Feasibility Study

for a Potomac River Basin

Toxics Data Report

by

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Executive Summary

The Interstate Commission on the Potomac River Basin was created in 1940 with a major function being the collection, evaluation, and dissemination of information about water quality in the Potomac River basin. The focus of this feasibility study is the cataloging of the spatial and temporal distribution of water quality data for toxic parameters in the basin. Having described the data, the issue of whether they are sufficient to warrant examination in detail in order to assess the levels, trends, and spatial extent of parameter values can be addressed.

Although the Potomac River basin is not heavily industrialized, the extent of problems with water borne toxic parameters is not well known. Many small towns and cities along the tributaries and main stem in the basin use these surface waters for municipal and industrial supply. In addition, each of the major water utilities in the Washington metropolitan area has a large raw water intake on the Potomac River. This heavily utilized resource is subject to potential and actual impact by toxic parameters.

The list of toxic parameters considered in this feasibility study has become known as the EPA "priority pollutant list". For this study, the priority pollutant list has been divided into the following four general categories: Inorganics, Organics, Metals, and Pesticides. The U.S. EPA STORET data base was the primary source of data for stations in the District of Columbia, Pennsylvania, Virginia, and West Virginia. Data collected by the state of Maryland were obtained directly from the Maryland Office of Environmental Programs. The data are of samples taken from three media: (1) the water column, (2) fish tissue, and (3) stream bottom sediments.

Summaries of toxic parameter data are presented in Figures 1-16. These figures describe, for each parameter with specified minimum numbers of observations, the number of observations, the number of stations, and record length. For stations with a record of at least five years; additional information is presented including station location, period of record, and sample medium.

While the number of observations, number of stations, location of stations, and period of record, vary among the toxic parameters, it is concluded that there are sufficient data to assess trends at one or more stations for 28 of the 129 priority pollutants. The criteria for determining whether a trend may be assessed (for a parameter, at a station) are that the record be at least ten observations. Spatial distribution of data for these 28 parameters varies from only one or two stations to fairly wide coverage of the minor streams in the basin. An assessment of the spatial distribution of toxics problems and trends may, as a result, be limited.

This assessment is based largely on data collected by the States' "Core" monitoring programs (and at its predecessors).

Data from other sources, including water utility intake monitoring and various non-recurring special studies, were located but not included in this report. In the preparation of a possible future report on concentration and trends in the data, these data may be used to increase the number of stations with useful data sets.

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Introduction

Since its creation in 1940, one of the major functions of the Interstate Commission on the Potomac River Basin (ICPRB) has been to collect, evaluate, and disseminate information about water quality in the Potomac River basin. Increasing attention is being paid to toxic compounds in the environment because of emerging knowledge of their impact on the environment and on human health. With this study, ICPRB hopes to increase the knowledge of the existance of measurements of toxics in the basin.

The focus of this feasibility study is the cataloging of the spatial and temporal distribution of water quality data for toxic parameters in the basin. Having described the data, the issue of whether they are sufficient to warrant examination in detail in order to assess the levels, trends, and spatial extent of parameter values can be addressed.

This study supplements other more general Potomac River basin water quality reports; see the listing in the References section of this report.

Basin Description

The Potomac River basin is located in the middle Atlantic coastal zone of the United States and the river is the second largest tributary of the Chesapeake Bay. The Potomac River main stem is approximately 283 miles in length from the confluence of the North and South Branches near Cumberland, Md. to its mouth at the Chesapeake Bay. The Headwaters of the North Branch, considered a part of the main stem, are approximately 100 miles upstream from the confluence of the North and South Branches. The drainage area of the basin is 14,670 sq. mi. which includes the District of Columbia and parts of Maryland, Pennsylvania, Virginia, and West Virginia. The relative areas drained in each jurisdiction are: 69 sq. mi. which is 100% of DC; 3,820 sq. mi. which is 36% of Md; 5,702 sq. mi. which is 14% of Va; 3,490 sq. mi. which is 14% of WVa; and 1,570 sq. mi. which is 3.5% of Pa.

Although the Potomac River basin is not heavily industrialized, the extent of problems with water borne toxic parameters is not well known. Many small towns and cities along the tributaries and main stem in the basin use these surface waters for municipal and industrial supply. In addition, each of the major water utilities in the Washington metropolitan area has a large raw water intake on the Potomac River. This heavily utilized resource is subject to potential and actual impact by toxic parameters.

Selection of Toxic Parameters

The list of toxic parameters considered in this feasibility study (see Congressional Hearings testimony reference) has its origins in the 1976 consent decree between the Natural Resources Defense Council and the U.S. Environmental Protection Agency (NRDC vs. Train, 8 ERC 2120) which identified 65 toxic pollutant classes to be given priority with regard to water pollution control. The basic terms of the consent decree were incorporated into the 1977 Federal Clean Water Act.

Pursuant to the 1977 Federal Clean Water Act, the Environmental Protection Agency (EPA) was assigned the responsibility of developing water quality criteria for toxic pollutants and technology-based effluent limitation requirements for dischargers of such pollutants. In partial fulfillment of this requirement, EPA (with guidance from a nationwide committee of experts) has identified a list of 129 compounds and elements from the 65 pollutant categories. The list of elements and compounds (the "priority pollutant list") includes substances with known toxic effects on aquatic life and human health, including those known or suspected to be carcinogens, mutagens or teratogens. The priority pollutant list includes parameters in the following four general categories:

- Inorganics (asbestos, cyanides)
- Organics
- Metals
- Pesticides

The organic parameters include the following categories:

- Phenols and Cresols
- Ethers
- Halogenated Aliphatics
- Polycyclic Aromatic Hydrocarbons
- Monocyclic Aromatics
- Nitrosamines and other Nitrogen compounds
- PCB's and related compounds
- Phthalate Esters.

The data examined in this study are of samples taken from three media: (1) the water column, (2) fish tissue, and (3) stream bottom sediments.

Sources of Data

The U.S. EPA STORET data base was the primary source of data for stations in the District of Columbia, Pennsylvania, Virginia, and West Virginia. In addition, each State's 305(b) reports and water quality monitoring agencies were contacted to determine whether data sets of significant size existed that are not on STORET. Data collected by the State of Maryland were obtained directly from the Maryland Office of Environmental Programs because the STORET data base lacks much of Maryland's data.

In addition to the major sources of data identified and accessed for the analysis and presentation in this report, several potential sources were also identified. These are typically the result of special monitoring studies in response to a specific problems, but would not generally exist on computerized data bases. In addition to special short-term monitoring studies, there is a small number of individual data collection programs at water utility river intakes and long term pollution sites which are of a continuing nature. Although these data are not part of state-wide routine water quality monitoring programs, they might provide useful augmentation to those identified and analyzed in this study.

In Virginia, high levels of mercury have been under investigation in Newman Lake which drains into Black's Run on the campus of James Madison University. Special monitoring of TCE has been carried out in the Middle River, and mercury discovered in the South River from DuPont operations is subject to on-going monitoring. Chlordane, arsenic and nickel are of concern on the North Fork Shenandoah, as are lead, zinc, arsenic, copper, nickel, and chromium in Opequon Creek. Nickel is also at high levels in Gunston Cove, Occoquan Creek, and South Run. High lead levels are of concern in Neabsco Creek and Potomac Creek; and copper is at high levels in Occoquan Creek below the Fairfax County Water Authority dam and in Potomac Creek.

In Pennsylvania, recently emerged problems with PCB disposal along the southern border of the state may be of concern in the Potomac basin.

In West Virginia, after mercury was found in Opequon Creek, an intensive program of monitoring sediment and fish tissue was conducted in 1984 and 1985. This may be related to the metals pollution upstream on Opequon Creek in Virginia.

In Maryland, a special study of pollution of the surface micro-layer is being conducted at three sites in the Potomac Estuary.

The major water utilities in the Washington metropolitan area sample raw water, prior to treatment, for a wide range of parameters including toxic materials. These data are generally gathered at relatively high frequency and consistency over long periods.

It is a simple, important, fact that data consistently derived from a long term monitoring station provides the best information for concentration and trend analysis.

Description of Data

The ability to evaluate trends depends on the number of observations, and on their temporal and spatial distribution. These characteristics for the priority pollutants are described in the accompanying Figures.

Figures 1, 5, 9, and 13, show the total number of observations for each parameter, grouped by Inorganic compounds, Organic compounds (excluding pesticides), Metals, and Pesticides. Only those parameters from the priority pollutants list with at least five observations in any one State are included. Pollutants with 1 to 4 observations were not included because no trend could be estimated, with reasonable level of confidence, with so few observations. Fish tissue, water column, and sediment, samples are counted together. Although these data are not directly comparable, this "lumping" of data was considered acceptable for the purposes of this gross assessment of data availability.

Forty eight of the 129 priority pollutants have at least 5 observations. There are 30 parameters with more than 100 observations, 19 with more than 500, and 9 (all metals) with more than 1000 observations.

Figures 2, 6, 10, and 14, show the number of stations and provide a summary of the length of record and distribution of observations among stations and over time. The Figures show, for each parameter, the number of stations with at least one observation, the number of stations with observations over at least five years (not necessarily contiguous years), and the number of years spanned by the longest record. As noted above the Figures do not include parameters with less than five observations total.

Of the 48 parameters with at least one station in one year, 33 have one or more stations with five or more years of data. Twenty parameters, mostly metals, have one or more stations with data spanning ten or more years.

The spatial distribution of toxics monitoring in the Potomac Basin is illustrated in Figures 3, 7, 11, and 15. For the categories of Inorganics, Organics, Metals, and Pesticides, each station with a period of record exceeding four years, for at least one parameter, is plotted on a map of the basin. The maps show that, as might be expected, long term monitoring is concentrated along main stem of the Potomac River and its major tributaries.

Information about the parameters monitored at each station plotted on the maps is presented in Figures 4, 8, 12, 16. These figures show the station identifying code; stream location; period of record; sample medium (water column (w), sediment (s), fish tissue (f)); and the total number of observations for each parameter.

Cyanide is the only inorganic compound on the priority pollutant list with a significant number of observations. Of the 25 stations with at least a five year record, 14 are in West Virginia concentrated along the main stem and in the Eastern Panhandle tributaries. Nine stations are in Maryland along the main stem, Antietam Creek, the Monocacy, and Anacostia tributaries. There is one station each in Pennsylvania and Virginia. Spatial coverage is relatively light in the Pennsylvania tributaries, the Shenandoah valley of Virginia, the District of Columbia, and the downstream Maryland and Virginia main stem and tributaries. Sixteen of these stations have ten or more observations of cyanide in the water column.

Thirteen stations have at least five years of record for one or more organics pollutants. Five are in Virginia with three in the Shenandoah valley and the others along lower tributaries of the main stem. The 6 Maryland stations are distributed along the main stem and the Conococheague, Antietam, and Monocacy tributaries. Coverage is sparse in West Virginia, Pennsylvania, and the District of Columbia. There are ten or more observations for only three organics parameters, hexachloro-benzine, PCP, and phenols. However the phenols record lapsed in 1973. There are four stations with an adequate record for the other two parameters.

Of the 213 stations with at least five years of record for one or more metals, 164 are in Virginia widely distributed over its share of the basin. West Virginia has 25 stations in the basin widely distributed along the main stem and tributaries. Pennsylvania has 3 stations along the Conococheague, Antietam, and Monocacy tributaries. The 19 stations in Maryland are distributed along the main stem and upstream tributaries. The District of Columbia has two stations on the main stem. Coverage is sparse along the up stream tributaries in Pennsylvania and the down stream tributaries in Maryland.

Twelve metals have long records, with at least 10 observations, at one or more stations; with either fish tissue or water column concentrations as the sampling medium. Metals data with five year (and more) records plus at least ten observations are found for 179 stations.

Of the 54 stations with at least five years of record for one or more pesticides, 32 are in Virginia widely distributed along the middle tributaries. There are 20 stations in Maryland well distributed along the main stem and up stream tributaries. Coverage is sparse in Pennsylvania, West Virginia, the District of Columbia, and the down stream tributaries in Maryland. Twelve pesticides from the priority pollutant list have been sampled at one or more stations for at least five years. Only 17 of the 54 stations shown in Figure 16 have 10 or more observations for any of these pesticides.

Applicability of Statistical Techniques

The degree to which the existing data on toxic pollutants support statistical trend analysis depends in part upon the types of statistical tools to be employed. Water quality data exhibit considerable variation. Therefore, recognizing the presence as well as the magnitude of "real" trends in complex water quality time series requires the rigorous use of valid statistical techniques. For the analysis of the data presented in this report, a nonparametric statistical test would be used to determine station parameter trends. The Kendall tau test is an easy and valid method for the identification of significant station parameter trends in water quality data. This test performs well with limited data sets with both missing and censored data and avoids the problematic assumptions associated with the more commonly used techniques. Following is a discussion of the commonly used statistical techniques and a presentation of the Kendall tau test.

Linear Regression and Tests for Trend

Statistical hypothesis testing is commonly used in the trend analysis of water quality data to test the significance of a linear regression of water quality values against time. Typically, a straight line is fit to an observed water quality time series and the significance of the slope is tested against the null hypothesis that the true value of this slope is zero. Water quality time series without a "true" trend can, infrequently, exhibit trend-like behavior purely by chance. The significance level of the test expresses the frequency with which this inevitably incorrect conclusion will be tolerated.

The use of linear regression is widespread, due in part to its easy application with readily available computer codes. However, there are several incompatibilities between the characteristics of routinely sampled water quality data and what these techniques require for effective application. First, underlying the use of this powerful statistical tool are a number of assumptions about the distribution and structure of the data being analyzed. When these assumptions are violated a severe degradation of the power and the significance of the commonly employed statistical tests can result. Many water quality time series violate these assumptions. The distribution of water quality monitoring data may be seasonally affected, skewed, and highly non-normal.

Second, and particularly important with the toxic parameters, monitoring data is frequently reported as "less than the limit of detection" (LD). LD observations do contain information about the ambient water quality, and the traditional parametric techniques are unable to incorporate data of this type in an unbiased fashion. Observations reported as LD have either been assigned arbitrarily low numerical values (producing biased parameter estimates), or have been ignored (using less information than is available, and biasing the record in the direction of high or significant values).

Third, water quality time series often contain incomplete, missing, or unevenly sampled records. All of these features, commonly encountered in real water quality data lead to erratic and unreliable results when traditional parametric tests are employed.

The Kendall Tau Test

The Kendall tau test is a nonparametric test based upon Kendall's test for correlation (Kendall(1975)). It is a test which can readily be used to test for trends in water quality time series. Skewed observations as well as censored and missing data can be handled without difficulty.

The nonparametric test statistic is simply a tally of the number of times each observation is greater than or less than all later observations in the time series. If no trend is present, observations made in early years and later years should appear to be independently drawn from the same distribution (the form of which need not be specified or even known). If this is the case, pair-wise comparisons are as likely to be increasing in time as they are to be decreasing. For water quality time series that are truly free from trends, the value of the test statistic will not be significantly different from zero.

It has been shown (Mann(1945)) that the test statistic will be symmetrical and normally distributed in the limit as the number of observations grows. Practically speaking, the normal approximation is excellent for a sample size of ten or more. The test statistic, therefore, is readily transformable into a standard normal deviate and may be compared to standard normal probability levels to determine the significance of any trends. This transformation uses the information that the expected value of the test statistic is zero and that the variance may be calculated based on the number of observations and the number of tied comparisons.

The Kendall tau test statistic uses the relative magnitudes of the observations as they occur relatively in time. This enhances its applicability to water quality data in two major ways. First, LD observations are handled easily; all LD observations are equal to each other (and represent ties) and are less than all measured observations. Second, the nonparameteric test is insensitive to gaps in the record.

Refinements of this test statistic may be employed as needed. These include modifications when seasonal or flow-related factors may be present. Seasonal influences are not expected with toxic pollutant data, particularly with the data resulting from sediment and fish tissue sampling. The flow-related adjustments may be investigated for use with data from the water column.

Conclusion

Summaries of toxic parameter data are presented in Figures 1-16. These figures describe, for each parameter with specified minimum numbers of observations, the number of observations, the number of stations, and record length. For stations with a record of at least five years; additional information is presented including station location, period of record, and sample medium.

While the number of observations, number of stations, location of stations, and period of record, vary among the toxic parameters, it is concluded that there are sufficient data to assess trends at one or more stations for 28 of the 129 priority pollutants. These are distributed as follows: inorganics 1; organics 3; metals 12; pesticides 12. The criteria for determining whether a trend may be assessed (for a parameter, at a station) are that the record be at least ten observations. Spatial distribution of data for these 28 parameters varies from only one or two stations to fairly wide coverage of the minor streams in the basin. An assessment of the spatial distribution of toxics problems and trends may, as a result, be limited. This assessment is based largely on data collected by the States' "Core" monitoring programs (and at its predecessors).

Data from other sources, including water utility intake monitoring and various non-recurring special studies, were located but not included in this report. In the preparation of a possible future report on concentration and trends in the data, these data may be used to increase the number of stations with useful data sets.

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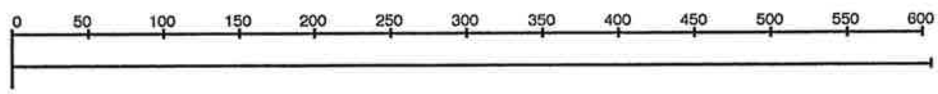
Potomac River Basin Water Quality 1982-1983, ICPRB Technical Publication 85-1, July 1985.

Potomac River Basin Water Quality Status and Trend Assessment 1973-1984, ICPRB Technical Publication 86-17 (DRAFT), January 1986.

FIGURE 1
Total Number of Observations in the Potomac River Basin for Inorganics.

Parameter #Observations

Cyanide (606)



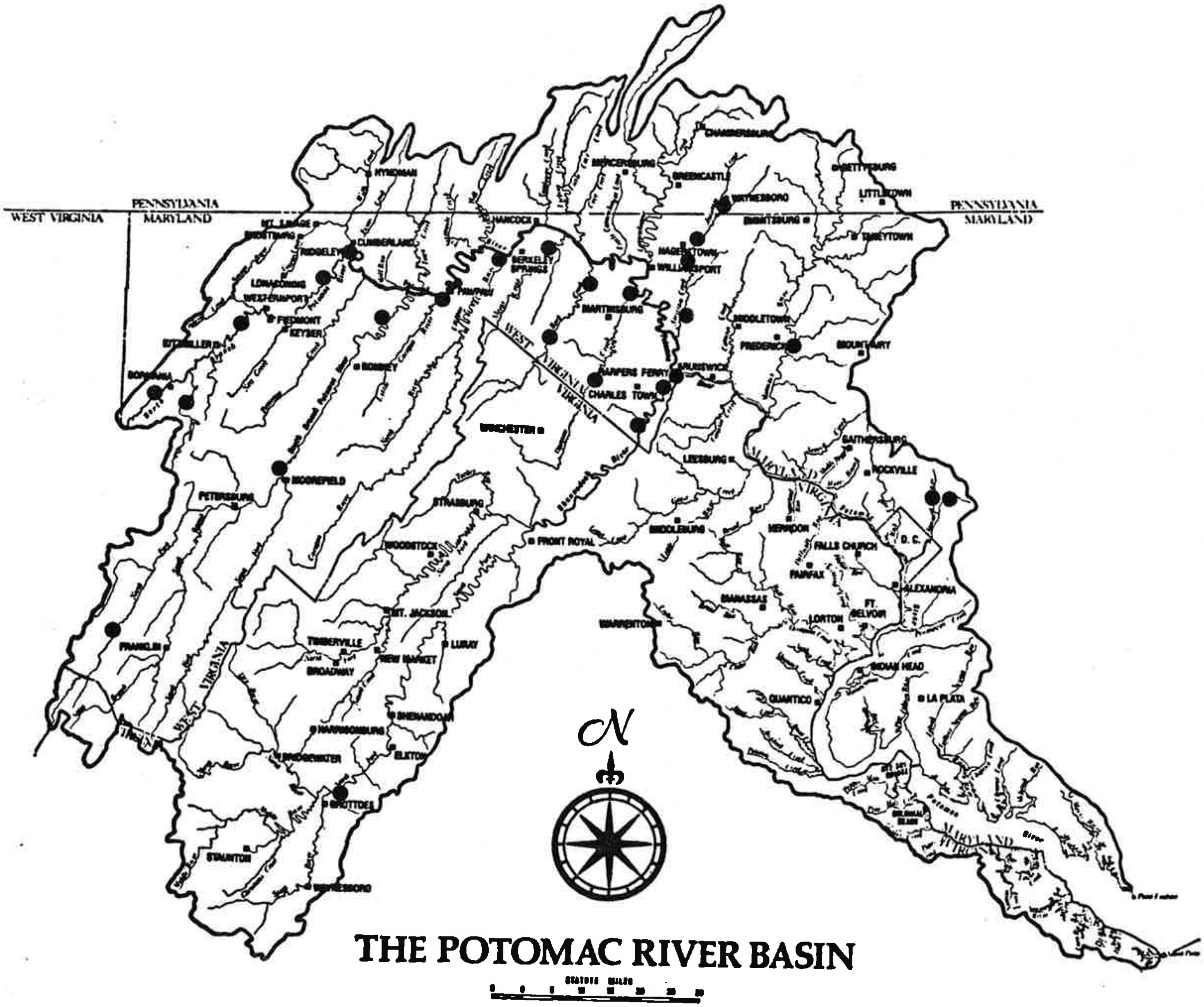
NOTE:
- -for inorganic compounds on the U.S. EPA Priority Pollutants List,
- -includes only those compounds with more than four observations in any single State in the basin,
- -all cyanide data are water column concentrations.

FIGURE 2
Number of Stations and Longest Record at a Station for Inorganics

Parameter	1+	5+	Longest
Cyanide	11	2	6

NOTE:
- -for Inorganics (cyanide) on the U.S. EPA Priority Pollutants List,
- -column labeled "1+" is the number of stations with one or more observations,
- -column labeled "5+" is the number of stations with data from a period of five or more years,
- -column labeled "Longest" is the number of years at the station(s) with the longest period of record,
- -fish tissue, water column, and sediment, samples are combined for each parameter.

FIGURE 3
Locations of Cyanide Sampling Stations
with Records of 5 Years or Longer



Key:

- ● Sampling Station
- ■ Town or City

FIGURE 4

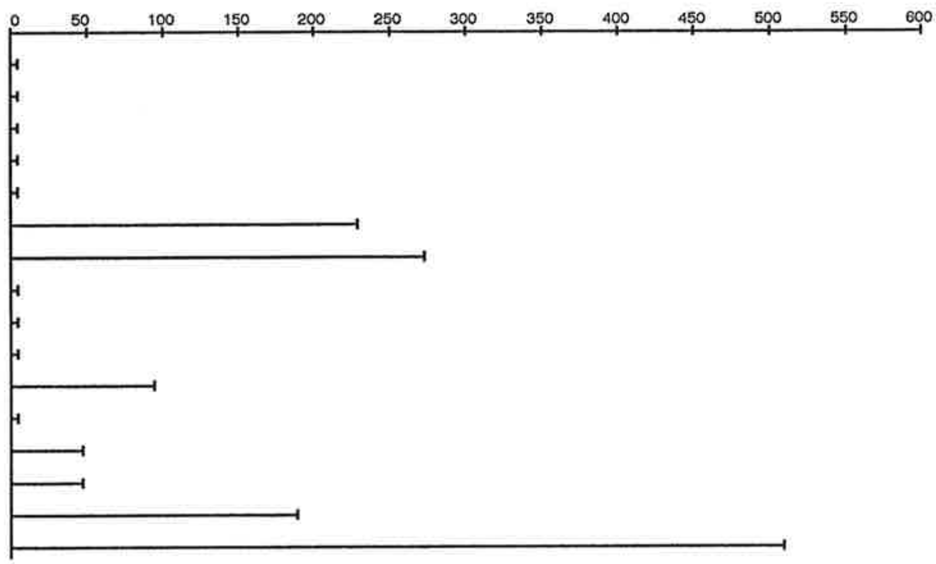
Cyanide Measurements in the Basin States

Stations with records of 5 years or longer

Station Code	Location	Period-m		Number of Cyanide Obs.
DISTRICT OF COLUMBIA				
(no data)				
MARYLAND (STORET)				
01603000	N B Potomac-Cumberl	61-73	w	10
01619500	Antietam-Sharpsburg	69-73	w	9
01595800	N B Potomac-Barnum	69-73	w	9
01600000	North Br-Pinto	69-73	w	9
01643020	Monocacy-Frederick	69-73	w	9
01649500	NE B Anacostia-Riverd	69-73	w	9
01651000	NW B Anacostia-Hyattsv	69-73	w	9
MARYLAND (OEP)				
ANT0229		69-73	w	8
ANT0241		68-73	w	11
PENNSYLVANIA				
01613000	Antietam-Waynesboro	69-73	w	7
VIRGINIA				
01628250	S F Shenandoah-Lynn	69-73	w	35
WEST VIRGINIA				
550462	Opequon-Bedington	74-84	w	40
550463	Opequon-Tarico Hghts	74-78	w	17
550464	Back Cr-Hedgesville	74-78	w	38
550843	South Br-Moorefield	78-83	w	23
550469	South Br-Springfield	74-84	w	38
550554	Stony R-Mt Storm	74-84	w	40
550555	Buffalo Creek-Bayard	74-84	w	40
550804	Cacapon-Gt Cacapon	76-84	w	30
550471	Shenandoah-Harpers F	74-84	w	40
550472	Shenandoah-Meyerstwn	74-84	w	40
550461	Potomac-Paw Paw	74-83	w	2
550465	Back Cr-Mill Gap	74-78	w	17
550466	Sleepy Cr-Bkly Spr	74-78	w	15
550470	N F South Br-Judy	74-78	w	16

FIGURE 5
Total Number of Observations in the Potomac River Basin
for Organics.

Parameter	#Observations
12Dichloroethane	(5)
Bromoform	(5)
Carbontet	(5)
Chloroform	(5)
Dichlorobromometh	(5)
Hexachloro_benzine	(229)
Methoxychlor	(273)
PCB_1016	(5)
PCB_1221	(5)
PCB_1232	(5)
PCB_1242	(94)
PCB_1248	(5)
PCB_1254	(47)
PCB_1260	(47)
PCP	(189)
Phenols	(509)



NOTE:
- for organic (non pesticide) compounds on the U.S. EPA Priority Pollutants List,
- includes only those compounds with more than four observations in any single State in the basin,
- the count for each parameter includes fish tissue, water column, and sediment, samples.

FIGURE 6
Number of Stations and Longest Record at a Station
for Organics

Parameter	1+	5+	Longest
Bromoform	4	0	1
Carbontet	4	0	1
Chloroform	4	0	1
Dichlorobromometh	4	0	1
12Dichloroethane	4	0	1
Hexachloro_benzine	63	5	7
Methoxychlor	28	14	9
PCB-1016	8	0	2
PCB-1221	9	0	2
PCB-1232	9	0	2
PCB-1242	28	1	5
PCB-1248	10	0	2
PCB-1254	24	1	5
PCB-1260	21	2	6
PCP	49	5	7
Phenols	70	2	10

NOTE:
- -for Organics on the U.S. EPA Priority Pollutants List,
- -column labeled "1+" is the number of stations with one or more observations,
- -column labeled "5+" is the number of stations with data from a period of five or more years,
- -column labeled "Longest" is the number of years at the station(s) with the longest period of record,
- -fish tissue, water column, and sediment, samples are combined for each parameter.

FIGURE 7
Locations of Organics Sampling Stations
with Records of 5 Years or Longer

Key:

- ● Sampling Station
- ■ Town or City

FIGURE 8

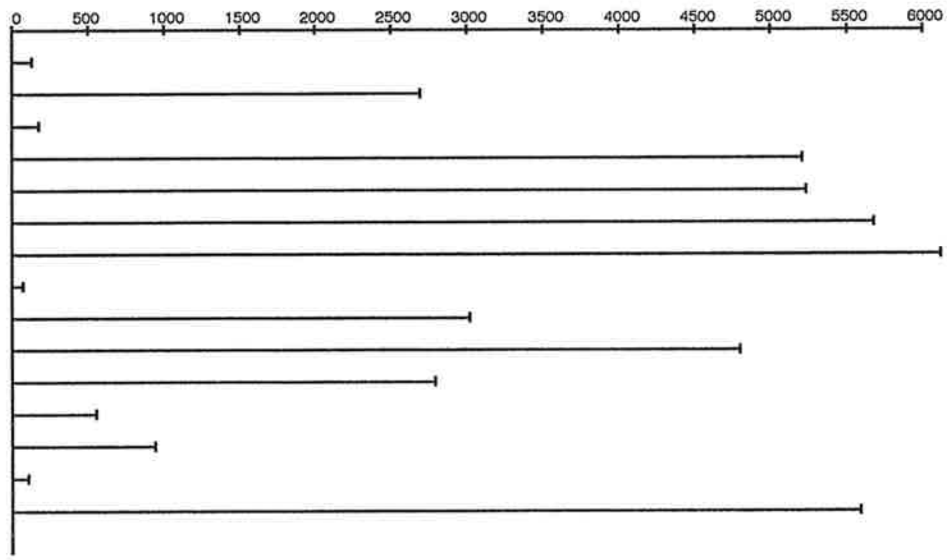
Organic Parameters Measured in Basin States

Stations with records of 5 years or longer

Station Code	Location	Period-m	HCB	PCB-1242	PCB-1254	PCB-1260	PCP	Phenols
			Number of Observations for each Organic					
DISTRICT OF COLUMBIA								
(no data)								
MARYLAND								
006	Potomac-Lt Falls	73-77 f		8	8	8		
01595800	N B Potomac-Barn	69-73 w						9
01600000	N B Potomac-Pint	69-73 w						8
01603000	N B Potomac-Cumb	61-73 w						10
01619500	Antietam-Sharpsb	69-73 w						7
01643020	Monocacy-Fredrck	69-73 w						8
PENNSYLVANIA								
01619000	Antietam-Waynesb	69-73 w						7
VIRGINIA								
LIF000.19	Little Hunting C	79-84 f	15				15	
GOO002.38	Goose Creek	79-85 f	10				10	
CDR013.29	Cedar Cr	79-85 f	10				10	
NFS000.69	N F Shenandoah	79-85 f	8				8	
SSF000.58	S F Shenandoah	79-85 f	10				10	
WEST VIRGINIA								
550468	S B Potomac-Spfd	78-83 f				6		

FIGURE 9
Total Number of Observations in the Potomac River Basin
for Metals.

Parameter	#Observations
Antimony	(136)
Arsenic	(2697)
Beryllium	(184)
Cadmium	(5212)
Chromium	(5236)
Copper	(5679)
Lead	(6125)
Magnesium	(74)
Manganese	(3022)
Mercury	(4799)
Nickel	(2792)
Selenium	(557)
Silver	(942)
Thallium	(111)
Zinc	(5588)



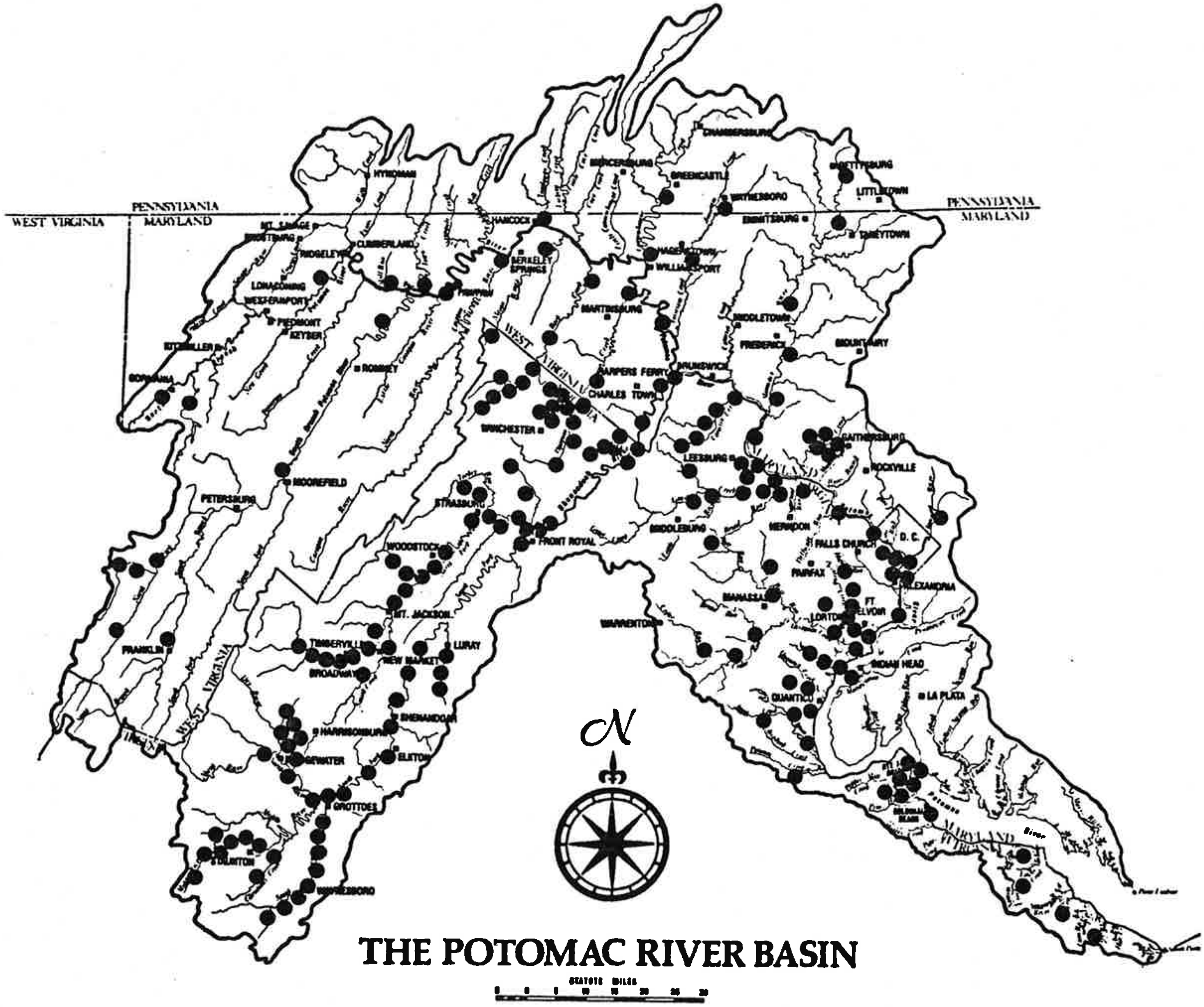
NOTE:
- -for Metals on the U.S. EPA Priority Pollutants List,
- -includes only those metals with more than four observations in any single State in the basin,
- -the count for each parameter includes fish tissue, water column, and sediment, samples.

FIGURE 10
Number of Stations and Longest Record at a Station for Metals

Parameter	1+	5+	Longest
Antimony	22	10	14
Arsenic	326	217	16
Berylium	37	7	11
Cadmium	530	230	16
Chromium	561	229	17
Copper	597	244	17
Lead	537	239	17
Magnesium	45	0	3
Manganese	195	35	19
Mercury	511	224	17
Nickel	297	194	14
Selenium	60	10	14
Silver	34	6	14
Thallium	27	0	3
Zinc	437	235	17

NOTE:
- -for Metals on the U.S. EPA Priority Pollutants List,
- -column labeled "1+" is the number of stations with one or more observations,
- -column labeled "5+" is the number of stations with data from a period of five or more years,
- -column labeled "Longest" is the number of years at the station(s) with the longest period of record,
- -fish tissue, water column, and sediment, samples are combined for each parameter.

FIGURE 11
Locations of Metals Sampling Stations
with Records of 5 Years or Longer



Key:

● Sampling Station
■ Town or City

FIGURE 12

Metals Measured in the Basin States

Stations with records of 5 years or longer

Station Code	Location	Period-m	As	Be	Cd	Cr	Cu	Pb	Ni	Ag	Zn	Sb	Se	Hg
			Number of observations for each Metal											
DISTRICT OF COLUMBIA														
100130	Potomac-D.C.	64-69 w	10	10	10	10	10	10	10	10	10			
POT113.49	Potomac	72-77 w	4		6	7	7	6			7			7
MARYLAND														
ANT0203	Antietam Creek	79-85 f	7		9	9	9	9			9			9
CON0005	Conococheague Cr.	79-84 f	14		14	14	14	14			14			14
MON0020	Monocacy River	79-85 f	13		14	14	14	14			14			14
MON0138	Monocacy River	80-85 f	12		14	14	14	14			14			14
MON0269	Monocacy River	79-85 f	10		13	13	13	13			13			13
MON0528	Monocacy River	79-85 f	19		21	21	21	21			21			21
NBP0103	N B Potomac	79-84 f	6		6	6	6	6			6			6
NEB0016	NE B Anacostia	80-85 f	6		8	8	8	8			8			8
POT1471	Potomac River	79-84 f	14		14	14	14	14			14			14
POT1830	Potomac River	80-84 f	13		13	13	13	13			13			13
POT2386	Potomac River	79-84 f	14		14	14	14	14			14			14
TOW0013	Town Creek	80-85 f	10		12	12	12	12			12			12
UHK0000	Trib. to Seneca Cr	75-79 w			22		22	22						
UHK0001	Trib. to Seneca Cr	74-79 w			8		8	8						
UHL0000	Trib. to Seneca Cr	74-79 w			28		28	28						
URG0015	Trib. to Seneca Cr	74-79 w			29		29	29						
URG0017	Trib. to Seneca Cr	75-79 w			17		17	17						
XDC1706	Potomac Estuary	78-85 f	17		19	19	19	19			19			19
XEA6596	Potomac Estuary	78-86 f	13		18	18	18	18			18			18

FIGURE 12

Metals Measured in the Basin States

Stations with records of 5 years or longer

Station Code	Location	Period-m		Number of observations for each Metal: As	Be	Cd	Cr	Cu	Pb	Ni	Ag	Zn	Sb	Se	Hg
PENNSYLVANIA															
WQN0501	Conococheague-Worley	73-86	w	4	4	13	14	15	14	14		14			8
WQN0503	Rock Cr-Gettysburg	73-86	w	4	4	13	14	14	14	14		15			8
WQN0504	E Br Antietam-Waynes	73-86	w	5	4	16	17	17	16	17		16			9
VIRGINIA															
ABR002.73	Abrams Creek	71-78	w	13		17	24	25	22	11		25			23
ABR005.80	Abrams Creek	73-78	w	7		9	12	11	11	11		12			12
ABR007.14	Abrams Creek	72-78	w	8		11	16	16	9	11		16			16
ACO001.78	Accotink Cr	75-86	w	12		13	14	14	14	6		14			13
ACO009.08	Accotink Cr	75-79	w	6		6	7	7	7	6		7			7
ACO014.57	Accotink Cr	71-86	w	18		21	30	29	27	18		30			27
		80-86	s	5		5	5	5	5	5		5			5
AUA001.91	Aquia Cr	72-77	w	4		6	8	8	7			8			8
AUA014.51	Aquia Cr	75-79	w	6		6	7	7	7	6		7			7
AUA019.99	Aquia Cr	70-74	w	7		7	16	15	13			16			13
BAC032.10	Back Creek	71-77	w	10		17	24	24	21			24			22
BAC041.86	Back Creek	73-78	w	5		9	12	12	11	10		12			12
BIR000.76	Big Rocky Run	75-79	w	6		6	6	6	6	6		6			6
CAX000.19	Catoctin Cr	73-77	w	4		5	8	8	7	7		8			8
CER000.20	Cedar Run	71-75	w	4		8	10	11	9			10			10
CER016.40	Cedar Run	75-79	w	6		7	7	7	7	7		7			7
CER032.15	Cedar Run	75-79	w	6		7	7	7	7	7		7			7
BRB002.15	Broad Run	73-86	w	14		14	17	17	16	17		18			18
		80-85	s	6		6	6	6	5	6		6			5
BRU006.65	Broad Run	73-79	w	8		9	11	11	10	10		11			11

FIGURE 12

Metals Measured in the Basin States

Stations with records of 5 years or longer

Station Code	Location	Period-m		As	Be	Cd	Cr	Cu	Pb	Ni	Ag	Zn	Sb	Se	Hg
				Number of observations for each Metal											
VIRGINIA (cont.)															
BUL011.03	Bull Run	71-79	w	9		12	14	14	13	9		14			14
CAM000.95	Cameron Run	75-86	w	9		10	11	11	11	11		11			9
		80-86	s	4		4	4	4	4	4		4			4
CHO003.65	Chopawamsic	75-86	w	14		15	15	15	15	14		15			14
		80-86	s	6		5	6	6	6	6		6			5
CLB000.26	Clearbrook Run	71-78	w	11		15	20	19	18	6		19			18
CUB003.74	Cub Run	74-79	w	6		8	8	8	11	8		8			8
DIF000.86	Difficult Run	72-86	w	10		11	15	14	14	11		15			14
FOU000.19	Four Mile Run	75-86	w	10		11	11	12	12	12		12			10
FOU001.92	Four Mile Run	75-86	w	7		8	8	8	8	8		8			7
		80-86	s	4		4	4	4	4	4		4			4
FOU004.22	Four Mile Run	75-79	w	6		6	7	7	7	7		7			5
GAM003.50	Gambo Creek	70-75	w	6		6	14	14	13			13			14
GOO002.38	Goose Creek	75-86	w	12		12	12	11	12	12		12			12
		79-86	s	7		7	7	7	7	7		7			6
		79-85	f												10
GOO011.23	Goose Creek	75-86	w	12		12	13	12	13	13		13			13
		79-84	s	6		6	6	6	6	6		6			5
GOO014.44	Goose Creek	70-74	w	4		5	12	12	9			12			10
GOO022.44	Goose Creek	75-86	w	12		12	13	11	13	13		13			13
		79-86	s	7		7	7	7	7	7		7			6
GOO030.75	Goose Creek	70-78	w	9		10	18	18	16	7		18			17
HOC003.67	Hogue Creek	73-78	w	5		9	12	12	11	10		12			12
HOC006.23	Hogue Creek	73-78	w	4		8	12	12	11	10		12			12
HOC007.96	Hogue Creek	73-78	w	5		9	12	12	11	10		12			12
HOR003.87	Horsepen Run	75-86	w	10		10	11	11	11	11		11			10
		79-86	s	7		7	7	7	7	7		7			6

FIGURE 12

Metals Measured in the Basin States

Stations with records of 5 years or longer

Station Code	Location	Period-m	As	Be	Cd	Cr	Cu	Pb	Ni	Ag	Zn	Sb	Se	Hg
			Number of observations for each Metal											
VIRGINIA (cont.)														
HUT000.01	Hunting Cr	75-86 w	10		11	12	12	12	12		12			10
		79-86 s	4		4	4	4	4	4		4			4
LIF000.19	Little Hunting Cr	75-86 w	10		11	12	12	12	12		12			10
		79-86 s	4		4	4	4	4	4		4			4
		80-84 f	12											15
MON002.60	Monroe Creek	74-78 w			7	9	9	9	7		9			9
NEA000.57	Neabasco Bay	72-86 w	10		12	14	14	13	11		14			14
		80-86 s	7		7	7	7	7	7		7			7
NEA002.89	Neabasco Cr	75-86 w	10		11	11	11	11	9		11			10
		80-85 s	5		5	5	5	5	5					
NEA009.12	Neabasco Cr	75-79 w	6		7	7	7	7	7		7			6
NOC004.38	N F Catoctin Cr	75-79 w	6			6	6	6	6		6			
NOF002.14	N F Broad Run	75-79 w	6		7	7	7	7	7		7			7
NOG005.69	N F Goose Cr	71-86 w	18		18	26	26	24	16		26			25
		79-86 s	7		7	6	7	7	7		7			6
OCC002.47	Belmont Bay	72-86 w	10		12	14	14	13	10		14			14
		80-86 s	6		6	6	6	6	6		6			6
OCC006.71	Occoquan Cr	75-85 w	11		12	12	12	12	12		12			11
		80-85 s	4		4	4	4	4	4		4			4
PIM000.15	Pimmit Run	73-86 w	11		12	16	15	15	13		16			15
		80-86 s	4		4	5	4	4	4		4			4
POH000.21	Gunston Cove	72-77 w	4		6	8	8	7	4		8			8
POH004.79	Pohick Creek	72-79 w	9		10	17	17	16	12		17			15
POH007.65	Pohick Cr	77-86 w	8		9	9	9	8	9		9			8
		80-86 s	4		4	4	4	4	4		4			3
POH015.09	Pohick Creek	74-78 w				4	4	4	3		4			
POM001.04	Potomac Creek	72-77 w	6		6	8	8	8	7		8			8
POT101.15	Potomac River	72-77 w	4		6	8	8	7	3		7			7

FIGURE 12

Metals Measured in the Basin States

Stations with records of 5 years or longer

Number of observations for each Metal

Station Code	Location	Period	m	As	Be	Cd	Cr	Cu	Pb	Ni	Ag	Zn	Sb	Se	Hg
VIRGINIA (cont.)															
POT170.40	Potomac River	70-79	w	11		12	19	19	16	10		19			18
OPE023.56	Opequon Creek	71-78	w	11		15	23	23	20	11		23			21
OPE032.52	Opequon Creek	71-78	w	12		16	19	24	21	10		24			22
OPE040.86	Opequon Creek	73-78	w	7		9	13	13	12	11		13			13
OPE047.44	Opequon Creek	73-78	w	7		9	13	13	12	11		13			13
QUA004.46	Quantico Cr	72-86	w	17		19	24	24	23	19		24			23
		80-86	s	6		6	6	6	6	6		6			5
RED000.46	Redbud Run	73-78	w	7		9	13	13	12	11		11			13
RED001.61	Redbud Run	73-78	w	5		7	11	11	10	9		11			11
RED004.45	Redbud Run	72-78	w	7		10	15	15	14	10		15			15
SCO000.76	Scott Run	75-79	w	6		6	6		6	6		6			
SLP034.20	Sleepy Creek	70-74	w				16	16	13			16			14
SOC001.66	S F Catoctin	73-86	w	13		14	17	17	16	12		17			17
		80-86	s	7		7	7	7	7	7		7			6
SOC011.82	S F Catoctin	73-79	w	6		6	10	10	9	9		10			10
SOC012.38	S F Catoctin	73-79	w	7		7	10	10	9	9		10			10
SOQ006.73	S F Quantico Cr	75-79	w	6		6	6	6	6	6		6			6
SUG004.42	Sugarland Cr	75-86	w	13		13	12	13	13	13		13			11
		80-85	s	6		6	6	6	6	6		6			6
TUS000.37	Tuscarora Cr	71-86	w	17		19	26	26	23	17		26			23
		79-86	s	7		7	7	7	7	7		7			6
TUS003.17	Tuscarora Cr	71-78	w	10		11	18	18	14	9		18			16
UMC001.36	Upper Machodoc Cr	73-77	w				5	5	4	4		5			5
UMC004.43	Upper Machodoc Cr	75-86	w	12		11	15	15	14	13		15			6
		81-86	s	6		6	6	6	6	6		6			6
UMC009.61	Upper Machodoc Cr	73-78	w				6	6	5	5		6			6
WLL000.00	Williams Creek	70-77	w	6		5	15	14	13	4		15			13
WLL001.30	Williams Creek	75-86	w	12		11	15	15	14	14		15			15
		81-86	s	5		5	5	5	5	5		5			5

FIGURE 12

Metals Measured in the Basin States

Stations with records of 5 years or longer

Station Code	Location	Period-m		As	Be	Cd	Cr	Cu	Pb	Ni	Ag	Zn	Sb	Se	Hg
				Number of observations for each Metal											
VIRGINIA (cont.)															
WLL002.21	Williams Creek	70-79	w	10		11	20	19	18	9		20			18
BLK000.57	Blacks Run	71-78	w	9		12	23	22	20	10		22			21
BLK002.10	Blacks Run	71-77	w	9		12	22	21	19			21			21
BLK003.86	Blacks Run	71-77	w	7		11	21	20	18			21			18
BLK006.04	Blacks Run	71-78	w	10		13	22	50	48	11		49			22
CDR002.84	Cedar Creek	73-78	w	6		8	12	12	11	10		12			12
CDR013.29	Cedar Creek	75-85	w	22		24	25	25	25	25		25			25
		79-85	s	3		3	3	3	3	3		3			3
		81-85	f	8											10
CKS001.03	Cooks Creek	71-78	w	10		14	23	52	49	11		51			22
CKS003.10	Cooks Creek	71-78	w	9		13	22	51	48	11		50			21
CKS005.10	Cooks Creek	70-78	w	9		13	23	51	49	11		52			21
CKS007.12	Cooks Creek	70-78	w	11		15	24	51	50	10		51			23
CST006.43	Christians Creek	70-78	w	11		16	24	24	21	12		24			23
CST016.20	Christians Creek	70-78	w	11		16	23	22	20	12		23			23
DGR000.23	Dog Run	70-78	w	12		16	26	25	25	12		77			25
DGR000.47	Dog Run	70-74	w	6		8	16	15	14			33			15
DGR004.02	Dog Run	72-78	w	7		9	13	13	12	10		42			13
HKS000.96	Hawksbill Creek	70-82	w	11		17	28	27	26	12		27			24
		79-83	s	2		2	2	2	2	2		2			2
HKS006.04	Hawksbill Creek	72-78	w	5		10	15	15	15	14		14			15
HKS006.23	Hawksbill Creek	70-78	w	11		15	26	26	24	10		25			23
HPY000.10	Happy Creek	70-78	w	11		15	22	22	19	10		22			21
HPY002.60	Happy Creek	70-78	w	12		16	23	22	21	10		22			22
LEW000.61	Lewis Creek	70-78	w	10		15	23	21	20	11		23			22
LEW002.80	Lewis Creek	71-82	w	11		16	24	24	21	13		24			23
LEW005.40	Lewis Creek	73-78	w	6		9	12	11	11	10		12			12
LEW005.68	Lewis Creek	73-78	w	6		9	12	10	11	10		12			12

FIGURE 12

Metals Measured in the Basin States

Stations with records of 5 years or longer

Number of observations for each Metal

Station Code	Location	Period-m	As	Be	Cd	Cr	Cu	Pb	Ni	Ag	Zn	Sb	Se	Hg
VIRGINIA (cont.)														
LEW006.93	Lewis Creek	73-78 w	7		10	13	13	12	11		13			13
LEW007.08	Lewis Creek	73-78 w	7		9	12	11	11	10		12			12
LMN004.84	Long Marsh Run	70-74 w				17	16	15			17			16
MDD001.65	Muddy Creek	70-78 w	11		15	24	23	22	11		23			23
MDL022.09	Middle River	70-78 w	12		17	24	23	22	11		23			24
MDL029.46	Middle River	70-78 w	11		15	23	22	20	11		23			21
MDL034.28	Middle River	74-78 w			7	8	8	8	7		8			8
NFS000.69	N F Shenandoah	71-85 w	28		32	40	40	38	28		66			39
		79-85 s	3		3	3	3	3	3		3			3
NFS010.34	N F Shenandoah	71-82 w	11		15	24	23	21	11		48			22
		79-83 s	2		2	2	2	2	2		2			2
NFS012.98	N F Shenandoah	70-78 w	9		13	17	21	19	10		22			21
NFS037.89	N F Shenandoah	70-78 w	11		15	24	23	21	9		24			22
NFS043.06	N F Shenandoah	70-78 w	10		15	24	23	20	11		24			22
NFS059.59	N F Shenandoah	70-78 w	11		15	24	23	20	12		24			22
NFS062.18	N F Shenandoah	70-78 w	11		15	24	23	21	12		24			22
NFS072.78	N F Shenandoah	74-78 w			6	7	7	7	7		7			7
NFS076.56	N F Shenandoah	70-74 w				15	14	12			15			13
NFS081.42	N F Shenandoah	71-82 w	10		13	23	22	20	11		23			21
		79-83 s	2		2	2	2	2	2		2			2
NFS087.02	N F Shenandoah	70-78 w	10		14	23	22	20	11		23			21
NFS088.00	N F Shenandoah	72-78 w	5		8	13	13	12	11		13			13
NFS088.38	N F Shenandoah	72-78 w	5		7	13	13	12	11		13			13
NFS090.16	N F Shenandoah	70-78 w	10		14	23	22	20	11		23			21
NFS093.53	N F Shenandoah	74-82 w	5		6	8	8	8	8		8			8
NTH000.18	North River	70-78 w	10		13	22	22	20	12		22			23
NTH016.24	North River	70-78 w	11		15	23	23	21	11		22			23
NTH020.40	North River	70-78 w	9		13	23	22	20	10		22			21

FIGURE 12
Metals Measured in the Basin States
Stations with records of 5 years or longer

Number of observations for each Metal

Station Code	Location	Period	-m	As	Be	Cd	Cr	Cu	Pb	Ni	Ag	Zn	Sb	Se	Hg
VIRGINIA (cont.)															
PSG001.36	Passage Creek	74-82	w	5		7	8	8	8	7		8			8
SHN022.63	Shenandoah River	71-82	w	13		17	29	28	28	13		82			26
		79-83	s	2		2	2	2	2	2		2			2
SHN038.27	Shenandoah River	70-78	w	12		16	27	26	26	11		83			22
SHN048.00	Shenandoah River	70-78	w	12		14	24	24	22	11		82			21
SHN054.22	Shenandoah River	70-78	w	11		16	23	23	20	11		76			22
SMT010.90	Smith Creek	70-78	w	9		12	22	21	19			22			20
SMT018.40	Smith Creek	70-74	w				16	14	13			16			14
SSF000.58	S F Shenandoah	71-85	w	25		30	38	37	36	23		72			35
		79-85	s	3		3	3	3	3	3		3			3
SSF003.56	S F Shenandoah	70-82	w	12		16	22	22	23	11		75			23
		79-83	s	2		2	2	2	2	2		2			2
SSF046.67	S F Shenandoah	70-78	w	10		15	24	22	21	10		23			22
SSF054.20	S F Shenandoah	70-82	w	10		16	26	25	23	12		25			23
		79-83	s	2		2	2	2	2	2		2			2
SSF060.57	S F Shenandoah	70-78	w	11		16	25	24	22	11		24			23
SSF078.24	S F Shenandoah	70-78	w	9		13	23	22	20	11		23			21
SSF085.08	S F Shenandoah	70-79	w	17		19	30	29	27	17		33			28
SSF092.69	S F Shenandoah	70-78	w	10		14	22	22	19	13		22			22
SSF100.07	S F Shenandoah	70-77	w	9		13	22	22	19	12		22			22
STH000.19	South River	70-78	w	8		12	21	21	18	12		21			21
STH007.80	South River	70-82	w	11		15	24	24	21	14		25			23
		79-83	s	2		2	2	2	2	2		2			2
STH014.49	South River	70-78	w	9		13	22	22	19	12		22			22
STH018.50	South River	70-78	w	10		14	23	23	20	13		24			23
STH023.70	South River	70-78	w	11		14	23	23	20	13		23			24
STH027.10	South River	74-82	w	5		6	8	8	8	7		8			8
		79-83	s	2		2	2	2	2	2		2			2

FIGURE 12

Metals Measured in the Basin States

Stations with records of 5 years or longer

Station Code	Location	Period-m		As	Be	Cd	Cr	Cu	Pb	Ni	Ag	Zn	Sb	Se	Hg
				Number of observations for each Metal											
VIRGINIA (cont.)															
STH028.51	South River	70-74	w				15	15	13			16			16
STH033.50	South River	70-77	w	9		12	22	22	19	12		22			22
STH038.50	South River	70-77	w	10		12	21	21	19	12		21			22
STV002.92	Stephens Run	70-78	w	11		16	23	22	20	11		73			22
STY001.22	Stony Creek	73-82	w	8		10	14	13	13	11		14			14
STY006.81	Stony Creek	73-78	w	7		9	13	13	12	11		13			13
01634000	N F Shenandoah-Stra	72-76	s	2		2	2	2	2	2		2			2
01628250	S F Shenandoah-Lynw	69-73	w				36	38							
510087	Shenandoah-Berryvil	62-69	w	17	17	17	17	17	17	17	17	17			
XAF9685	Coan River	74-79	f			15		15				15			
XBD6829	Nomini Creek	74-79	f			17		17				17			
XBE1722	Yeocomico River	74-79	f			20		20				20			
XBF7084	Lower Machodoc Cr	74-79	f			21		21				21			
XBF8885	Nomini Bay	74-79	f			15		15				15			
WEST VIRGINIA															
210701	N F S Br Pot-N F Gap	70-80	w					19	19			22			
210702	N F S Br Pot-Seneca	71-80	w					15	15			16			
210703	Bushy Run	71-80	w					16	16			17			
210704	Seneca Cr	71-80	w					15	15			16			
210705	Big Run	71-80	w					15	15			15			
210801	S Br Pot-Ranger Sta	70-80	w					19	19			20			
550462	Opequon-Bedington	71-84	w	36		123	55	48	131	29	43	58	10	26	65
550463	Opequon-Tarico Hgts	71-78	w	17		37	22	20	42	15	29	26			34
550464	Back Cr-Hedgeville	71-84	w	37		127	56	48	133	29	32	59	10	24	65
550843	S Br Pot-Moorefield	78-84	w	19		74	20	26	75	15	15	20	9	13	16

FIGURE 12

Metals Measured in the Basin States

Stations with records of 5 years or longer

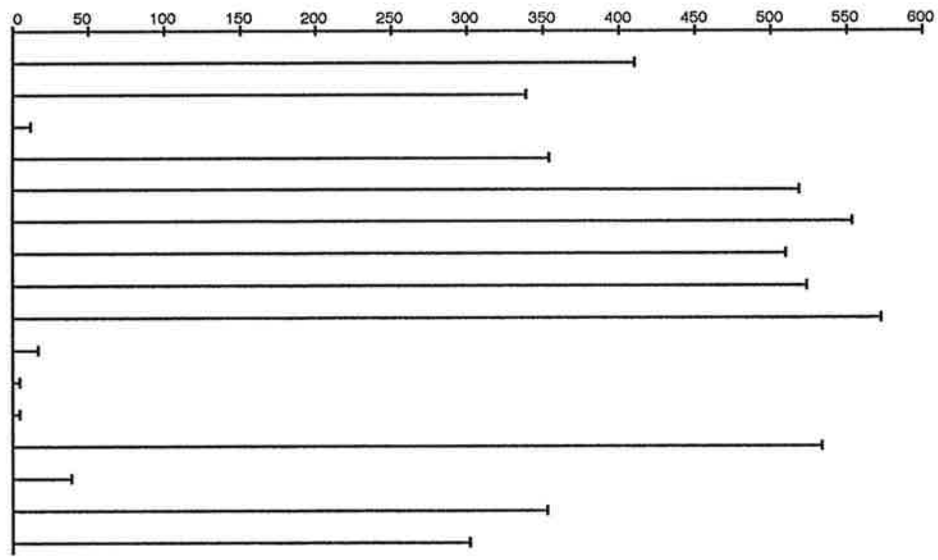
Station Code	Location	Period-m		As	Be	Cd	Cr	Cu	Pb	Ni	Ag	Zn	Sb	Se	Hg
WEST VIRGINIA (cont.)															
550468	S Br Pot-Springfield	71-84	w	36		136	61	61	136	26	47	65	10	24	71
		78-83	f			6	5	6	6			6			6
550469	S Br Pot-Franklin	71-84	w	39		20	37	50	66	30	44	43	21	26	50
550554	Stony River-Mt Storm	74-86	w	36		122	67	80	119	17	37	68	10	33	64
550555	Buffalo Cr-Bayard	74-84	w	33		62	52	63	55	16	31	52	12	27	49
550804	Cacapon-Gt Cacapon	76-84	w	26		35	24	35	34	22	24	23	11	25	23
550471	Shenandoah-Harpers F	71-84	w	37		126	54	49	132	29	43	57	10	22	64
550472	Shenandoah-Meyerstwn	71-84	w	37		126	55	49	132	28	42	57	11	26	64
550461	Potomac-Paw Paw	71-83	w	5		18	2	7	26	2	17	7			17
550465	Back Cr-Mill Gap	71-78	w	17		37	21	20	40	15	29	26			34
550466	Sleepy Cr-Berkley S	71-78	w	15		51	35	20	53	13	27	39			46
550467	N Br Pot-Pinto	70-74	w												15
550470	N F S Br Pot-Judy Gp	71-78	w	20		64	25	26	41	17	32	31			38
01600000	N Br Pot-Pinto	73-79	w			3	6	3	3			3			
01618000	Potomac-Sheperdstwn	79-86	w	29	14	29	28	29	29	26	29	29		29	29
01636500	Shenandoah-Millville	76-86	w	45	14	45	44	46	45	38	49	45		45	45
		72-76	s	2	2	2	2	2	2	2	2	2			2

Number of observations for each Metal

FIGURE 13
Total Number of Observations in the Potomac River Basin
for Pesticides.

Parameter #Observations

Aldrin (410)
AlphaBHC (339)
DeltaBHC (12)
GammaBHC (354)
Chlordane (519)
DDD (554)
DDE (510)
DDT (524)
Dieldrin (573)
A-Endosulfan (17)
B-Endosulfan (5)
Endosulfan_Sulf (5)
Endrin (534)
Heptachlor (39)
Heptachloro_epox (353)
Toxaphene (302)



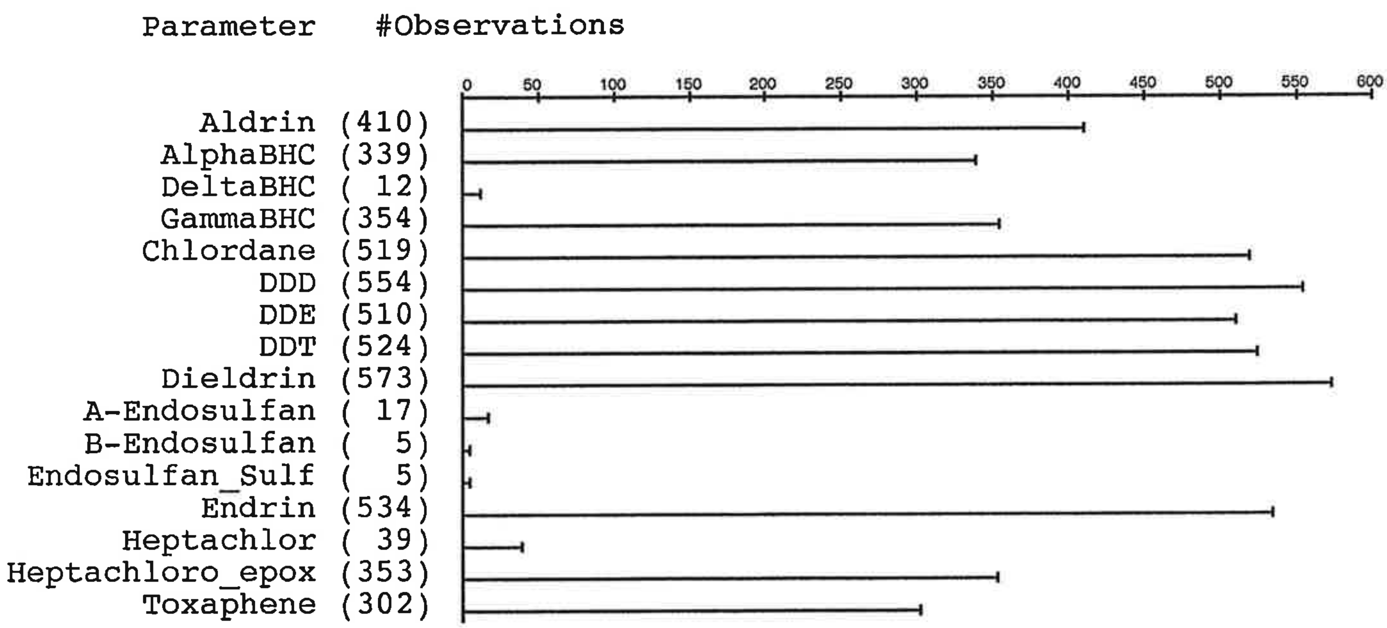
NOTE:
-for Pesticides on the U.S. EPA Priority Pollutants List,
-includes only those Pesticides with more than four observations in any single State in the basin,
-the count for each parameter includes fish tissue, water column, and sediment, samples.

FIGURE 14
Number of Stations and Longest Record at a Station for Pesticides

Parameter	1+	5+	Longest
Aldrin	109	38	10
alpha_BHC	46	20	9
delta_BHC	7	0	1
gamma_BHC	65	25	10
Chlordane	123	26	9
DDD	91	20	9
DDE	90	20	9
DDT	101	20	9
Dieldrin	127	26	9
a_Endosulfan	10	0	1
b_Endosulfan	7	0	1
Endosulfan	7	0	1
Endrin	119	28	10
Heptachlor	35	9	10
Heptachloro_epoxide	62	17	10
Toxaphene	57	16	9

NOTE:
- -for Pesticides on the U.S. EPA Priority Pollutants List,
- -column labeled "1+" is the number of stations with one or more observations,
- -column labeled "5+" is the number of stations with data from a period of five or more years,
- -column labeled "Longest" is the number of years at the station(s) with the longest period of record,
- -fish tissue, water column, and sediment, samples are combined for each parameter.

FIGURE 13
Total Number of Observations in the Potomac River Basin for Pesticides.



NOTE:
- for Pesticides on the U.S. EPA Priority Pollutants List,
- includes only those Pesticides with more than four observations in any single State in the basin,
- the count for each parameter includes fish tissue, water column, and sediment, samples.

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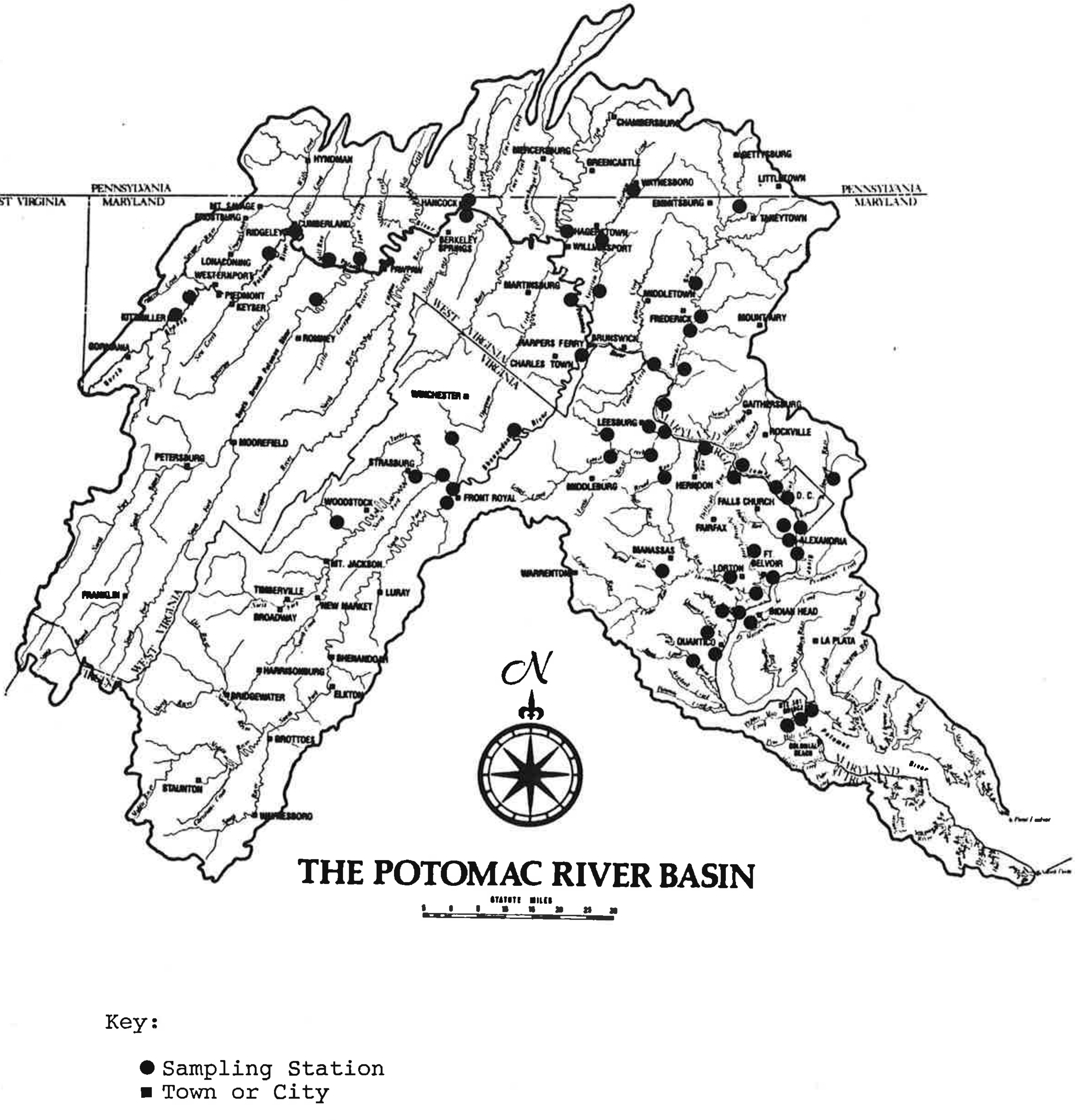
Aldrin	109	38	10
alpha_BHC	46	20	9
delta_BHC	7	0	1
gamma_BHC	65	25	10
Chlordane	123	26	9
DDD	91	20	9
DDE	90	20	9
DDT	101	20	9
Dieldrin	127	26	9
a_Endosulfan	10	0	1
b_Endosulfan	7	0	1
Endosulfan	7	0	1
Endrin	119	28	10
Heptachlor	35	9	10
Heptachloro_epoxide	62	17	10
Toxaphene	57	16	9

NOTE:
- -for Pesticides on the U.S. EPA Priority Pollutants List,
- -column labeled "1+" is the number of stations with one or more observations,
- -column labeled "5+" is the number of stations with data from a period of five or more years,
- -column labeled "Longest" is the number of years at the station(s) with the longest period of record,
- -fish tissue, water column, and sediment, samples are combined for each parameter.

FIGURE 15
Locations of Pesticides Sampling Stations
with Records of 5 Years or Longer



Key:

- ● Sampling Station
- ■ Town or City

FIGURE 16

Pesticide Parameters Measured in Basin States

Stations with records of 5 years or longer

Station Code	Location	Period-m	Aldrin	Chlordane	Endrin	HpClEp	HeptCl	Toxaphene	AlphaBHC	GBHC-Lind	Dieldrin	P,P'DDT	P,P'DDD	P,P'DDE
			Number of Observations for each Pesticide											
VIRGINIA (cont.)														
HUT000.01	Hunting Cr	79-83 w	5											
NEA000.57	Neabasco Bay	79-84 w	6											
NEA002.89	Neabasco Cr	79-83 w	5											
NOG005.69	N F Goose Cr	79-83 w	5											
OCC002.47	Belmont Bay	79-84 w	5											
OCC006.71	Occoquan Cr	79-84 w	5											
PIM000.15	Pimmit Run	79-83 w	5											
POH007.65	Pohick Cr	79-84 w	6											
QUA004.46	Quantico Cr	74-83 w	7								5			
SUG004.42	Sugarland Cr	79-84 w	6											
TUS000.37	Tuscarora Cr	79-83 w	5											
UMC004.43	Upper Machadoc	79-84 w	7											
WLL001.30	Williams Cr	74-84 w	7											
CDR013.29	Cedar Cr	79-85 f	10	10	10				10	10	10	10	10	10
NFS000.69	N F Shenandoah	79-85 f	8	8	8				8	8	8	8	8	8
SSF000.58	S F Shenandoah	79-85 f	10	10	10				10	10	10	10	10	10
STY001.22	Stony Cr	78-82 w	4											
01636290	Shenandoah-Millw	72-76 w	4	4	4	4	4	3		4	4			
01634000	N F Shenandoah-S	72-76 s	2	2	2		2			2	2			
WEST VIRGINIA														
550468	S B Potomac-Spfd	78-83 f							6				5	6
01636500	Shenandoah-Millv	72-76 s	2	2	2		2			2	2			

FIGURE 16

Pesticide Parameters Measured in Basin States

Stations with records of 5 years or longer

Station Code	Location	Period-m	Aldrin	Chlordane	Endrin	HpClEp	HeptCl	Toxaphene	AlphaBHC	GBHC-Lind	Dieldrin	P,P'DDT	P,P'DDD	P,P'DDE
			Number of Observations for each Pesticide											
DISTRICT OF COLUMBIA														
(no data)														
MARYLAND (STORET)														
01595500	N B Potomac-Kitz	72-76 s	2	2	2		2			2	2			
01613000	Potomac-Hancock	72-76 s	2	2	2		2			2	2			
01638500	Potomac-Pt of R	72-76 s	2	2	2		2			2	2			
01619500	Antietam-Sharpsb	72-76 s	2	2	2		2			2	2			
230040	Potomac-Gt Falls	58-67 w	17		17	17	17			17				
006	Potomac-Lt Falls	70-77 f	23		23	26	11	19				26	26	26
MARYLAND (OEP)														
ANT0203	Antietam Creek	79-85 f		9	9	9		9	9	9	9	9	9	9
CON0005	Conococheague Cr.	79-84 f		14	14	14		14	14	14	14	14	14	14
MON0020	Monocacy River	79-85 f		14	14	14		14	14	14	14	14	14	14
MON0138	Monocacy River	80-85 f		14	14	14		14	14	14	14	14	14	14
MON0269	Monocacy River	79-85 f		13	13	13		13	13	13	13	13	13	13
MON0528	Monocacy River	79-85 f		23	23	23		23	23	23	23	23	23	23
NBP0103	N B Potomac River	79-84 f		6	6	6		6	6	6	6	6	6	6
NEB0016	NE B Anacostia	80-85 f		8	8	8		8	8	8	8	8	8	8
POT1471	Potomac River	79-84 f		14	14	14		14	14	14	14	14	14	14
POT1830	Potomac River	80-84 f		13	13	13		13	13	13	13	13	13	13

FIGURE 16

Pesticide Parameters Measured in Basin States

Stations with records of 5 years or longer

Station Code	Location	Period-m	Aldrin	Chlordane	Endrin	HpClEp	HeptCl	Toxaphene	AlphaBHC	GBHC-Lind	Dieldrin	P,P'DDT	P,P'DDD	P,P'DDE
			Number of Observations for each Pesticide											
MARYLAND (OEP) (cont)														
POT2386	Potomac River	79-84 f		14	14	14		14	14	14	14	14	14	14
TOW0013	Town Creek	80-85 f		12	12	12		12	12	12	12	12	12	12
XDC1706	Potomac Estuary	78-85 f		20	20	20		20	20	20	20	20	20	20
XEA6596	Potomac Estuary	78-86 f		19	19	19		19	19	19	19	19	19	19
PENNSYLVANIA														
(no data)														
VIRGINIA														
LIF000.19	Little Hunting C	79-84 f	15	15	15				15			15	15	15
ACO001.78	Accotink Cr	79-84 w	6											
AUA010.26	Aquia Cr	79-83 w	6											
BRB002.15	Broad Run	79-84 w	6											
CAM000.95	Cameron Run	79-83 w	5											
CHO003.65	Chopawamsic	79-83 w	6											
DIF000.86	Difficult Run	79-83 w	5											
FOU001.92	Four Mile Run	79-83 w	5											
GOO002.38	Goose Creek	79-85 f	10	10	10				10			10	10	10
		77-81 w									4			
GOO011.23	Goose Creek	79-83 w	6											
GOO022.44	Goose Creek	79-83 w	5											
HOR003.87	Horsepen Run	79-83 w	6											