Ohio River Valley
Water Sanitation Commission

Water Quality Monitoring Strategy

for the Ohio River and Lower Reaches of

Major Tributaries

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* as of September 1, 1982

Water Quality Monitoring Strategy

for the Ohio River and Lower Reaches of Major Tributaries

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Foreword to the 1982 Edition

In May, 1973, the Ohio River Valley Water Sanitation Commission, an interstate water pollution control agency formed in 1948, charged a study team with the purpose of developing a monitoring strategy for the Ohio River and the lower reaches of its major tributaries. The strategy has been changed many times since then as water quality information needs and pollution control regulations changed. In 1980, the Commission gave its Monitoring Strategy Committee the task of revising the existing program.

This document details the complete revised strategy and includes both proposed strategy recommendations as well as those which have been implemented since 1973. Revisions have been made to recognize the need for toxics control and biological monitoring. Intensive surveys are also emphasized in this updated strategy. Certain sampling frequency reductions which have been made since 1973 are also delineated. These were made based upon budgetary considerations and after statistical evaluation indicated that no data reliability would be sacrificed.

An expanded biological monitoring program is introduced in this document. This was developed by the Commission's Biological Water Quality Committee at the direction of the Technical Advisory Committee. The revised strategy includes greater emphasis on biological monitoring to further aid in assessment of water quality in the Valley. The Biological Water Quality Committee is to be commended for their contribution to this report.

Water quality monitoring is a labor- and-time-intensive activity and sample analysis is costly. However, without the data gathered through monitoring and surveillance operations, the protection of Ohio Valley water supplies would be almost impossible. Regular monitoring for pollution-indicating parameters provides the baseline against which criteria can be compared and indicates source control needs. The answers to the difficulties imposed on monitoring programs by financial and staffing constraints are cooperation and the sharing of resources. Such answers are provided to the eight state members of the ORSANCO Compact by the Commission.

Members of the Commission's Monitoring Strategy Committee instrumental in the development of this document were:

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T.P. Chang, Indiana Stream Pollution Control Board

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Cincinnati, Ohio
June,1982

EXECUTIVE SUMMARY

Introduction

Water quality monitoring is essential if water pollution control agencies are to fulfill their objectives to protect the designated uses of rivers, lakes and streams. Information gathered through monitoring activitiies - both at fixed stations and through intensive surveys - enables pollution control agencies to:

- determine progress toward meeting water quality goals;
- identify sources of pollutants and determine their effect on water quality
- determine water quality trends; and
- determine presence of dangerous levels of toxic pollutants.

Monitoring data can also indicate source control needs.

The Monitoring Strategy for the Ohio River and Lower Reaches of Major Tributaries was originally published in 1973 by the Ohio River Valley Water Sanitation Commission, (ORSANCO) an interstate agency formed in 1948 to combat water pollution in the Ohio River Valley. The strategy was developed by a committee consisting of representatives of the participating state and federal agencies. Since then, a number of revisions in station location and frequency of parameter coverage have taken place, all based upon extensive evaluation to ensure that the changes did not result in significant loss of data reliability. Furthermore, shifts in emphasis regarding pollutants of major concern have occurred since the initial publication of the strategy. Toxic substances control has become a high priority among state and federal agencies. The need for increased biological monitoring has been recognized. Intensive surveys concerning certain parameters are viewed as essential to enable protection of water supplies. These revisions to the monitoring strategy and changes in agency needs led the Commission in 1980 to request that the Monitoring Strategy Committee update the Monitoring Strategy document.

Current Program (see Table 1, p.17 and map in Appendix A for station locations)

The monitoring systems currently operated by the Ohio River Valley Water Sanitation Commission with the participation of state and federal agencies and certain Ohio Valley water utilities and concerned industries include:

Electronic Monitors: providing real-time data on temperature, pH, dissolved oxygen and specific conductance,

these monitors are operated at 21 locations on the Ohio River and major tributaries;

Manual Sampling Program: providing monthly data on 29 parameters, including heavy metals, phenolics, and nutrient compounds from 37 locations on the Ohio River and major tributaries;

Organics Detection System: providing daily data on concentrations of 17 volatile halogenated organic compounds to detect unreported spills or accidental discharges. Stations located at 11 Valley water utilities and concerned industries; operating support provided by these cooperators as well as state and federal agencies and the Commission; monthly sample analysis for base-neutral extractables from each ODS site is done by a contract laboratory.

Fish Population Surveys: providing annual data on fish populations and tissue analysis for pesticides and certain heavy metals (see Table 4, p.23). (Note: after 1981, survey will be done biennially). Done in cooperation with Ohio River mainstem states' natural resource and enviromental protection agencies, US EPA, US Fish and Wildlife Service, US Army Corps of Engineers and US Food and Drug Administration. Water samples are collected concurrently and analyzed for same parameters as fish tissue.

Water Users Data: providing data on various parameters and according to various schedules from 21 water utilities on the Ohio River and its major tributaries: (see Chapter 2, p. 5).

Major Recent Changes Already Adopted as Recommended by Monitoring Strategy Committee (see Appendix C for detailed information):

- reduction in sampling frequency in Manual Sampling Program to once per month, except where special requirements exist (see Table 2, p.19);
- reduction in Fish Population Survey and tissue analysis frequency from annually to biennially;
- expansion of biological monitoring program to include annual macroinvertebrate sampling until a baseline of data has been established.
- development and implementation of the Organics Detection System to enable regular monitoring of a certain group of toxic pollutants (1978 to present);
- expanded intensive survey programs; and
- formalization of quality control measures through publication of Quality Control Assurance Manual

(originally published in 1977; updated in 1981).

The full monitoring strategy is presented in Chapter 3 of this document.

Chapter 1

Introduction

Since the Ohio River Valley Water Sanitation Commission (ORSANCO) was established in 1948 to combat water pollution in the Ohio Valley, the eight states signatory to the authorizing Compact have delegated much of the routine monitoring of the mainstem Ohio River and lower reaches of the major tributaries to the Commission. In this way, the states have been able to avoid duplication of effort and resources. Therefore, state staffs have been able to concentrate their efforts on intrastate streams.

However, since the states formulate commission policy on Ohio River monitoring, they should maintain active participation in overseeing the monitoring of this major river system. The periodic review of the monitoring strategy for the river is one activity in which the states, the federal government and the Commission are all involved.

Although partially revised several times since its first publication in 1973, the Water Quality Monitoring Strategy for the Ohio River and Lower Reaches of Major Tributaries underwent major review and revision starting in 1980. The major purpose of this review was to determine whether the Strategy met the existing needs of the eight member states of the Commission in view of identified and potential pollution problems, the comprehensive monitoring requirements of the Clean Water Act of 1972 (PL 92-500) and its 1977 Amendments (PL 95-217) and US EPA's Basic Water Monitoring Program (BWMP, EPA 440/9-76-025) for Core Stations. The group assigned by the Commission to review and revise the strategy was the Commission's Monitoring Strategy Committee, consisting of representatives from the states' water pollution control agencies, the US Environmental Protection Agency, the US Geological Survey, the US Army Corps of Engineers and the Commission. This document includes both the revisions recommended by the Committee as well as those that have been implemented since 1973.

Monitoring is an ongoing, long-term activity. Pollution levels to be found in a river the size of the Ohio can change drastically and often as industries build plants, develop new products or reduce operations and municipalities grow or shrink in population. Another major impact on water quality is caused by variations in river flow. Periodic review and revision of the Commission's monitoring strategy help to ensure an effective pollution control program in the Ohio Valley.

An example of the shifts in river usage that may necessitate corresponding changes in monitoring emphasis is the current development of low-head hydropower electricity generating facilities at the 19 dams along the Ohio River mainstem. The use of the water for hydropower generation may decrease

reaeration of the river waters at the dams. This could result in lowered dissolved oxygen levels in the water during periods of low flow.

At the present time, the Ohio River is also experiencing something of a resurgence as a valuable fishery resource, due to improved water quality and pollution control efforts over the years. Fish sensitive to fluctuations in dissolved oxygen are again flourishing in the river. To protect this resource in the light of potential dissolved oxygen decreases, increased monitoring for dissolved oxygen levels should take place. One hydropower plant currently under construction has agreed to tie into the Commission's Electronic Monitoring System with instruments located at the hydropower site. Ports to reaerate the water when dissolved oxygen concentrations reach critical levels are also being installed.

The potentially toxic chemicals being developed and produced in the Ohio Valley is another concern which underscores the need for a review of the monitoring strategy. The protection of water supplies and recreational uses of the river mandate that increased attention be given to these potentially harmful substances.

However, some of these newer products are considered to be potentially toxic at very low levels, in the microgram per liter range. Equipment and techniques to detect these materials are very costly. Monitoring in general is labor, time and equipment intensive. Another objective in reviewing the monitoring strategy is to determine the most effective and efficient way of conducting these essential activities with no loss of data reliability. By utilizing the Commission as a vehicle for interstate cooperation in monitoring and surveillance, the eight states in the Compact can accomplish this goal.

Chapter 2

Current Ohio River Primary In-Stream Monitoring Network

Objectives of Monitoring

The major reasons for water quality monitoring are the basic objectives of the state, interstate and federal pollution control agencies:

a. to monitor progress toward meeting water quality goals;
b. to identify sources of pollutants and determine their effect on water quality;
c. to determine water quality trends; and
d. to determine the presence of dangerous levels of organic chemical pollutants.

In support of these objectives are:

a. State laws and regulations;
b. the Commission Compact and regulations;
c. the National Environmental Policy Act of 1970 (NEPA, PL 87-88)
d. the federal Clean Water Act (1972), as amended (1977), (PL 92-500 and PL 95-217)

Monitoring Systems for Ohio River

Five systems currently monitor the water quality of the Ohio River and lower reaches of major tributaries. They are operated by the Commission, in cooperation with member state agencies, the US Environmental Protection Agency, the US Army Corps of Engineers, the US Geological Survey, Ohio Valley water utililties and several concerned industries. The development of these systems was initiated by the monitoring needs of Commission member states and federal agencies over the years. Changes in monitoring frequency and parameters are based upon the changing needs of these agencies. These changes are delineated in the revised Monitoring Strategy presented in the next chapter.

Current Ohio River monitoring systems are:

Electronic Monitors

Found at 21 locations on the Ohio River and lower reaches of major tributaries (see Map, Appendix A) the Electronic Monitors provide real-time measurements of temperature, specific conductance, dissolved oxygen and pH. Data is transmitted to Commission headquarters where maximum, minimum and average values are computed automatically. In addition, flow forecast data is reported from the US Weather Bureau stations. Electronic Monitor data is stored at the National Computer Center, Research Triangle Park, NC. Edited daily summaries are placed in the US EPA

STORET system. Monthly summaries are published in the Commission's Quality Monitor. Currently, the US Army Corps of Engineers is the major user and supporter of this monitoring system. The Corps regularly needs this data for the maintenance of water quality along with navigation operations on the river.

Manual Sampling Program

Monthly water samples are taken from 37 locations (see map, Appendix A). Samples are analyzed for dissolved oxygen, pH, temperature, specific conductance, suspended solids, dissolved solids, sulfate, total hardness, total phosphorus, total kjeldahl nitrogen, ammonia nitrogen, un-ionized ammonia,combined nitrate/nitrite, fecal coliform bacteria, biochemical oxygen demand, chemical oxygen demand, magnesium, sodium, phenol, cyanide, cadmium, copper, iron, lead, manganese, mercury and zinc. Quarterly samples are analyzed for barium, chromium, selenium and silver. This data, along with information on river flows and sampling dates, is published quarterly in the Commission's Quality Monitor. Data is also stored in US EPA's STORET, a computerized water quality database.

Organics Detection System (ODS)

This system is an 11-station network of water utilities and concerned industries in the Ohio Valley aimed at detecting unreported spills and accidental discharges of volatile halogenated organic chemicals (see map, Appendix A for locations). Daily samples are analyzed by gas chromatograph. Data summaries are telecopied to the Commission weekly. Chromatographs are mailed to the Commission, where reports are compiled and data processed for computer storage. Monthly reports are prepared and distributed to ODS sites and state and federal agencies.

The detection of a chemical concentration greater than 25 micorgrams per liter (ug/l) or 10 times the previous day's level at an ODS site initiates a Commission emergency response procedure, in which chromatographs are immediately telecopied to Commission headquarters, where they are evaluated. Water samples are sent by special courier to a contract laboratory for GC/MS confirmation. Meanwhile, the appropriate state and federal agencies are notified of this conditional alert, as are downstream water users. Laboratory results determine whether this conditional alert is cancelled or continued. The contract laboratory is also utilitized for routine checks on station quality assurance.

Currently the following parameters are monitored at all 11 stations: Chloroform, 1,1,1-Trichloroethane; Tetrachloroethylene; Trichloroethylene; Methylene chloride; Dichlorobromomethane; Carbon Tetrachloride; 1,4-Dichlorobenzene; 1,2-Dichloroethane; Dibromochloromethane; 1,1-Dichloroethane; Bromoform; Trichlorofluoromethane; Bromochloromethane; 1,1-Dichloroethylene;

Chlorobenzene; and 1,2-Dichloropropane. In addition, two stations also test for levels of purgeable aromatic organic compounds, including benzene, toluene and other dichlorobenzenes. Monthly analyses for base-neutral extractables are also performed at a contract laboratory (see Table 3, p.21).

Fish Population Surveys

Occasionally between 1957 and 1968 and annually since then the Commission has coordinated a fish population survey at lockchambers along the Ohio River and lower reaches of major tributaries. Natural resource and environmental protection agencies from the six mainstem states as well as the US Army Corps of Engineers, US EPA and US Fish and Wildlife Service participate. Analyses for pesticides and heavy metals are performed on fish fillets by the US Food and Drug Administration and on whole fish by the US Fish and Wildlife Service. These analyses fulfill the US EPA's BWMP requirements at Core Stations. Water samples are collected and analyzed for the same parameters as the fish tissue.

In 1981, the Biological Water Quality Committee recommended biennial surveys of fish populations and tissue analysis because trend analysis showed only minor changes between annual surveys. See Table 1, p.17 for fish survey stations. This strategy revision was adopted by the Commission for implementation in FY 1983.

Water Users Data

Seventeen water utilities on the Ohio River mainstem and four on major tributaries perform regular analyses on raw river water and provide the Commission with the resulting data. Although it is difficult to compare the data because of the variations in sampling schedules and analysis procedures among the utilities, this data does provide long-term information about water quality at various points along the rivers. Parameters monitored by the water utilities include: temperature, turbidity, alkalinity, pH, hardness, non-carbonate hardness, chloride, sulfate, fluoride, iron, threshold odor, manganese, total coliform, fecal coliform and conductance. Not all parameters are measured at all sites. In addition, a few water utilities monitor for phenols, silica, dissolved oxygen, ammonia and dissolved solids.

Chapter 3

Revised Monitoring Strategy

The monitoring strategy described below is based upon the monitoring needs expressed by state, interstate and federal agencies with jurisdiction in the study area, which has been defined to be the Ohio River mainstem and the lower reaches of its major tributaries. These needs are detailed in Appendix D (p.

These needs are essentially based upon the goals of the states, Commission Compact and the Clean Water Act of 1972, as amended in 1977, which are to achieve a degree of water quality capable of providing safe drinking water after treatment and recreational water for human population, supporting fish and wildlife propagation, and maintaining other uses, such as agriculture, industry and navigation. Data generated by the monitoring programs described below should assess progress toward this goal, establish baselines of water quality, assess compliance with water quality standards and obtain information needed for reports required by Sections 305(b) and 526(a) of the Clean Water Act as amended (PL 92-500 and PL 95-217), the Commission Compact and directives and Office of Management and Budget Circular A-67 (1964). See Appendix F for details on report requirements.

The needs expressed by the agencies basically encompass the measurement of the physical/chemical and biological integrity of the waters of the study area and the analysis of the resulting data. Strategies for measurement of physical/chemical and biological parameters will be presented first, with information on strategies for analysis following.

1. Fixed Station Monitoring

A. For Physical/Chemical Parameters

1. Introduction

Fixed station monitoring for physical and chemical parameters consists of the Electronic Monitors, Manual Samplng Program, and the Organics Detection System. The needs of the Army Corps of Engineers and others for real-time data for decision-making support the Electronic Monitors as an effective data base for immediate assessment of water quality along the Ohio River. Stations for this and other monitoring systems and parameters were selected to provide an adequate representation of surface water quality at each location and a general assessment of the river as a whole. Each year, a review is made by the Commission's Monitoring Strategy Committee to determine whether the current program meets state,

interstate and federal needs.

2. Primary stations are located in the study area based upon one or more of the following criteria:

   a. at points located within intensive survey areas, which on the basis of information from such surveys to represent reaches, have the most critical water quality problems.

   b. at stations upstream and downstream of major population and/or industrial centers where it is possible to measure differences resulting from usage and discharges.

   c. at points within pools to measure water quality, eutrophic condition, bioaccumulation and accumulation of pollutants in water and sediments.

   d. in major high quality water use areas, such as public water supply intakes and recreational areas.

   e. in stream-bed sediments where applicable.

   f. to meet the accounting requirement of OMB Circular A-67 (1964).

Since flow measurements are essential to accurately analyze water quality, stations are also selected where flow data is available.

Locations of current stations are provided in Table 1, p.17 and map, Appendix A.

3. Physical/Chemical Parameter Coverage and Sampling Frequencies

   Coverage for the primary network includes, where relevant:

   a. parameters known or suspected to be associated with major upstream pollution sources such as areas of high population, industrial centers, agricultural and urban run-off, and mine drainage; and parameters water quality standards relating to the sampling area; for example (see Table 2, p.19 for complete listing):

      1) phenols

      2) volatile halogenated organic chemicals

      3) base-neutral extractables (recommended and adopted, 1981)

      4) sodium

5) fecal coliform bacteria (a biological indicator but monitored as part of the Manual Sampling Program and also collected at Water Users Stations;

b. at sediment stations, heavy metals and other toxic materials, oil and grease, chemical oxygen demand, total kjeldahl nitrogen, and pesticides in sediment; heavy metals to include: cadmium, cyanide, copper, iron, lead, manganese, mercury and zinc;

c. continuous dissolved oxygen, temperature, pH and conductivity;

d. total phosphorus, total kjeldahl nitrogen, nitrite and nitrate combined, ammonia; and

e. other parameters specified in US EPA's Basic Water Monitoring Program (BWMP) to meet the needs of a national network of Core stations.

Frequencies of sampling for the above parameters are based upon the best available knowledge of data requirements and statistical realibility. Frequencies for parameters currently monitored are provided in Table 2, p.19. Background information on the determination of sampling frequencies for the Ohio River is provided in Appendix C.

B. Fixed Station Monitoring for Biological Parameters

1. Introduction

Fixed station monitoring for biological parameters involves the Fish Population Survey at Ohio River lockchambers and other biological organism studies. The Biological Water Quality Committee of the Commission has recommended a more extensive biological monitoring program than has been undertaken in previous years. The recommended strategy requiring fixed station monitoring is outlined below and that requiring intensive surveys is detailed in later pages. For a complete review, background and analysis of the need for this increased effort in biological monitoring, see Appendix B.

2. Fixed Station Biological Monitoring includes the following parameter coverage:

a. biological parameters at selected stations, and other parameters sufficient to evaluate the balances and conditions of indigenous communities of aquatic organisms;

b. biologically related chemical and physical analyses, and observations at selected stations, including chemical; analyses of tissue as necessary to determine presence, extent, and impact of toxic pollutants;

c. microbiological parameters, indicator organisms, and where appropriate, specific pathogens; and

d. water samples for concurrent analyses with fish tissue.

3. To cover these parameters, the Biological Water Quality Committee (BWQC) has recommended the following program at fixed stations:

a. Long term trend analyses:

1) Lock chamber fish population studies (biennially - recommended and adopted, 1981)

2) Fish tissue analysis (biennially at Core Stations) to include residue analysis for:

- PCB's
- Cis- and trans- chlordane and Cis- and trans-nonchlor
- Toxaphene
- Per cent fat
- Pentachlorophenol and Pentachloroanisole
- Heavy metals (every four years)
- BHC, Heptachlor, H.epoxide, Dieldrin, DDT and metabolites (every four years)
- additional compounds as needed

3) Macroinvertebrates (annually at Core Stations - recommended and adopted, 1981).

II. Intensive Surveys

A. For Physical/Chemical Parameters

1. Introduction

Intensive surveys are conducted to meet one or more of the following purposes:

a. to determine additional required pollution control or water management actions;

b. to determine the effectiveness of water pollution control actions taken;

c. to obtain data for:

- updating water quality management plans
- setting effluent limitations, determining compliance with water quality standards, and
- verifying the classifications of river segments;

d. to measure and evaluate the quantitative cause and effect relationships between river water quality and the contribution of pollutants to the Ohio River from point and non-point sources; and

e. to set priorities for establishing or improving pollution controls.

2. The Commission will coordinate the development of an annual projected schedule of surveys to be conducted in the study area contingent on mutual agreement between the parties involved in execution of surveys. The annual projected schedule of surveys will be submitted to the appropriate US EPA Regional Administrator with each state's program submission consistent with their respective proposed involvements. The work devoted to a given monitoring survey shall depend upon the complexity of the pollution problem in the survey area. The surveys should assist the states in assessing the adequacy of the design and operation of the treatment facilities for all significant municipal and industrial discharges affecting the survey area. Station locations, parameter coverage, and sampling frequencies for intensive surveys shall be selected consistent with the particular objectives of the study and known or suspected forms and variabililty of pollution occurring in the survey area. The following factors are to be considered:

a. Station locations

1) in wastewater outfalls or at representative sites for measuring pollutant contributions from point and non-point sources;

2) in receiving waters for determining mass balances of pollutants, including stations to define mixing and stratification characteristics and profiles or gradients of water quality with respect to distance and/or transformation rates.

3) at study area boundaries for measuring flow and water quality entering and leaving the study area;

4) at locations particularly selected for biological monitoring;

5) in sediment deposits for measuring benthic demands, concentrations of pollutants in sediments, and the extent to which sediments act as sinks or sources for the various constituents of the water, and for investigating, where needed, sediment transport of pollutants; and

6) in locations as may be required to define other pollutant sources, factors and sinks for completing determinations of mass balances of pollutants.

b. Parameter coverage

Review of discharge permits and daily monitoring reports should provide guidance in the determination of parameters to be covered in the study area. The physical, chemical, biological, microbiological, hydraulic, hydrologic, climatic, and geometric parameters to be measured during intensive surveys will depend upon the survey purpose and local conditions, and be tailored to the specific pollution problems of the area. However, all surveys should include, at representative sites, measurements of dissolved oxygen, temperature, pH, and pollutants known or suspected to be entering the surface waters of the survey area from specific point sources of pollution. All surveys of flowing streams should include measurements or estimates of stream flow.

Depending upon the survey purpose and localized conditions within the study area, the following parameters should be measured where needed to satisfy objectives of the particular study:

1) water quality and related parameters to measure intermediate forms or final effects of pollutants to determine balances of materials affecting water quality; and

2) hydraulic and geometric parameters of the streams and bodies of waters in the study area if such data are not otherwise available at representative sites. Such parameters include cross-sectional area and depth, or mean width and depth; and stream velocities, or times of travel.

c. Sampling frequencies

Sampling frequencies must be determined on the basis of the variability of each of the parameters associated with the pollution problem and must be adequate to define the pollution problem within statistically determined confidence intervals. The sampling frequencies during intensive surveys must be adequate to determine mass balances of pollutants and to define fluctuations of water quality and related parameters in receiving waters and pollutant sources.

B. For Biological Parameters

1. Parameter Coverage

Biological parameters monitored in intensive surveys shall include:

a. biological parameters to evaluate the balance and condition of indigenous communities of aquatic organisms;

b. biologically related chemical and physical measurements, analyses, and observations, including necessary chemical analyses of tissue of aquatic organisms to determine the presence and extent of toxic materials; and

c. microbiological parameters (both indicator organisms and specific pathogens where appropriate) in water, sediments, and aquatic biota.

2. To meet these requirements, the Commission's Biological Water Quality Committee has pointed out that the inclusion of biological parameters may often be useful in meeting objectives of intensive surveys. Some biological parameters/methods to be employed as needed are:

a. Benthic macroinvertebrates

b. Plankton/Periphyton

c. Microbiological organisms

d. Bioassays; and

3. The Biological Water Quality Committee proposes an intensive survey for the presence of polyaromatic hydrocarbons (PAHs) in fish tissues from selected sites (recommended, 1981).

See Table 5 , p.24 for a summary of intensive survey needs as recommended by participating state, interstate and

federal agencies.

II Compliance Monitoring (point source)

The states and US EPA carry out monitoring activities to determine compliance with their NPDES permits and applicable water quality standards, to validate self-monitoring reports, and as necessary, to provide support for enforcement actions. Procedures for carrying out such activities should be mutually agreed upon by the appropriate states and the US EPA Regional Administrators.

The Commission is not involved in any compliance monitoring activities but data from this program may be used in planning for other water quality studies.

IV Laboratory Support and Quality Assurance

Monitoring programs should produce data and information to describe the water quality in the study area in an accurate and consistent manner. Therefore, laboratories (or combinations of laboratories) supporting the monitoring program should provide a level of analytical capability and quality assurance as described in ORSANCO's Quality Control Assurance Program Manual. Contract laboratories are utilized as part of the Manual Sampling Program and Organics Detection System.

V Data Processing, Verification and Reporting

Data from routine monitoring activities and intensive surveys are provided to the appropriate state and federal agencies and the public as soon as possible through the following methods:

A. US EPA's National Computing Center (NCC) and its water quality data base, STORET. All data collected through Commission monitoring programs is stored in NCC. Summaries of Electronic Monitor data (daily maxima, minima and averages) and all Manual Sampling Program data are placed in the STORET database and can be accessed by agencies and other interested parties. (Placement of Organics Detection System, Water Users and Fish Survey data at NCC currently in process; Manual Sampling and Electronic data entry is ongoing).

Electronic monitoring data collected since FY74 has been stored in NCC and STORET along with station latitude and longitude coordinates, type codes and other descriptors. Also provided is pertinent hydraulic and geometric data obtained through monitoring and surveillance.

It is planned that intensive survey data will also be

stored in the US EPA database and thus, the formatting of all data should be suitable for entry to STORET.

B. Commission publications, including

1. Quality Monitor: monthly publication of Electronic Monitor data and quarterly publication of Manual Sampling Program data. (Note: publication of Organics Detection System and Water Users Data currently under consideration).

2. Assessment of Water Quality Conditions: Ohio River Mainstem: prepared biennially to meet requirements of Section 305(b) of the Clean Water Act.

3. Technical reports on various subjects utilizing monitoring data.

4. Monthly ODS reports sent to ODS sites and state and federal agencies.

5. Intensive Survey Reports summarizing significant findings.

C. Print and Broadcast Media

Procedures for releasing information related to monitoring and surveillance follow established policies. ("Policy for Release of Commission Data to the Media, September, 1978"; see Appendix E.) Included are provisions for review of news releases on sampling programs by cooperating agencies five days prior to release; notification by telephone to appropriate agencies when immediate or critical information is to be released; and the concurrent mailing of releases to the Commission, its Technical and Public Interest Advisory Committees, chairmen of other committees and the media.

D. In addition, the following data shall be submitted to the appropriate US EPA Regional Administrator:

1. All compliance monitoring data collected by state agencies and other pollution control entities.

2. A listing each fiscal year of the stations to be monitored in the primary in-stream monitoring network in the following year, highlighting changes from the current year; and including for each station, descriptions of station location, station type, parametric coverage and sampling frequencies (reviewed annually by Monitoring Strategy Committee for consideration by Commission).

TABLE 1

List of Station Locations, September, 1982

Abbreviation	System	Frequency
Electronic	Electronic Monitors	Real-Time
Manual	Manual Sampling	Monthly[1]
ODS	Organics Detection System	Daily/Monthly[3]
Fish	Fish Population Survey	Biennially

River	Location	M.P.[2]	Station Type
Allegheny	Lock #3	14.5	Fish
	*Oakmont	13.3	Electronic & Manual
	Pittsburgh Water Works	7.4	Organic Detection System (ODS)
Monongahela	Aldrich Water Works	24.5	ODS
	Lock #2	11.2	Fish
	*So. Pittsburgh Water Works	4.5	Electronic & Manual
Ohio	West View Water Authority	4.5	ODS
	Dashields L & D	13.3	Fish
	*South Heights	15.2	Electronic & Manual
Beaver	*Beaver Falls Water Works	5.3	Electronic & Manual
	Beaver Falls, Pa.	5.3	Fish
Ohio	*East Liverpool	40.2	Electronic & Manual
	New Cumberland L & D	54.4	Fish
	*Pike Island L & D	84.2	Manual & Fish
	Wheeling Water Works	86.8	ODS
	Shadyside	102.4	Electronic & Manual
	*Hannibal Lock & Dam	126.4	Manual & Fish
	*Willow Island L & D	161.8	Manual & Fish
Muskingum	Lock & Dam #2	5.8	Manual
Ohio	Parkersburg	190.3	ODS
	*Belleville	203.9	Manual & Fish
	Racine	238.0	Fish

	*Addison	260.0	Electronic & Manual
Kanawha	St. Albans	38.3	ODS
	Winfield L & D	31.1	Electronic & Manual
Ohio	*Gallipolis L & D	279.2	Electronic, Manual & Fish
	*Huntington	306.9	Electronic, Manual, ODS and Fish
	Kenova	315.8	Manual
Big Sandy	*Louisa	20.3	Electronic, Manual & Fish
Ohio	Greenup L & D	341.0	Manual & Fish
	Portsmouth Water Works	350.1	ODS
Scioto	Lucasville	15.3	Manual
Ohio	Meldahl L & D	436.2	Manual
	Cincinnati Water Works	462.8	Electronic, Manual & ODS
L. Miami	Near Cincinnati	7.5	Manual
Licking	*Covington	4.5	Electronic, Manual & Fish
Ohio	North Bend	490.0	Electronic & Manual
Great Miami	Elizabethtown Br.	5.5	Manual
Ohio	Markland L & D	531.5	Electronic & Manual
	*Louisville Water Works	600.6	Electronic, Manual & ODS
	McAlpine	606.8	Fish
	*West Point	625.9	Electronic & Manual & Fish
	Cannelton L & D	720.7	Electronic & Manual
Green	*Near Sebree	41.3	Manual & Fish
Ohio	*Evansville Water Works	791.5	Electronic, Manual & ODS
	Uniontown L & D	846.0	Manual & Fish
Wabash	New Harmony	51.5	Electronic & Manual
Ohio	Smithland L & D	918.5	Manual (Electronic, FY 83)
Cumberland	Near Grand Rivers	30.6	Manual
Tennessee	*At Rt.60	6.0	Manual & Fish
Ohio	*Joppa	952.3	Electronic & Manual
	Lock #53	962.6	Fish

*indicates Core Station in US EPA Basic Water Monitoring Program

[1] for most parameters. See Table 2 for specific frequency

[2] River Milepoint

[3] See Table 3 for specific compounds analyzed monthly at ODS sites

TABLE 2

FIXED STATIONS
PRIMARY MONITORING NETWORK
PARAMETERS AND FREQUENCIES
revised 12/81

Codes

R = Real-time
D = Daily
M = Monthly
Q = Quarterly
A = Annually or Biennially

* - Selected Station
** - CORE Stations only
*** - ODS Station only

Parameter	Parameter Frequency: Combined Electronic-Manual Stations	Manual Station Only	Other Stations
Basic Physical & Chemical			
Temperature	R	M	
pH	R	M	
Dissolved Oxygen	R	M	
Conductivity	R	M	
Flow	D	D	
General Chemical			
Activity	M	M	
Alkalinity	M*	M	
BOD_5	M*	M*	
Cyanide	M	M	
Total Hardness	M	M	
Ammonia-Nitrogen (N)	M*	M*	
Nitrite-Nitrate-N	M	M	
Total Kjeldal-N	M*	M*	
Phenolics	M	M	
Total Phosphorus-P	M*	M	

Solids, Dissolved	M		M
Solids, Suspended	M		M
Sodium	Q mainstem only		Q mainstem only
COD	M**		M**
Trace Metals			
Arsenic	Q		Q
Barium	Q mainstem		Q mainstem
Cadmium	M		M
Chromium, Total	Q		Q
Chromium, Hexavalent	As needed by total chrome		As needed by total chrome
Copper	M		M
Iron	M		M
Lead	M		M
Manganese	Q		Q
Magnesium	Q		Q
Mercury	M		M
Nickel	Q		Q
Selenium	Q		Q
Silver	Q		Q
Zinc	M		M
Others			
Purgeable Halogenated Organics (daily) ODS			D-ODS sites
Pesticides	As needed	As needed	A-selected stations
PCB	As needed	As needed	A-selected stations
Extractable Organics (Base neutrals)			M-ODS sites
Pesticides-Fish tissue			A-selected stations
Bacterial			
Coliform, Fecal	M*		M*
Coliform, Total			

Table 3

BASE-NEUTRAL EXTRACTABLES
Monitored Monthly at ODS Sites

	Compound	Detection Limit
1B	Acenaphthene	5 ppb
2B	Acenaphthylene	"
3B	Anthracene	"
4B	Benzidine	"
5B	Benzo(a)Anthracene	"
6B	Benzo(a)Pyrene	"
7B	3,4-Benzofluoranthene	"
8B	Benzo(ghi)Perylene	12 ppb
9B	Benzo(k)Fluoranthene	5 ppb
10B	bis(2-Chloroethoxy)Methane	"
11B	bis(2-Chloroethyl)Ether	"
12B	bis(2-Chloroisopropyl)Ether	"
13B	bis(2-Ethylhexyl)Phthalate	"
14B	4-Bromophenyl Phenyl Ether	"
15B	Butyl Benzyl Phthalate	"
16B	2-Chloronaphthalene	"
17B	4-Chlorophenyl Phenyl Ether	"
18B	Chrysene	"
19B	Dibenzo(a,h)Anthracene	12 ppb
20B	1,2-Dichlorobenzene	5 ppb
21B	1,3-Dichlorobenzene	"
22B	1,4-Dichlorobenzene	"
23B	3,3-Dichlorobenzidine	"
24B	Diethyl Phthalate	"
26B	Di-N-Butyl Phthalate	"
27B	2,4-Dinitrotoluene	"
28B	2,6-Dinitrotoluene	"
29B	Di-N-Octyl Phthalate	"
30B	1,2-Diphenylhydrazine (as Azobenzene)	"
31B	Fluoranthene	"
32B	Fluorene	"
33B	Hexachlorobenzene	"
34B	Hexachlorobutadiene	"
35B	Hexachlorocyclopentadiene	"
36B	Hexachloroethane	"
37B	Indeno(1,2,3-cd)Pyrene	12 ppb
38B	Isophorone	5 ppb
39B	Naphthalene	"
40B	Nitrobenzene	"
41B	N-Nitrosodimethylamine	"
42B	N-Nitrosodi-N-Propylamine	"
43B	N-Nitrosodiphenylamine	"
44B	Phenathhrene	"
45B	Pyrene	"
46B	1,2,4-Trichlorobenzene	"

Table 4

Parameters to be tested in Fish Tissue and Concurrent Water Sample Analysis as recommended in US EPA's BWMP*

Parameters -- Water Samples	Parameter -- Fish Tissue Samples
	Weight (fish/shellfish only
	% lipid content (fish/shellfish only)
PCBs	PCBs
Aldrin	Aldrin
Dieldrin	Dieldrin
Total DDT	Total DDT
o, p DDE	o, p DDE
p, p' DDE	p, p' DDE
o, p DDD	o, p DDD
p, p' DDD	p, p' DDT
o, p DDT	o, p DDT
p, p' DDT	p,p' DDT
Chlordane	Chlordane
cis isomer of chlordane	cis isomer of chlordane
trans isomer of chlordane	trans isomer of chlordane
cis isomer of nonachlor	cis isomer of nonachlor
trans isomer of nonachlor	trans isomer of nonachlor
Endrin	Endrin
Methoxychlor	Methoxychlor
Hexachlorocyclohexane	Hexachlorbenzene
alpha BHC isomer	Pentachlorophenol
gamma isomer	Hexachlorocyclohexane
Hexachlorobenzene	alpha BHC isomer
Pentachlorophenol	gamma isomer
Arsenic, total	Arsenic
Cadmium, total	Cadmium
Copper, total	Chromium
Chromium, total	Copper
Mercury, total	Mercury
Lead, total	Lead

*See Biological Water Quality Committee's recommendations in Chapter 3, p. 9 and Appendix B.

TABLE 5

INTENSIVE SURVEY NEEDS

Agency	Description	Location	Remarks
Illinois	Integrated basin/basin segment surveys	N.I.	P, C, and B
Indiana	Comprehensive 24-hour type survey	Ohio River, significant point	B, including benthics, P, C
Kentucky	Surveys designed for calibration and verification of wasteload allocations models or determination of segment maximum daily loads to insure attainment of applicable water quality standards	Ohio River mainstem	N.I.
Ohio	Biological (fish, macroinvertebrates) surveys for NPDES permits, wasteload allocations, and water quality standards issue and decision making	Ohio River mainstem Known problem areas involving Ohio EPA permitted industries and municipalities (i.e., E. Liverpool, Steubenville, Marietta, Ironton, Cincinnati areas.	Surveys must be fully integrated with on-going monitoring programs, lengthy survey segments may be needed; sampling locations must be closely (5-10 mi.) located in order to define longitudinal trends.
ORSANCO	Mercury Fecal coliform Phenolics	Cincinnati to Evansville McAlpin and Cannelton Pools Pittsburgh to Shadyside, Cincinnati to Evansville	N.I.
Pennsylvania	Biological surveys of pollution problem areas	N.I.	N.I.
	Update previous modeling and load allocation work	Monongahela River	

N.I. -- not indicated

P -- Physical; C -- Chemical; B -- Biological

INTENSIVE SURVEY NEEDS

Agency	Description	Location	Remarks
US Army Corps of Engineers	N.I.	N.I.	N.I.
US Environmental Protection Agency	Follow-up surveys to identify sources and extent of toxics identified from other aspects of monitoring program	Determine from other monitoring	Organics and inorganic toxicants
US Geological Survey	N.I.	N.I.	N.I.
West Virginia	Surveys to evaluate sources, effects, etc., of various materials associated with industrial development	Upper Ohio and areas around Huntington, WV	Phenols, cyanide, etc.

N.I. -- not indicated

P -- Physical; C -- Chemical; B -- Biological

Revised, December 1981

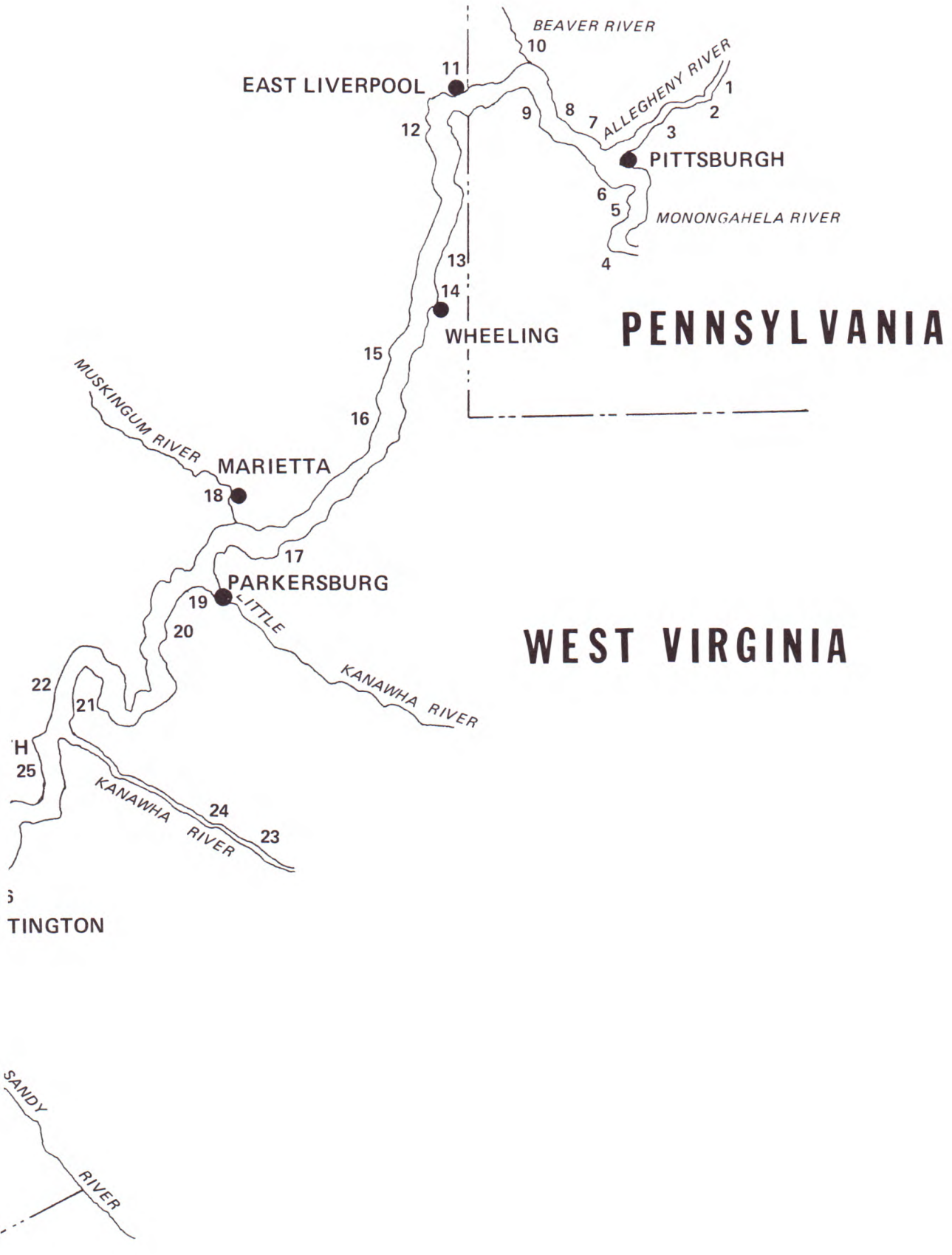
APPENDICES

Station Number	Location	River	Mile-Point	Station Type
1	Lock #3	Allegheny	14.5	Fish
2	*Oakmont, PA	Allegheny	13.3	Electronic & Manual
3	Pittsburgh Dept. of Water	Allegheny	7.4	Organics Detection System (ODS)
4	West Penn Water, Aldrich Plt.	Monongahela	24.5	ODS
5	Lock #2	Monongahela	11.2	Fish
6	*S.Pittsburgh Water Works	Monongahela	4.5	Electronic & Manual
7	West View Water Authority	Ohio	4.5	ODS
8	Dashields Locks & Dam	Ohio	13.3	Fish
9	*South Heights, PA	Ohio	15.2	Electronic & Manual
10	Beaver Falls, PA	Beaver	5.3	Electronic, Manual & Fish
11	*East Liverpool, OH	Ohio	40.2	Electronic & Manual
12	New Cumberland L & D	Ohio	54.4	Fish
13	*Pike Island L & D	Ohio	84.2	Manual & Fish
14	Wheeling Water Dept.	Ohio	86.8	ODS
15	Shadyside, OH	Ohio	102.4	Electronic & Manual
16	*Hannibal L & D	Ohio	126.4	Manual & Fish
17	*Willow Island L & D	Ohio	161.8	Manual & Fish
18	Lock & Dam #2	Muskingum	5.8	Manual
19	Parkersburg, WV	Ohio	190.3	ODS
20	*Belleville, WV	Ohio	203.9	Manual & Fish
21	Racine, WV	Ohio	238.0	Fish
22	*Addison, OH	Ohio	260.0	Electronic & Manual
23	St. Albans, WV	Kanawha	38.3	ODS
24	Winfield L & D	Kanawha	31.1	Electronic & Manual
25	*Gallipolis L & D	Ohio	279.2	Electronic, Manual & Fish
26	*Huntington, WV	Ohio	306.9	Electronic, Manual, ODS & Fish
27	Kenova, WV	Ohio	315.8	Manual
28	*Louisa, KY	Big Sandy	20.3	Electronic, Manual & Fish
29	*Greenup L & D	Ohio	341.0	Manual & Fish
30	Portsmouth, OH, Water Works	Ohio	350.1	ODS
31	Lucasville, OH	Scioto	15.0	Manual
32	Meldahl L & D	Ohio	436.2	Manual
33	Cincinnati Water Works	Ohio	462.8	Electronic, Manual & ODS
34	Near Cincinnati, OH	Little Miami	7.5	Manual
35	*Covington, KY	Licking	4.5	Electronic, Manual & Fish
36	North Bend, OH	Ohio	490.0	Electronic & Manual
37	Elizabethtown Bridge, OH	Great Miami	5.5	Manual
38	Markland L & D	Ohio	531.5	Electronic & Manual
39	*Louisville Water Co.	Ohio	600.6	Electronic, Manual & ODS
40	McAlpine L & D	Ohio	606.8	Fish
41	*West Point	Ohio	625.9	Electronic, Manual & Fish
42	Cannelton L & D	Ohio	720.7	Electronic & Manual
43	*Near Sebree, KY	Green	41.3	Manual & Fish
44	*Evansville Water Works	Ohio	791.5	Electronic, Manual & ODS
45	Uniontown L & D	Ohio	846.0	Manual & Fish
46	New Harmony, IN	Wabash	51.5	Electronic & Manual
47	Smithland L & D	Ohio	918.5	Manual (Electronic in FY 83)
48	Near Grand Rivers, KY	Cumberland	30.6	Manual
49	*At Rt. 60, KY	Tennessee	6.0	Manual & Fish
50	*Joppa, IL	Ohio	952.3	Electronic & Manual
51	Lock #53	Ohio	926.6	Fish

* Indicates Core Station


ILLINOIS
WABASH RIVER
46
EVANSVILLE
44
42
45
GREEN
43
RIVER
TRADEWATER RIVER
MISSISSIPPI
51
50
47
CAIRO
CUMBERLAND
49
PADUCAH
TENNESSEE RIVER
48
RIVER
KENTUCKY DAM (Below)

STATION LOCATIONS, 1982



September, 1982

APPENDIX B

Background and Supporting Documentation for

A Biological Monitoring Program

The Biological Water Quality Committee (BWQC) of the Ohio River Valley Water Sanitation Commission was asked to provide guidance on biological monitoring for inclusion in this document and in the recommendations of the Monitoring Strategy Committee. What follows is the BWQC recommendations and their supporting backgroud, reproduced here verbatim. An outline of these recommendations is found in the Revised Monitoring Strategy described earlier in this document.

BIOLOGICAL MONITORING STRATEGY

Summary Recommendations

Current Ohio River water quality assessments are comprised mainly of collecting conventional water quality data which are compared with desired values and included in a monthly report. Biological data are rarely included in these reports and the program fails to assess, on a regular basis, levels of toxicants or other materials in the river that might impair biological integrity (Cairns 1981).

At present, the lock chamber fish studies, while valuable for providing long term trend analyses, are limited in scope for definitive assessment of Ohio River fish populations. Such assessments are necessary to meet the objectives of PL 92-500 and PL 95-217.

In an effort to better understand the relationship between effluent and surface water quality and the quality and quantity of aquatic life in the Ohio River, the ORSANCO Technical Advisory Committee asked the Biological Water Quality Committee to prepare recommendations for biological monitoring needs in the Water Quality Monitoring Strategy.

The Biological Water Quality Committee recommends a minimum two-faceted biological monitoring program be initiated, consisting of (1) a long-term trend analysis biological monitoring network and (2) selected intensive surveys conducted in river segments and/or pools designed to describe the biological communities.

The following outlines the basic biological parameters that could be utilized in these two program elements.

I. Long term trend analyses

   A. Lock chamber fish population studies (every two years). (All stations same year).

   B. Fish tissue biennially at Core stations. (All stations same year).

   C. Macroinvertebrate (annually at Core stations). (To be analyzed by state biologist with state's Core stations).

II. Intensive Surveys (coverage as needed)

   A. Fish

   B. Benthic macroinvertebrates

   C. Plankton/Periphyton

D. Microbiology

E. Bioassay

III. Residue Analysis

Recommendations for:

A - Trend Monitoring

B - Intensive Survey Monitorings.

The following material provides the rationale for these recommendations and proposes specific study elements.

Biological Monitoring and the Federal Water Pollution Control Act

Recognizing the interdependence of human health and welfare and aquatic life, the Congress, in preparing the most recent amendments to the Federal Water Pollution Control Act (PL 92-500 and PL 95-217), placed great emphasis on the need to restore and maintain the biological integrity of the nation's waters. The intent of the Congress was revealed in the many references throughout the Act to the importance of the protection and propagation of fish, shellfish, and wildlife, and the effects of pollutants on the diversity, productivity, and stability of communities of indigenous aquatic organisms. Emphasis was also placed on determining the biological properties (toxicity) of effluents and the effects of effluents on aquatic life in receiving waters. The definition of biomonitoring in the law was very broad and included the determination of the effects of pollutants on all aquatic life, such as plankton, periphyton, aquatic plants, macroinvertebrates and fish.

The goals of the Act are primarily biological in nature, and the success of the Federal and state water pollution control programs can be measured only in biological terms. For this reason, the legislation included the authorization and/or directives for the U.S. Enviromental Protection Agency and state agencies to conduct comprehensive biological monitoring programs. Based on the Act, the principal objectives of the biomonitoring programs would be to determine:

- Long-term trends in the "diversity, productivity and stability" of aquatic life in surface waters.
- The dispersion and persistency of pesticides, toxic metals, and other toxicants in water and aquatic life.

The legislative mandate for the collection of biological data by the Environmental Protection Agency and other federal, state, and

private agencies is either clearly stated or implied in at least nineteen sections of the Federal Pollution Control Act Amendments of 1972 and 1977. Some of the more prominent examples are found in Sections 101, 104, 105, 106, 302, 303, 304, 305, 308, 311, 314, 403, and 502 (renamed the Clean Water Act, PL-92-500 and PL 95-217).

Section 502 (15) of the Act defined biological monitoring as "the determination of the effects on aquatic life, including the accumulation of pollutants in tissue, in receiving water due to the discharge of pollutants (A) by techniques and procedures including sampling of organisms representative of appropriate levels of the food chain appropriate to the volume and the physical, chemical, and biological characteristics of the effluent, and (B) at appropriate frequencies and locations." Other sections refer to measurement of the biological properties of effluents, the effects of toxic and heated effluents on the aquatic life in receiving waters, and the trophic status of recreational lakes.

The Importance of Biological Monitoring Data

Water pollution literature has extensive documentation of the value of biological data in water quality assessment. Early in this century, Forbes (1913) pointed out that "...biological tests... (of water quality) ... are, on the whole, more reliable (than chemical tests) if they are used with intelligence and discretion, because they show the accumulated general consequences of local conditions, favorable and unfavorable, while the chemical determination applies only to the moment and to the place of the collection of the sample tested." The advantages of biological data in assessing water quality through reflection of past water history and synergistic effects of environmental components have been stated by many researchers (Patrick, 1949; Butcher, 1955; Hynes, 1960; Wilhm and Dorris, 1968).

Determination of water quality using chemical and physical tests has the advantage of yielding immediate results but also has disadvantages in that occasional pollution is not detected. It takes only a single, lethal level of some toxic pollutant to eliminate a large portion of the aquatic biota, and such a "slug" may easily be overlooked by grab samples for chemical analysis.

Plants and animals often are more sensitive to changes in their environment than may be indicated by physical and chemical tests (Goodnight, 1973; Hynes, 1960), especially when the process of biological magnification (Hynes, 1970; Odum, 1971) serves to amplify a normally sublethal chemical concentration into a lethal one.

Assessments of water quality using macroinvertebrates can be made, using criteria based on analyses of the structural

organization and species composition of the benthic community (Resh and Unzicker, 1975). Such analyses are based on the assumption that natural communities represent meaningful assemblages of organisms with respect to their habitat (Hairston, 1959), so an alteration of their habitat should result in detectable changes in community structure.

Current enforcement emphasis is being placed upon toxic "hot spot" problems: but with many of these sites, grab sample chemical analysis screening will not always detect toxicity. In many cases the only way to detect toxic materials is through bioassay procedures or examination of community structure, both of which are forms of biological monitoring.

The value of comparable long-term biological data in evaluating water quality changes with respect to time is critical for it is, after all, these communities that we are charged by law to protect.

In keeping with federal mandates, biological data have been collected at various sites along the Ohio mainstem and selected tributaries. The collection and use of this data has benefited federal and state regulatory agencies as well as a variety of private industrial concerns, consultants, and municipalities. Some specific examples of uses of these data include development of environmental impact statements for the following: sand and gravel dredging, pipeline crossings, maintenance of navigation dredging, electrical utilities, industrial discharges and improvements of instream navigation structures. In addition to those uses listed, frequent requests for the data are received from persons associated with universities, fish and wildlife agencies, and commercial musseling operations. Any agency having responsibility for a portion of the Ohio River receives frequent requests for biological data that might be available in their area.

Historical Review of Ohio River Biological Monitoring

A biomonitoring program was maintained in the past on the Ohio River by the Federal Water Pollution Control Agencies (predecessors of the U.S. Environmental Protection Agency) as a part of the National Water Quality Network.

A total of nine monitoring stations from Pittsburgh, Pennsylvania, to Cairo, Illinois, was sampled periodically from 1956 to 1968. A summary of the macroinvertebrate data collected during this monitoring phase was published by the U.S. Environmental Protection Agency (Mason, et al. 1971). The results of this monitoring program reflected the adverse impact of industrial pollution sources on aquatic life in the upper Ohio River and provides an important baseline of data to monitor trends of water quality in subsequent years. Since 1968, there has been no basin-wide evidence of the response of the benthic community to changes in Ohio River quality. However, there are

a number of studies that have been performed in many sections of the basin to support individual projects.

The Ohio Basin Region, Federal Water Quality Administration operated a biological monitoring program on the Ohio River and its major tributaries from 1968 to 1972. The program emphasized the macroinvertebrate community, although plankton, periphyton and fish monitoring were performed at selected stations. The data obtained from this system have been tabulated and provided to state, federal and private concerns whose interest and responsibility related to Ohio River aquatic life. During this period 17 Ohio River stations were monitored for macroinvertebrates, 11 for plankton, and 12-16 stations for fish. General trends observed during this period indicated continued stress to aquatic life in the upper Ohio River, but trends of recovery were evident (Preston and White, 1978).

The responsibility for the operation of the National Water Quality Network (later named the Water Pollution Surveillance System) was transferred to the regional offices in 1968, and the operation of the system was decentralized (Weber, 1980).

In 1972, responsibility for the water quality monitoring program was assigned to the state agencies. Biological monitoring has been maintained sporadically in portions of the Ohio River but not in a consistent and organized manner. The Commission has coordinated a cooperative fish sampling effort since 1975 which, at present, is the only biomonitoring program operating on the mainstem.

Other aquatic life monitoring has not been maintained in any formal program. A macroinvertebrate sampling program was sponsored by ORSANCO in 1976 and 1978 on ten Ohio River stations. The general conclusion of this study indicated continued recovery in the upper Ohio River with localized points of degradation (ORSANCO, 1979).

Recommended Biological Monitoring Program

The Biological Water Quality Committee recommends a minimum two-faceted biological monitoring program be initiated. The two elements of this program consist of a long-term trend biological monitoring network and selected intensive surveys conducted in river segments and/or pools. The committee's recommendations for a biomonitoring program is based on the recognized need for data to determine the biological integrity of the Ohio River.

I. Long-term Trend Analyses

Biological monitoring at trend stations will generate data for long-term analyses in support of the existing ORSANCO chemical sampling network and will aid in the determination of the suitability of the Ohio River for supporting abundant, useful, and diverse communities of aquatic organisms. Specifically, long-term trend data will provide for a

continuing assessment of the effectiveness of water pollution control programs, identify new or existing water quality problems that may not be readily identified by other monitoring methods, and aid in the identification of areas where intensive surveys may be necessary.

A. Lock Chamber Fish Population Studies

In order to maintain continuity with the fish monitoring programs that have been performed, it is recommended that the lock chamber fish sampling continue on a frequency of every two years at designated locations. The data gathered in this program have provided valuable information, while limited in scope, to the states and federal agencies.

B. Fish Tissue

In order to maintain continuity of the historic record and trend analysis and provide a convenient and economic program for assessing human health impacts of metals and pesticide residue in fish it is necessary to continue residue studies at the same sites. More specific programs requiring more advanced forms of analysis and of limited area would be undertaken as intensive surveys.

C. Macroinvertebrates

The committee believes one phase of trend monitoring could be accomplished by sampling annually 15 to 20 stations for macrobenthic organisms. In general, the methods should follow those outlined in the U.S. EPA methods manual (Weber, 1973), i.e., three multiple-plate artificial substrate samplers of the modified Hester-Dendy type analyzed individually from each site. The colonization period should be six weeks during July and August. Samplers are recommended to be established on exterior lock walls because they provide a homogeneous habitat and past studies have utilized these areas. In addition, the probability of vandalism and the problems of logistics are reduced.

II. Intensive Surveys - Biological Parameters

State water pollution control agencies plan and perform intensive water quality surveys on stream segments for a variety of purposes: to address cause-effect relationships, wasteload allocations, and water quality standards assessment; to facilitate interpretation of ambient monitoring data; and to improve resource management (U.S. EPA, 1977). In developing plans for conducting intensive surveys, the role of aquatic life investigations has not been fully utilized. Biological parameters, properly sampled and examined can provide extremely useful information in understanding ecological relationships in these comprehensive surveys. The number of stations, sampling frequency and

parametric coverage would be determined on a case-by-case basis.

In the Ohio River, planning and performance of an intensive survey for a particular section presents several problems, including but not limited to interstate cooperation, manpower and expertise availability. The opportunity to provide strong coordination in planning and conducting such surveys on the Ohio River appears to be made to order for a multi-state organization such as ORSANCO.

III. Residue Analysis Recommendations

A. Trend Monitoring

Examination of contaminant trends within the Ohio Valley and nationwide indicates that levels of important compounds change gradually enough to be adequately assessed by biennial sampling. Furthermore, some compounds traditionally monitored have never been found in the Ohio River at concentrations high enough to be of concern and others (such as DDT) have been sufficiently reduced over the past levels to require less frequent sampling. The following outline for a minimum frequency of sampling different compounds was arrived at from evaluation of past tissue residue research.

1) Parameters needed every two years:

   a) PCB's: continuous low level discharges exist in the basin and occasional high values have been seen in the existing data.

   b) cis- and trans-chlordane and cis- and trans-nonchlor: Levels still high throughout the entire length of the river.

   c) Toxaphene: needs to be continued since some doubts exist regarding its absence in the watershed's fish.

   d) Per cent fat.

   e) Pentachlorophenol and Pentachloroanisole

2. Parameters needed every four years:

   a) Heavy metals - Hg, Pb and Cd. They currently exist in measurable amounts.

   b) BHC, Heptachlor, H. expoxide, Dieldrin, DDT and metabolites. This frequency should be adequate for future trend analysis.

3. Parameters presently found at very low levels, therefore or of little biological concern are the following: Endrin, Aldrin, Methoxychlor, Hexachlorobenzene, Arsenic, Zinc, and

Copper.

The analysis for the above parameters should include any additional compound element which can be obtained with little additional incremental cost.

B. Intensive Survey Monitoring - Residue Analysis

Advances in analytical techniques now present the opportunity to evaluate levels of complex organics which are known to be health hazards. Pilot surveys for compounds associated with industries located along the Ohio River should be initiated to determine whether those compounds pose a threat to aquatic populations or human health.

The BWQC recommends that the first of these should address the occurrence of PAHs in the Ohio River. These chemicals are known to be produced by coking facilities and will be produced by syn-fuel plants. They are also proven mammal carcinogens and have been shown to accumulate in fish, where they are also associated with high tumor rates. The technology to quantify these compounds at levels of ppb now exists and prior environmental studies will allow comparison and interpretation of the data. Further studies of importance would include GC/MS scanning techniques for non-routine organic contaminants in areas of possible concern, such as those performed by the U.S. EPA's Environmental Research Laboratory in Duluth.

Role of ORSANCO in Ohio River Biological Monitoring

ORSANCO is the primary water quality monitoring agency for the Ohio River. This interstate agency has played a leading role in the development of water quality assessment for the Ohio River mainstem. These water quality assessments are comprised mainly of conventional water quality analyses compared with desired values and included in a monthly report. In these reports biological data are rarely included, and the data base lacks a frequent assessment of levels of toxicants or other materials in the river that might impair biological integrity (Cairns, 1981).

The Technical Advisory Committee has asked the Monitoring Strategy Committee to update and revise the Water Quality Monitoring Strategy. In the updating of this strategy the above biomonitoring strategy is to be recommended for inclusion. If the biomonitoring strategy is to be a reality, it will depend on ORSANCO's role in the development and implementation of the biomonitoring program.

The Commission's role should be one that coordinates in planning and implementation of the fixed station biological monitoring network, and the periodic intensive surveys conducted on selected river segments. This role should also include participation in field collection activities; coordination of analyses of data; function as a repository for data collected; collator of data; and disseminator of information derived from the data. Considering ORSANCO's experience and successes with the physio-chemical and periodic biological data in past water quality assessments, the incorporation of continuous biological data should present few new challenges.

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Developed by the Biological Water
Quality Committee of the Ohio
River Valley Water Sanitation

Appendix C

Background Documentation on Sampling Frequency Changes for Primary In-Stream Monitoring Network

The Primary In-Stream Monitoring Network for the Ohio River consists of 37 stations, of which 23 are located on the Ohio River mainstem and 14 in the lower reaches of major tributaries. This network represents a nucleus of key locations above and below major populations and industrial areas, and in critical water quality sections of the high level pools on the Ohio River. The stations were selected from a compendium of locations recommended by the participating agencies to satisfy their needs for monitoring data. This did not preclude the addition of more stations as they became necessary, or changing sites based upon experience and intensive surveys. The network simply represented the best judgment of the study team assigned the task of selecting monitoring locations in 1973. This network is reviewed annually by the Monitoring Strategy Committee.

The parameters selected and the periodicity of sampling (Table 2, p.19) were designed to provide sufficient information on which to assess water quality conditions at each location and to compare water quality with that of other sections of the river. Again, it was noted that experience might indicate the need for changes based upon data requirements and cost effectiveness.

The Commission's Monitoring Strategy and Data Evaluation Committee (MSDE) recommended revisions to the monitoring network to the Commission's Engineering Committee at its September, 1978 meeting. These revisions were accepted by the Engineering Committee and recommended to the Commission, which proceeded to adopt them. Some of these revisions to the monitoring network addressed the designation of Core Stations. Core Stations were stations selected by the states along the Ohio River mainstem to comply with US EPA's Basic Water Monitoring Program (BWMP; EPA 440/9-76-025). These stations continue to be monitored by the Commission for the mainstem states. The Core Stations are identified in Table 1, p.17 by an asterisk (*). This program was implemented in October, 1978.

The Monitoring Strategy and Data Evaluation Committee (MSDE) at its meeting in April, 1980, again addressed revisions to the ORSANCO monitoring network. These modifications were:

1. The reduction of service to the Electronic Monitors from three to two times monthly;

2. The reduction in sampling frequency for cyanides and phenolics at eight upper Ohio River stations from three to two times monthly;

3. The reduction in sampling frequency for nutrients and

fecal coliforms at the 23 Electronic Monitors from three to two times monthly from May through October;

4. The elimination of the radiological sampling program; and

5. The suspension of monthly organics sampling for the extractable (base-neutral compounds) program.

The committee further recommended that their name changed to the Monitoring Strategy Committee (MSC) with the function and operation of the committee to remain the same.

These recommendations were made and accepted by the Engineering Committee at its May, 1980 meeting. The Commission adopted these recommendations at its May, 1980 meeting.

The new Monitoring Strategy Committee also recommended that the Commission's Monitoring Strategy document of 1973 be revised to include guidance from the Biological Water Quality Committee on possible development of biological monitoring programs as well as other revisions. Ths recommendation was approved by both the Engineering Committee and the Commission at their May, 1980 meetings and the revisions implemented in July, 1980.

The Monitoring Strategy Committee met again in March 1981 to review the monitoring program for FY82 and recommended the following:

1. That Commission staff develop a cooperative arrangement with U.S. Geological Survey (USGS) to eliminate duplication of effort in sample collection and provide samples for parameters not available through the USGS Strategy. These samples would be shipped to the Commission's contract laboratory for analysis. (cancelled in December, 1981, because budget reductions required USGS to reduce sampling frequencies below acceptable requirements).

2. That organic sampling at the Organics Detection System for extractable organic analysis (base-neutral compounds) be reinstated.

3. That Commission staff perform an evaluation on each station before returning to three times per month sampling. (See memorandum to Policy and Program Implementation Committee, dated April 29, 1981, page 49).

4. That the Electronic Monitoring stations on the Great Miami River and at Miami Fort Power Station be eliminated but continue as stations in the Manual Sampling Program.

The recommendations were made and accepted by the Technical

Advisory Committee (formerly, the Engineering Committee) at its May, 1981 meeting. The Commission accepted and approved these recommendations at its May, 1981 meeting (see Table 1 in Chapter 3, p.17 for a listing of current monitoring stations.)

Memorandum

OHIO RIVER VALLEY WATER SANITATION COMMISSION

414 WALNUT STREET CINCINNATI, OHIO 45202

April 29, 1981

TO: Policy and Program Implementation Committee

FROM: Executive Director

RE: Periodic (manual) Sampling Program - Analysis of Sampling Frequencies

At the March 16, 1981 meeting of the committee, some question was raised as to the proposal in the draft Fiscal Year 1982 Program Plan to return the periodic sampling program to a frequency of three times per month from its present basic one per month. Specifically, the staff was requested to provide a brief analyses of the programmatic and statistical aspects relating to three versus one sample per month program data base.

The attached paper has been prepared with the counsel of Mr. Paul Britton, a statistician associated with USEPA's program quality assurance efforts. The findings therein indicate clearly that little justification appears to exist to increase the present sampling frequencies in light of the program's present objectives. The periodic sampling program, now proposed in the draft Fiscal Year 1982 Program Plan, has been rewritten to continue at a frequency of one per month. The revised program plan was forwarded as an enclosure to the Commission agenda mailed April 23, 1981.

cc: Technical Advisory Committee

OHIO RIVER VALLEY WATER SANITATION COMMISSION
Ambient Monitoring

Evaluation of Periodic (Manual) Sampling Frequencies

Background

The Commission periodic sampling program for analysis of raw river water, implemented in 1975, serves to provide detailed water quality data for a selection of physical and chemical constituents. The initial program schedules required sampling at 36 stations at a frequency of one time per month for heavy metals and BOD and three times per month for an additional fifteen parameters. This sampling frequency strategy was based, in large part, on personnel and logistical (budget) resources available at that time.

Several major changes effecting sampling frequencies were adopted in 1978 and 1979 as follows:

(1) In 1978, the sample frequency was reduced, due to budget constraints, to essentially one sample per month for all parameters. In addition, certain changes were incorporated to provide compatibility with USEPA's Basic Water Monitoring Program (BWMP). Specifically,the revised program called for sampling at a frequency of one per month at all stations with the following exceptions:
   a. Two additional samples for nutrients and fecal coliform for the months of May through October at 22 stations.
   b. No sampling for nutrients, fecal coliform and BOD at non-BWMP (14) stations for the months of November through April.
   c. Additional sampling would be conducted at the request of the states at key locations for "problem" parameters.

(2) In 1979, further budget constraints required one of the two additional samples, described by (1a) above, to be eliminated.

A listing of the physical and chemical parameters comprising the sampling schedule, current and prior to 1978, are shown on Table 1.

The Commission has requested an increase in funding from the signatory states beginning FY82. In considering the use of potentially available additional funds, one option identified includes returning the periodic sampling frequency to three times per month. To facilitate the evaluation of such an increase, a brief analysis has been developed, with the assistance of USEPA statistical personnel, comparing the statistical aspects of a one, two and three sample per month program.

Table 1

Schedules for Analysis of Periodic (Manual) Sampling

Current

(September 1978 to Present)

All Samples	Monthly	Quarterly
Flow	Suspended Solids	Magnesium
Temperature	Sulfate	Sodium
pH	Total Hardness	Arsenic
Dissolved Oxygen	Cyanide	Barium
Specific Conductance	Phenolics	Chromium
	Nutrients	Manganese
	Total Phosphorus	Nickel
	Total Kjeldahl Nitrogen	Selenium
	Ammonia	Silver
	Nitrate	
	Fecal Coliform Bacteria	
	Biochemical Oxygen Demand	
	Chemical Oxygen Demand	
	Cadmium	
	Copper	
	Iron	
	Lead	
	Mercury	
	Zinc	

Special: Cyanide and phenolics--three per month at all locations upstream of Belleville in cold weather months

Fecal coliform and nutrients--from May through October
- three per month at continuous monitor locations, 1978
- two per month at continuous monitor locations, 1979 - present

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Previous

(through August, 1978)

Three per Month	Monthly	Quarterly
Flow	Barium	Arsenic
Temperature	Cadmium	Selenium
pH	Chromium	Silver
Dissolved Oxygen	Copper	
Specific Conductance	Iron	
Suspended Solids	Lead	
Sulfate	Manganese	
Cyanide	Mercury	
Phenolics	Nickel	
Nutrients	Zinc	
Total Coliform	Biochemical Oxygen Demand	
Fecal Coliform		
Calcium (tributaries only)		
Magnesium (tributaries only)		
Dissolved Solids (tributaries only)		

Comparison of Statistical Aspects - One, Two and Three Samples per Month Periodic Monitoring Frequency

Validity of Data

As a matter of quality assurance, raw water quality data must be initially edited to discount those sample values unusually high or low and deemed as incorrect. Limits of acceptability are established statistically based on all available data observations. As an accepted norm, usable data are defined as falling within approximately two standard deviations (σ) from the mean and based on a confidence that 95 percent of all data will fall between 2σ. This is otherwise expressed as "95% confidence at 2σ."

For a sampling frequency of one, two and three samples per month, below are listed the number of standard deviations at 95% confidence for groups of data based on seasonal (3 month)and yearly (12 month) accumulations of observations.

Number of Samples per Month	Number of Standard Deviations from the Mean* for 95% Confidence of Data			
	Seasonal Period of Record		Yearly Period of Record	
	Total Samples	Number of σ	Total Samples	Number of σ
1	3	4.3	12	2.2
2	6	2.6	24	2.1
3	9	2.3	36	2.0

* Student's t-distribution

The above summary of standard deviations indicate several apparent general conclusions:

1. A minimum of three samples per month would be required to establish statistical limits for analyzing individual data observations for seasonal evaluation (2.3σ at 95% confidence).
2. If the data were to be evaluated by yearly cycles, little improvement in statistical edit capability would be realized by an increase in sampling frequency from one to three per month (2.2σ vs 2.0σ).

Analysis of Data

The number of samples needed to compare groups of data for cyclic trends (monthly-seasonal-yearly) depends on the desired degree of statistical ability to detect changes. The "standard error of a sample mean", defined mathematically as the standard deviation, σ, divided by the square root of the number of observations, $\sqrt{n}$, provides a convenient mechanism to describe the relative degree of detectable change. The standard error provide an indication as to the degree of normal variation that

may be expected when comparing means of groups of data. For twelve, twenty-four and thirty-six yearly data values (one, two and three samples per month respectively), the standard or expected error of the mean of these data groups is as follows:

Number of Samples per Month	Number of Samples per Year n	Standard Error or the Mean $\sigma/\sqrt{n}$
1	12	$\sigma/3.5$
2	24	$\sigma/4.9$
3	36	$\sigma/6$

If the standard deviation for each data set can be assumed as approximately equal, then the following statements may be made:

1. The standard error of the mean of yearly data based on one, two and three samples per month is $\frac{1}{3.5}$, $\frac{1}{5}$ and $\frac{1}{6}$ respectively of the standard deviation.
2. The standard error of the mean of data based on three samples per month is on the order of one-half that for a one sample per month frequency.
3. The difference of standard errors between 12 and 24 data values (1 per month and 2 per month) is about $\frac{1}{18}$ of the standard deviation.

Summary, Observations and Conclusions

The appropriate frequency of periodic sampling depends on a number of factors, but to a great extent the behavior of the medium to be sampled and the intended use of the data. The use of data may range from spill detection or compliance, to the establishment of long-term trends. In order to utilize the periodic monitoring program as a compliance mechanism, sample frequencies would have to be increased significantly.

Periodic sampling frequencies of one to three per month will provide an adequate number of data observations to establish long-term trends. Observations and conclusions comparing the statistical implications are as follows:

1. From the initiation of the periodic sampling program (1975) through August, 1978, three samples per month for fifteen water quality parameters were taken. In 1978, the sampling frequency was reduced to essentially one per month due to budgetary constraints.
2. Based on 95% confidence of data at two standard deviations, reinstituting a sample frequency of three per month would allow individual

observations over a season to be evaluated. There is no appreciable advantage to increasing sampling frequency beyond one per month for analysis of individual observations over a yearly cycle.

3. The amounts of data needed for analysis of cyclic trends depends on the desired degree of statistical sensitivity in establishing that a change has occurred. Based on the calculated "standard error of a sample mean," the standard or normal variability which could be expected when comparing means of data sets, is 1/3.5, 1/5 and 1/6 of the standard deviation of the data resulting from sample frequencies of one, two and three times per month respectively. The standard error therefore, would be reduced by about one half if sampling frequencies were increased from one to three per month. It is important to note that the use of standard error in this analysis serves simply to define the extent of normal variability of the means of data groups for comparison. Determining precisely the resulting level of sensitivity for detecting trends, given a range of sampling frequencies (what percent change in the presence of a pollutant may be detected) requires a more detailed analysis, including correlation of measured concentrations to stream flow.

4. The parameters which would be subject to increased sampling are suspended solids, sulfate, cyanide, phenolics, nutrients, total coliform, fecal coliform, calcium, magnesium, dissolved solids. Several of these parameters are not presently of priority concern for purposes of domestic, industrial or recreational use.

5. The present periodic sampling program provides for increased sampling for parameters which are of concern. Increased sampling (two per month) for cyanides and phenolics are being conducted upstream of Belleville in cold weather months and for fecal coliform and nutrients at electronic monitor locations from May through October.

APPENDIX D

Survey Results: Monitoring Needs of State, Interstate and Federal Agencies on Ohio River and Tributaries

Introduction:

Each of the agencies represented on the Monitoring Strategy Committee was asked to identify the applicable sections(s) of statutes or regulations concerning water quality monitoring. Appendix F is a listing of these provisions. The agencies from the six states along the mainstem and the federal agencies were further asked to identify their monitoring needs. As a result of this, the needs of the states could be categorized according to the monitoring activity through which they could be met, namely fixed station monitoring and intensive surveys. The strategy--station locations, parameters, and sampling frequencies--are provided in the main portion of this document, as are descriptions of current monitoring systems. What follows here are the monitoring needs of the participating agencies as reported to the Monitoring Strategy Committee in the preparation of this document.

Illinois recommends that:

1. the Commission assume a portion of the water quality monitoring programs in the Illinois section of the Ohio River, particularly at locations where a record has been established, with emphasis on dissolved oxygen, temperature, heavy metals, and organics at significant points;

2. the Commission initiate an integrated basin-wide biological survey program as well as an intensive survey program;

3. the Commission assist in the application of modeling techniques to predict water quality conditions; and

4. the Commission conduct monitoring to supplement state or federal monitoring in the basin in a cost-effective manner to avoid duplication of effort.

Indiana recommends that:

1. the Commission initiate a perodic sampling program (monthly or semi-monthly) upstream and downstream from five major communities in the Indiana section of the Ohio River for biological and chemical parameters;

2. the Commission coordinate an intensive field survey of the Ohio River and major tributaries whenever interstate concerns are involved (including biological parameters and benthic deposits);

3. the Commission prepare a biennial report integrating survey and stream monitoring results on river conditions for use by states in complying with the Clean Water Act, as amended, (PL 92-500 and PL 95-217); and

4. the Commission continue the existing Electronic Monitor network.

Kentucky recommends that:

1. the Commission be instrumental in coordinating intensive surveys for the calibration and verification of wasteload allocation models for the determination of segment maximum daily loads to insure the attainment of applicable water quality standards on the Ohio River mainstem;

2. the Commission place increased emphasis on biological monitoring within its primary in-stream network; and

3. the Commission continue to work toward the elimination of duplication of effort and thus develop a more cost-effective overall network. The current primary in-stream monitoring network meets Kentucky's needs for water quality data.

Pennsylvania recommends that:

1. the Commission provide increased coordination among participating agencies in sampling programs to encourage the sharing of data and thus eliminate duplication of effort.

2. the Commission continue to coordinate the fish collection and fish tissue analysis program at Core Stations; and

3. the Commission continue the Electronic Monitoring Program which provides Pennsylvania with much needed data, particularly during periods of low flow.

West Virginia recommends that:

1. the Commission continue the Primary In-Stream Monitoring Network which provides West Virginia with the needed information on physical, chemical, and biological parameters for the nine locations on the mainstem and the seven locations on the tribuaries of major interest to the state.

U. S. Corps of Engineers: Water management activities related to reservoirs, planning (PL 87-88) and navigation operations require water-quality intelligence on specific river conditions

and trends. The Corps of Engineers recommends that:

1. the Commission continue the Electronic Monitoring Program to provide priority access to real time temperature, dissolved oxygen, pH, and conductivity data in the study area during the summer and early fall low-flow periods;

2. the Commission continue the Electronic Monitoring Program to provide priority access to real time level stage heights at selected locations;

3. the Commission provide information on long and short-term trends in water quality at the same locations over the entire calendar year for the above-listed parameters, plus an expanded list of chemical and biological parameters;

4. the Commission continue the fish surveys on the Ohio River and major tributaries; and

5. the Commission initiate biological surveys using biological indicators other than fish as recommended by the Biological Water Quality Committee.

U. S. Environmental Protection Agency: The monitoring strategy must be responsive to the Clean Water Act, as amended (PL 92-500, PL 95-217) and the US EPA Basic Water Monitoring Program (EPA 440/9-76-025). The US EPA recommends that:

1. primary in-stream monitoring network to measure long and short-term water quality trends and (with input from continuous, electronic monitoring) compliance with water quality standards be continued;

2. intensive basin/segment surveys to identify and define local water quality problems and their causes, provide input to wasteload allocations, and meet other specific needs for short-term water quality information be initiated;

3. quality assurance, data handling, storage, verification, and reporting be an integral part of the monitoring strategy;

4. expanded toxics monitoring be undertaken; and

5. biological monitoring be more specifically defined with US EPA input.

U. S. Geological Survey recommends that:

1. the monitoring program providing data needed by USGS to meet its mission of investigating the occurrence, quantity, quality, distribution, and movement of

surface and ground waters throughout the United States be continued. This includes activities such as those of Level 1 of the National Water Data Network. These data are necessary to meet the objectives of (1) accounting for the quantity and quality of water moving within and from hydrologic accounting units, (2) to depict a real variability of water quantity and quality, (3) to detect changes in stream quality, and (4) to lay the groundwork for future assessments of stream quality. Relating to these activities in the Commission Compact area:

a. more than 200 sites are currently (1982) operated within the Compact area. These include thirteen sites operated as part of the National Stream Quality Accounting Network (NASQAN). Site operations are reviewed annually and adjusted, as necessary, to meet changes in program objectives, budgetary levels, and other factors; and

b. characteristics measured at various sites include stream discharge, temperature, specific conductance, pH, common dissolved constituents, major nutrients, organic constituents, trace elements, biological constituents, and suspended sediments. In addition, pesticide residues and radiochemical constituents are analyzed at selected sites.

Ohio River Valley Water Sanitation Commission: basic need is for data to evaluate river quality conditions to implement Articles VI and VIII of the Commission Compact. Other purposes are: (1) to aid in establishing stream-quality criteria; (2) to provide information to determine effluent discharge requirements; (3) to determine whether stream-quality criteria are being met; and (4) to measure trends in water quality. To meet these objectives, the Commission recommends:

1. the continuation of the Primary In-Stream Monitoring Network with stations located so as to satisfy the following objectives:

   a. to measure conditions in areas where waste discharges have a major impact on water quality;

   b. to measure the water quality at points of usage (i.e., water treatment plants and in recreational areas); and

   c. to measure water quality at points of interstate concern (i.e., state boundaries).

2. the continuation of the use of water and wastewater treatment plant laboratories for certain water quality data, including

bacteriological data;

3. the maintenance of laboratory quality control program to assure reliability of data from cooperating laboratories;

4. the continuation of the Organics Detection System with regular reviews by participants and others concerned to determine the most efficient and effective systems and techniques of providing detection of organic chemical pollutants in river waters.

APPENDIX E

POLICY FOR RELEASE OF COMMISSION DATA TO THE MEDIA

It shall be the Commission's policy to release promptly to the public all data collected through whatever means is most appropriate. As a part of its interstate role, the Commission shall also release comprehensive information about water quality in the Ohio River derived from multiple sources, both state and federal, in situations of sufficient public interest (i.e., spills, accidental discharges, etc.). Monitoring data is normally released in the monthly publication of the Quality Monitor. Project data is published in project reports which are available to the public on request. Alerts are sent to state agencies and, through them, to the public when unusual and/or potentially serious quality conditions exist, via the Commission's "Ohio River Quality Update." A news release is issued when data is of sufficient public importance that these do not provide the appropriate widespread availability to the public.

Procedures for releasing information to the news media will be as follows:

1. In situations of an immediate or critical nature which necessitate immediate release of information to the media, affected states, utilities, federal agencies or other water users will be notified of the contents of the release by telephone prior to its circulation to the media, including news and wire services. A situation of an immediate or critical nature includes spills of radioactive materials, toxic substances, known carcinogens, and untreated sewage, whether deemed to have a major water quality impact or not.

2. Any news release issued is to be prepared by the Information Specialist with the assistance of the appropriate technical staff and approved by the Executive Director.

3. News releases shall be issued to those media in the appropriate geographical areas.

4. Copies of news releases issued shall be mailed simultaneously to members of the Commission, the Technical Advisory Committee, the Public Interest Advisory Committee, and chairmen of other advisory commmittees.

5. When the data to be released results from a cooperative sampling or study program, those agencies or utilities cooperating in the effort will be sent a draft of the proposed release five days prior to its mailing to the media. Comments derived therefrom will be carefully evaluated, but the Commission is not constrained to adopt any changes recommended by individual project participants. The release will be distributed to the media after the five-day review period.

6. News releases issued by the Commission will not attempt interpretation of limits and standards adopted by other agencies which do not deal directly with water quality (i.e., U.S. FDA tolerance limits), nor will they contain detailed statements as to health effects, which is not the area of Commission expertise. When information is available regarding the rationale for such standards or limits, it will also be included in the release. Where possible, expert contacts in appropriate agencies will be sought to which media representatives may be referred.

September, 1978

APPENDIX F

STATUTORY REQUIREMENTS OF PARTICIPATING AGENCIES

The following is a compilation of applicable sections of federal, interstate and state statutes that require water quality monitoring by the participating agencies.

FEDERAL

FWPCA Amendments of 1972 (PL 92-500) and of 1977 (PL 95-217)	Description
Sec. 101(e)	Public participation in the development, revision, and enforcement limitation, plan, or program.
Sec. 102(a)	The Administrator shall prepare or develop comprehensive programs for preventing, reducing, or eliminating the pollution of the navigable waters and ground waters and improving the sanitary condition of surface and underground waters. Joint investigations are authorized.
Sec.104(A) (1)	Promote the coordination and acceleration of, research, investigations, experiments, training, demonstrations, surveys, and studies relating to the causes, effects, extent, prevention, reduction, and elimination of pollution.
Sec. 104(a) (2)	Encourage, cooperate with, and render technical services.
Sec. 104(a) (5)	The Administrator shall establish, equip, and maintain a water quality surveillance system for the purpose of monitoring the quality of the navigable waters and ground waters and the continuous zone and the oceans, and shall report on such quality in the report under subsection (a) of Section 516.
Sec. 105(d) (3)	The Administrator shall develop, refine, and achieve practical application of improved methods and procedures to identify and measure the effects of pollutants on the chemical, physical, and biological integrity of water, including those pollutants created by new technological developments.
Sec. 106(e) (1)	No grants shall be made to any State which has not provided or is not carrying out as a

	part of its program the establishment and operation of appropriate devices, methods, systems, and procedures necessary to monitor, to compile, and analyze data on the quality of navigable waters, including biological monitoring; and annually updating and including it in the report required under Section 305.
Sec. 115	Administrator to identify the location of in-place pollutants with emphasis on toxic pollutants in harbors and navigable waterways.
Sec. 208(a)(2),(3)	The State(s) shall identify each area which as a result of urban-industrial concentrations or other factors, has substantial water quality control problems.
Sec. 210	The Administrator shall annually make a survey to determine the efficiency of the operation and maintenance of treatment works constructed with grants under the Act. The results are to be included in the report required under Section 516(a).
Sec. 301(b)(1)(C)	Achieve not later than July 1, 1977, any more stringent limitation, including those necessary to meet water quality standards, etc.
Sec. 302(a)	The Administrator, if effluent limitations required under Section 301(b)(2), interfere with the attainment or maintenance of water quality standards, shall establish effluent limitations which can reasonably be expected to contribute to the attainment or maintenance of such water quality.
Sec. 303(a),(b),(c)	Set water quality standards.
Sec. 303(d)(1)(A)	State to identify those waters for which effluent limitations required by Sec. 301(b)(1)(A) and Sec. 301(b)(1)(B) are not stringent enough to meet water quality standards.
Sec. 303(d)(1)(B)	State to identify those waters for which controls on thermal discharges under Sec. 301 are not stringent enough to assure protection and propagation of shellfish, fish, and wildlife.

Sec. 303(d)(1)(C)	States shall establish the total maximum daily load, for those pollutants identified under Sec. 304(a)(2), at a level necessary to implement the applicable water quality standards.
Sec. 303(d)(1)(D)	States shall estimate the total maximum daily thermal load required to assure protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife.
Sec. 303(d)(2)	Each State to submit to the Administrator for his approval, the waters identified and the loads established under paragraphs (1)(A)), (1)(B), (1)(C), and (1)(D) of this subsection. If disapproved, the Administrator shall establish.
Sec. 303(d)(3)	Each State to submit to the Administrator for his approval the identity of all waters not identified under paragraph (1)(A) and (1)(B) of this subsection and an estimate of the total maximum daily loads for pollutants identified under Sec. 304(a)(2), including thermal discharges.
Sec. 303(e)	Each State shall have a continuing planning process.
Sec. 304(a)	The Administrator shall develop and publish water quality criteria and information.
Sec. 305(a)	The Administrator is to prepare the 1973 Water Quality Inventory for submittal to Congress.
Sec. 305(b)	Each State, thereafter, shall biennially on even numbered years submit to the Administrator a Water Quality Inventory.
Sec. 305(b)(1)(E)	Each State to submit to the Administrator a description of the nature and extent of non-point sources, recommend control programs including an estimate of costs.
Sec. 308	Provides for inspections, monitoring and entry.
Sec. 309(a)(1),(2)	Federal Enforcement.
Sec. 401	Provides for Certification.
Sec. 402(a)(2)	The Administrator shall prescribe conditions for NPDES permits.

Sec. 516(a)	Reports to Congress -- Contains among other things a summary of the results of the survey required under Sec. 210.

National Environmental Policy Act	Description
Sec. 2	Declares a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological system and natural resources important to the nation.
Sec. 102(g)	All agencies of the federal government shall initiate and utilize ecological information in the planning and development of resource-oriented projects.

U.S. Geological Survey -
P.L. 97-100 as amended annually
95 Stat. 1397
20 Stat. 394
43 U.S.C. 31
25 Stat. 526
28 Stat. 398

Authority for carrying out its mission derives from legislation of 1879 (20 Stat. 394; 43 U.S.C. 31), which created the Geological Survey; legislation of 1888 (25 Stat. 526) and 1894 (28 Stat. 398) which provided for gauging the streams and determining the water supply of the Nation; and Congressional appropriations which have been made annually since 1894. The most recent annual act is PL 97-100 (94 Stat. 2963) which authorizes the Survey "to perform surveys, investigations, and research covering. . . water resources of the United States, its Territories and possessions, and other areas as authorized by law."

Circular A-67
1964

OMB	Description
1.	This Circular prescribes guidelines for the coordination of Federal activities in acquiring water data from streams, lakes, resevoirs, estuaries, and ground waters.

Included in such activities are the collection of quantitative and qualitative data, their processing, publication, and storage. The responsibility for the coordination of Federal water data acquisition activities has been assigned to the Department of Interior, Geological Survey, Office of Water Data Coordination.

2. The Department of Interior is responsible for the design and operation of a national network for acquiring water data on the quantity and quality of surface and ground water, including the sediment load of streams. Departments and agencies whose operating requirements cannot be met efficiently through the national network, including appropriate adjustments therein, will arrange for specialized data acquisition. Determination as to the need for specialized data is entirely the responsibility of the user agencies.

3. In operating the national network, the Department of Interior will utilize the services of other agencies in acquiring national network water data when such cooperative arrangements are more effective or economical than having the Department acquire such data. Conversely, agencies needing water data to meet their special operating requirements should first determine the availability of the services of the Department of the Interior. Each agency will coordinate its activities with those of a similar nature being conducted under State and local auspices.

4. The Department of Interior maintains a central catalog of information on national network and specialized water data and on Federal activities being planned or conducted to acquire such data.

5. The Department of Interior prepares, and keeps current, a Federal plan for the efficient utilization of network and related specialized water data acquisition activities.

OHIO RIVER VALLEY WATER SANITATION COMPACT

Description

Art. I Pledges signatory states to pollution control and outlines uses to be protected for public and industry: water supply, recreational usage, maintaining fish and other aquatic life, freedom from unslightly or malodorous nuisances due to floating solids or sludge deposits.

Art. VI Recognizes variation of size, flow, location,

character, self purification and usage of water within the district. The guiding principle is that wastewaters from one state shall not injuriously affect the various uses of interstate waters. Wastewaters must be treated to protect health or preserve the waters for other legitimate purposes. Tributary streams within a state shall be maintained in such condition that quality is at least equal to the interstate stream immediately above the confluence. Rules, regulations and standards may be promulgated.

Art. VIII Commission shall conduct a survey, study the pollution problems and make report for prevention or reduction of stream pollution. Commission shall confer with agencies of the federal government, and regional planning bodies as well as consult with various states, communities, corporations, personnel or other entities with regard to waste disposal.

Art. IX Authorizes the issuance of enforcement orders and prescribes the methods of compliance.

STATES

ILLINOIS
Environmental Protection Act
July 1, 1970

	Description
Sec. 4b	The Agency shall have the duty to collect and disseminate such information, acquire such technical data and conduct such experiments as may be required to carry out the duties of this Act including ascertainment of the quantity and nature of discharges from any contaminant source and data on those sources, and to operate and arrange for the operation of devices for the monitoring of environmental quality.
Sec. 4c	The Agency shall have authority to conduct a program of continuing surveillance and/or regular or periodic inspection of actual or potential contaminants or noise sources, or public water supplies, and of refuse disposal sites.
Sec. 13	The Board, pursuant to procedures prescribed in (in part) Title 7 of this Act may adopt regulations to promote purposes of this type (water pollution). Without limiting the generalities of this authority, such regulations may, among other things, prescribe: Part 9 - Requirements and Standards for equipment and procedures for monitoring contaminant discharges and their sources, the collection of samples and the collection, reporting, and retention of data

resulting from such monitoring.

Sec. 27 (in part) — The Board may adopt substantial regulations.

INDIANA

Stream Pollution Control Law	Description
(IC 13-l-3) Sec.3	The Technical Secretary of the Stream Pollution Control Board "shall...make or arrange for such investigations and surveys and obtain, assemble or prepare such reports and data as the Board may direct or authorize".
Environmental Management Act	
(IC 13-7) 22 Sec. 1 (c) & (s) as amended	It shall be the duty of the (Environmental Management) Board to conduct a program of continuing surveillance ... of actual or threatened sources of environmental pollution by contamination....
Chapter 5, Sec. 1(b)	...the Board shall have the power to: (b) Have a designated agent enter, upon any private or public property to inspect for and investigate possible violations of this article or regulations promulgated by the Board.

KENTUCKY

Environmental Protection Kentucky Revised Statutes	
Sec. 224.033(4)	Develop and conduct a comprehensive program for the management of water, land, and air resources to assure their protection and balance utilization consistent with the environmental policy of the Commonwealth.
Sec. 224.033(7)	Secure necessary scientific, technical, administrative, and operational services, including laboratory facilities, by contract or otherwise.
Sec. 224.033(16)	Monitor the environment to afford more effective and efficient control practices, to identify changes and conditions in ecological systems and to warn of emergency conditions.
Sec. 244.033(22)	Require, by regulation, that any person

	engaged in any operation regulated pursuant to this chapter install, maintain, and use at such locations and intervals as the department may prescribe any equipment, device or test and the methodologies and procedures for the use of such equipment, device or test to monitor the nature and amount of any substance emitted or discharged into the ambient air or waters or land of the Commonwealth and to provide any information concerning such monitoring to the department in accordance with the provisions of subsection (23) of this section;
Sec. 244.033(23)	Require by regulation that any person engaged in any operation regulated pursuant to this chapter file with the department reports containing information as to location, size, height, rate of emmission or discharge, and emitted into the waters or onto the land of the Commonwealth, and such other information as the department may require;

PENNSYLVANIA
The Clean Streams Law
of 1937 Act 394, 1987
Amended in 1980

	Description
Sec. 4(5)	The achievement of the objective herein set forth requires a comprehensive program of watershed management and control.
Sec. 5(b)(2)(4)	Establish policies for effective water quality management in the Commonwealth of Pennsylvania and coordinate and be responsible for the development and implementation of comprehensive public water supply, waste management and other water quality plans. Report from time to time to the Legislature and to the Governor on the Commonwealth's public water supply and water quality control program. Make such inspections of public or private property as are necessary to determine compliance with the provisions of this act, and the rules, regulations, orders or permits issued hereunder.
Sec. 304	The department shall have power to make a complete survey of the waters of the Commonwealth in order to ascertain the

extent of pollution in each of said waters, and the remedies to be employed to purify said waters. It shall have power to adopt, prescribe, and enforce such rules and regulations, not inconsistent with this act, as may be deemed necessary for the protection of the purity of the waters of the Commonwealth, or parts thereof, and to purify those now polluted, and to assure the proper and practical operation and maintenance of treatment works approved by it. A violation of which rules and regulations, after notice, shall also constitute a nuisance under this act.

WEST VIRGINIA Water Pollution Control Act as amended 1969	Description
Chapter 20 Article 5A-3	To encourage, participate in, or conduct studies, or cause to be conducted studies, scientific or other investigations, research, experiments and demonstrations relating to water pollution, and the causes, control and reduction thereof, and to collect data with respect thereto, all as may be deemed advisable and necessary to carry out the purposes of this article; To collect and disseminate information relating to water pollution and the control and reduction thereof; To sample ground and surface water with sufficient frequency to ascertain the standards of purity or quality from time to time of the waters of the State.

OHIO Chapter 6111 Ohio Revised Code Water Pollution Control	Description
6111.03	The director of environmental protection may:
6111.03(E)	Encourage, participate in, or conduct studies, investigation, research, and demonstrations relating to water pollution, and the causes, prevention, control, and abatement thereof, as is advisable and necessary for the discharge of its duties under sections 6111.01 to 6111.08 of the Revised Code;

6111.42 6111.41(A)	The environmental protection agency shall: Collect, study, and interpret all available information, statistics, and data pertaining to the study, use, conservation, and replenishment of the underground and surface waters in the state;

VIRGINIA

State Water Control Law	Description
Section 62.1-44.14	Inspections and investigations, etc. - The Board State Water Control Law shall make such inspections, conduct such investigations and do such other things as are necessary to carry out the provisions of this chapter within the limits of appropriation, funds, or personnel which are, or become, available from any source for this purpose.
Section 62.1-44.15	Powers and duties - To study and investigate all problems concerned with the quality of State waters and to make reports and recommendations thereon.

VIRGINIA

State Water Control Law	Description
Amended 1972	(4) To conduct or have conducted scientific experiments, investigations, studies, and research to discover methods for maintaining water quality consistent with the purposes of this chapter. To this end the Board may cooperate with any public or private agency in the conduct of such experiments, investigations and research and may receive in behalf of the State any moneys which any such agency may contribute as its share of the cost under any such cooperative agreement. Provided, that such moneys shall be used only for the purposes for which they are contributed and any balance remaining after the conclusion of the experiments, investigations, studies, and research, shall be returned to the contributors. (6) To make investigations and inspections, to insure compliance with any certificates, standards, policies, rules, regulations, rulings and special orders which it may adopt, issue or establish and to furnish advice, recommendations, or instructions for the purpose of obtaining such compliance.

(11) To investigate any large-scale killing of fish.

Regulation No.6 (NPDES)

Any duly authorized agent of the Board may, at reasonable times and under reasonable circumstances, enter any establishment or upon any property, public or private, for the purpose of obtaining information or conducting surveys or investigations necessary in the enforcement of the provisions of these regulations.

NEW YORK

Conservation Law S 17-0303, 5 S	Description
	It shall be the duty and responsibility of the Department to:
	h. Establish a Water Quality Surveillance Network with sufficient stations and sampling schedule to meet the needs of the State, including ground water and surface water, both fresh and salt, and publish the results of such Water Quality Surveillance Network periodically.

Ohio River Valley Water
Sanitation Commission
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