STATUS AND TRENDS OF TOXIC PARAMETERS IN THE POTOMAC

EXECUTIVE SUMMARY AND GUIDE TO USING THIS REPORT

This report presents an assessment of toxic parameters in water, sediment, and fish tissue of the Potomac River basin. It is the result of a recently completed feasibility study (ICPRB, 1987a). The purpose of this assessment is to identify recent concentrations and trends in concentration. This is the first analysis of toxic water quality parameters by the Interstate Commission on the Potomac River Basin (ICPRB); therefore, no comparisons can be made in a consistent manner with any past work. It is also the first such analysis performed on this river basin as a whole hydrological unit. The results presented in this report are expected to be useful to the signatories of the 1987 Chesapeake Bay Agreement in the fulfillment of their commitment to establish a Toxics Loading Inventory, and in other aspects of the Chesapeake Bay Basinwide Toxics Reduction Strategy which is now under development. The data used in this work were collected by several agencies and organizations in the basin, and the results of the analysis are presented as summary statistics in tabular form.

As in past ICPRB water quality reports on the analysis of conventional pollutants, the Potomac River basin is divided into six subdivisions so as to give a reasonable geographically consistent coverage for analysis: Potomac Highlands, Upper Great Valley, Shenandoah River, Potomac Piedmont, Potomac Urban Estuary, and Lower Potomac Estuary (see Map 1). The stations included in this report are those where data were recorded by a specified collecting agency for any of the defined parameters. They include stations sampled by regulatory agencies of each of the major jurisdictions in the Potomac River Basin: West Virginia, Virginia, Pennsylvania, Maryland, and the District of Columbia. In addition, data collected by the U.S. Geological Survey, Fairfax County (Virginia) Deptartment of Public Works, and several major water supply utilities were assessed. ICPRB obtained these data from the U.S. Environmental Protection Agency data base system (STORET), or directly from the utilities and agencies.

For the purposes of this report, monitoring stations for toxic parameters in the Potomac River basin are organized hydrologicly by sub-basin in downstream order (see Table A1). In addition, station and stream Indexes (pages D1-1 and D2-1) may be used to locate information concerning toxics in particular jurisdictions or tributaries.

The concentration of toxic parameters is reported for different aquatic media: fish (f), sediment (s), and water (w). All toxic parameter concentrations in water are expressed as ug/l; sediment and fish data are reported as mg/kg wet weight, except for some pesticides in sediment reported as ug/kg where dry weight (-dwt) is indicated.

Toxic water quality information is presented in two tables for each monitoring station. Information in the first table is derived from the entire period during which the toxic parameter was monitored at the station. The table shows the medium sampled and the number of observations during that period and also, in parentheses (), the number of observations at the detection limit. Noting the percentage of observations at the detection limit is important to interpreting the data compiled in the tables. If the percentage of observations at the detection limit is high, the actual concentration could be significantly lower than the reported median. This is true because the median is calculated using the detection limit where indicated. The maximum concentration that occurred during the period of record and the date that it occurred are reported; often the maximum value was observed more than once, in which case the most recent date of that observation is reported.

The first table also reports results of the Kendall tau trend analysis (Hirsch et al., 1982). It is an analysis that tallies the number of times each parameter observation is greater than or less than later observations for a given month in succeeding years. The test uses only relative position in time and relative magnitude. With this technique, missing data, multiple observations per month, and seasonal effects may easily be accommodated in the analysis without skewing the trend. For this reason, the Kendall tau trend is superior to a linear regression. Linear regression is most useful when data are highly normal and non-seasonal, neither of which criteria are met by toxic water quality parameter data. The significance level of the Kendall tau test indicates whether a significant trend in a toxic parameter concentration at a site occurred. If the significance level is less than 0.05, we can be reasonably certain (>95% confident) that a trend has occurred. If the significance level is greater than 0.05, our certainty that a trend actually occurred is diminished (<95%). In cases where there is a significant trend, the slope of the Kendall tau analysis indicates the direction (+ or -) and magnitude of the trend. NA appears on the table when there is an insufficient number of observations to perform the trend analysis.

The second table is concerned with the status of the river or tributary at the monitoring site, based upon the most recent 12 months of record. The mean and median concentrations are based upon fewer but more recent observations than the trend analysis. Checking the number of observations in the trend table informs the reader on the percentage of observations at the detection limit.

STATUS AND TRENDS OF TOXIC PARAMETERS IN THE POTOMAC

The status table reports health risks calculated at the median concentration for toxic parameters during the most recent 12 month period of record. The health risk calculations are performed at a screening level; i.e., their purpose is to screen chemical concentration data for observations that are associated with substantial risk. If concentrations associated with high risk are found, these calculations should be considered as a starting point for a more detailed and site-specific risk assessment, performed according to EPA guidelines.

THE HEALTH RISK VALUES IN THIS REPORT MUST BE USED WITH CAUTION AND FULL RECOGNITION OF THE FOLLOWING ASSUMPTIONS UNDERLYING THE CALCULATIONS.

Human health risks for toxic parameters in water were computed assuming that a person is drinking two liters of untreated river water per day throughout the year. Human health risk associated with toxic compounds in fish is based upon the daily consumption of 6.5 g of fish caught from the river. While these are not average circumstances for drinking water and fish consumption, they are the standard factors employed by EPA in performing conservative assessments of risk.

Health risks for carcinogens are expressed as the expected excess number of cancer cases per million people exposed. Attention is called to parameters in the text where an excess of 10 or more cancer cases might be expected. The health risk for toxicants is expressed in terms of a Hazard Index, which is simply the ratio of the observed concentration to the acceptable intake concentration established from toxicology tests. Attention is called to parameters in the text where a ratio greater than or equal to 0.5 is determined. If the Hazard Index is greater than one, the observed concentration is higher than the threshold concentration above which health effects occur.

The number of stations at which metals were measured within the last five years is a fraction of the total number of stations with toxic chemical data (see Tables I.1 and I.2). Toxic parameters were monitored at more stations in the Urban Estuary than in any other sub-basins. In contrast, the number of stations with recent metals monitoring data in some subdivisions is very small (6 or fewer). Since metals are measured more frequently than organic parameters, the summary data suggests that there are geographic areas of the river basin that have inadequate <u>recent</u> monitoring data for the determination of current status and trends, or detection of problems concerned with toxic parameters in the river.

STATUS AND TRENDS OF TOXIC PARAMETERS IN THE POTOMAC

The summary data highlight differences in median parameter concentrations in the various subdivisions. For example, Arsenic levels in the Potomac Highlands waters are elevated in relation to median levels in other portions of the Potomac River Basin. Copper concentrations in the water seem to increase somewhat from the Highlands to the Lower Estuary. Lead levels in the water column in the Highlands, the Upper Great Valley, and the Urban Estuary are at least an order of magnitude higher than those in the other sub-basins. Although median Zinc concentrations in the water appear to be fairly consistent from the headwaters to the mouth, the range of concentrations occurring in some subdivisions is quite large.

Fewer measurements of metals in sediments than in water have been made in the past 5 years, and there is a conspicuous absence of recent sediment data in the Potomac Highlands and the Upper Great Valley. Since toxic pollutants can desorb from sediments, current sediment monitoring is important in determining present and future toxic water quality status. The summary data for toxics in sediments show that both the median and the range of Lead concentrations are higher in Urban Estuary sediments than in other sub-basins. Zinc levels in sediments are generally highest in the Urban Estuary, but maximum concentrations of Zinc in sediments are greatest in the Shenandoah and Piedmont subdivisions.

There follows a summary of results for each subdivision.

POTOMAC HIGHLANDS

Toxic parameters have been monitored at 63 stations in the Potomac Highlands; however, at many stations, the sampling period was terminated in the 1970's or early 1980's. In addition, in many cases, short-term studies provided insufficient data for a complete analysis of toxics status and trend.

Trend

The only consistent significant trends occurring throughout this subdivision are decreasing trends in Copper and Chromium concentrations. Interestingly, Hexavalent Chromium levels have not changed significantly, although very small positive trends were noted at some stations. Scattered downward trends for metals, including Zinc, Mercury, Lead, Nickel, and Silver have occurred. A positive trend in Lead levels was found at one station on the South Branch.

STATUS AND TRENDS OF TOXIC PARAMETERS IN THE POTOMAC

Human Health; Toxic Status/Standards Exceedance

Antimony and Lead are the toxic parameters consistently posing human health hazard in drinking water in the Potomac Highlands, and Lead levels throughout the sub-basin may be in violation of West Virginia water quality standards. Other parameters found at levels exceeding standards include Cadmium, Zinc, Mercury, Silver, and Chromium.

UPPER GREAT VALLEY

Toxic parameters were monitored at 81 stations in the Upper Great Valley. In many cases only a few parameters were analyzed, and at only a few stations were fish tissue or sediment data collected.

Trend

Regional patterns in toxic water quality trends are somewhat mixed. Significant declining trends were determined for Cadmium and Lead in Conococheague Creek; and for Chromium, Copper, and Lead in Opequon Creek and its tributaries. Increasing trends were determined for Cadmium in Opequon Creek, and for Chromium and Lead in the main stem Potomac at Shepherdstown. The increasing trends in the Potomac main stem are contrary to those of its upstream tributary, Opequon Creek. No significant parameter trends were determined for Antietam Creek.

Human Health

Toxic parameters with potentially hazardous levels for human health included particularly high values of Arsenic in Opequon and Tuscarora creeks and of Antimony in Tuscarora Creek. Cadmium, Chlordane, Aldrin, Dieldrin, and PCB's were found at potentially hazardous levels scattered throughout the Opequon and its tributaries. Chromium and Lead were hazardous at one and two stations, respectively, in the Opequon. Fish tissue was found to be contaminated with Arsenic in the Conococheague; and Arsenic, Lead, Chlordane, Dieldrin, and PCB's were found in Anteitam Creek at potentially hazardous levels.

Toxic Status/Standards Exceedance

Concentrations of Cadmium, Lead, Methyl Mercury, and Phenols in Opequon Creek and its tributaries appeared to be near or in violation of state water quality standards and criteria in West Virginia.

STATUS AND TRENDS OF TOXIC PARAMETERS IN THE POTOMAC

SHENANDOAH RIVER BASIN

Trend

Water quality data from the 97 sampling stations in the Shenandoah River basin was generally not very current. However, regional patterns in toxic water quality trends usually indicated decreases in concentration. Where the parameter values are indicated as being at or below the limits of detection, this most likely indicates refinements in detectability. Significant negative trends were most common for Arsenic, Copper, and Lead.

Human Health

Potential human health hazards for Cadmium were almost everywhere significant, as were potential cancer risks for Arsenic. However, concentration values for these parameters were almost always flagged as being at or below the detection limits. Several notable exceptions were: Arsenic in fish tissue from Cedar Creek and the North Fork, and in water from the North River; and Antimony in water from the Shenandoah in West Virginia.

Toxic Status/Standards Exceedance

The comparison of recent data with state water quality standards indicated that parameter concentrations were generally within standards' with a few exceptions near the mouth of the Shenandoah River.

POTOMAC PIEDMONT

Trend

Water quality Data were available from 97 stations in the Potomac Piedmont. Regional patterns in toxic water quality parameter trends in the Potomac main stem were decreasing for Barium, Chromium, and Lead. The trend for Copper was increasing at Whites Ferry but decreasing downstream at the water utility intakes. Rock Creek, a tributary to the Monocacy River in Pennsylvania, indicated significant negative trends in Cadmium and Lead. The remainder of the Monocacy River stations revealed mixed trends: increasing for Lead and Chromium, and both increasing and decreasing for Copper. The only other significant trend determined in the data for the Potomac Piedmont Subdivision was a decline in Arsenic in Tuscarora Creek (Loudon County, Virginia).

STATUS AND TRENDS OF TOXIC PARAMETERS IN THE POTOMAC

Human Health

Concentrations of Arsenic and Cadmium throughout the subdivision which were at or below the detection limit indicated a health risk. Analysis of fish tissue revealed potential human risk of cancer from Arsenic, PCB's, and Dieldrin in the Potomac, the Monocacy, and Goose Creek. Chlordane was found at potentially human cancer risk levels in fish taken from Potomac and Goose Creek sampling stations. In addition, Aldrin, Alpha BHC, Heptachlor, Heptachlor Epoxide, and Toxaphene were found at potentially human cancer risk levels in fish from Goose Creek.

Toxic Status/Standards Exceedance

Apparent violations of the state water quality standard for Aldrin were scattered throughout the Virginia tributaries.

POTOMAC URBAN ESTUARY

Trends

Within the Potomac Urban Estuary, the most distinctive finding is a downward trend in Copper (approximately 8-10 ug/l per year) at several stations in the Potomac main stem and the Anacostia River. A smaller but significant decreasing trend in Arsenic occurs in Virginia tributaries, including Pimmit Run, Four Mile Run, Hunting Creek, and Little Hunting Creek. Mercury concentrations in water are also decreasing in Virginia streams, including Pimmit Run, Accotink Creek, and Pohick Creek. In the upper tributaries of the Northwest Branch of the Anacostia, Cadmium, Lead, Nickel, and Mercury showed significant increasing trends in the late 1970's.

Human Health

Although the data suggest that several chemicals, including Arsenic, Cadmium, Copper, and Lead are approaching hazardous levels for drinking water, the fact that either all values are at detection limit, or that the reporting period is not current prevents the formation of a reliable conclusion concerning the human health status of the Potomac Urban Estuary waters in relation to these parameters. Recent extensive analysis of toxic parameters in water, fish, and sediment in Little Hunting Creek showed that cancer risks of 10 to 279 in 1 million exist for consumption of fish containing Aldrin, Alpha BHC, Dieldrin, and Arsenic.

Toxics Status/Standards Exceedance

Relatively high levels of metals including Cadmium, Copper, Lead, and Zinc were reported in recent years at many urban

estuary stations; however, except for Zinc, the reported values are at detection limits, and therefore, actual metals levels could be lower than those reported. It is impossible to determine whether actual concentrations of these metals in the water exceed water quality standards.

High Lead (63-166 mg/kg) and Zinc (112-373 mg/kg) concentrations were detected in the sediments of Four Mile Run, Cameron Run, and Hunting Creek, but sediments of other Virginia streams entering the Potomac to the south contained significantly lower concentrations of these parameters. Median Zinc concentrations in the water column generally varied between 12 and 50 ug/l, but at some stations, particularly in the Anacostia River, median concentrations were 100 ug/l or greater. These Zinc levels exceeded the District of Columbia aquatic life criteria of 50 ug/l. It is interesting that the majority of maximum Zinc concentrations (116 to 737 ug/l) occurred from January through April of 1984 in the Potomac urban estuary. In Virginia streams, one reported Aldrin concentration of 0.1 ug/l exceeded the state criteria of 0.03 ug/l.

LOWER POTOMAC ESTUARY

Trend

Relatively few trends were determined from the data from the 123 stations of the Lower Potomac Estuary ~~su~~bdivision. Lead showed a decreasing trend in Aquia Creek, and Nickel showed significant increasing trends in Williams Creek and Upper Machodoc Creek. No significant trends were determined for the data from the Occoquan River, Mattawoman Creek, Quantico Creek, and the smaller Maryland tributaries. Among the smaller Virginia tributaries, Lead was determined to have a significant decreasing trend in Aquia Creek; while Nickel was determined to have a large increasing trend in Williams Creek and Upper Machodoc Creek.

Human Health

For those stations on the Potomac main stem where Arsenic and Cadmium were sampled, their concentrations (often reported as being at or below the limit of detection) indicated potential human health risk. Human health risk indicators for water are less meaningful in the main stem of the lower estuary because of its unlikely use as a drinking water source. PCB's were found in fish tissue at levels of potential cancer risk at all stations from near Quantico, Virginia, to the mouth of the river. Chlordane and Dieldrin were also found in fish tissue at levels indicating potential risk to humans from cancer at most of the lower Potomac stations. In the Occoquan catchment, human health hazard was indicated from Lead in Cedar Run and from

Cadmium in the Occoquan. Human risk of cancer was indicated in the Occoquan from Arsenic. A potential Health hazard was indicated from Lead at 3 stations in the Quantico Creek catchment. Among the smaller Virginia tributaries, Arsenic data indicated potential cancer risk in Gambo Creek and Upper Machodoc Creek. Concentrations of Cadmium above the limit of detection indicated potential human health risk in Accokeek Creek, Williams Creek, and Upper Machodoc Creek. Fish tissue data indicated human cancer risk in Lower Machodoc Creek.

Toxic Status/Standards Exceedance

Apparent violations of Virginia state water quality standards were indicated for Aldrin in the Occoquan River and in Belmont Bay. Virginia water quality standards were also violated by Zinc and Lead concentrations at 1 and 2 stations respectively in the Quantico Creek catchment, and by Cadmium in Williams Creek and Upper Machodoc Creek.

INTERSTATE COMMISSION ON THE POTOMAC RIVER BASIN

Summary Highlights of Toxic Parameter Status

The number of stations at which metals were measured within the last five years is a fraction of the total number of stations with toxic chemical data (see Tables I.1 and I.2). Toxic parameters were monitored at more stations in the Urban Estuary than in any other sub-basins. In contrast, the number of stations with recent metals monitoring data in some subdivisions is very small (6 or fewer). Since metals are measured more frequently than organic parameters, the summary data suggests that there are geographic areas of the river basin that have inadequate recent monitoring data for the determination of current status and trends, or detection of problems concerned with toxic parameters in the river.

The summary data highlight differences in median parameter concentrations for the mostt recent twelve months in the period of record in the various subdivisions. For example, Arsenic levels in the Potomac Highlands waters are elevated in relation to median levels in other portions of the Potomac River Basin. Copper concentrations in the water seem to increase somewhat from the Highlands to the Lower Estuary. Lead levels in the water column in the Highlands, the Upper Great Valley, and the Urban Estuary are at least an order of magnitude higher than those in the other sub-basins. Although median Zinc concentrations in the water appear to be fairly consistent from the headwaters to the mouth, the range of concentrations occurring in some subdivisions is quite large.

Fewer measurements of metals in sediments than in water have been made in the past 5 years, and there is a conspicuous absence of recent sediment data in the Potomac Highlands and the Upper Great Valley. Since toxic pollutants can desorb from sediments, current sediment monitoring is important in determining present and future toxic water quality status. The summary data for toxics in sediments show that both the median and the range of Lead concentrations are higher in Urban Estuary sediments than in other sub-basins. Zinc levels in sediments are generally highest in the Urban Estuary, but maximum concentrations of Zinc in sediments are greatest in the Shenandoah and Piedmont subdivisions.

Table I.1 Summary of Median Metals Concentrations (ug/l) in Potomac River Waters (1983-1988).

Sub-basin	Parameter	No. Sta	Min	Max	Median
Highlands	Antimony	8	40	80	45
Upper Valley	Antimony	2	150	180	165
Shenandoah	Antimony	2	90	150	120
Highlands	Arsenic	9	0.45	30	30
Upper Valley	Arsenic	13	0.01	30	0.1
Shenandoah	Arsenic	5	1	30	1
Piedmont	Arsenic	11	1	2	2
Urban	Arsenic	40	1	5	5
Lower Estuary	Arsenic	10	1	3	1
Piedmont	Beryllium	10	1	2.2	2.1
Urban	Beryllium	8	1	2.2	2.1
Lower Estuary	Beryllium	6	2	2.1	2.0
Highlands	Cadmium	12	0.1	4	2.5
Upper Valley	Cadmium	4	0.28	4	2.3
Shenandoah	Cadmium	5	1	4	1
Piedmont	Cadmium	11	1	5	3.5
Urban	Cadmium	42	1	18	3.5
Lower Estuary	Cadmium	6	1	55	4.5
Highlands	Chromium+6	8	1	2	1
Highlands	Chromium	13	0.1	80	4
Upper Valley	Chromium	8	0.5	4	2.4
Shenandoah	Chromium	5	1	4	3
Piedmont	Chromium	16	0.5	10	7.5
Urban	Chromium	45	0.5	10	7.5
Lower Estuary	Chromium	11	0.5	1.5	1
Highlands	Copper	11	0.1	10.5	4
Upper Valley	Copper	14	0.1	50	0.15
Shenandoah	Copper	5	4	10	10
Piedmont	Copper	11	1	10	10
Urban	Copper	42	10	25	17.5
Lower Estuary	Copper	10	10	200	10

Table I.1 Summary of Median Metals Concentrations (ug/l) in Potomac River Waters (1983-1988).

Sub-basin	Parameter	No. Sta	Min	Max	Median
Highlands	Lead	9	10	40	40
Upper Valley	Lead	4	4	40	28
Shenandoah	Lead	5	1	40	1
Piedmont	Lead	11	1	2	2
Urban	Lead	42	1	50	27.5
Lower Estuary	Lead	10	1	100	3.3
Highlands	Mercury	9	0.1	0.3	0.2
Upper Valley	Mercury	4	0.2	1.1	1
Shenandoah	Mercury	5	0.2	1.1	0.3
Piedmont	Mercury	11	0.3	0.3	0.3
Urban	Mercury	40	0.2	0.3	0.2
Lower Estuary	Mercury	6	0.3	0.3	0.3
Highlands	Nickel	9	10	40	40
Upper Valley	Nickel	54	10	100	25
Shenandoah	Nickel	5	10	40	10
Piedmont	Nickel	11	10	100	10
Urban	Nickel	8	100	100	100
Lower Estuary	Nickel	6	35	100	100
Highlands	Selenium	9	0.5	1.5	1
Upper Valley	Selenium	2	1	2	1.5
Shenandoah	Selenium	2	1	1	1
Piedmont	Selenium	10	1	4.3	2.1
Urban	Selenium	40	1	6.2	5
Lower Estuary	Selenium	6	2	3.1	2.0
Highlands	Silver	9	2	4	4
Upper Valley	Silver	2	2	4	4
Shenandoah	Silver	2	4	4	4
Highlands	Zinc	9	12	308	22
Upper Valley	Zinc	4	10	40	29
Shenandoah	Zinc	5	10	36	30
Piedmont	Zinc	11	10	40	15
Urban	Zinc	42	10	704	17
Lower Estuary	Zinc	10	10	1300	25

Table I.2 Summary of Median Metals Concentrations (mg/kg) in Potomac River Sediments (1983-1988)

Sub-basin	Parameter	No. Sta	Min	Max	Median
Shenandoah	Arsenic	14	1.6	23.2	11.2
Piedmont	Arsenic	15	1.6	15.3	6.8
Lower Estuary	Arsenic	6	7	25.1	11.7
Shenandoah	Beryllium	14	1.6	7.7	2.1
Piedmont	Beryllium	15	0.52	7.6	1.3
Lower Estuary	Beryllium	4	0.77	2.5	2.1
Shenandoah	Cadmium	13	0.16	0.8	0.22
Piedmont	Cadmium	14	0.16	0.8	0.29
Urban	Cadmium	6	0.2	1.87	0.22
Lower Estuary	Cadmium	6	0.2	0.21	0.2
Shenandoah	Chromium	14	5.4	74.8	20.6
Piedmont	Chromium	15	9.2	81.1	26.5
Urban	Chromium	6	7.2	32.7	26.6
Lower Estuary	Chromium	6	9.95	39.9	17.3
Shenandoah	Copper	14	4	56.1	19.5
Piedmont	Copper	15	4	72.8	23.4
Urban	Copper	6	3.6	70.5	30.1
Lower Estuary	Copper	6	3.1	81.7	21.3
Shenandoah	Lead	14	13.5	129	38
Piedmont	Lead	15	12.3	107.2	30
Urban	Lead	6	9.6	166	50
Lower Estuary	Lead	6	6.9	46.8	31
Shenandoah	Mercury	14	0.13	8.9	0.21
Piedmont	Mercury	15	0.1	8.9	0.14
Lower Estuary	Mercury	6	0.09	0.13	0.1
Shenandoah	Nickel	14	5.7	32.6	19.5
Piedmont	Nickel	15	5.7	32.6	16
Urban	Nickel	6	4.3	24.9	16
Lower Estuary	Nickel	6	3	13.5	9.1
Shenandoah	Zinc	14	23.9	862.2	77
Piedmont	Zinc	15	23.9	862.2	78
Urban	Zinc	6	16.5	373	111
Lower Estuary	Zinc	6	19.25	69.4	55

INTERSTATE COMMISSION ON THE POTOMAC RIVER BASIN
Toxics Report (December 1988) Trend Summary

SUMMARY OF SIGNIFICANT TRENDS

Significant trends in concentration among all the toxics data were found only for the metals:-

Arsenic	Lead
Barium	Mercury
Cadmium	Nickel
Chromium	Silver
Chromium(6)	Zinc
Copper	

Trends were determined for some of the organic parameters, but these were not statistically significant.

The detection of trend for a parameter depends upon several factors including:-

the location and persistence of sampling,

improvement in detection levels (would indicate a decline in concentration),

significant trends are defined as those with at least a 95% certainty of being different from zero.

The trends were generally declining. However, Lead and Hexavalent Chromium were increasing in the Highlands subdivision, and Chromium and Lead were increasing in the Potomac at Shepherdstown. Opequon Creek showed declining trends except for Cadmium. The Monocacy River basin showed increasing trends for Chromium and Lead, and mixed trends for Copper. Copper was also increasing in the Potomac at Whites Ferry. The Northwest Branch Anacostia showed increasing trends in four metals: Cadmium, Lead, Mercury, and Nickel. Nickel was also increasing in two of the Virginia tributaries to the Lower Estuary.

INTERSTATE COMMISSION ON THE POTOMAC RIVER BASIN
Toxics Report (December 1988) Trend Summary

SUBDIVISION	PH	UGV	SRB	PP	UE	LPE
No. of Stas.	63	81	97	97	122	123
Trends (- decreasing; + increasing)						
Arsenic			-			
(Tusc Cr Va)				-		
(Va Tribs)					-	
Barium						
(Pot)				-		
Cadmium						
(Conoco)		-				
(Opequon)		+				
(Rock Cr Pa)				-		
(NW Br Ana)					+	
Chromium	-					
(Opequon)		-				
(Pot Shep)		+				
(Pot)				-		
(Monocacy)				+		
Chromium(6)	+					
Copper	-		-		-	
(Opequon)		-				
(Pot Wh Fy)				+		
(Pot Utils)				-		
(Monocacy)				+/-		
Lead	-		-			
(So. Br.)	+					
(Conoco)		-				
(Opequon)		-				
(Pot Shep)		+				
(Pot)				-		
(Rock Cr Pa)				-		
(Monocacy)				+		
(NW Br Ana)					+	
(Aquia)						-
Mercury	-					
(Va Tribs)					-	
(NW Br Ana)					+	
Nickel	-					
(NW Br Ana)					+	
(Wms Cr)						+
(U Machmad)						+
Silver	-					
Zinc	-					

INTERSTATE COMMISSION ON THE POTOMAC RIVER BASIN
Summary Human Health Impacts based on
Fish Tissue Analysis

Interpretation:-

Risk is determined as the number of excess cancer cases expected per million population exposed (eating 6.5 grams of fish per day for a lifetime). While these are not average circumstances, they are the standard factors employed by EPA in performing conservative assessments of risk.

Low risk in the following list implies well under 100 excess cancer cases per million population exposed for most parameters.

Moderate risk implies more than 100 excess cancer cases per million population exposed for most parameters.

The determination of risk at some level may be grounds for the issuance of a health advisory notice with regard to the eating of fish from a particular water body.

The determination of risk in this study was accomplished by comparing the median fish tissue concentration of a parameter for the last twelve months of record with EPA reference concentrations. The number of samples upon which the median is based varied from 1 to 6.

Fish act as integrators (and sometime accumulators) of constituents in water over time. Thus, the presence of toxic parameters in fish tissue implies that those parameters are (or have been) present in the water and/or sediment where the fish live. As with biomonitoring in general, the variable presence of a parameter which may have been missed by a grab sample of water may be detected in fish tissue.

For some parameters, at some locations, during some time periods, there may appear to be a health risk even though one did not exist. This is possible where the actual concentration and risk reference concentration of a parameter are both less than the reported limit of detection. For example, the EPA risk reference concentration for Asrenic is less than one tenth of the detection limit, and the ratio is one fourth for PCB's.

Conclusions:-

The conclusions drawn from the results of analysis of fish tissue data are heavily influenced by the characteristics of the data which are available. The choice of parameters to be monitored, timing and location of sampling, accuracy and variability all affect the conclusions. This study examined the available data; collected for what ever reasons.

To conclude that a health risk is (or was) present is to accept that the risk is based upon the conservative EPA assumption of an average daily intake of 6.5 grams of fish for a lifetime.

Fish tissue data were available from 51 stations in the Potomac River basin. For one third of these stations the most recent data was from before 1980. The analyses indicate that more than 100 excess cancer cases per million population exposed would occur at 12 stations for most parameters with data that implied a risk. None of these moderate risk stations was present at the extremedies of the basin (Highlands and Lower Estuary).

Although the sampling was directed at many parameters at most sites, attention was drawn to parameters which demonstrated some degree of risk. The two toxic parameters which consistently posed the highest risk were Arsenic and PCB's. Apart from Arsenic, inorganic contamination does not seem to be a problem; whereas several other organic compounds sometimes posed moderate risk.

This analysis, and indeed the data on which it is based, should be regarded as a screening tool only. Results which indicate moderate risk demonstrate a need to re-examine the data and re-sample with the purpose of confirming the presence of risk and the targeting of remedial action. Results which indicate low risk demonstrate the need to re-examine the data to determine the extent of the influence of detection limits as opposed to actual readings.

There follows a summary of human health risk findings:-

Potomac Highlands

North Branch Potomac; low risk from Arsenic and several organic compounds; 1984.

South Branch Potomac; 2 stations; low risk from several organic compounds; 1983/1984, 1981/1983/1984.

Town Creek, Md.; 2 stations; low risk from Arsenic and several organic compounds; 1979, 1985.

Potomac near Hancock; low risk from Arsenic and several organic compounds; 1984.

Upper Great Valley

Conococheague; low risk from Arsenic and several organic compounds; 1984.

Pond on Wrights Run, Va.; moderate risk from Dieldrin; 1974.

Opequon Cr., Va.; 5 stations; moderate risk from organics; 1974; low risk from organics 1981/1983; insignificant risk from Mercury; 1982; moderate risk from PCB's; 1982.

High View Manor Pond, Va.; risk data not available for P,P'DDD; 1974.

Potomac River @ Shepherdstown; low risk from Arsenic and several organics; 1984.

Anteitam Cr.; 2 stations; moderate risk from Arsenic and several organics; 1984, 1985.

Shenandoah

Cedar Cr.; moderate risk from Arsenic and several organics; 1985/1986.

North Fork Shenandoah; moderate risk from Arsenic and several organics; 1985.

South Fork Shenandoah; moderate risk from Arsenic and several organics; 1985.

Shenandoah River, Va.; moderate risk from Arsenic; 1987.

Shenandoah River, WVa.; low risk from several organics; 1983.

Potomac Piedmont

Potomac River at 340 Br.; low risk from several organics; 1977.

Momocacy R. @ 6 stations; low risk from Arsenic and several organics; 1985, 1980, 1985, 1979, 1985, 1985.

Big Pipe Cr., Md.; low risk from Arsenic and several organics; 1982.

Potomac R., Whites Fy.; low risk from Arsenic and several organics; 1984.

Goose Cr.; Moderate risk from Arsenic and several organics; 1985/1986

Potomac R., Violets Lk.; low risk from Arsenic and several organics; 1978.

Urban Estuary

Rock Cr.; low risk from Arsenic and several organics; 1984.

NE Br. Anacostia; Moderate risk from Arsenic and several organics; 1984/1985.

Potomac River; 2 stations; low risk from Arsenic and several organics; 1981, 1986.

Little Hunting Cr., Va.; 2 stations; moderate risk from Arsenic; 1980; low risk from Arsenic and several organics; 1984/1987.

Lower Estuary

Potomac River; 6 stations; low risk from several organics; 1986, 1986, 1977; low risk from Arsenic and several organics; 1985, 1984; insignificant risk from metals; 1975.

St. Clement Bay, Md.; low risk from several organics; 1976.

Nomini Cr., Va; 2 stations; insignificant risk from metals; 1979, 1979.

Lower Machodoc, Va.; low risk from PCB's; 1971.

Yeocomico River, Va.; insignificant risk from metals; 1979.

Coan River, Va.; insignificant risk from metals; 1979.