ORSANCO

1971

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(as of April, 1972)

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The Commissioners of the

OHIO RIVER VALLEY WATER SANITATION COMMISSION

an interstate compact agency
created jointly in 1948 by the

State of Illinois
State of Indiana
Commonwealth of Kentucky
State of New York
Commonwealth of Pennsylvania
Commonwealth of Virginia
State of West Virginia
State of Ohio

with approval of the
Congress of the United States

respectfully submit their

TWENTY-THIRD YEARBOOK 1971

HEADQUARTERS: 414 Walnut St., Cincinnati, Ohio 45202 Telephone: 421-1151

PERSPECTIVE ON PERFORMANCE

ALMOST TWO DECADES HAVE ELAPSED since eight states in the Ohio Valley united their efforts under a compact to execute a regional program of water pollution control. What evidence can be presented to delineate the outcome of these efforts?

An answer to this question assumes importance because of contemporary public concern over environmental degradation and the difficulties associated with assessment of its dimensions. Recognition of these difficulties long ago motivated the eight-state Ohio River Valley Water Sanitation Commission (ORSANCO) to initiate inventory and monitoring procedures as a basis for evaluating conditions and trends. A major portion of this annual report is devoted to a summarization of findings from these endeavors.

INVENTORY FINDINGS

The initial approach to charting dimensions of the pollution problem was the development of an inventory of sources of municipal and industrial-waste discharges, along with a tabulation of the status of control facilities. Over the years this type of accounting has provided a measure of progress -- state by state and by river basins -- in the installation of treatment works. On the Ohio River, for example, the inventory shows how discharges of raw sewage from 99 percent of the sewered population in 1948 have been successively curbed to less than one percent today.

This inventory, titled "Tally for the Valley," has been published annually; the latest edition will be found on page 28. Not the least of what it now reveals is evidence of the response by municipalities in upgrading sewage-treatment facilities to comply with higher river standards. For example:

Improvements to existing facilities in the region are under construction at 43 plants serving 123 communities whose sewered population totals 2.1 million. Along the Ohio River alone construction is underway for addition of secondary treatment facilities at 5 plants serving 79 communities with a sewered population of 1.3 million.

The tally also shows that secondary-treatment facilities are currently in operation at 875 plants serving 952 communities with a sewered population of almost 6.2 million.

Finally, during the past year new treatment plants serving 15 communities with a population of 43,600 have been placed in operation, while improvements to existing facilities have been completed for 10 communities with a population of over 56,000.

With respect to industrial-waste control, three quarters of the 1,648 industries discharging wastewaters directly into streams are in compliance with currently upgraded state requirements. Meantime, construction for improved control facilities is underway at 72 additional industries.

A different type of inventory, this concerned with the status of aquatic-life resources of the Ohio River and certain tributaries, was initiated in 1957. It involved a determination of the species of fish, their location and abundance, as well as an assessment of limnological conditions. The object of this undertaking was to establish a baseline for comparative purposes in the future. Thus a yardstick has been fashioned for measuring pollution abatement in terms of changes in fish diversity and production. Such an appraisal is now being contemplated.

WATER QUALITY TRENDS

Meantime, a more precise yardstick for measuring pollution-abatement results was being developed. It began in 1951 with creation of a Water Users Committee consisting of managers of municipal and industrial-water utilities who undertook to provide daily analyses of the quality of the river water they were processing. This data was supplemented through contractual arrangements with the U. S. Geological Survey for the conduct of quality observations on various streams throughout the Ohio River Valley region.

In 1960 the ORSANCO staff pioneered development of an electronic monitoring system that has made possible an hourly checking of quality changes at strategic locations. In addition, support of the National Weather Service was enlisted in providing daily river flow and velocity, the influence of which profoundly affects river-quality variations.

Acquisition and evaluation of this kind of information has provided unusual opportunities for diagnosing river quality conditions and trends. And it offers a factual basis for judgments concerning how much and where river conditions have improved or need improvement.

Furthermore, the challenge of translating these scientific observations into a form whose significance may be readily grasped, has produced a methodology that has broad usefulness for appraising the status of pollution abatement. It is simply this: observed conditions are matched against established quality standards and from this a comparison is made of percentage of time the standards either were met or violated. This kind of appraisal offers a quantitative measure of how good or how poor river conditions are, as well as denoting whether the trend of change is for better or worse.

Details of such interpretation are presented starting on page 8 of this report. Following are a few examples of comparative findings:

In the Ohio River during the 1959-1970 period dissolved-oxygen levels have increased at 5 of the 9 monitor locations and there has been a lowered trend at 2 locations. Improvement of pH values (a measure of degree of acidity or alkalinity) has occurred at 11 of 22 sampling locations. A reduction in maximum values of temperature has been recorded at 5 of 17 locations, and there has been an increase at only one location. Dissolved solids have been reduced at 6 of the 9 places being monitored; meantime chloride levels have decreased at 12 of 19 locations and increased slightly at one location.

From this kind of analysis of data it is possible to reach conclusions on the current situation with respect to quality conditions, and to determine where improvement has occurred and where more stringent controls are needed.

EXTENSION OF MONITORING

Budget limitations have constrained ORSANCO in extending its river monitoring endeavors. But possibilities now exist for widening this service through contractual arrangements with several of the signatory states. Two factors may be cited as favorable to such extension.

The first is a desire by the signatory states to take full advantage of facilities and skilled personnel at Commission headquarters for computer-assisted analysis of data. The second factor is a provision in a proposed federal law that would make it mandatory for each state to submit annually a description of quality conditions of all navigable waters within the geographic boundaries of the state.

This requirement would probably impose a burden on most states that they are not presently able to shoulder. However, it does appear that the monitoring program of ORSANCO, which has been in operation for two decades, could be easily adapted to satisfy pending federal requirements.

QUALITY MANAGEMENT MODEL

The electronic monitor system developed by ORSANCO along with its computer-assisted diagnostic procedures suggested possibilities of devising a means for forecasting water quality. The basic idea involved design of a mathematical model that would simulate quality conditions in a river in response to variations in waste loadings, amount of flow, temperature, physical characteristics and several other factors.

Work on this project over the past three years, supported in part with a research grant from the Water Quality Office of the U.S. Environmental Protection Agency, has reached the point where it appears that a suitably tested model will soon be available. Significant features of this integrated series of computer programs and subroutines are:

- Universality, in terms of the model's applicability to any river for which the geometry, hydrological characteristics and other variables can be defined.
- Dynamic in its characteristics with respect to use of such parameters as flow, temperature and waste loadings; these may be represented as constants, as a series of discrete daily values, or in terms of cyclic time functions.
- Simplicity of manipulation because once certain basic data has been assembled no specialized knowledge of programming is required to operate the model.
- Flexibility of adaptation because FORTRAN coding and program options are provided which permit the user of the model to add subroutines of his choice or to modify existing program subroutines.

Components of model -- Two data "banks" and a control-card unit are required for operation of the model. One bank comprises information that defines the section of a river being studied. It includes data on place-dependent events, such as: volume and characteristics of sewage or industrial waste or tributary discharges, and variations in river geometry that influence quality changes. These data inputs are referenced to the location or mile point at which the event occurs. Once established, the place-dependent data need not be specified for each model run; only those entries which are to vary from this established definition are specified for a given run of the model.

The second data bank includes such time-dependent information as daily river flow or temperature for one or more segments of the river being modeled. This input may be re-used in a series of simulations, where, for example, the influence of changes in waste-discharge locations or characteristics is being evaluated. On the other hand, the time-dependent data input can be replaced for each trial when the model is used to evaluate the effect of hydrologic variability on quality or to forecast future conditions.

In addition to the two data banks, operation of the model requires one or more control cards that specify where, when and what for the individual trial and the desired output. The model is so designed that if an option is not selected the program automatically defers to an established value or operating step. Thus, the control cards serve to tailor a simulation to the users requirements.

Model applications-- The model would appear to offer a versatile tool for management of water quality. It provides a means for evaluating the influence of wastewater discharges, stormwater overflows, tributary discharges and changes in stream flow or channel configuration on quality characteristics in the river. Thus the model can be employed for such purposes as establishing treatment requirements for existing or proposed wastewater discharges; for determining the impact of river-flow augmentation or diversion; and for assessing the influence of dams and navigation facilities on water quality conditions.

Additionally, the forecast options in the model permit day-by-day estimates of future water quality along a reach of the river or at specific locations. This mode of operation can provide the basis for optimizing a regional program of pollution-control.

The model also can be used for the diagnosis of in-stream conditions affecting water quality. It has the capability for establishing the relative significance of such factors as bottom-deposits, carbonaceous and nitrogeneous demand rates, changes in reaeration rates and land run-off. Finally, the model has usefulness as an instructional aid in water-resources management courses.

SUBSURFACE WASTE DISPOSAL

Following submission of a staff report calling attention to the increasing number of installations of injection wells for underground disposal of industrial wastewaters and the desirability of regional action in formulating guidelines on regulatory procedures, the Commission appointed an advisory committee of geologists from the signatory states to develop recommendations.

The Advisory Committee on Underground Injection of Wastewaters has submitted its first progress report, which contains the following tentative conclusions:

Subsurface injection is a technically acceptable method of wastewater disposal or long-term storage whereby pollutants can be removed from the surface environment and placed in remote underground locations, which are of no value for other purposes.

Techniques, personnel and agencies are available within the ORSANCO district for evaluation of the geologic and engineering feasibility of subsurface disposal and for determination of the risks, if any, that may exist to public health and to the environment.

There would be justification for the Ohio River Valley Water Sanitation Commission to adopt a policy that wastewater injection may be used when regulatory authorities with legal jurisdiction have considered other alternative methods of waste management, and then, after weighing all available evidence, have determined that:

1. Geologic and hydrologic conditions will, beyond a reasonable doubt, provide adequate protection of the public and natural resources;

2. The volume, chemical and physical composition, and toxicity of the fluid to be injected are compatible with the geologic and hydrologic conditions;

3. Appropriate safety factors and monitoring devices are incorporated in the design of the injection well and its auxiliary facilities;

4. Assurance is obtained that the waste injection system will be operated in a manner compatible with the geologic conditions, waste character and system construction;

ADVISORY COMMITTEE ON UNDERGROUND INJECTION OF WASTEWATERS

Committee Chairman—Dr. Don L. Warner
Department of Geology
University of Missouri

ORSANCO Staff Liaison—Mr. Russell A. Brant, Geologist

ILLINOIS

Dr. John Frye, Chief
State Geological Survey
Alternate: Dr. Robert Bergstrom
Coordinator, Environmental Geology

INDIANA

Dr. John C. Patton, State Geologist
State Geological Survey

KENTUCKY

Dr. Wallace W. Hagan,
Director and State Geologist
State Geological Survey

NEW YORK

Dr. James F. Davis, State Geologist
State Geological Survey
Alternate: Mr. Lynn Kreidler
Senior Research Geologist

OHIO

Mr. Horace Collins, Chief
Division of Geological Survey
Alternate: Mr. Michael Clifford, Geologist

PENNSYLVANIA

Dr. Arthur Socolow, State Geologist
Topographic and Geological Survey
Alternate: Mr. William Lytle,
Senior Research Geologist

VIRGINIA

Dr. James L. Calver, State Geologist
Division of Mineral Resources

WEST VIRGINIA

Dr. Robert B. Erwin,
Director and State Geologist
Geological and Economic Survey

U. S. GEOLOGICAL SURVEY

Mr. Joseph Callahan, Chief
Groundwater Branch, Water Resources Division

5. An approved alternative plan for waste management is available in the event that operational problems occur during the use of the injection system;

6. The injection well will be properly plugged and marked before abandonment;

7. A permanent public record will be kept which documents the complete operational history of the injection system.

PLANT INSPECTION AND AUDIT

The engineering committee of the Commission has responded to a policy declaration looking toward intensification of state inspection and performance-audit of wastewater control installations by preparing guidelines for this purpose.

The program includes the following components:

- A detailed inspection, including plant performance tests and evaluation of facility adequacy is to be completed annually for each sewage and industrial wastewater control facility.

- Supplementary to the annual inspection all facilities with a design capacity in excess of 250,000 gallons per day are to be inspected at least quarterly and smaller facilities inspected at least semiannually.

- Operating reports from treatment plants are to be submitted monthly. Reports are to include influent and effluent analysis, and such other information as may be appropriate to determine facility compliance with all applicable permit requirements, effluent standards and stream criteria.

- Facility inspection to be conducted by qualified agency personnel assigned primarily to this program activity.

Consideration is being given to development of a manual of recommended practice for plant inspection and possible application of data processing techniques, as well as the establishment of a facility inspector's training program.

FEDERAL CONFERENCES

ORSANCO was a participant in three conferences that were called by the federal Environmental Protection Agency concerning pollution control activities on the Ohio and Monongahela rivers.

Ohio River -- The Ohio River conferences were conducted on September 30, 1971, at Pittsburgh, Pennsylvania, and on October 13, 1971, at Wheeling, West Virginia.

The thrust of the recommendations agreed to at Pittsburgh is to require "secondary treatment" of all municipal and industrial wastes. This is in conformance with requirements previously established by Pennsylvania and the Commission. Deadline for installation of necessary facilities is December 1973, a schedule that conforms with timetables which were previously established by Pennsylvania and submitted to ORSANCO.

Recommendations adopted at the Wheeling conference reflect virtual endorsement by the federal participants of effluent standards previously adopted by the signatory states. Much of the wording in the recommendations is identical to that contained in ORSANCO Control Standard No. 1-70. Additional wording included a statement that "In general, a total net oil concentration of less than or equal to 10 mg/l will be considered adequate for discharge." Control measures for temperature and radioactive materials, which are incorporated in ORSANCO Standard 1-70, were not considered in the EPA staff report submitted to the conference, and therefore not included in recommendations of the conferees.

Monongahela River -- Recommendations that emanated from the Monongahela conference on August 24-25, 1971, were as follows:

The state and interstate conferees recognize that the abandoned mine drainage problem is primarily a regional development matter. Therefore they request that the Appalachian Regional Commission direct and coordinate with the Environmental Protection Agency and other appropriate agencies the abatement program which has been recommended by the conferees.

The Appalachian Regional Commission should be charged with but not be limited to the following responsibilities:

- Develop within three months a methodology for assignment of action priorities;
- Establish within nine months appropriate priorities for areas or sub-basins.
- Evaluate progress and accomplishments of existing abatement projects looking toward refinement of abatement technology.
- Prepare within fifteen months more finite estimates on the cost of high priority projects;
- Determine and develop financial assistance required to execute high priority abatement projects;
- Prepare semi-annual progress reports for submission to the states and ORSANCO.

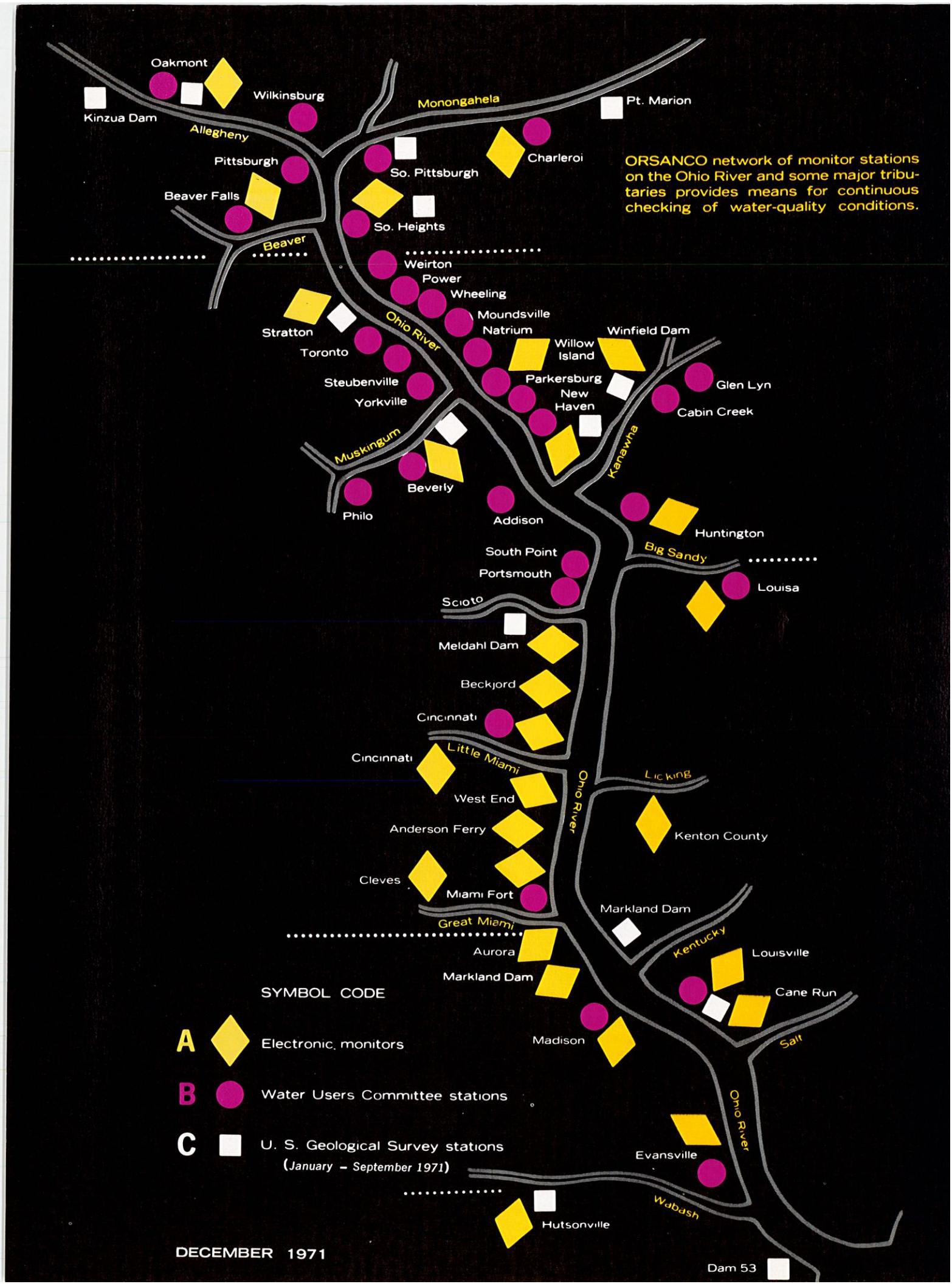
All the conferees recommended that a study be financed by the EPA covering an analysis of legal problems in controlling water pollution from mining and associated functions as a basis for devising model legislation.

All the conferees supported the view that the Environmental Protection Agency adopt a nation-wide policy to include in its standards program the abatement of pollution from active mines no later than September 1, 1972. By this date all waters discharged from active mines in the Monongahela basin shall meet the following criteria or state water quality standards, whichever is more restrictive: pH between 6 and 9 standard units; no net acidity as determined by Standard Methods; and total iron concentration of 7 milligrams per liter or less. Discharges from facilities to abate pollution from inactive mines shall meet water quality criteria.

All the conferees agreed that quarterly meetings be scheduled until September 1, 1972, for the purpose of reviewing progress reports on all activity in the basin.

The federal conferee recommended that all mine operators immediately institute procedures to prevent sedimentation in the water courses. Additionally, it was recommended that all mine operators opening new mines or expanding mines already in operation shall abate water pollution both during mine operation and after mining activity has ceased. Abatement plans shall be submitted to the appropriate state agency six (6) months prior to commencement of mining. Mining activities shall not begin until the state agency has reviewed and approved the plan.

The federal conferee also recommended that each state provide a quarterly report to the conferees listing: new and reopened mines; active existing mines which became inactive during the quarter; and status of actions to control pollution from the closed mines.


ORSANCO network of monitor stations on the Ohio River and some major tributaries provides means for continuous checking of water-quality conditions.
Oakmont
Wilkinsburg
Kinzua Dam
Allegheny
Monongahela
Pt. Marion
Pittsburgh
So. Pittsburgh
Charleroi
Beaver Falls
So. Heights
Beaver
Weirton
Power
Wheeling
Moundsville
Natrium
Stratton
Toronto
Ohio River
Winfield Dam
Willow Island
Parkersburg
New Haven
Glen Lyn
Cabin Creek
Steubenville
Yorkville
Muskingum
Beverly
Philo
Addison
Kanawha
Huntington
Big Sandy
South Point
Portsmouth
Louisa
Scioto
Meldahl Dam
Beckjord
Cincinnati
Cincinnati
Little Miami
Licking
West End
Ohio River
Kenton County
Anderson Ferry
Cleves
Miami Fort
Markland Dam
Great Miami
Kentucky
Louisville
Aurora
Markland Dam
Cane Run
SYMBOL CODE
A Electronic monitors
Madison
Salt
B Water Users Committee stations
Ohio River
C U. S. Geological Survey stations
(January – September 1971)
Evansville
Wabash
Hutsonville
DECEMBER 1971
Dam 53

RIVER QUALITY APPRAISAL

FOLLOWING IS A SUMMARY OF QUALITY CONDITIONS in the Ohio River and some of its major tributaries during 1970. The summary is based on an evaluation of more than a million items of analytical information, including measurements on chemical, physical and bacteriological characteristics at ORSANCO-sponsored monitor stations. Locations of monitor stations are shown on the map and in the following tabulation.

Quality analyses were made through one or more of the following arrangements: 32 locations (22 on the Ohio River main stem) were monitored on a voluntary basis by managers of municipal and industrial water treatment plants, who are members of the ORSANCO Water Users Committee; 14 locations (7 on the Ohio River) were monitored during the period January through September by the U.S. Geological Survey under a contractual

ORSANCO WATER QUALITY MONITOR STATIONS

OHIO RIVER STATIONS

	Mile Point	Type
Pittsburgh (Reed) Pa.	2.3	B
South Heights, Pa.	15.8	A, B, C
Stratton, Ohio	55.0	A, C
Toronto, Ohio	59.1	B
Weirton, W. Va.	62.2	B
Steubenville, Ohio	65.3	B
Power, W. Va.	79.3	B
Yorkville, Ohio	83.6	B
Wheeling, W. Va.	86.8	B
Moundsville, W. Va.	111.0	B
Natrium, W. Va.	119.4	B
Willow Island, W. Va.	161.0	A, B
Parkersburg, W. Va.	183.7	B
New Haven, W. Va.	241.6	A, B, C
Addison, Ohio	260.7	B
Huntington, W. Va.	304.2	A, B
South Point, Ohio	318.0	B
Portsmouth, Ohio	350.7	B
Meldahl Dam	436.2	A, C
New Richmond (Beckjord) Ohio	452.8	A
Cincinnati (Waterworks) Ohio	462.8	A, B
Cincinnati (West End) Ohio	471.3	A
Cincinnati (Anderson Ferry) Ohio	479.1	A
North Bend (Miami Fort) Ohio	490.0	A, B
Aurora, Ind.	496.7	A
Markland Dam	531.5	A, C
Madison (Clifty Creek) Ind.	559.5	A, B
Louisville (Waterworks) Ky.	600.6	A, B
Louisville (Cane Run) Ky.	616.8	A, C
Evansville, Ind.	791.5	A, B
Dam 53	962.7	C

TRIBUTARY STATIONS

	Mile at which tributary enters Ohio River	Miles from sampling station to confluence of tributary with Ohio River	Type
Allegheny River near Kinzua, Pa.	0.0	198.0	C
Allegheny River at Oakmont, Pa.	0.0	13.3	A, B, C
Allegheny River at Wilkinsburg, Pa.	0.0	8.9	B
Monongahela River at Point Marion, Pa.	0.0	90.8	C
Monongahela River at Charleroi, Pa.	0.0	42.6	A, B
Monongahela River at South Pittsburgh, Pa.	0.0	4.5	B, C
Beaver River at Beaver Falls, Pa.	25.4	5.3	A, B
Muskingum River at Philo, Ohio	172.2	66.8	B
Muskingum River near Beverly, Ohio	172.2	28.0	A, B, C
New River at Glen Lyn, W. Va.		193.9	B
Kanawha River at Cabin Creek, W. Va.	265.7	74.3	B
Kanawha River at Winfield, W. Va.	265.7	31.1	A, C
Big Sandy River near Louisa, Ky.	317.1	20.3	A, B
Little Miami River at Cincinnati, Ohio	463.5	3.4	A
Licking River at Kenton County, Ky.	470.3	4.5	A
Great Miami River near Cleves, Ohio	491.1	5.5	A
Wabash River near Hutsonville, Ill.	848.0	174.0	A, C

arrangement with ORSANCO; 27 locations (17 on the Ohio River) were under 24-hour surveillance using ORSANCO robot monitor units.

Supplemental data for the year is available from the Federal Environmental Protection Agency, which made analyses periodically on trace elements.

Information on river flow is furnished by the U.S. Geological Survey, which operates a network of stream gaging stations. This information is supplemented by forecasts from the Ohio River Forecast Center of the National Weather Service, National Oceanic and Atmospheric Administration. Daily forecasts, which are provided for 24 locations on the Ohio River and its tributaries, include estimates on volume and velocity of flow for the current day and for each of the next three days.

In the following sections, observed river conditions are matched against criteria adopted by ORSANCO.

QUALITY CONDITIONS IN THE OHIO RIVER

FINDINGS IN BRIEF - Criteria established by ORSANCO for appraising river quality conditions specify limiting concentrations for twenty-one chemical and bacteriological characteristics. In 1970, many of the specifications were met 100 percent of the time at all monitor locations; and except for three characteristics -- dissolved oxygen, coliform bacteria and threshold odor number -- all specifications were met 98 percent of the time or better.

With regard to dissolved-oxygen levels, the criterion for aquatic life was met 97 percent of the time or better at seven of ten monitor stations. At three stations, the criterion was met from 75 percent of the time (at Cane Run) to 87 percent of the time (at Louisville). Completion of secondary sewage-treatment facilities and installation of additional industrial wastewater treatment facilities, as required under ORSANCO Pollution Control Standard No. 1-70, should result in substantial improvement of dissolved-oxygen conditions in the next few years.

With regard to bacteriological conditions, the criteria for public water supply and for recreation were met 80 percent of the time or better at Huntington and Portsmouth. At six other locations, however, coliform levels exceeded both criteria during most of the year. In order to get a better understanding of bacteriological conditions and also of the potential influence of sewage-treatment plant effluents on river quality, action has been taken to substitute the "fecal" coliform test for the "total" coliform test. And it is anticipated that examinations using the fecal coliform test will be initiated during the coming year.

The criterion for threshold odor established by the Commission was met 100 percent of the time at Portsmouth, Cincinnati and Louisville, and for 70, 80 and 89 percent of the time, respectively, at Parkersburg, Natrium and Evansville.

RIVER FLOW -- The accompanying graphs provide a comparison between 1970 monthly-average flows and long-term average or "normal" flows at three Ohio River gaging stations. The stations for which data is presented include Sewickley at Mile 12, Cincinnati at mile 471, and Evansville at mile 792.

Generally, there is an inverse relationship between rate of flow and the concentration of dissolved mineral constituents, and a direct relationship between rate of flow and the concentration of dissolved oxygen and coliform bacteria. Because of these relationships, the

most critical months of the year with regard to quality conditions are usually August, September and October.

As can be seen in the graphs, monthly-average flows were near normal during the first seven months of the year, and above normal during the last five months. In view of this finding, it may be concluded that concentrations of dissolved mineral constituents, at least during the last half of 1970, were below "normal" or long-term average levels, and that dissolved-oxygen concentrations were above average levels to be expected under present conditions of waste treatment. Coliform densities in 1970 were also above long-term average levels, which fact may be attributed, at least in part, to above average rainfall, with a consequent increase in soil runoff and a decrease in time for natural die-off of bacteria.

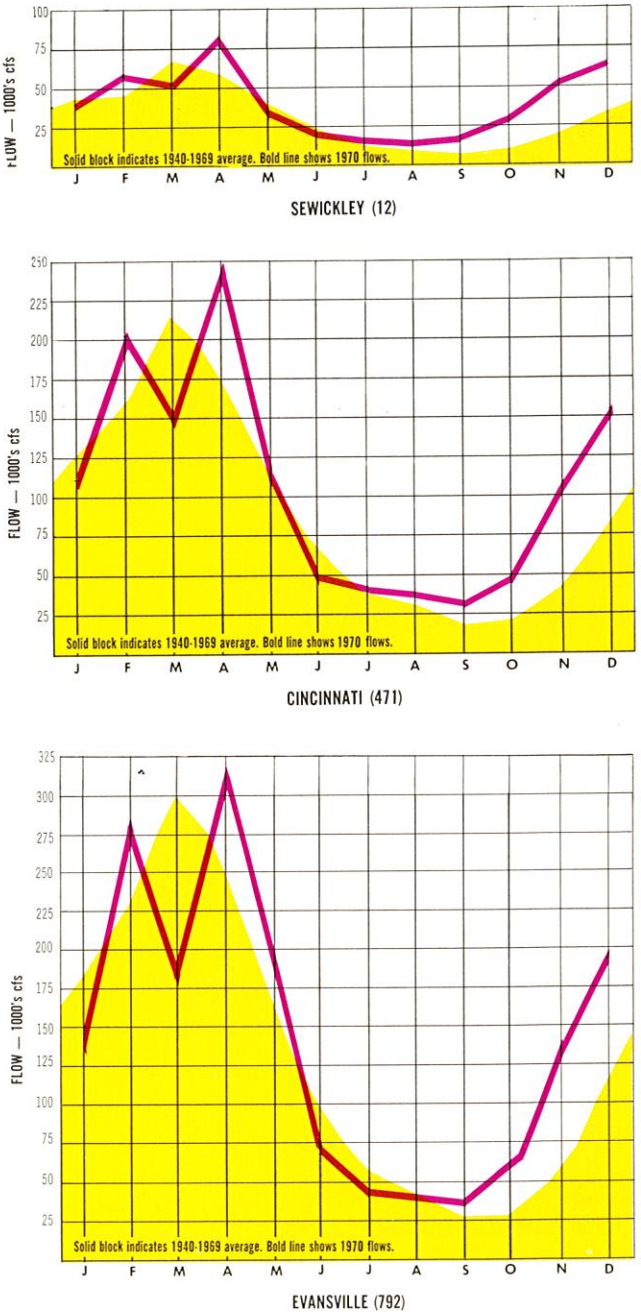
VISIBLE ASPECTS OF POLLUTION -- Sixty-eight incidents of visible or obvious pollution were reported from surveillance operations conducted during 1970. This is twenty-nine more than the number reported during 1969.

There were thirty spills of oil and petroleum products, four spills of chemicals, twenty-three occurrences of objectionable appearance (color, debris, foam, raw sewage), six taste-and-odor problems and five fish kills.

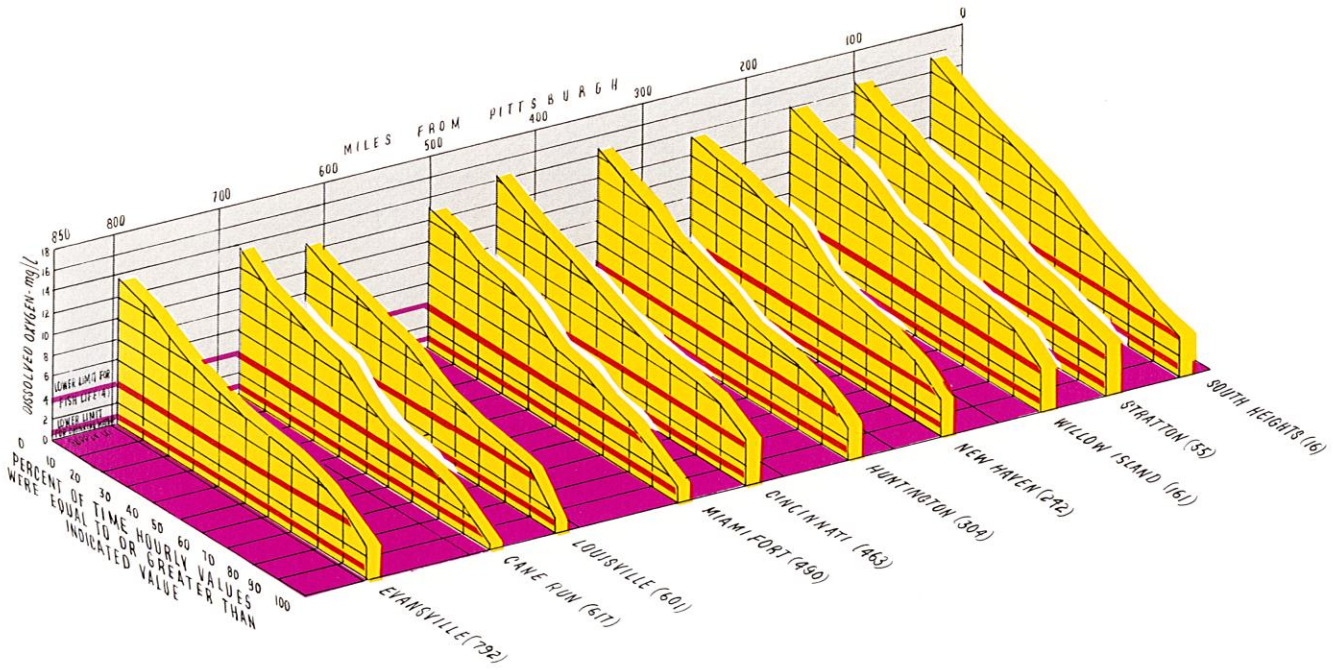
Spills of oil and petroleum products were attributed to: Discharges from industrial operations (10); leaking barges (8); spills from refineries and loading facilites (7); pipeline breaks (2); tank truck accidents (2); and watercraft accidents (1).

Of the twenty-three episodes of objectionable appearance reported in 1970, nineteen occurred on tributary streams. Most of these resulted from malfunctions of sewage lift stations or small sewage-treatment plants. Others resulted from spills at industrial plants. The instances of objectionable appearance on the Ohio River resulted from malfunctions of lift stations or treatment plants (2), storm overflow (1), and industrial discharge (1).

Each incident was investigated by a representative of the state involved or the ORSANCO staff. Where responsibility was determined, steps were taken by state agencies to insure that chances for recurrence were minimized or eliminated.



Monthly-average flows in the Ohio River at three gaging stations during 1970 and comparison with normal flows at each station over a 30-year period (1940 through 1969)



DISSOLVED-OXYGEN QUALIGRAMS — 1970

(Daily-minimum values)

DISSOLVED OXYGEN - Criteria for evaluating river conditions with respect to the maintenance of aquatic life specify that DO concentrations should not be less than 4.0 mg/l at any time, nor less than 5.0 mg/l as a daily-average value.

Daily-minimum DO readings during 1970 at ten monitor stations on the Ohio River are plotted against the frequency of occurrence as shown in the accompanying qualigrams. The qualigrams show, for example, that at Cincinnati (mile 463) hourly readings were greater than 4.0 mg/l for 100 percent of the time. At Miami Fort (mile 490), however, only 88 percent of all hourly readings exceeded 4.0 mg/l.

The range in DO concentrations during the year was from a low of 0.4 mg/l at Cane Run to a high of 15.9 mg/l at South Heights. Taken collectively, the data from all stations show that concentrations exceeded the minimum level of 4.0 mg/l specified in the criteria for 97 percent of the time.

With regard to daily-average concentrations of DO in 1970, the following tabulation shows for each monitor station the percent of days on which the average concentrations were equal to or greater than 5.0 mg/l:

Station	Percent of days average DO values were equal to or greater than 5.0 mg/l
South Heights	98
Stratton	100
Willow Island	99
New Haven	97
Huntington	99
Cincinnati	99
Miami Fort	84
Louisville	87
Cane Run	75
Evansville	98

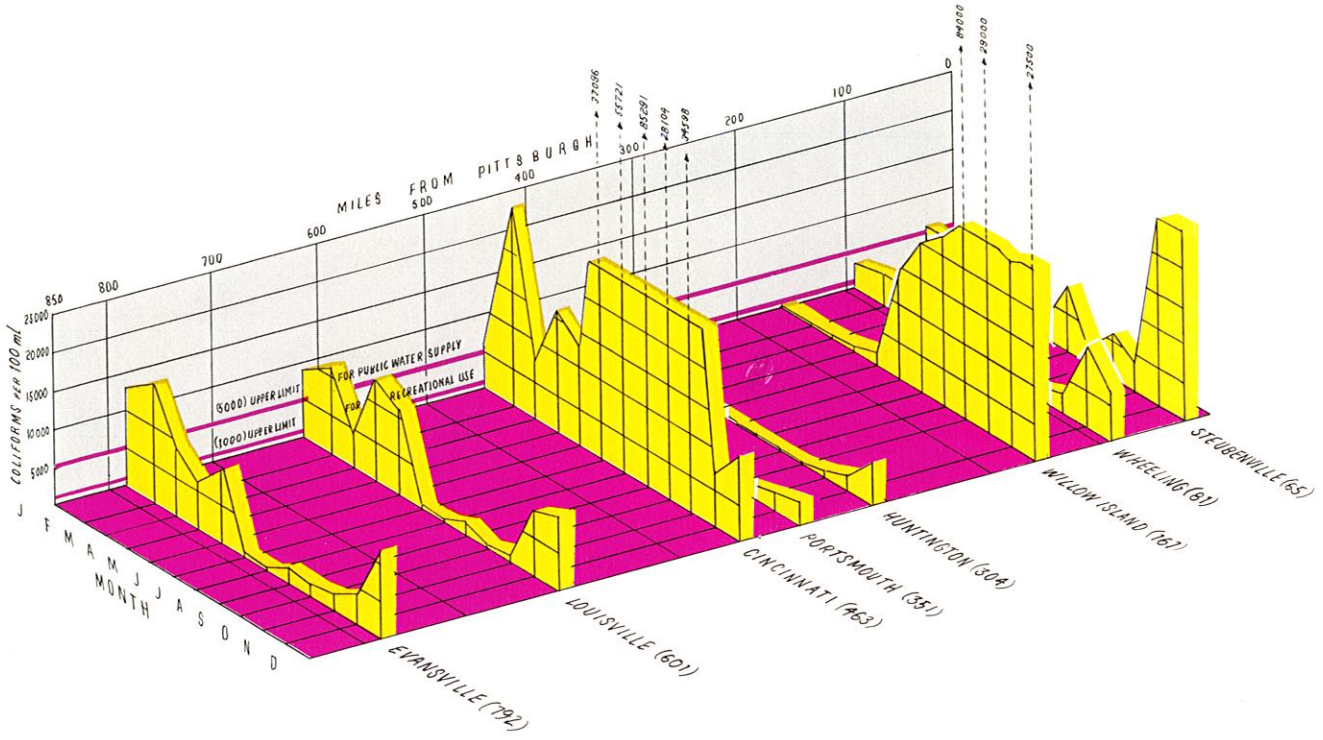
Quality criteria for water used as a source of supply for industrial purposes specify that DO concentrations should not be less than 1.0 mg/l at any time nor less than 2.0 mg/l as a daily-average value. These specifications were met 100 percent of the time in 1970 at all monitor locations.

COLIFORM DENSITY - The test for coliform bacteria, which themselves are not disease producing, is a presumptive test indicating the potential presence of fecal and possibly pathogenic organisms. The test may also indicate the presence of bacteria of non-fecal origin, such as those normally found in soil runoff. Therefore, an assessment of whether the density of coliform bacteria represents a potential health hazard in a particular location usually cannot be made without the benefit of field surveys to determine whether there are sewage discharges in the vicinity of the sampling point, and the extent to which analytical results are influenced by such discharges.

Criteria employed by ORSANCO for appraising bacterial quality conditions contain the following specifications:

For public water supply and food processing industry: Coliform group not to exceed 5,000 per 100 ml as a monthly-average value; nor exceed this number in more than 20 percent of the samples examined during any month; nor exceed 20,000 per 100 ml in more than five percent of such samples.

For recreational purposes: Coliform group not to exceed 1,000 per 100 ml as a monthly-average value; nor exceed this number in more than 20 percent of the samples examined during any month; nor exceed 2,400 per 100 ml on any day.



COLIFORM DENSITY PROFILES — 1970
(Monthly-average values)

Coliform densities were measured routinely at eight locations in 1970. Findings are shown in the accompanying profiles and tables.

With regard to criteria specifications for public water supply, the profiles show that monthly-average values of 5,000 per 100 ml or less were observed as follows: For twelve months of the year at Portsmouth, for eleven months at Huntington, for ten months at Wheeling, for six months at Steubenville, Louisville and Evansville, for two months at Willow Island, and in none of the months at Cincinnati. These findings together with information on frequencies at which additional criteria specifications were met are shown in the following tabulation:

Station	Number of months average value less than 5,000 per 100 ml	Number of months 80 percent or more of daily values less than 5,000 per 100 ml	Number of months 95 percent or more of daily values less than 20,000 per 100 ml
Steubenville	6	6	8
Wheeling	10	9	10
Willow Island	2	2	2
Huntington	11	10	12
Portsmouth	12	12	12
Cincinnati	0	0	2
Louisville	6	5	8
Evansville	6	5	7

With regard to recreational use, the frequencies at which monthly-average and over-run specifications were met at Huntington, Portsmouth, Louisville and Evansville during the five recreational months of May through September are detailed in the following tabulation. At all other stations, coliform densities exceeded criteria specifications throughout the five-month period.

	Number of months during May-September in which:		
Station	Monthly-average values less than 1,000 per 100 ml	80 percent or more of daily values less than 1,000 per 100 ml	All daily values less than 2,400 per 100 ml
Huntington	5	4	4
Portsmouth	5	4	5
Louisville	3	2	2
Evansville	2	2	1

DISSOLVED SOLIDS - The accompanying profiles summarize monthly-average values of specific conductance and dissolved solids at Ohio River monitor locations in 1970. The profiles are based on measurements of specific conductance and conversion of these measurements into dissolved-solids levels in accordance with ratios established by previous correlation studies. For the Ohio River, a conductance value of 800 micromhos/cm corresponds to a dissolved-solids concentration of 500 mg/l.

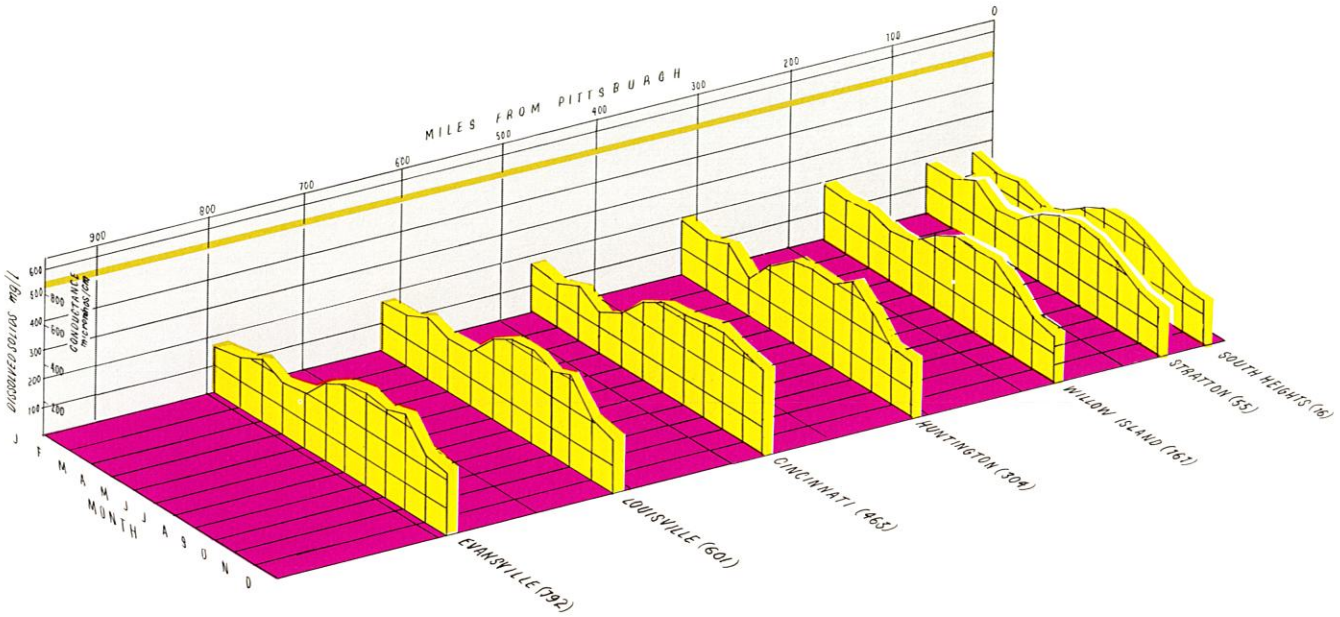
The ORSANCO criteria for river water used as a source of public water supply require that dissolved solids shall not exceed 750 mg/l at any time, nor exceed 500 mg/l in terms of monthly-average values. These specifications were met 100 percent of the time at all stations. Since the criteria for public water supply purposes are more restrictive than those for industrial water supply purposes, it follows that the latter requirements were also met 100 percent of the time at all stations as well.

HARDNESS -- The accompanying profiles show monthly-average values of hardness during 1970 at eight Ohio River stations. The U.S. Geological Survey has adopted the following nomenclature for designating various levels of hardness in water:

	Hardness concentration
Soft water	0 to 60 mg/l
Moderately hard	61 to 120
Hard	121 to 180
Very hard	Greater than 180

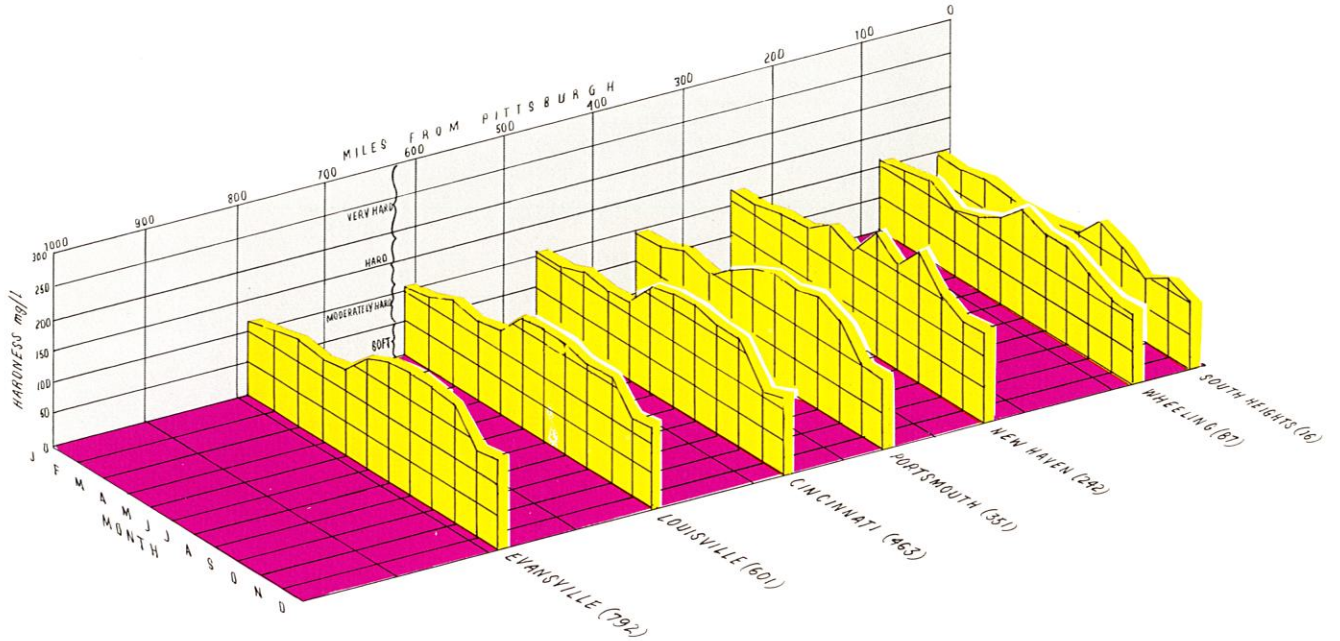
On the basis of these designations, Ohio River water may be regarded as ranging from "soft" to "very hard."

Hardness levels ranged from 90 mg/l (at South Heights in April and May) to 202 mg/l (at New Haven in September). As may be seen from the profiles, hardness concentrations in the river generally were highest during the months of July through September. This finding indicates an inverse relationship between hardness concentrations and volume of river flow, since the period of July through September is also usually the period of lowest flow.



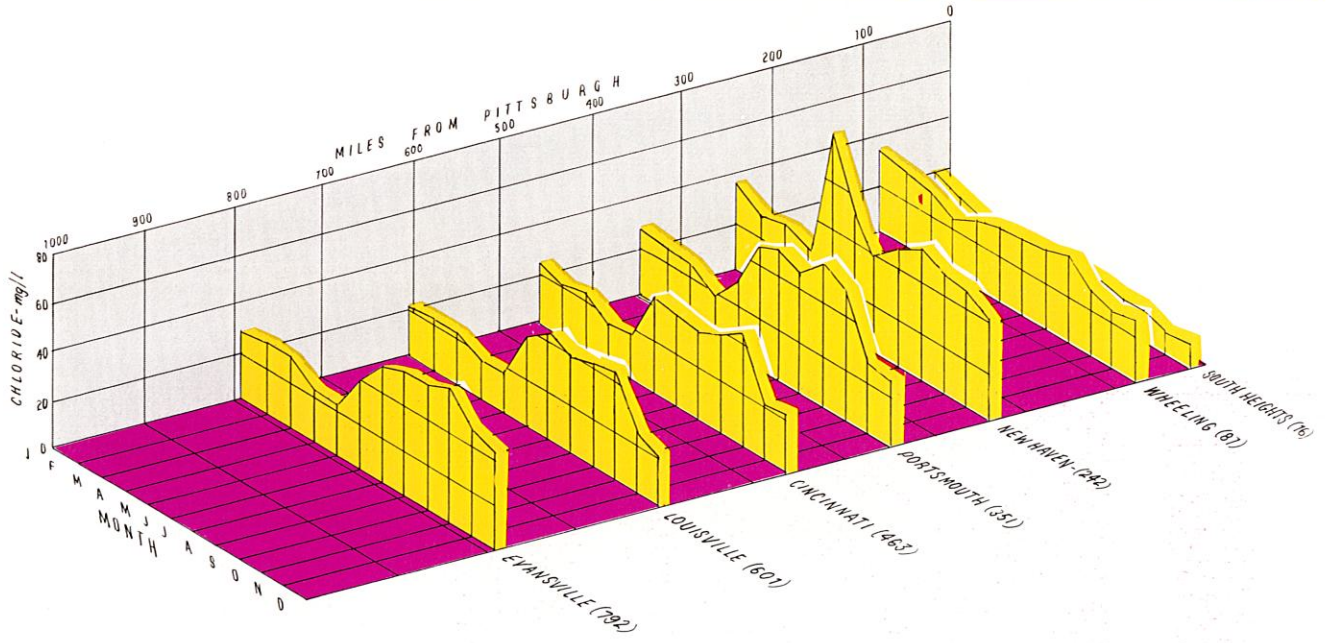
DISSOLVED SOLIDS (CONDUCTANCE) PROFILES — 1970

(Monthly-average values)

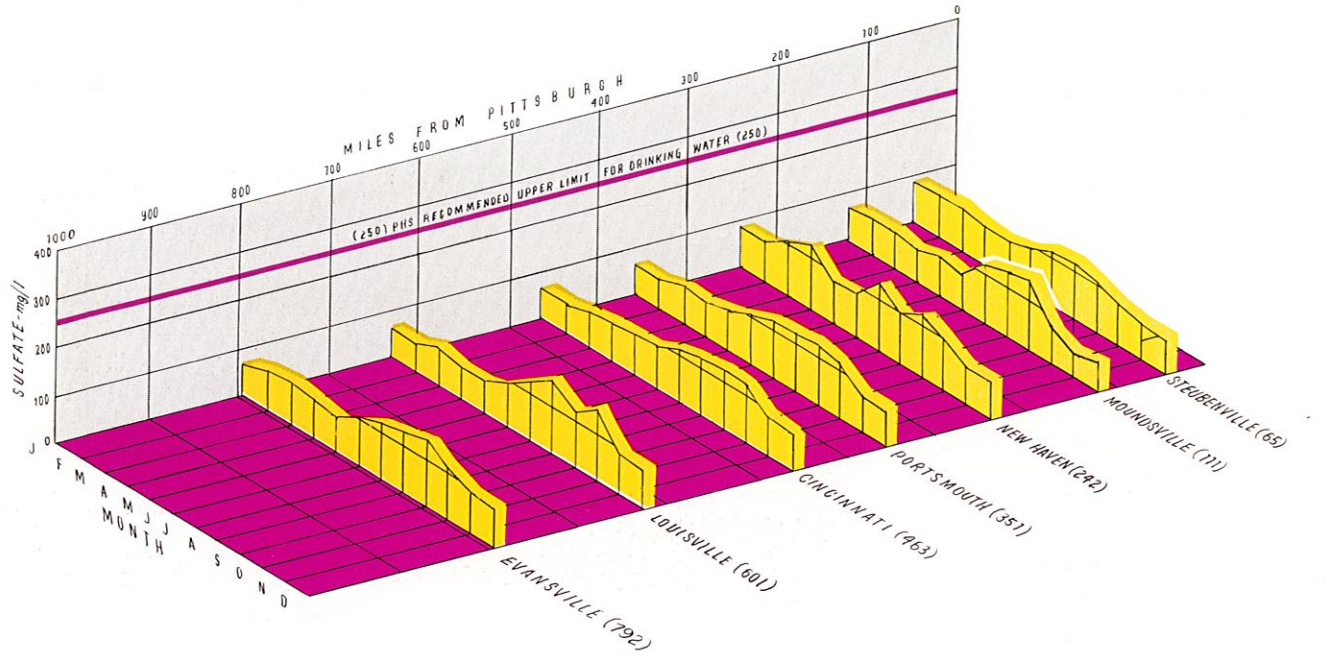


HARDNESS PROFILES — 1970

(Monthly-average values)



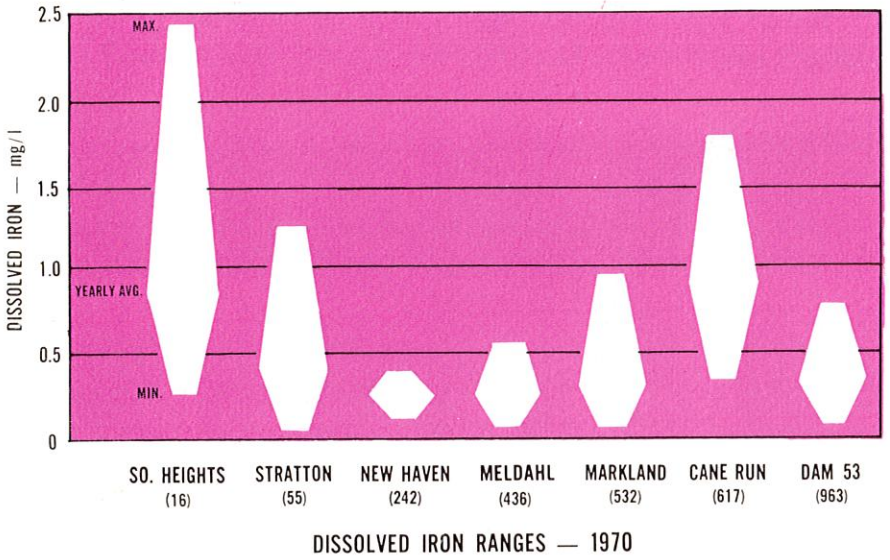
CHLORIDE PROFILES — 1970
(Monthly-average values)



SULFATE PROFILES — 1970
(Monthly-average values)

CHLORIDE - All concentrations of chloride reported in 1970 were well below the limit of 250 mg/l recommended by the U.S. Public Health Service for drinking water. The maximum monthly-average value in 1970 was 80 mg/l (at New Haven in May). The lowest monthly-average value during the year was 10 mg/l (at South Heights in January and Willow Island in April).

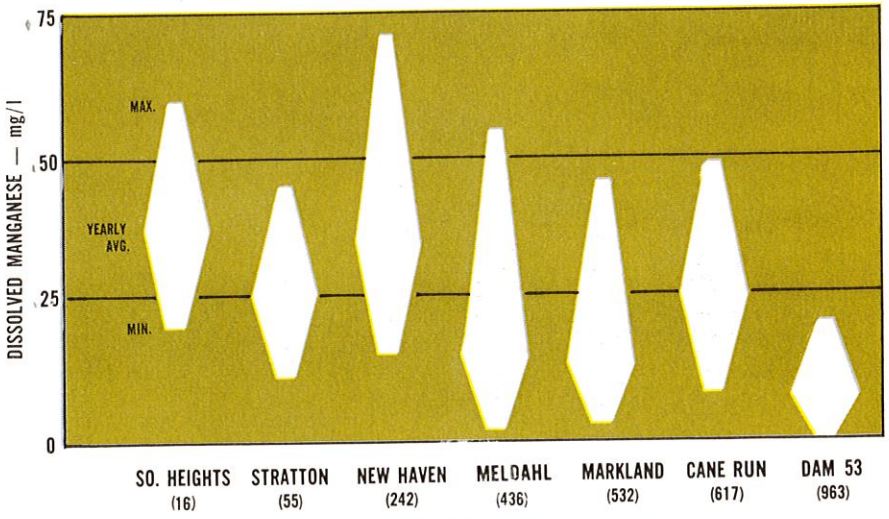
SULFATE - The accompanying profiles show monthly-average concentrations of sulfate at seven stations during 1970. All values were below 250 mg/l, the upper limit recommended for drinking water by the Public Health Service. The highest monthly-average concentration recorded at these stations was 151 mg/l, which value was observed at Louisville in October.



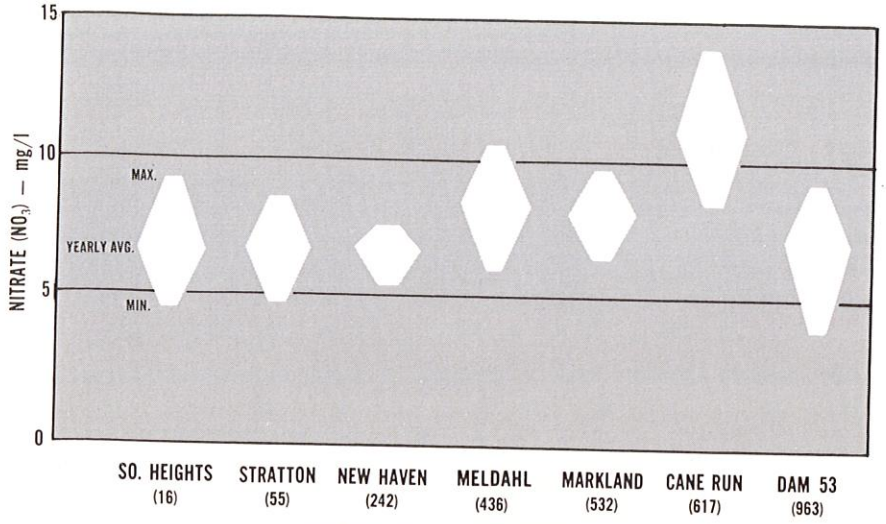
DISSOLVED IRON RANGES — 1970

IRON -- Levels of iron in 1970 were slightly lower than in 1969. No criteria for dissolved iron have been adopted as yet by ORSANCO. The Engineering Committee has concluded that there is insufficient evidence to justify establishment of such criteria for public-water supply at this time. With regard to aquatic life, the ORSANCO Aquatic Life Advisory Committee has concluded that " . . . the setting of allowable levels for iron and manganese in mg/l is unrealistic, of little practical value, and can be very misleading."

MANGANESE - The accompanying chart shows maximum monthly-average, yearly-average, and minimum monthly-average concentrations of manganese at seven locations along the Ohio River during 1970. Concentrations in 1970 tended to be slightly lower than concentrations observed in the previous year.



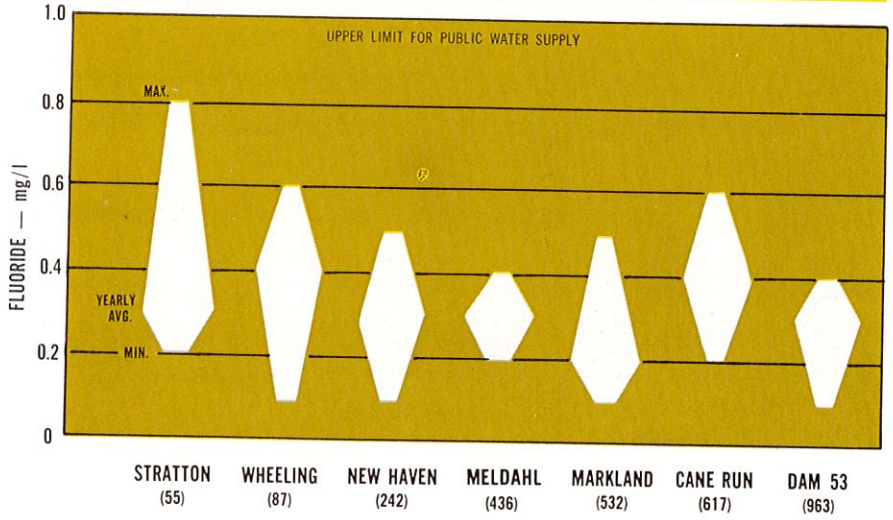
DISSOLVED MANGANESE RANGES — 1970



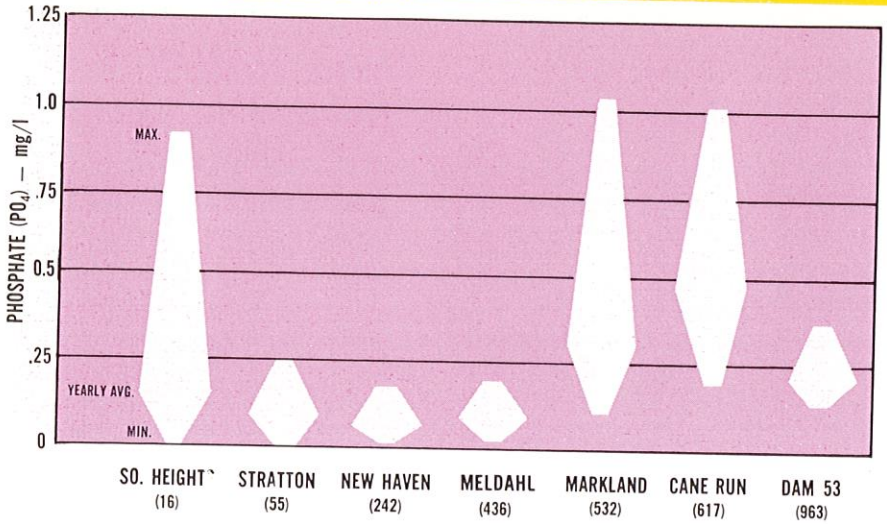
NITRATE (NO_3) RANGES — 1970

NITRATE - The accompanying chart shows maximum monthly-average, yearly-average, and minimum monthly-average values of nitrate concentrations at monitoring locations on the Ohio River during 1970. Values ranged from 4.0 mg/l (at Dam 53) to 14.0 mg/l (at Louisville). All values during the year were well below 45 mg/l, the limiting value for drinking water recommended by the U.S. Public Health Service.

FLUORIDE - The accompanying chart shows maximum monthly-average, yearly-average values and minimum monthly-average values of fluoride concentrations at monitoring locations on the Ohio River during 1970. Values ranged from 0.1 mg/l to 0.8 mg/l. The highest single value recorded during the year was 1.0 mg/l (at Wheeling), which value coincides with the upper limit specified in the ORSANCO criteria for public water supply.



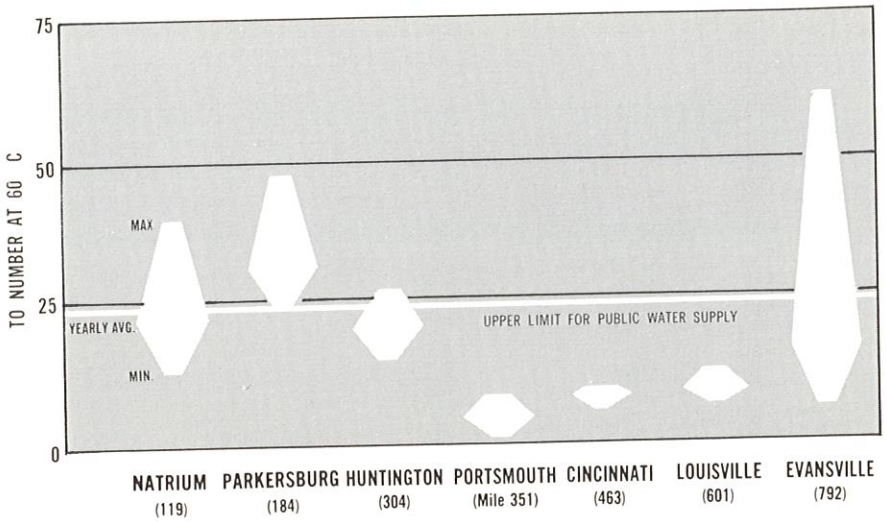
FLUORIDE RANGES — 1970



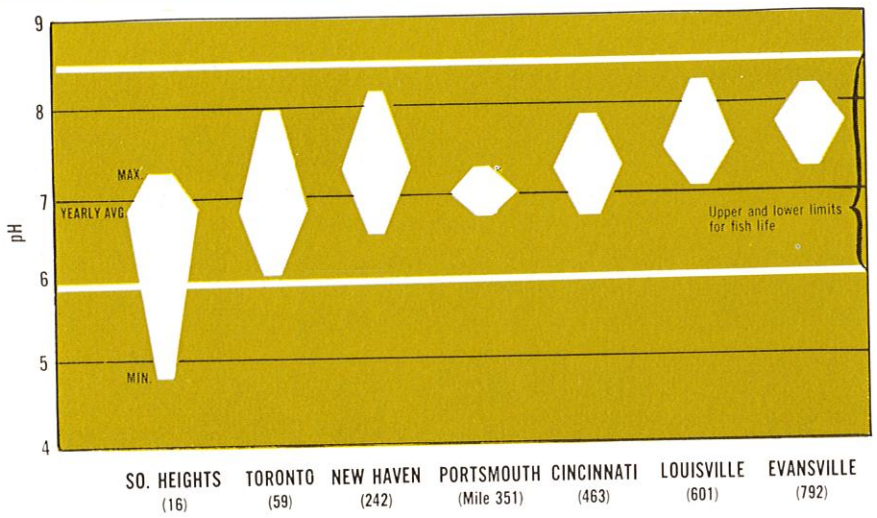
PHOSPHATE (PO_4) RANGES — 1970

PHOSPHATE - The accompanying chart shows maximum monthly-average, yearly-average, and minimum monthly-average concentrations of phosphate at seven locations along the Ohio River. Concentrations ranged from 0.0 mg/l (at South Heights and Stratton) to 1.0 mg/l (at Markland and Cane Run). This range in concentration is essentially the same as that observed for the past several years. The highest single value recorded in 1970 was 2.2 mg/l (at Markland).

THRESHOLD-ODOR CONDITIONS - The ORSANCO criteria for public water supply specify that threshold-odor numbers of raw river water should not exceed 24. This specification was met 100 percent of the time at Portsmouth, Cincinnati and Louisville. At other stations, threshold-odor numbers of 24 or less were observed as follows: 70 percent of the time at Parkersburg; 80 percent of the time at Natrium; and 89 percent of the time at Evansville.



THRESHOLD-ODOR NUMBER RANGES — 1970

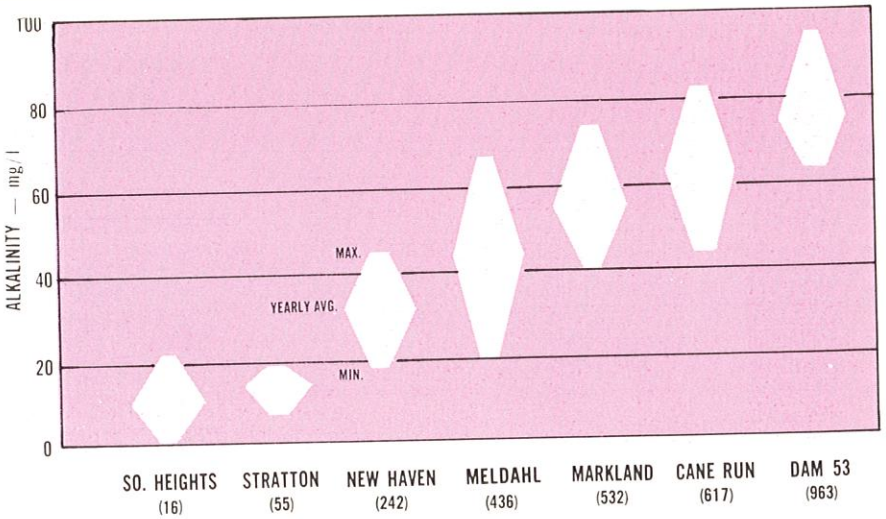


pH RANGES — 1970

pH CHARACTERISTICS - During 1970 over ninety-nine percent of all values were within the desired range of 6.0 to 8.5, as prescribed in the ORSANCO criteria. In the upper portion of the river, pH values tend to be on the low side of the desired range. This tendency is attributed, for the most part, to the influence of mine drainage. At some stations in the lower portion of the river, values tend toward the high side of the desired range. This latter tendency may be attributed to industrial operations and algal conditions.

ALKALINITY - Ranges in alkalinity concentrations are shown in the accompanying graph. Concentrations were lowest in the upper reaches of the river and increased progressively moving downstream. The following yearly-average values, for example, were recorded: 11 mg/l at South Heights (mile 16), 31 mg/l at New Haven (242), 63 mg/l at Cane Run (617) and 75 mg/l at Dam 53 (963).

Low levels of alkalinity in the upper river can be attributed in



ALKALINITY RANGES — 1970

large part to the influence of acid mine drainage from tributary streams. For example, the yearly-average concentration of 11 mg/l in the Ohio River at South Heights may be compared with yearly-average values of 6 mg/l in the Allegheny River (at Oakmont) and 8 mg/l in the Monongahela River (at South Pittsburgh).

TEMPERATURE - The Commission has established the following table of allowable temperature values (maximum not to be exceeded at any time during the month specified) for the Ohio River:

Month	Maximum allowable temperature (deg. F)	Month	Maximum allowable temperature (deg. F)
January	50	July	89
February	50	August	89
March	60	September	87
April	70	October	78
May	80	November	70
June	87	December	57

Measurements made in 1970 at 17 robot monitor stations indicate that 99.5 percent of all readings during the year were within maximum allowable values as set forth in the foregoing table. The highest single value recorded was 89.8 deg. at New Haven in August.

The following table shows the percent of readings that were within criteria specifications at each of the 17 stations:

Location	Mile Point	Percent of values with criteria specifications
South Heights	16	100
Stratton	55	100
Willow Island	161	100
New Haven	242	99
Huntington	304	99
Meldahl	436	100
Beckjord	453	100
Cincinnati	463	100
West End	471	96
Anderson Ferry	479	100
Miami Fort	490	99
Aurora	497	99
Markland	532	99
Clifty Creek	560	100
Louisville	601	100
Cane Run	617	99
Evansville	792	100

RADIOACTIVE SUBSTANCES -- During 1970 analyses on levels of radioactivity were made by the federal Environmental Protection Agency on 134 samples of Ohio River water. Following is a summary of results of these analyses, expressed in terms of picocuries per liter (pc/l):

	Dissolved	Suspended	Total
Alpha	0 to 4	0 to 9	0 to 9
Beta	0 to 24	0 to 43	1 to 49

The ORSANCO criteria for public water supply specify that activity from dissolved alpha emitters should not exceed 3 pc/l, that gross beta activity should not exceed 1,000 pc/l and that activity from dissolved strontium-90 should not exceed 10 pc/l.

Findings in 1970 indicate that, with the exception of one analysis for dissolved alpha emitters, radioactivity levels in the Ohio River were within levels specified in the criteria. No information is available on activity from dissolved strontium-90 during 1970.

OTHER CHEMICAL CONSTITUENTS -- The following paragraphs summarize results of analyses made in 1970 for other chemical constituents. Findings reveal that, except in the case of lead, virtually all results were within maximum allowable values specified either in the ORSANCO criteria or in USPHS drinking water standards.

Arsenic: 116 samples from 24 locations; maximum observed value was 0.01 mg/l; 53 samples were reported as "less than" 0.050 mg/l the upper limit specified in the ORSANCO criteria.

Barium: 39 samples from 10 locations were analyzed; maximum value was 0.186 mg/l and the average concentration was 0.081 mg/l; limiting value for barium specified in the ORSANCO criteria is 1.0 mg/l.

Cadmium: 165 samples from 22 locations were analyzed; reported concentrations were 0.010 mg/l or less in 125 samples and less than 0.020 mg/l in 40 samples; limiting value for cadmium specified in the criteria is 0.010 mg/l.

Chromium: 161 samples from 22 locations were analyzed for total chromium; all samples showed concentrations of 0.042 mg/l or less; since the analysis measured both trivalent and hexavalent chromium, it is evident that levels of hexavalent chromium were well below the limit of 0.050 mg/l specified in the ORSANCO criteria.

Copper: 157 samples from 22 locations were analyzed; the maximum concentration was 0.20 mg/l and the average value for all samples was 0.024 mg/l; limiting value for copper specified in USPHS drinking water standards is 1.0 mg/l.

Cyanide: 57 samples from 8 locations were analyzed; two samples were reported to contain 0.03 mg/l cyanide and 55 values contained less than 0.02 mg/l; the limiting value for cyanide specified in the ORSANCO criteria is 0.025 mg/l.

Selenium: 23 samples from 13 locations were analyzed; the maximum reported value was 0.004 mg/l, well below the limit of 0.01 mg/l specified in the ORSANCO criteria.

Lead: 152 samples from 22 locations were analyzed; the maximum value was 0.116 mg/l, and 18 samples had concentrations in excess of 0.05 mg/l, the limiting concentration specified in the ORSANCO criteria; with two exceptions, the high lead values were found in monthly-composite samples collected in August and September and in quarterly-composite samples collected during July-September; the remaining two high values were found in quarterly-composite samples collected during October-December.

Silver: 57 samples from 15 locations were analyzed; all values were reported as less than 0.002 mg/l; the limiting value specified in the ORSANCO criteria is 0.05 mg/l.

Zinc: 94 samples from 16 locations were analyzed; the maximum concentration was 0.38 mg/l and the average for all samples was 0.06 mg/l; the limiting value for zinc specified in USPHS drinking water standards is 5.0 mg/l.

Berylium: 49 samples from 10 locations were analyzed; all values were reported as less than 0.0002 mg/l.

Boron: 32 samples from 8 locations were analyzed; concentrations ranged from 0.034 to 0.375 mg/l.

Cobalt: 113 samples from 16 locations were analyzed; the maximum concentration was 0.050 mg/l.

Molybdenum: 40 samples from 10 locations were analyzed; concentrations ranged from less than 0.040 to 0.124 mg/l.

Nickel: 132 samples from 22 locations were analyzed; concentrations in all samples were less than 0.10 mg/l.

Strontium: 38 samples from 10 locations were analyzed; concentrations varied from 0.088 to 0.67 mg/l.

Vanadium: 39 samples from 10 locations were analyzed; all samples were reported as less than 0.040 mg/l.

QUALITY CONDITIONS IN TRIBUTARIES

In general, quality conditions in tributary streams during 1970 were slightly better than in previous years. The Monongahela continued to be high in sulfate, iron and manganese, and low in pH. The Muskingum River contained high concentrations of chloride, hardness-producing materials and dissolved solids. The Kanawha River was characterized by low dissolved-oxygen conditions on occasion.

TEMPERATURE -- Recordings of temperature were made during 1970 at seven monitor stations located on tributaries. The following table provides a comparison between maximum temperatures observed at each station in each month with maximum allowable temperature as recommended by federal EPA for adoption by the signatory states:

Month	Maximum Allowable Temp. (deg.F)	Maximum Observed Temperature (deg. F.)						
		Allegheny	Monongahela	Beaver	Muskingum	Kanawha	Big Sandy	Wabash
Jan.	50	36	44	43	43	41	41	45
Feb.	50	36	46	46	44	44	44	44
March	60	42	50	47	49	49	52	54
April	70	59	66	65	76(a)	65	65	65
May	80	69	78	79	76	82(b)	78	77
June	90	78	82	84	82	90	87	84
July	90	81	87	86	85	87	89	89
Aug.	90	85	87	86	89	88	87	90
Sept.	90	78	84	83	85	86	83	87
Oct.	78	68	76	72	71	79(c)	67	70
Nov.	70	56	68	60	66	64	59	58
Dec.	57	46	55	48	55	54	55	53

(a) 15% of hourly values at Beverly over 70 deg.
(b) Less than 1% of hourly values at Winfield over 80 deg.
(c) Less than 1% of hourly values at Winfield over 78 deg.

ALKALINITY -- During 1970 alkalinity concentrations in tributaries ranged from 0 to 158 mg/l. The accompanying table shows maximum monthly-average, yearly-average and minimum monthly-average values of alkalinity concentrations at eleven monitor locations on eight tributaries.

Tributary	Station	Alkalinity mg/l Max.	Avg.	Min.
Allegheny	Wilkinsburg	36	24	2
	Oakmont	10	5	0
Monongahela	So. Pittsburgh	14	5	1
	Point Marion	8	1	0
Beaver	Beaver Falls	66	58	42
Muskingum	Beverly	116	92	68
	Philo	156	109	71
Kanawha	Winfield	27	19	13
New	Glen Lyn	53	46	39
Big Sandy	Louisa	104	56	26
Wabash	Hutsonville	158	99	71

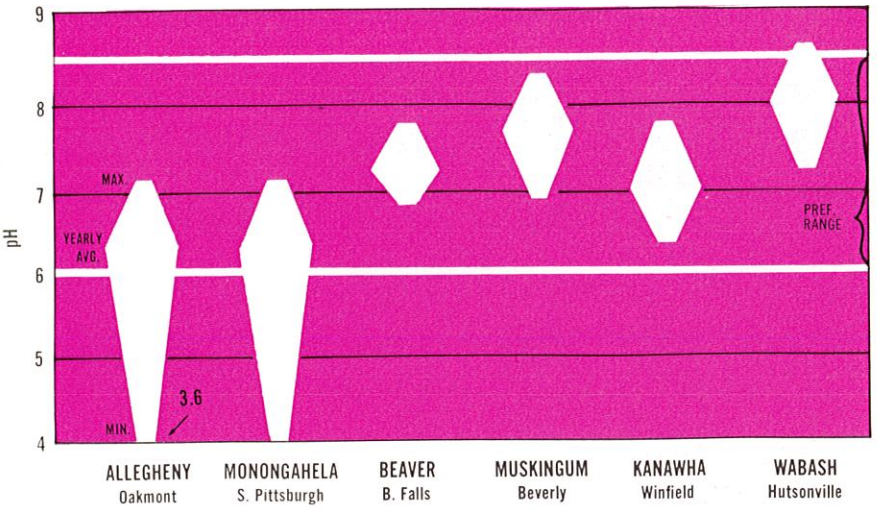
RADIOACTIVE SUBSTANCES -- During 1970 the federal Environmental Protection Agency analyzed 115 samples from fourteen tributaries for levels of radioactivity. Following is a summary of results of these analyses, expressed in picocuries per liter (pc/l):

	Dissolved	Suspended	Total
Alpha	0 to 4	0 to 6	0 to 10
Beta	1 to 51	0 to 45	1 to 68

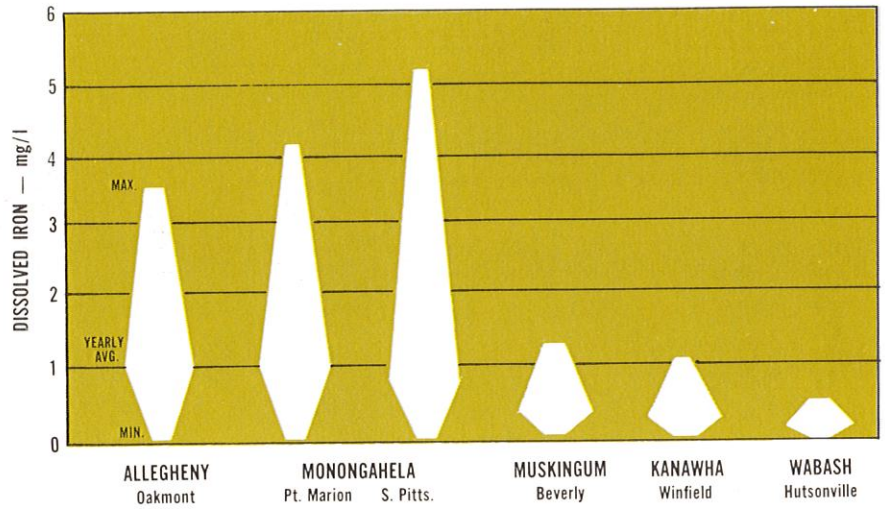
This summary shows that, with the exception of one analysis for dissolved alpha emitters, radioactivity levels in the tributary samples were within levels specified in the ORSANCO criteria.

The ORSANCO criteria for public water supply specify that gross beta activity should not exceed 1,000 pc/l, that activity from dissolved alpha emitters should not exceed 3 pc/l.

pH CHARACTERISTICS – In the Beaver, Muskingum and Kanawha all values were within the range of 6.0 to 8.5. Both the Allegheny and Monongahela rivers are characterized by low pH values on occasion. Minimum single values and minimum monthly-average values were: 3.6 and 5.7 on the Allegheny; 4.0 and 5.7 on the Monongahela. The Wabash normally shows high pH levels. The yearly-average value in 1970 was 8.0, the maximum monthly-average value was 8.5, and the maximum single value was 8.6.



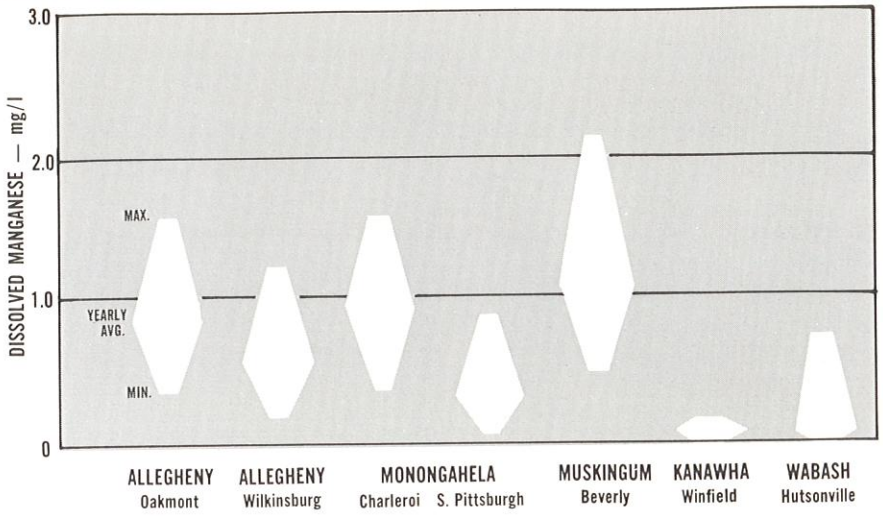
pH RANGES — 1970



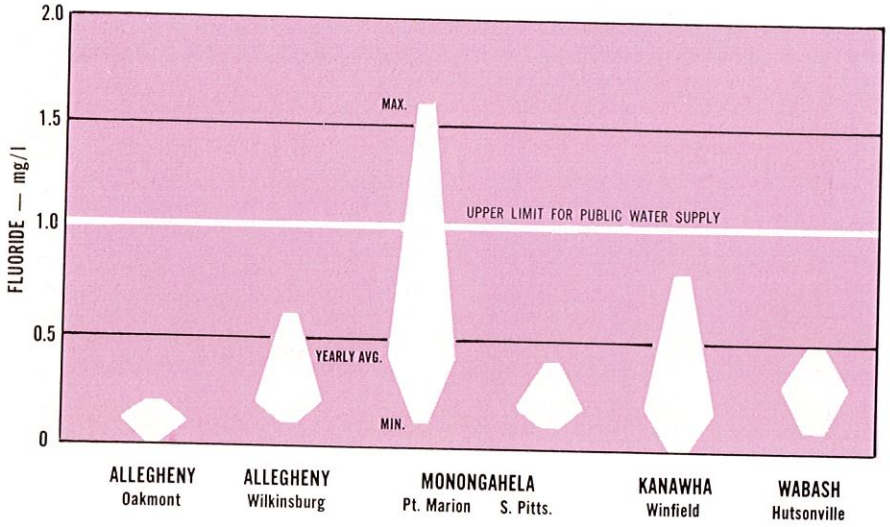
DISSOLVED IRON RANGES — 1970

IRON - In terms of yearly-average values, levels of iron were lower in 1970 than in 1969 at four monitor locations: Pt. Marion on the Monongahela, Beverly on the Muskingum, Winfield on the Kanawha and Hutsonville on the Wabash. At the other two stations, Oakmont on the Allegheny and South Pittsburgh on the Monongahela, levels of iron were essentially the same in the two years.

MANGANESE - Concentrations of dissolved manganese in 1970 ranged from zero to 2.16 mg/l. Average levels of manganese in 1970 were, in general, slightly less than corresponding levels in 1969.



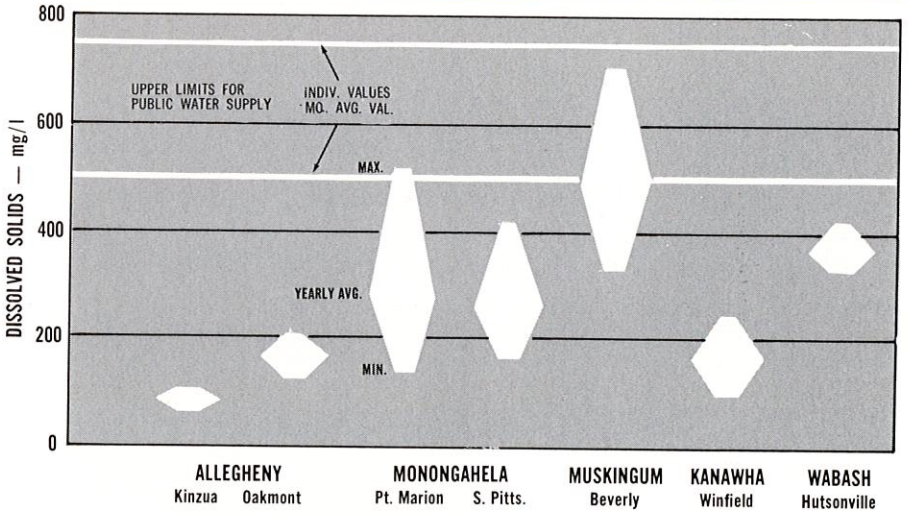
DISSOLVED MANGANESE RANGES — 1970



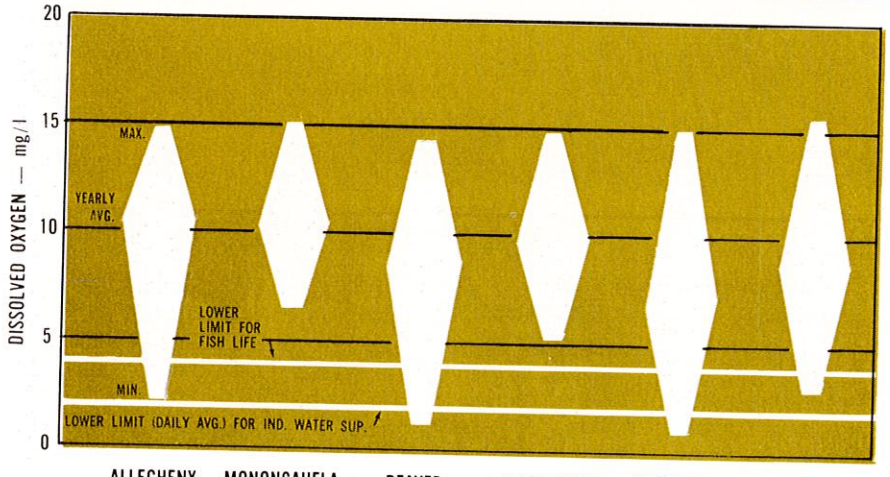
FLUORIDE RANGES — 1970

FLUORIDE – The highest concentration of fluoride observed in tributaries during 1970 was 1.6 mg/l, which value was recorded at Pt. Marion on the Monongahela River. Ranges in concentration observed in 1970 were essentially the same as those observed in the past several years.

DISSOLVED SOLIDS -- The dissolved solids criterion for public water supply was met 92 percent of the time in 1970. No individual values exceeded 750 mg/l the upper limit specified in the criterion. Some monthly-average values (on the Monongahela and the Muskingum rivers) were in excess of 500 mg/l, a limitation included in the criterion. The industrial-water-supply criterion (concentration not to exceed 750 mg/l as a monthly-average value, nor exceed 1,000 mg/l at any time) was met 100 percent of the time at all stations.



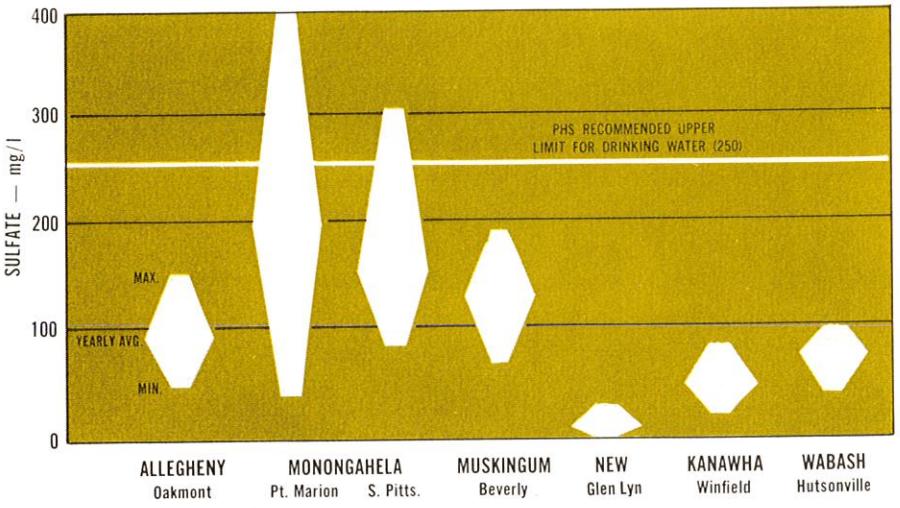
DISSOLVED SOLIDS RANGE — 1970



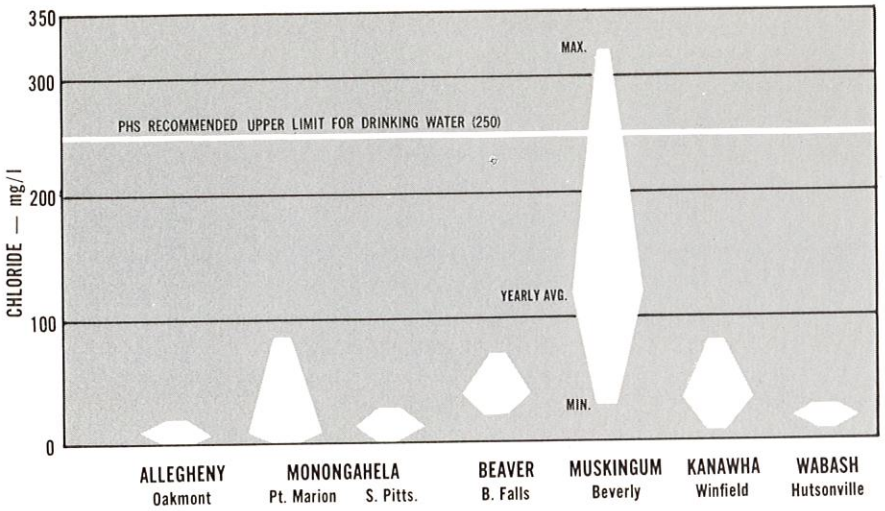
DISSOLVED OXYGEN RANGES — 1970

DISSOLVED OXYGEN - The accompanying chart shows ranges of DO levels during 1970 at six tributary locations. Hourly values ranged from 1.0 mg/l on the Kanawha River to 15.5 mg/l on the Wabash River. Taken collectively, the data show that DO criteria adopted by ORSANCO were met 83 percent of the time on tributaries.

SULFATE - Ranges in sulfate concentration during 1970 are shown in the accompanying chart. Except on the Monongahela, all values were well below the PHS recommended upper limit for drinking water (250 mg/l). The range was from a minimum of 2 mg/l on the New River at Glen Lyn, to a maximum of 400 mg/l on the Monongahela River at Point Marion.



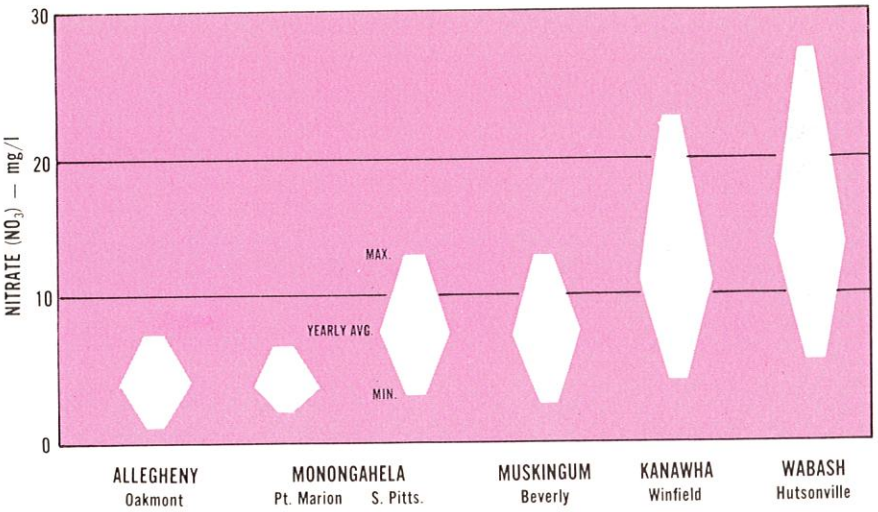
SULFATE RANGES — 1970



CHLORIDE RANGES — 1970

CHLORIDE - The accompanying chart shows chloride concentrations at seven sampling stations on tributaries. Over ninety-nine percent of all values were below 250 mg/l, the recommended upper limit for drinking water in USPHS standards. Only on the Muskingum River, and only four times, did chloride concentrations exceed 250 mg/l, the PHS recommended upper limit for drinking water.

NITRATE -- Measurement of concentrations of nitrate during 1970 show that all values were well below the limiting value of 45.0 mg/l established for drinking water by the U.S. Public Health Service. Values ranged from a minimum of 1.7 mg/l at Oakmont on the Allegheny to a maximum of 27.0 mg/l at Hutsonville on the Wabash River.



NITRATE (NO_3) RANGES — 1970

COLIFORM DENSITY -- Coliform densities were measured at Wilkinsburg on the Allegheny River, at South Pittsburgh on the Monongahela River, and at Beaver Falls on the Beaver River.

The extent to which coliform specifications in the ORSANCO criteria for public-water supply were met is shown in the following tabulation, together with information on maximum and yearly-average values:

	Wilkinsburg	So. Pittsburgh	Beaver Falls
Number of months in which average coliform counts did not exceed 5,000 per 100 ml	7	6	0
Number of months in which 80 percent or more of daily values were less than 5,000 per 100 ml	6	5	0
Number of months in which 95 percent or more of daily values were less than 20,000 per 100 ml	8	11	0
Maximum monthly-average value (coliform per 100 ml)	32,400	11,200	55,800
Yearly - average value (coliforms per 100 ml)	8,000	5,100	29,000

The extent to which specifications in the criteria for recreational use were met during the months of May through September is shown in the following tabulation, together with information on maximum and seasonal-average values:

	Wilkinsburg	So. Pittsburgh	Beaver Falls
Number of months in which average coliform counts did not exceed 1,000 per 100 ml	1	6	0
Number of months in which 80 percent or more of daily values were less than 1,000 per 100 ml	0	5	0
Number of months in which all daily values were less than 2,400 per 100 ml	0	11	0
Maximum monthly-average value (coliforms per 100 ml)	32,400	11,200	19,900
Seasonal-average value (coliform per 100 ml)	11,000	7,400	16,400

OTHER CHEMICAL CONSTITUENTS - Limiting concentrations for heavy metals are specified in ORSANCO criteria and U.S. Public Health Service standards. The following paragraphs provide a comparison between the limits that have been specified and results of analyses made in 1970 on samples taken from tributary streams (analyses made under USGS-ORSANCO cooperative arrangement or by federal Environmental Protection Agency).

Allegheny River: 90 analyses; concentrations of the following substances within specified limits in all samples analyzed: arsenic (specified limit: 0.05 mg/l), cadmium (0.01 mg/l), chromium (0.05 mg/l), copper (1.00 mg/l), cyanide (0.025 mg/l), lead (0.05 mg/l), zinc (5.00 mg/l).

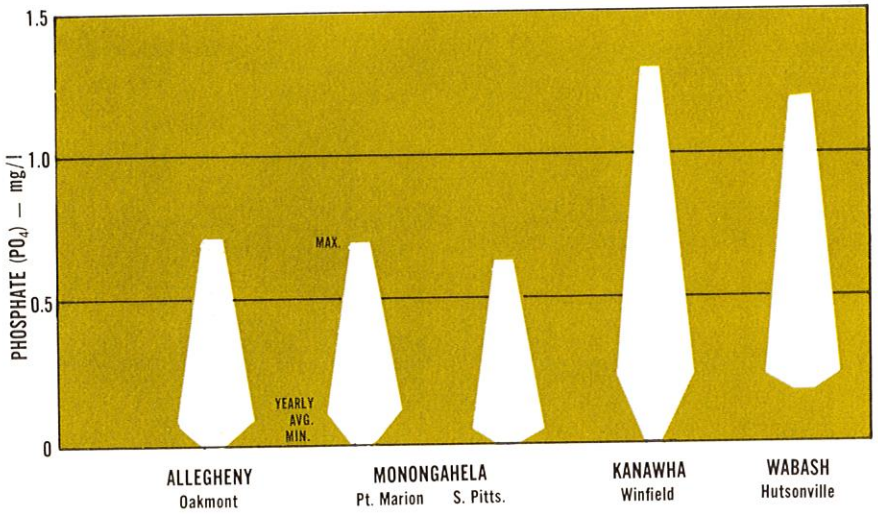
Monongahela River: 74 analyses; concentrations of the following substances within specified limits in all samples analyzed: arsenic, cadmium, chromium, copper, zinc. Eight of seventeen samples analyzed for cyanide contained concentrations in excess of the specified limit of 0.025 mg/l; highest value observed was 0.060 mg/l. Two of seven samples analyzed for lead contained concentrations in excess of the specified limit of 0.05 mg/l; highest value observed was 0.07 mg/l.

Beaver River: 18 analyses for cyanide, three of which showed concentrations exceeding the specified limit of 0.025 mg/l. Highest value observed was 0.040 mg/l.

Muskingum, Kanawha, Guyandot and Big Sandy rivers: six analyses for cyanide on the Muskingum, Guyandot and Big Sandy, five analyses for cyanide on the Kanawha, one analysis for arsenic on each river; concentrations of cyanide and arsenic within specified limits in all samples analyzed.

Wabash River: 92 analyses; concentrations of the following substances within specified limits in all samples analyzed: cadmium, chromium, copper, lead, silver.

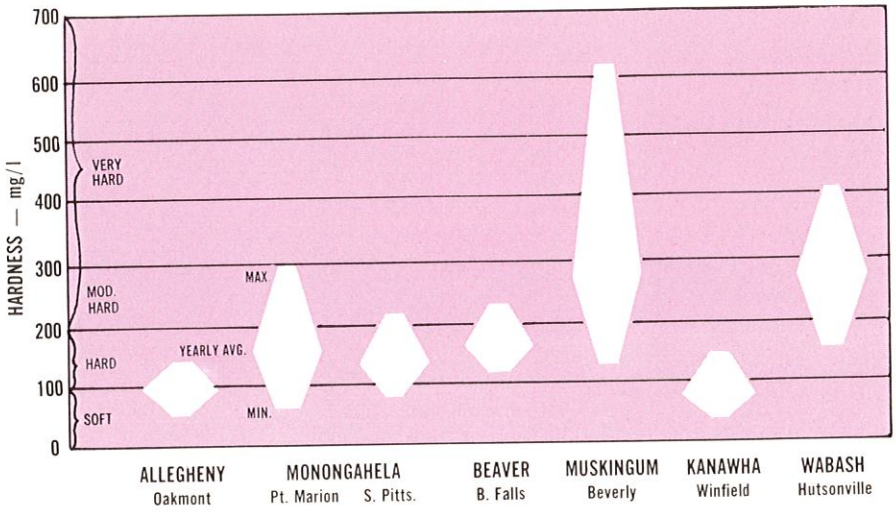
Little Miami, Licking, Whitewater, Great Miami and Kentucky rivers: four quarterly-composite samples from each river; concentrations of the following substances within specified limits in all samples analyzed: arsenic, barium (specified limit: 1.00 mg/l), cadmium, chromium, copper, selenium (0.01 mg/l), silver (0.05 mg/l), zinc. Three samples, one each from the Little Miami, Licking and Whitewater, contained concentrations of lead in excess of the specified limit of 0.05 mg/l; values observed in these samples were: 0.100 mg/l on the Little Miami, 0.214 mg/l on the Licking, 0.070 mg/l on the Whitewater.



PHOSPHATE (PO_4) RANGES — 1970

PHOSPHATE -- Concentrations of phosphate observed at stations on five tributaries in 1970 are summarized in the accompanying chart. Values ranged from 0.0 mg/l (on the Allegheny, Monongahela and Kanawha rivers) to 1.30 mg/l (on the Kanawha).

HARDNESS -- Ranges in hardness levels at seven sampling locations are shown in the chart. Findings show that hardness concentrations in 1970 in tributaries ranged from "soft" to "very hard" on the basis of designations adopted by the U.S. Geological Survey (see page 14).



HARDNESS RANGES — 1970

TALLY FOR THE VALLEY

THE STATUS OF POLLUTION CONTROL FACILITIES at all sewered communities and industrial establishments discharging directly to streams in the compact district is compiled from information submitted annually by each of the signatory states. Highlights and summaries of the status of control facilities for the year ending June 30, 1971, follow:

Municipal status – On the main stem of the Ohio River, 129 sewage-treatment plants serve 291 communities which comprise 99.5 percent of the 3,575,000 sewered population. For the compact district as a whole, 1,218 treatment plants serve 1,498 communities which comprise 95.8 percent of the 12,040,000 sewered population.

For the compact district, construction of new facilities, either new plants or improvements to existing plants, was completed at 27 locations serving 25 communities and a sewered population of 99,800. In addition, new facilities or improvements to existing facilities were under construction at 66 locations serving 153 communities and a sewered population of 2,145,000. Twenty-three of the plants that were completed or placed under construction are located on the Ohio River main stem, and will serve 98 communities with a population of 1,530,000.

The following tabulation shows percentages of sewered population on the Ohio River and in tributary basins in relation to the degree of treatment provided:

Degree of treatment	Percent of sewered population	
	Ohio River	Tributary Basins
None	0.5	5.8
Primary	38.6	13.3
Intermediate	58.9	8.8
Secondary	2.0	71.4
Tertiary		0.7

The adoption on November 13, 1970, of ORSANCO pollution control standards Nos. 1-70 and 2-70 requires communities on the Ohio River to install additional facilities to provide a higher degree of treatment than can be attained with most existing plants. This means that they will have to install "secondary" treatment facilities which will provide for solids removal and for the required 85 to 92 percent BOD reduction.

Industrial Status – 1,648 industrial plants discharge wastewater directly to surface waters in the compact district. Of these 1,347 (81.7 percent) comply with minimum requirements established by ORSANCO, and 1,217 (73.8 percent) comply with minimum and other control requirements established by ORSANCO and the states.

Basin status – the 19 major streams tributary to the Ohio River range in size from the Little Kanawha with a sewered population of 11,000 and a drainage area of 1,185 square miles, to the Wabash River with a sewered population of 2,263,000 and a drainage area of 33,000 square miles. The following table shows, for each river basin, the sewered population and the percent of this population served by treatment facilities, and the number of industrial plants and the percent of these plants reported as complying with all applicable control requirements.

Basin	Sewered Population (thousands)	Percent of population served by treatment facilities	Number of industrial plants	Percent of plants complying with requirements
Ohio River	3,575	99.5	209	70.0
Allegheny	777	85.4	188	76.6
Monongahela	700	70.7	185	80.0
Beaver	660	99.5	121	71.9
Muskingum	563	98.7	116	71.6
Little Kanawha	11	82.0	5	100.0
Hocking	89	97.6	4	75.0
Kanawha	381	91.0	120	69.2
Guyandot	18	87.1	47	53.2
Big Sandy	67	76.1	75	65.3
Scioto	924	99.6	31	64.5
Little Miami	179	99.5	7	85.7
Licking	48	99.1	5	60.0
Great Miami	929	99.8	63	69.8
Kentucky	153	100.0	26	92.3
Salt	90	100.0	20	85.0
Green	91	99.1	23	95.6
Wabash	2,263	97.3	247	72.1
Cumberland	69	100.0	19	94.7
Tennessee	113	85.5	23	82.6
Minor tributaries	345	94.1	114	81.6
TOTAL	12,044	95.8	1,648	73.8

STATUS OF MUNICIPAL AND INSTITUTIONAL SEWAGE-TREATMENT FACILITIES–July 1, 1971

Number of communities (top numbers) and population (bottom numbers)

STATUS	ILL.	IND.	KY.	N.Y.	OHIO	PA.	VA.	W.VA.	TOTAL	% OF TOTAL
Control currently acceptable	69 345,972	171 1,612,528	201 1,179,217	4 14,340	280 2,035,995	253 1,326,396	42 132,804	113 535,648	1,133 7,182,900	63 2 59.6
Treatment provided, improvements needed	7 14,799	62 492,358	4 7,770	9 61,790	95 1,473,806	31 146,078	32 62,659	2 945	242 2,260,205	13.5 18.8
Treatment provided, improvements under construction	1 250	8 161,810	5 91,860	1 21,800	21 410,341	80 1,310,986	2 2,475	5 93,510	123 2,093,032	6.9 17.4
New treatment works under construction		9 7,285	1 450	1 8,480	1 921	11 23,678	4 7,610	3 2,904	30 51,328	1.6 0.4
No treatment; construction not started	7 9,720	48 44,604	4 4,967	2 2,350	20 22,457	92 205,596	9 12,210	83 154,408	265 456,312	14.8 3.8
TOTAL	84 370,741	298 2,318,585	215 1,284,264	17 108,760	417 3,943,520	467 3,012,734	89 217,758	206 787,415	1,793 12,043,777	100.0 100.0

STATUS OF INDUSTRIAL WASTE CONTROL FACILITIES – July 1, 197 1

STATUS	ILL.	IND.	KY.	N.Y.	OHIO	PA.	VA.	W.VA.	TOTAL	% OF TOTAL
Complying with ORSANCO minimum requirements	28	209	161	15	277	372	47	238	1,347	81.7
Control currently acceptable	28	193	154	8	249	352	45	188	1,217	73.9
Control facilities inadequate, improvements in progress	4	15			23	11		10	63	3.8
New control facilities under construction	2	1			3	3			9	0.6
Improvements or new control facilities being planned	5	35	2	17	51	17	1	39	167	10.1
No effective action	8	21	12	5	35	38	4	69	192	11.6
Number of Industries	47	265	168	30	361	421	50	306	1,648	100.0

Chairman Raymond H. Fuller

ADMINISTRATIVE AFFAIRS

On June 30, 1948, eight states entered into a compact to cooperate in abating existing pollution and control future pollution of the waters of the Ohio Valley district. The compact "district" includes that portion of the Ohio Valley drainage basin that lies within the boundaries of the following states: Illinois, Indiana, Kentucky, New York, Ohio, Pennsylvania, Virginia and West Virginia.

The Ohio River Valley Water Sanitation Commission was established as the agency to administer the provisions of the compact. It is the role of the Commission to coordinate and supplement the efforts of its signatory states in a regional water-pollution control program.

The Commission is composed of three representatives from each of the eight signatory states and three members representing the United States government. State commissioners are appointed by their respective governors. Federal commissioners are appointed by the President of the United States. Commissioners receive no monetary compensation but are reimbursed for expenses incurred in the discharge of their duties in connection with Commission activities.

For the fiscal year starting July 1, 1971, Raymond H. Fuller served as chairman of the Commission and James S. Shropshire as vice-chairman. These offices are filled from the membership of the commission for a one-year term. The post of secretary has been filled since 1948 by Fred H. Waring, who retired as chief engineer of the State of Ohio in 1961. Mrs. Verna B. Ballman, a member of the Commission staff, has served as Treasurer since 1956.

Mr. Fuller is executive director of Burgess and Niple, Limited, a consulting engineer firm based in Columbus, Ohio. He has specialized in the design, construction, operation and financing of waterworks and sewerage systems and has authored papers on these subjects. His expertise is recognized in "Who's Who in Engineering". Mr. Fuller was appointed to ORSANCO by Governor Rhodes of Ohio in 1966.

Mr. Shropshire was appointed to ORSANCO in 1968. At that time he served as commissioner of the Department of Natural Resources of the Commonwealth of Kentucky. Governor Nunn referred to him as a "man of the soil who understands agriculture and the value of soil and water." Mr. Shropshire resigned his post with the Commonwealth of Kentucky in May, 1972, and therefore no longer serves as a member of ORSANCO.

Membership changes -- At the beginning of the fiscal year two vacancies existed in federal representation. President Nixon appointed Donald T. Williams, Chief, Planning Division, Ohio River Division of the U. S. Corps of Engineers, to succeed Louis G. Feil, retired, effective July 30, 1971. Subsequently, the president named Francis T. Mayo, Regional Administrator, Region V, Environmental Protection Agency, to succeed Carl L. Klein, effective March 3, 1972.

In April of 1972 Dr. John W. Cashman assumed the duties of Director of Health of the State of Ohio, automatically becoming an ex officio member of ORSANCO. Dr. T. A. Gardner, as Acting Director of Health, served in this capacity from January, 1972 until April, 1972.

Staff changes -- The Commission acceded with regret to the request of Edward J. Cleary to assume retirement status as of December 31, 1971. Dr. Cleary served the Commission as its first executive director from February, 1949 until October, 1967. Since that time he had served as consultant to ORSANCO.

On January 12, 1972, members of ORSANCO paid tribute to Dr. Cleary at a dinner held in his honor. It was announced at that time that the American Academy of Environmental Engineers would establish an annual award in recognition of Dr. Cleary's administrative skill and leadership in advancing environmental-protection works. Gifts received from Dr. Cleary's friends and associates will be used to underwrite this award which will serve as a continuing recognition of his many contributions in the field of water quality management.

Financial – Operating funds of the Commission are derived from appropriations from the eight signatory states, the amount paid by each representing a pro rata share based one-half in proportion to population, and one-half in proportion to land area within the compact district. The appropriation for fiscal 1972 was $182,000. In addition, the Commission received a federal grant of $175,657 under the Federal Water Pollution Control Act.

Advisory Committees – The Commission makes use of a number of specialist committees. These include: an engineering committee composed of the chief engineers of state pollution-control agencies, together with technical experts from federal agencies; a group of seven industry committees representing chemical, coal, metal-finishing, oil, electric power, paper and steel interests; a water users committee composed of managers of municipal and industrial water treatment plants; and an aquatic life committee that includes scientists and fish-management specialists. In addition, the Commission retains consultants from time to time on special assignments.

CHAIRMEN OF ORSANCO ADVISORY COMMITTEES

(as of May, 1972)

Aquatic-Life Advisory Committee — LLOYD L. SMITH, JR., University of Minnesota, St. Paul, Minnesota

Chemical Industry Committee — ERNEST C. LADD, FMC Corporation, Philadelphia, Pennsylvania

Coal Industry Advisory Committee — LARRY COOK, Ohio Reclamation Association, Columbus, Ohio

Metal-Finishing Industry Action Committee — ROBERT G. CLARKE, JR., Hamilton Cosco, Inc., Columbus, Indiana

Petroleum Industry Committee — KENT G. DRUMMOND, Marathon Oil Company, Findlay, Ohio

Power Industry Advisory Committee — JAMES H. CARSON. Ohio Edison Company, Akron, Ohio

Pulp and Paper Industry Action Committee — HAROLD JUDD, Champion Paper and Fiber Company, Hamilton, Ohio

Steel Industry Action Committee — HOUSTON R. WOOD, Weirton Steel Division, Weirton, West Virginia

Water Users Committee — CARL RELYEA, National Weather Service, Cincinnati, Ohio

FINANCIAL REPORT

The following information relative to revenues collected and expenses paid, and statement of resources, was taken from the Audit Report of Wm. H. Mers and Company, Certified Public Accountants, for the year ended June 30, 1971.

OHIO RIVER VALLEY WATER SANITATION COMMISSION

STATEMENT OF REVENUES COLLECTED AND EXPENSES PAID
YEAR ENDED JUNE 30, 1971

Revenues collected:		
From signatory states:		
State of Illinois		$ 9,282.00
State of Indiana		32,942.00
Commonwealth of Kentucky		37,765.00
State of New York		2,002.00
State of Ohio		45,318.00
Commonwealth of Pennsylvania		27,664.00
Commonwealth of Virginia		6,370.00
State of West Virginia		20,657.00
		182,000.00
From U. S. Environmental Protection Agency (Grant by authority of Federal Water Pollution Control Act)		175,657.00
Sale of publications		741.55
Interest earned on bank deposit		2,427.22
Miscellaneous income		556.57
Total revenues collected		361,382.34
Expenses paid:		
From general funds	$208,509.51	
(Includes $14,075.50 encumbered at June 30, 1970)		
From federal funds	167,156.55	
Total expenses paid		375,666.06
Excess of expenses paid over revenues collected (Authorized budget of $200,000.00 provides for $18,000.00 to be used from available resources)		$ 14,283.72

STATEMENT OF RESOURCES JUNE 30, 1971

	General Funds	Federal Funds	Total
Available resources for period to June 30, 1970	$ 45,777.59	$ 697.08	$ 46,474.67
Transfer to general funds of federal funds earned in prior years	9,197.53	(9,197.53)	.....
Add: Revenues collected:			
Annual Budget–July 1, 1970 to June 30, 1971	182,000.00		182,000.00
U. S. Environmental Protection Agency		175,657.00	175,657.00
Sale of publications	741.55		741.55
Interest earned on bank deposit	2,427.22		2,427.22
Miscellaneous income	556.57		556.57
	240,700.46	167,156.55	407,857.01
Less: Expenses paid:			
July 1, 1970 to June 30, 1971	208,509.51	167,156.55	375,666.06
Available resources at June 30, 1971 before encumbrances	$ 32,190.95	$	$ 32,190.95
Encumbered resources at June 30, 1971	14,616.95		14,616.95
Available resources at June 30, 1971	17,574.00	.....	17,574.00

The above amount of $32,190.95 is comprised as follows:		
Cash on deposit with The Central Trust Company		$ 28,727.32
Cash on deposit with American Airlines, Inc.		425.00
Cash on deposit with Ohio Bureau of Workmen's Compensation		186.00
Petty cash on hand		200.00
Accounts receivable:		
Advances for employees:		
Employees' pension trust	$ 2,045.29	
Hospitalization	607.34	
Total		2,652.63
		$ 32,190.95

REGULATORY AGENCIES OF THE SIGNATORY STATES

ILLINOIS

Environmental Protection Agency
State of Illinois
Springfield, Illinois 62706
Phone: 217-525-6580

INDIANA

Indiana Stream Pollution Control Board
1330 West Michigan Street
Indianapolis, Indiana 46206
Phone: 317-633-4420

KENTUCKY

Kentucky Water Pollution Control Commission
275 East Main Street
Frankfort, Kentucky 40601
Phone: 502-564-3410

NEW YORK

Environmental Health Services
NYS Dept. of Environmental Conservation
50 Wolf Road
Albany, New York 12201
Phone: 518-457-7469

OHIO

Division of Engineering
Ohio Department of Health
P. O. Box 118
Columbus, Ohio 43216
Phone: 614-469-4470

PENNSYLVANIA

Department of Environmental Resources
P. O. Box 2351
Harrisburg, Pennsylvania 17120
Phone: 717-787-2666

VIRGINIA

State Water Control Board
P. O. Box 11143
Richmond, Virginia 23230
Phone: 703-770-2241

WEST VIRGINIA

Division of Water Resources
Department of Natural Resources
1201 Greenbrier Street
Charleston, West Virginia 25311
Phone: 304-348-2107