graph are obtained as follows: the observed rainfall amounts at all County stations, plus Dulles, and National airports for each month and for each year are averaged to obtain a composite county average amount, for the year of interest. The long-term average uses the climatological values from the two airports. Annual rainfall in 2003 was 38.59 inches, 1.13 inches below normal. Annual rainfall in 1996 was 55.83 inches, the wettest year since 1974. The driest year was in 1980, 29.94 inches of rainfall, 10.84 inches below normal.

The right graph is a plot of the annual mean temperatures. The warmest annual mean temperature was set in 1998 at 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 2003 was 57.6°F. There has been an upward trend in the annual mean temperature in the County since 1975. 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 that can collect heat during the day and hold on to it longer at night, increasing the temperature of the surrounding air.

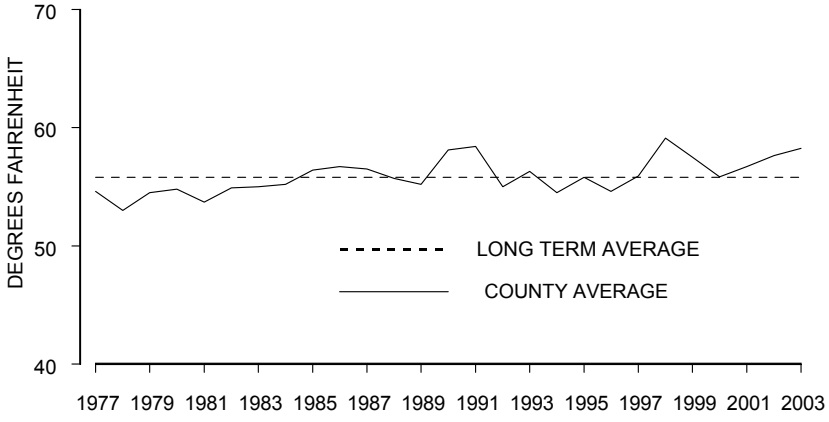
ANNUAL TRENDS

GROUP F

RAINFALL



ANNUAL MEAN TEMPERATURE

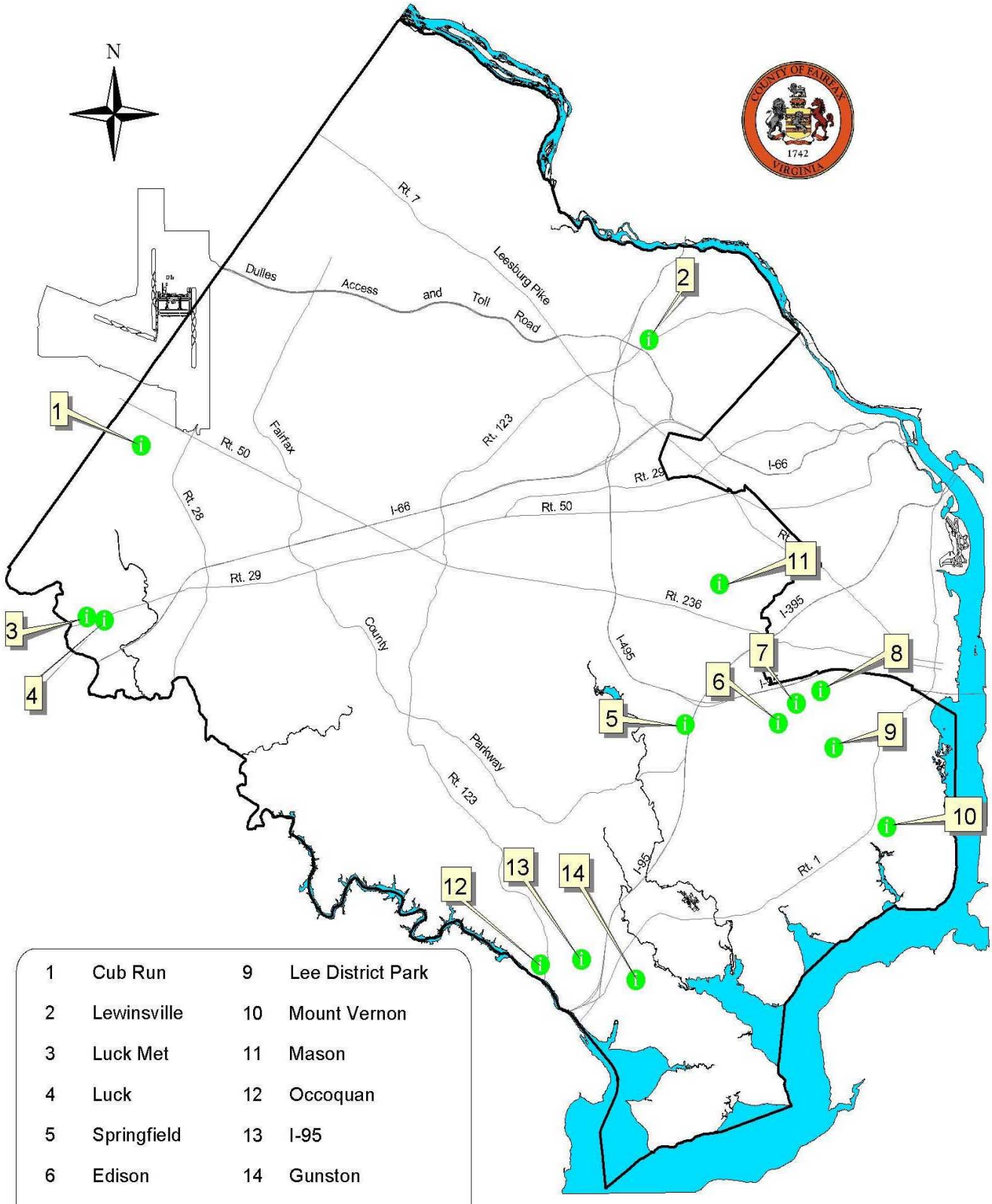


APPENDIX B/MONITORING SITES AND MAP

SITE	ADDRESS	LATITUDE	LONGITUDE	UTM COORDINATES	TAX MAP	AIR POLLUTANT PARAMETERS	METEOROLOGICAL PARAMETERS
CUB RUN AIRS: 51-059-0005	Upper Cub Run Dr. Chantilly, VA 20151	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	Robert E. Lee Rec Center 6601 Telegraph Rd. Franconia, VA 22310	38° 46' 22" N	77° 06' 20" W	317.090 km, 4293.450 km N	92-1	O3; PM2.5	None
LEWINSVILLE AIRS: 51-059-5001	McLean Governmental Center 1437 Balls Hill Rd. Mclean, VA 22101	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; Temperature; Precipitation
MOUNT VERNON AIRS: 51-059-0018	Mount Vernon Fire Station 2675 Sherwood Hall Ln. Mount Vernon, VA 22306	38° 44' 32" N	77° 04' 37" W	319.488 km E, 4290.214 km N	102-1	O3; PM10	Wind; Temperature; Precipitation
MASON AIRS: 51-059-0018	Mason Governmental Center 6507 Columbia Pike. Annandale, VA 22003	38° 50' 15.1" N	77° 09' 47.6" W	312.24 km E, 4300.762 km N	61-3	CO; O3; NO/NO2; SO2; PM2.5	Wind; Temperature; Precipitation
BUSH HILL*	Bush Hill Elementary School 5927 Westchester St. Alexandria, VA 22310	38° 47' 24" N	77° 07' 25" W	315.46 km E 4295.400 km N	81-4	TSP; Lead	None
CLERMONT*	Clermont Elementary School 5720 Clermont Dr. Alexandria, VA 22310	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	Gunston Elementary School 1100 Gunston Rd. Lorton, VA 22079	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	I-95 Resource/Recovery 9850 Furnace Rd. Lorton, VA 22079	38° 41' 30.5" N	77° 14' 41.5" W	305.280 km E, 4284.740 km N	113-1	TSP; Lead	None
LUCK MET* AIRS: 51-059-0123	Luck Stone P.O. Box 1817 Centreville, VA 20122	38° 49' 34.4" N	77° 29' 43" W	4300.427 km E, 283.427 km N	42-4	Wind; Temperature; Precipitation	Wind; Temperature; Precipitation
LUCK* AIRS: 51-059-0123	Luck Stone 6911 Bull Run Post Office Rd Centreville, VA 20120	38° 49' 34.4" N	77° 29' 43" W	4300.427 km E, 283.427 km N	42-4	PM10	None
OCCOQUAN HILL* AIRS: 51-059-0023	Water Authority 9800 Ox Rd. Lorton, VA 22079	38° 41' 23.8" N	77° 15' 34.7 W	303.475 km E, 4284.648 km N	112-2	TSP; PM10; Lead	Wind; Temperature; Precipitation
SPRINGFIELD AIRS: 51-059-3002	6120 Brandon Ave. Springfield, VA 22150	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*	Edison High School 5801 Franconia Rd. Alexandria, VA 22310	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.

Air Quality & Meteorological Sites



1	Cub Run	9	Lee District Park
2	Lewinsville	10	Mount Vernon
3	Luck Met	11	Mason
4	Luck	12	Occoquan
5	Springfield	13	I-95
6	Edison	14	Gunston
7	Bush Hill		Political Boundries
8	Clermont		Major Roads

Base data provided by Fairfax County Department of Information Technology, Geographic Information Services Division