ORSANCO

1970

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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-SECOND YEARBOOK 1970

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

HIGHLIGHTS OF 1970

ADOPTION OF A REVISED STATEMENT OF POLICIES and an updating of quality standards for the Ohio River dominated attention of the Commission during the past year. In addition, the staff completed a report on subsurface disposal of industrial wastes and continued its endeavors in devising a mathematical model for the prediction of river-quality changes based on monitoring variations in flow, waste discharges and other factors that influence conditions.

POLICY APPRAISAL

Motivation for policy revision stemmed from a desire to codify changes that had occurred since 1948 when ORSANCO policies were first enunciated. Adaptation to new circumstances had taken place from time to time within the framework of original policy declarations, but this had been done on an ad hoc basis. It appeared appropriate, therefore, to undertake a comprehensive review and consolidation of policy considerations.

Perhaps the most significant policy declaration is that calling for secondary treatment (defined as removal of not less than 85 percent of the biochemical-oxygen-demand) of all discharges of municipal sewage and industrial waste. Heretofore the minimum requirement, except as otherwise determined after public hearing, was primary treatment (about 35 percent BOD removal). Among other things, the new policy reflects recognition that an initial goal of the ORSANCO compact—securing installation of facilities to provide at least primary treatment of all waste discharges—has now been virtually achieved.

Another new policy declaration asserts the importance of conducting performance-audits of existing treatment facilities, and to that end proposes development of a uniform program among the states for plant inspections and river surveillance.

With respect to river monitoring, the Commission has long regarded this as one of its fundamental service undertakings. Accordingly, the policy statement emphasizes expansion of ORSANCO monitoring and data-evaluation capabilities and the sharing of staff expertise on these matters with the signatory states.

These and other aspirations for enhancing the utility of ORSANCO in its conduct of a regional program of water-quality management are embodied in the statement of policies adopted May 15, 1970. The complete statement is reproduced starting on page 31.

QUALITY STANDARDS

Updating of quality standards for the Ohio River, which were first promulgated by the Commission in the period 1949-54, was contemplated five years ago. Indeed, staff studies and deliberations by the ORSANCO Engineering Committee toward this end had been undertaken even earlier. An early outcome from these endeavors was agreement among the eight states on a set of criteria for judging the suitability of river water for various uses, which was intended to establish a basis for the promulgation of uniform quality standards.

However, in 1966 an edict of the Federal Water Quality Administration stipulated that each state individually had to adopt standards for submission to the Secretary of the Interior. This apparent restriction to joint action had the effect of deterring the Commission from its statuatory task of establishing regional standards for the Ohio River and its tributaries. Action was deferred with the hope that public hearings individually conducted by the states and based on ORSANCO criteria previously adopted would result in selection of standards that would be compatible. This hope was not realized.

By late 1969 it became apparent that differences in standards for the Ohio River submitted by the various states were such as to deny complete approval by federal authorities. Since the federal authorities were experiencing difficulties in reconciling differences among some of the states, the Commission concluded it should wait no longer in the exercise of its responsibility for formulating uniform standards.

Accordingly, the ORSANCO commissioners directed the Engineering Committee (which includes the chief sanitary engineers of each state and the regional director of the Federal Water Quality Office)

and its staff to draft standards for the Ohio River to be submitted for public hearing on September 16, 1970.

The hearing board, on the basis of evidence offered at the hearing, recommended certain modifications in the original proposals. The report of the Hearing Board, including recommended changes, was submitted to the Commission for its consideration on November 13, 1970.

The new standards, as adopted by the Commission, are set forth elsewhere in this report. Of special interest are the requirements devised for prevention of thermal pollution. Orthodox approaches to this matter have relied simply on specifying temperature limits not to be exceeded in a stream. Precisely how such a ruling was to be administered posed some questions.

Accordingly, the staff proposed a quantitative basis for allowable heat output from a discharge. The calculation is made by determining the differential between actual river temperature and maximum-allowable temperature, and then converting this difference into British thermal units (Btu's) in accord with the volume of available river flow. Such a calculation provides a practical measure of how many heat units may be added to the river without exceeding the standard. The formula for doing this and other details of its application are given in the standards which are reproduced on page 35.

SUBSURFACE WASTE DISPOSAL

A staff report on the regulation of underground injection of wastewaters, submitted to the Commission on December 1, 1969, prompted the following actions:

- Development by ORSANCO of a registry of locations and details on all disposal wells drilled and tested in its district, the purpose of which is to provide a central file for the public reference needs; and
- Sponsorship of an ad hoc committee of State Geologists from each of the signatory states and a representative of the U. S. Geological Survey, whose mission is to develop guidlines on regulatory procedures and evaluation criteria pertaining to the practice of underground injection in the Ohio Valley.

Based on findings and recommendations set forth in the staff report the following specific questions have been addressed to the committee:

1. Do regulatory agencies have access to—or means of acquiring—adequate geologic, hydrologic and technologic information for evaluating the long-range feasibility of injection-well applications?

2. Where information is inadequate, what is the nature and scope of investigations and research that should be initiated to remedy these deficiencies?

3. On the basis of existing information is it possible to broadly delineate areas that appear to be (a) favorable for practice of injection; (b) utterly unsuitable; and (c) questionable pending more detailed examination?

4. Are there reasons other than convenience and economic preferment that can be advanced to justify subsurface disposal, and how valid are these reasons?

5. On the basis of theoretical considerations and practical experience, what are the risk probabilities of wastewater injection causing (a) environmental hazards; and (b) impairment of utility of the underground and future extraction of its mineral resources?

6. In view of the unknowns presently associated with the practice of subsurface injection, under what circumstances and conditions should society find it reasonable to trade off probabilities of risk?

A synopsis of the staff report dealing with public policy, legislative and legal aspects along with excerpts from the section on geological and technical considerations was published in the *Journal* of the American Water Works Association, August 1970. Reprints are available by request to the Commission.

STATUS OF INSTALLATIONS

Facilities for treating sewage from 95 percent of the 11.6 million sewered population in the district are now in operation. Control facilities for industrial wastes are installed at 83 percent of the 1,817 establishments that discharge directly into waters of the district. These and other findings relative to the current status of pollution-control installations are derived from the annual inventory, details of which are summarized in this report on pages 26-27.

Inventory data shows that almost half of the sewered population in this district is currently served by biological (so-called "secondary") treatment works, 25 percent by intermediate, and 21 percent by primary treatment processes.

RIVER QUALITY MODEL

A three-year research project looking toward development of water-quality forecast procedures and demonstration of their application to river-quality management was initiated by the staff in January 1969. Components of this endeavor, which is supported in part by the federal Water Quality Office, are: (1) design of a mathematical model that will simulate quality variations in the Ohio River; (2) evaluation of the influence of wastewater discharges, stormwater overflows, tributary discharges and other factors on quality characteristics of the river; (3) operation of a model for predicting quality changes at selected locations; and (4) application of these procedures as an analytical tool for managing water quality.

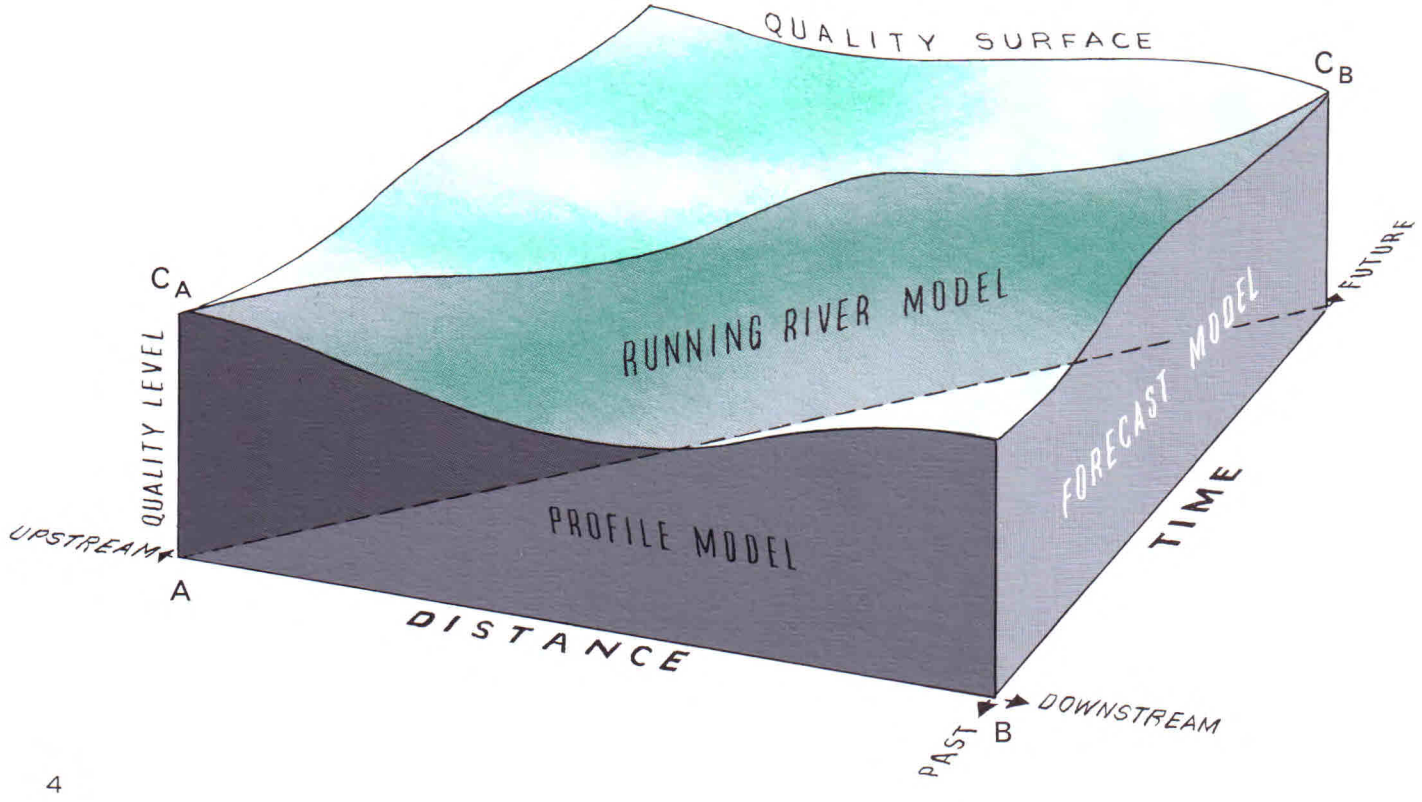
A 168-mile stretch of the Ohio River was selected for the project studies. This stretch includes the 95-mile Markland pool and the 73-mile McAlpine pool. It extends from Meldahl Dam (some 30 miles upstream from the Cincinnati metropolitan area) to the vicinity of the Louisville water supply intake.

For continuous measurement of quality characteristics the existing ORSANCO electronic monitor network in this stretch of the river was expanded by the addition of ten monitors. Information from the electronic monitors is supplemented with river quality data obtained by laboratories at six municipal and private water-treatment plants.

Waste-load information is provided daily by nine municipal and industrial dischargers. Daily forecasts

Portrayed here is a graphical representation of variations in river quality as related to time and distance of travel downstream. This three-dimensional model depicts interrelationships that can be computed to forecast quality conditions at specific locations on a river and the expected time of their occurrence.

The model is designed to answer questions relating to future water quality conditions under varying circumstances that may be anticipated over a period of several days, weeks or even months from now. The illustration represents, for example, changes in dissolved-oxygen concentration. The concentration at some location "A" is plotted at point "C_A;" at location "B" downstream, the predicted dissolved-oxygen concentration, calculated as a function of distance and time of flow, is shown at point "C_B."



on river flow are provided by the Ohio River Forecast Center of the National Weather Service, National Oceanic and Atmospheric Administration.

Project activities fall into three categories. The first is the systematic acquisition, editing and storage of river quality, river flow, waste load, and allied information in the computer-based facilities. This phase of the project represents an expansion of ORSANCO monitor and data-handling activities, and it has been integrated with routine operations.

The second category embraces statistical evaluation of data to identify relationships among variables. These studies involve: development of equations that define river depth and velocity as a function of flow magnitude and location; establishment of correlations between values of a water-quality parameter at successive monitoring locations, or among values of several parameters at a single monitoring point; and the determination of time-series relationships involving such matters as variation in waste loads and seasonal changes in river temperatures. Empirical derivations of these and other relationships are providing basic information for development of a mathematical model that will simulate response of river quality to natural and man made influences.

Design and testing of the model constitutes the third category of project activity. The design is intended to satisfy the following criteria:

Simplicity of application so as to serve the needs of users without requiring detailed knowledge on their part of the structure or internal behavior of the model.

Flexibility of adaptation to the appraisals of a broad range of variables that may be encountered in any river or section thereof.

Reasonable computer system requirements based on utilization of a medium-size IBM 1130 or its equivalent.

Programming that uses FORTRAN language to permit operation of the model on most computers with little or no modification.

The development, writing and debugging of programs, as well as initial test runs of the model, should be completed early in 1971. This will be followed by extensive testing looking toward perfecting and extending model capabilities.

RIVER QUALITY CONDITIONS

Quality analyses made during 1969 (the last full year for which data is available) reveal that of the twenty-one chemical and bacteriological criteria adopted by ORSANCO for appraising river quality conditions, sixteen (involving 14 substances or quality characteristics) were met 99 percent of the time or better at all monitor stations on the Ohio River.

Only for three quality characteristics did conditions fall short of meeting criteria specifications for 99 percent of the time. These were: dissolved oxygen (two criteria: aquatic life and industrial water supply), coliform density (two criteria: public water supply and recreation), and threshold odor.

The dissolved-oxygen criterion for aquatic life was met, on the average, about 90 percent of the time, and the DO criterion for industrial water supply was met 98 percent of the time.

The coliform criterion for public water supply was met, on the average, about 51 percent of the time, and the criterion for recreational use was met 11 percent of the time.

The threshold-odor criterion (for public water supply) was met, on the average, 94 percent of the time.

A detailed appraisal of quality conditions in the Ohio River and some of its major tributaries during 1969 is presented on pages 7 to 25 of this report.

ORSANCO network of monitor stations on the Ohio River and some major tributaries provides means for continuous checking of water-quality conditions.

RIVER QUALITY APPRAISAL

FOLLOWING IS A SUMMARY OF QUALITY CONDITIONS in the Ohio River and some of its major tributaries during 1969. 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 in the following tabulation, and accompanying map.

Quality analyses are made through one or more of the following arrangements: 32 locations (22 on the Ohio River main stem) are 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) are monitored by the U. S. Geological Survey under a contractual arrangement with ORSANCO; 27 locations (17 on the Ohio River) are under 24-hour surveillance using ORSANCO robot monitor units.

Supplemental data is obtained from the Water Quality Office of the Federal Environmental Protection Agency, which office makes analyses periodically on trace elements.

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

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 for judging the suitability of river water for various uses.

QUALITY CONDITIONS IN THE OHIO RIVER

FINDINGS IN BRIEF—Quality analyses made during 1969 reveal that ten chemical and bacteriological criteria (involving eight substances or quality characteristics) adopted by ORSANCO for appraising river-quality conditions were met one hundred percent of the time at all monitor stations on the Ohio River. Characteristics for which criteria were met at all times include the following: dissolved solids (for both public and industrial water supply), temperature (for aquatic life and industrial water supply), arsenic, barium, chromium, fluoride, silver and radioactive materials.

In addition, criteria for the following substances and characteristics were met for 99.1 to 99.5 percent of the time: pH (for aquatic life and industrial water supply), lead and cadmium.

Only for three quality characteristics did conditions in 1969 fall short of meeting criteria specifications for 99 percent of the time at monitor stations. These characteristics were: dissolved oxygen, coliform density and threshold odor.

The dissolved-oxygen criterion for aquatic life was met, on the average, about 90 percent of the time (considering data from all stations collectively), and the DO criterion for industrial water supply was met 98 percent of the time at all stations.

Monthly-average coliform densities met the ORSANCO criterion for public water supply for twelve months of the year at Huntington and Portsmouth, for eight months at Wheeling, for seven months at Louisville, for five months at Steubenville, for four months at Cincinnati and Evansville, for three months at Willow Island, and in none of the months at Weirton.

Monthly-average coliform densities met the criterion for recreational use in two of the five recreational months (May through September) at Portsmouth, in one of these months at Louisville, and in none of these months at the other monitor stations.

Specifications for threshold-odor levels in the ORSANCO criteria for public water supply were met 100 percent of the time at Portsmouth, Cincinnati, Louisville and Evansville. The criterion was met 98 percent of the time at Parkersburg, 84 percent of the time at Huntington and 79 percent of the time at Natrium.

Concentrations of the following substances at all times were within limiting values recommended in U. S. Public Health Service standards for drinking water: chloride, nitrate, copper and zinc. Values of sulfate, with one minor exception, were also within USPHS drinking water standards.

Alkalinity levels during 1969, in terms of yearly-average values, ranged from 17 mg/1 (at Stratton) to 53 mg/1 (at Dam 53).

Monthly-average values of hardness-producing materials varied from a minimum of 50 mg/1 (at Reed Power Station) to a maximum of 258 mg/1 (at Parkersburg). According to classifications used by the U. S. Geological Survey, Ohio River water may be regarded as varying from "soft" (concentrations of 0 to 60 mg/1) to "very hard" (concentrations greater than 180 mg/1).

These comments summarize only the major findings. Further details and other findings on quality conditions in the Ohio River and its tributaries are presented in the following pages.

RIVER FLOW—Monthly-average flows during 1969 at three Ohio River gaging stations are shown in the accompanying graphs. The stations for which data is presented include Sewickley at mile 12, Cincinnati at mile 471 and Evansville at mile 792. Also shown on the graphs are average, or "normal," flows for each month at each station as revealed by records over a 30-year period (1940 through 1969).

Generally, there is an inverse relationship between rate of flow and the concentration of chemical materials affecting water quality. The greater the flow, the lower the concentration of the materials—simply because there is more water available for dilution. Because of this relationship, the most critical months of the year with regard to quality conditions are usually August, September and October.

As may be seen in the graphs, flow values during the months of August, September and October of 1969 were very close to normal, or long-term-average values. This finding leads to the conclusion that quality characteristics in 1969, at least during the most critical period of the year, were at levels that could be considered to be normal or average under existing schedules of waste treatment. Without any changes in treatment schedules, it may be expected that in years of lesser flow quality conditions will not be as good as those observed in 1969.

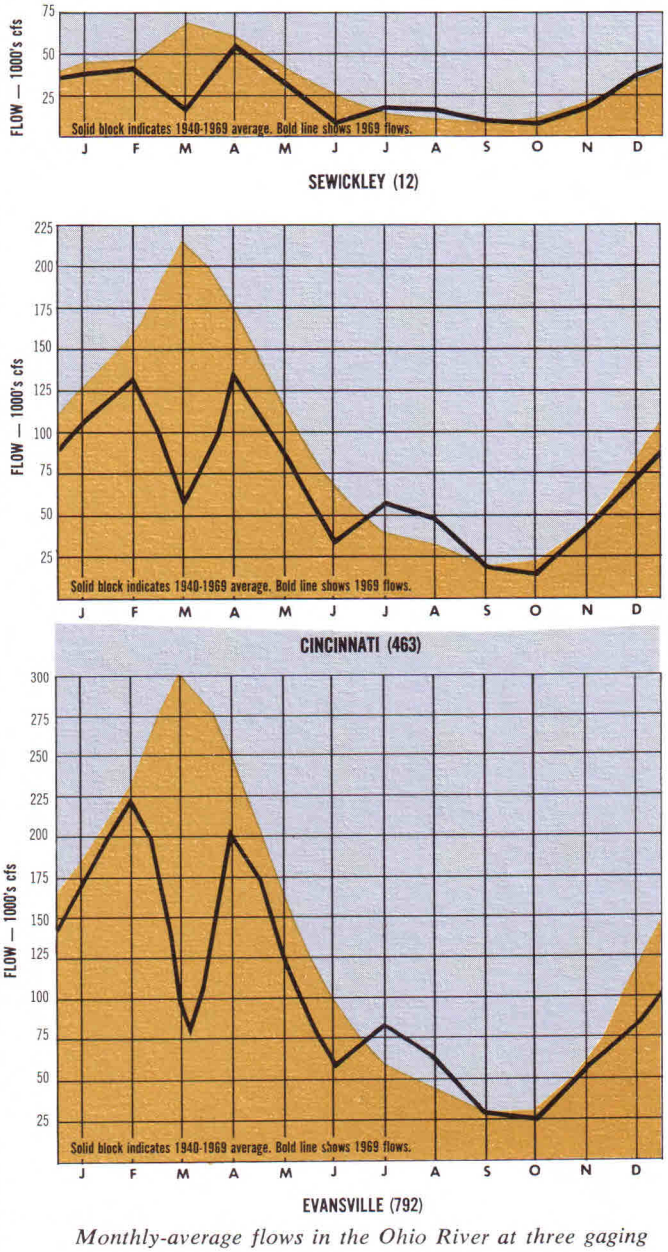
VISIBLE ASPECTS OF POLLUTION—Thirty-nine incidents of visible or obvious pollution were reported from surveillance operations conducted by state agencies and ORSANCO during 1969. This number of incidents is four less than the number reported in 1968.

Incidents in 1969 include 15 spills of oil and other petroleum products, eight spills of chemicals, 14 incidents of objectional appearance (color, debris, foam, raw sewage) and two fish kills. This record should be regarded as only a "sampling," because of the limited scope of ORSANCO surveillance operations and the lack of reporting from outside agencies.

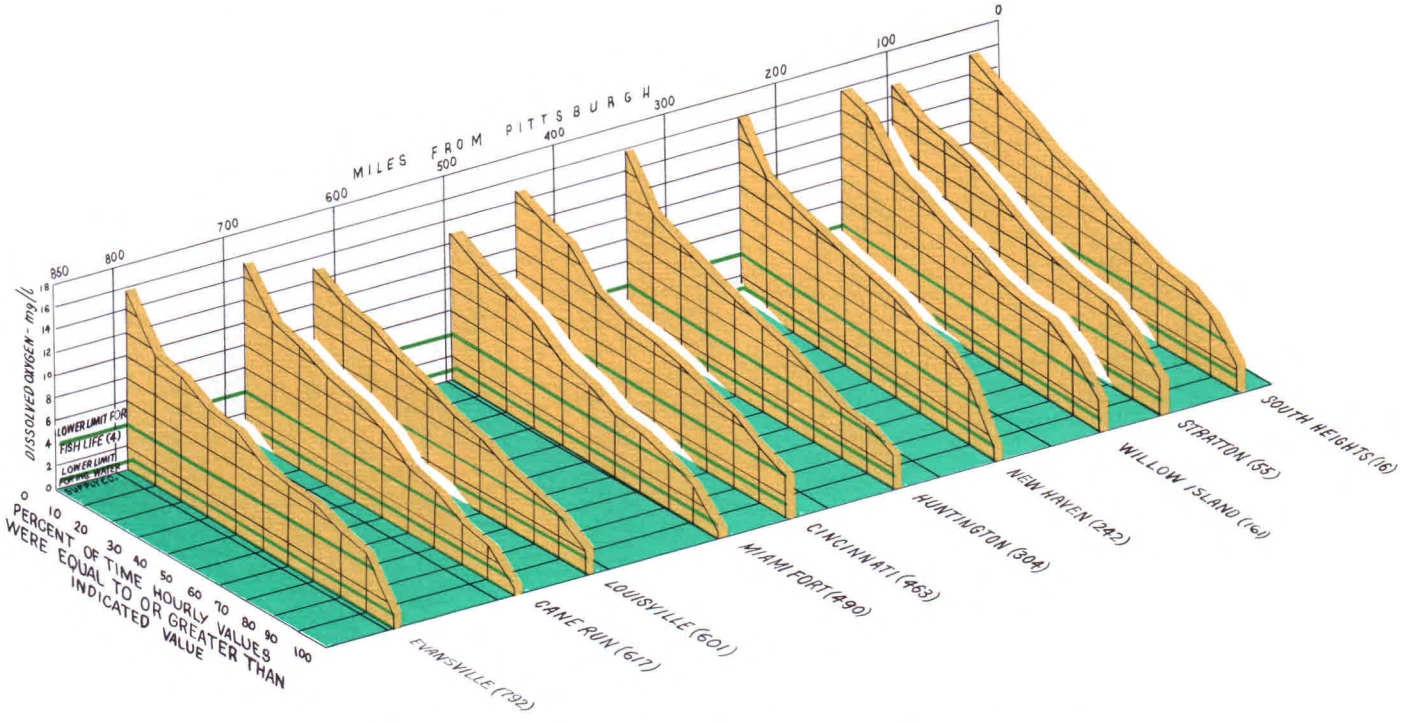
The two fish kills reported to ORSANCO at the time of occurrence include one in Mill Creek and another in Muddy Creek, both of which are tributary to the Ohio River near Cincinnati. The Mill Creek kill was caused by the discharge of chemicals, and the Muddy Creek kill was caused by the discharge of raw sewage.

Spills of oil and other petroleum products were attributed to: Leaking barge (1), failure of a refinery lagoon (1), pipe-line break (1), operations in petroleum processing plants (5), discharges from manufacturing plants (7).

Each incident was investigated by a representative of the state involved or by 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 1969 and comparison with normal flows at each station over a 30-year period (1940 through 1969)



DISSOLVED-OXYGEN QUALIGRAMS — 1969
(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/1 at any time, nor less than 5.0 mg/1 as a daily-average value.

Hourly DO readings during 1969 at ten monitor stations on the Ohio River are plotted against frequency of occurrence in the accompanying qualigrams. The qualigrams show, for example, that at Cincinnati (mile 463) hourly readings were greater than 4.0 mg/1 for 100 percent of the time. At Miami Fort (mile 490), however, only 85 percent of all hourly readings exceeded 4.0 mg/1.

The range in DO concentrations during the year was from a low of 0.4 mg/1 at Miami Fort to a high of 15.9 mg/1 at South Heights. Taken collectively, the data from all stations show that concentrations exceeded the minimum level of 4.0 mg/1 specified in the criteria for 94 percent of the time.

With regard to daily-average concentrations of DO in 1969, the following tabulation shows for each monitor station the percent of days on which average concentrations were equal to or greater than 5.0 mg/1:

Station	Percent of days average DO values were equal to or greater than 5.0 mg/1
South Heights	94
Stratton	97
Willow Island	97
New Haven	93
Huntington	87
Cincinnati	99
Miami Fort	73
Louisville	79
Cane Run	66
Evansville	91

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/1 at any time nor less than 2.0 mg/1 as a daily-average value. These specifications were met for 100 percent of the time in 1969 at all monitor locations except Miami Fort and Cane Run. At these two stations, hourly readings were be-

low 1.0 mg/1 for one percent of the time, and daily-average values were below 2.0 mg/1 on one day at Miami Fort and on five days at Cane Run.

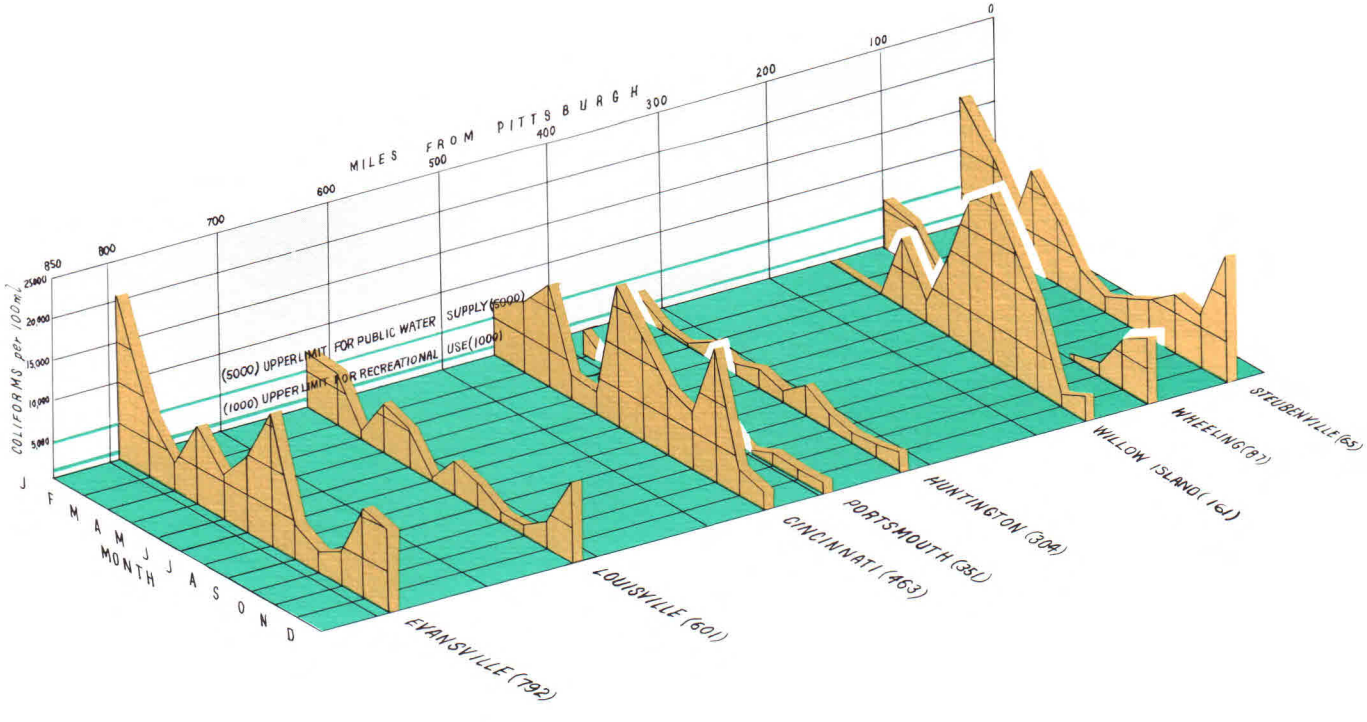
These findings reveal that if DO specifications contained in the ORSANCO criteria are to be met 100 percent of the time in the Ohio River, additional facilities for reduction of biochemical-oxygen-demand (BOD) characteristics of waste discharges will have to be installed by municipalities and industries. Requirements for upgrading existing primary and intermediate treatment facilities (35 to 50 percent BOD reduction) to secondary treatment facilities (85 to 92 percent reduction) were established by the Commission in November 1970.

COLIFORM DENSITY — In evaluating bacterial quality conditions as indicated by the density of coliform organisms, certain limitations of the coliform test must be considered. 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 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 — 1969
(Monthly-average values)

Coliform densities were measured routinely at nine locations in 1969. Findings are shown in the accompanying profiles and tables.

With regard to the criterion 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 Huntington and Portsmouth, for eight months at Wheeling, for seven months at Louisville, for five months at Steubenville, for four months at Cincinnati and Evansville, for three months at Willow Island, and in none of the months at Weirton. These findings together with information on frequencies at which additional criteria specifications were met are shown in the following tabulation:

Station	Mile Point	Number of months average value less than 5,000/100 ml	No. of months 80% or more of daily values less than 5,000/100 ml	No. of months 95% or more of daily values less than 20,000/100 ml
Weirton	(62)	0	0	3
Steubenville	(65)	5	4	6
Wheeling	(87)	8	7	9
Willow Island	(161)	3	3	6
Huntington	(304)	12	9	12
Portsmouth	(351)	12	10	12
Cincinnati	(463)	4	3	6
Louisville	(601)	7	4	11
Evansville	(792)	4	1	5

With regard to recreational use, the frequencies at which monthly-average and over-run specifications were met at Portsmouth and Louisville 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.

	No. of months during May-Sept. 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
Portsmouth	2	0	2
Louisville	1	1	0

In order to improve quality conditions in the Ohio River with respect to coliform densities and thus minimize hazards from the potential presence of pathogenic organisms, the Commission, in November 1970, established the following standard of treatment for municipal and industrial wastes discharged to the Ohio River: Reduction of fecal coliform bacteria to such degree that: (1) during the months of May through October fecal coliform density in the discharge does not exceed 200 per 100 ml as a monthly geometric mean (based on not less than ten samples per month), nor exceed 400 per 100 ml in more than ten percent of the samples examined during a month; and (2) during the months of November through April the density does not exceed 1,000 per 100 ml as a monthly geometric mean (based on not less than ten samples per month), nor exceed 2,000 per 100 ml in more than ten percent of the samples examined during a month.

DISSOLVED SOLIDS — The accompanying profiles summarize monthly-average values of dissolved solids at Ohio River monitor locations in 1969.

The ORSANCO criteria for river water used as a source of public water supply require that dissolved solids shall not exceed 750 mg/1 at any time, nor exceed 500 mg/1 in terms of monthly-average values. These specifications were met at all stations at all times during the year.

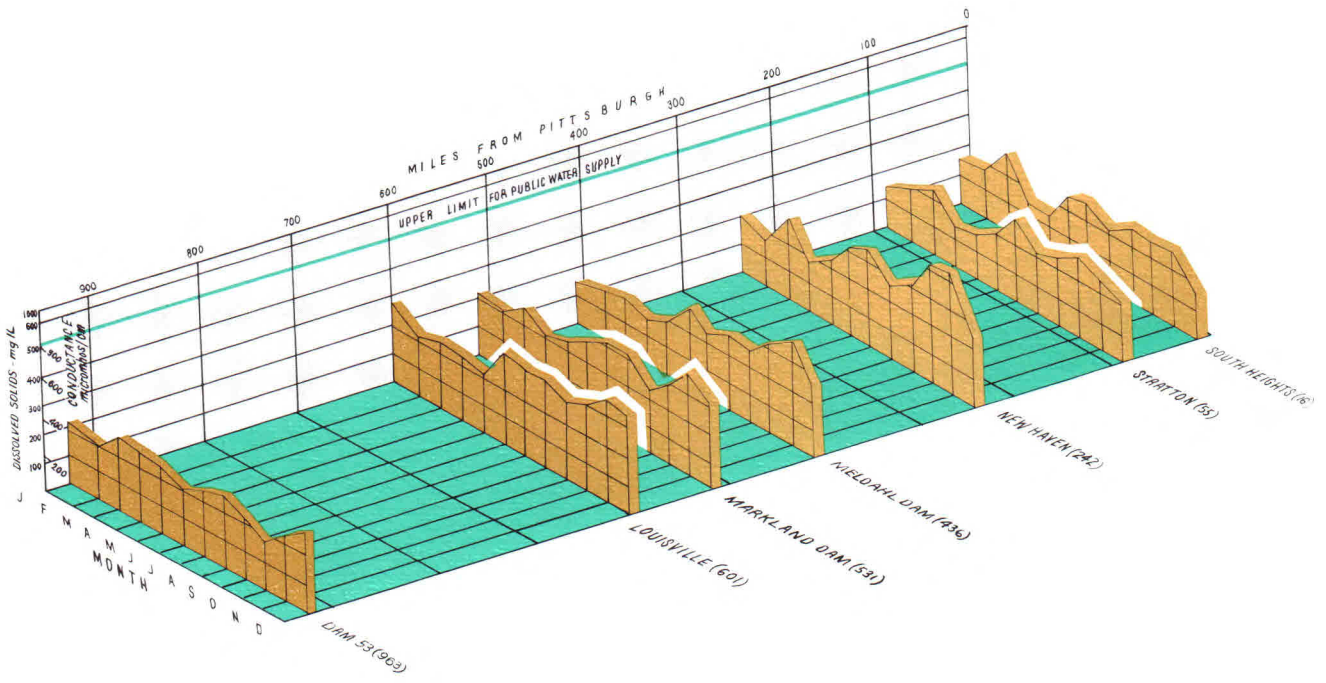
Because the criteria for public water supply purposes are more restrictive than those for industrial water supply purposes, it follows that the latter requirements were met 100 percent of the time as well. The highest single concentration of dissolved solids measured during the year was 434 mg/1, which value was recorded at New Haven (mile 242) during the month of November.

HARDNESS — Determinations for hardness were made at 21 locations on the Ohio River during 1969; the qualigram shows the characteristic of 8 selected 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

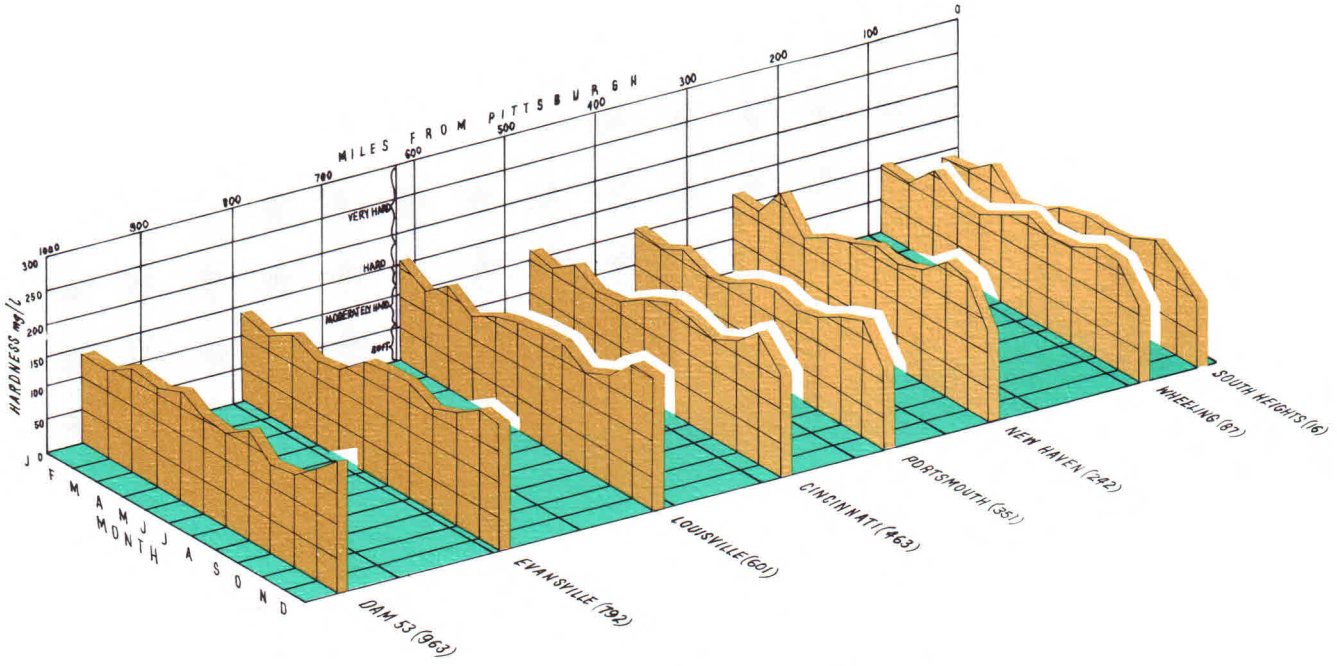
On the basis of these designations, Ohio River water may be regarded as ranging from "soft" to "very hard."

The accompanying profiles show monthly-average values of hardness at selected Ohio River monitor points. The range in values is from 50 mg/1 (at Reed Power Plant in February) to 258 mg/1 (at Parkersburg in November). As may be seen from the profiles, hardness concentration of the river is highest during the months of September through November. This finding indicates an inverse relationship between hardness and flow, since the months of September through November are also the period of lowest flow.



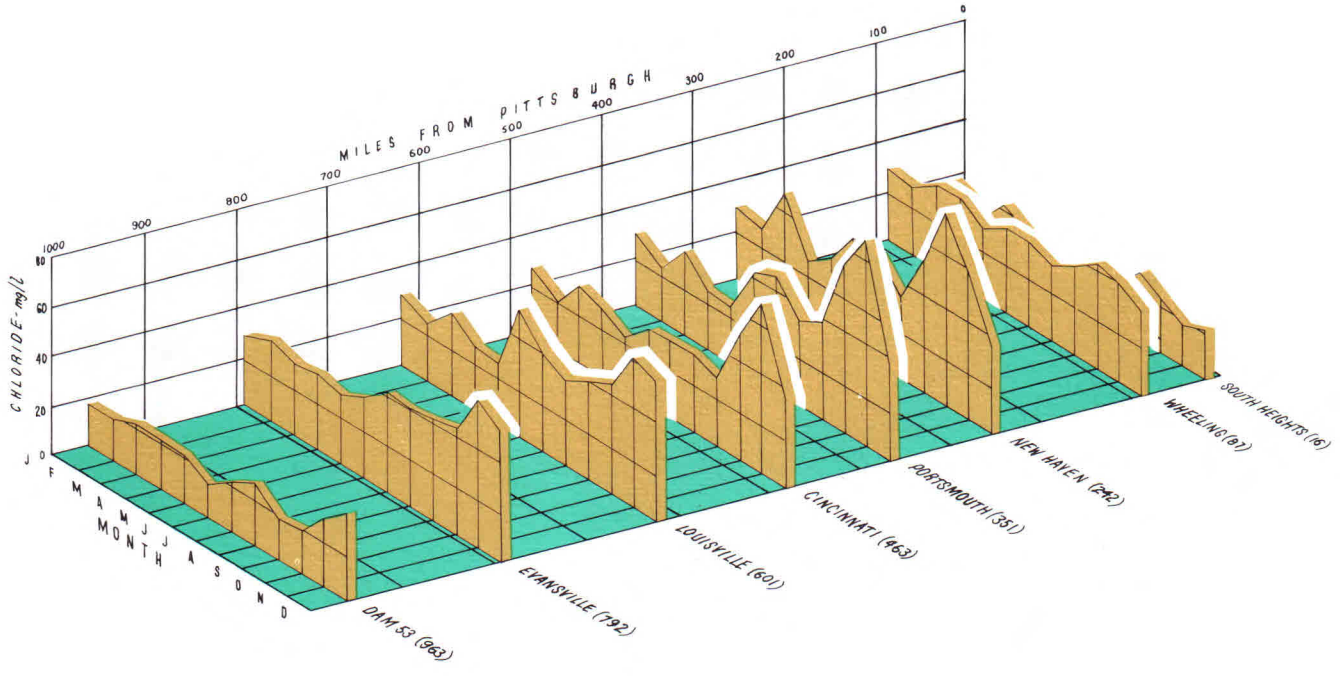
DISSOLVED SOLIDS (CONDUCTANCE) PROFILES — 1969

(Monthly-average values)



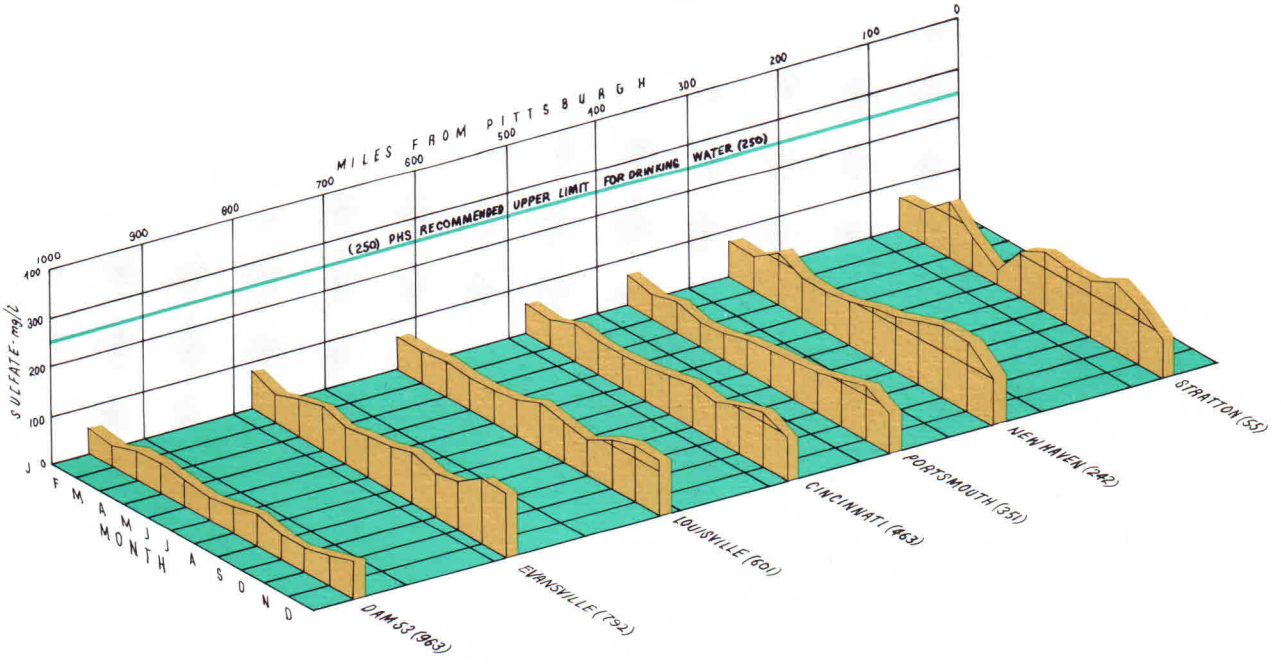
HARDNESS PROFILES — 1969

(Monthly-average values)



CHLORIDE PROFILES — 1969

(Monthly-average values)



SULFATE PROFILES — 1969

(Monthly-average values)

CHLORIDE — All concentrations of chloride reported in 1969 were well below the limit of 250 mg/1 recommended by the U.S. Public Health Service for drinking water. The maximum monthly-average value in 1969 was 88 mg/1 (at Parkersburg in October). The lowest monthly-average value during the year was 9 mg/1 (at Willow Island in April).

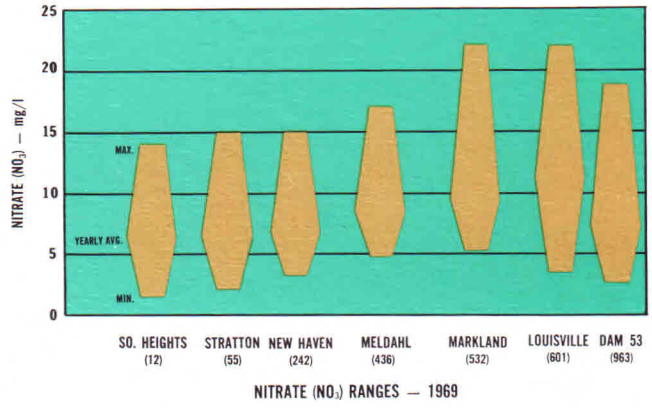
SULFATE — The accompanying profiles show monthly-average values of sulfate concentrations at 7 stations during 1969. With one exception, all values were below 250 mg/1, the upper limit recommended for drinking water by the Public Health Service. In October, a monthly-average value of 256 mg/1 was recorded at Parkersburg.

IRON—The accompanying chart shows maximum monthly-average, yearly-average and minimum monthly-average values of iron concentration at seven locations. The range in monthly-average values is from 0.01 mg/l to 5.40 mg/l. This range is essentially the same as that observed in previous years.

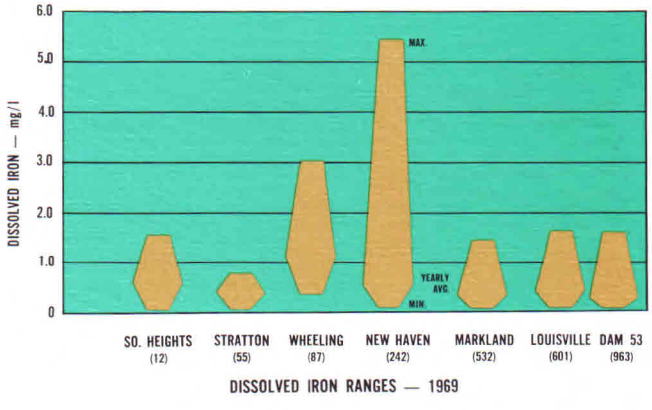
No criteria for dissolved iron have been adopted as yet by ORSANCO. Insofar as use of the river for public-water supply purposes is concerned, the Engineering Committee has concluded that there is insufficient evidence to justify establishment of such criteria at this time. With regard to aquatic life, 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 1969. Findings reveal progressively increasing concentrations from the head of the river downstream to Wheeling, and then progressively lower concentrations from that point to Dam 53. Average manganese concentrations in 1969 in the lower part of the river (Louisville and Dam 53) were the same as those observed in 1968. In the upper part of the river (Stratton and New Haven) however, concentrations in 1969 tended to be slightly less than those observed in the previous year.

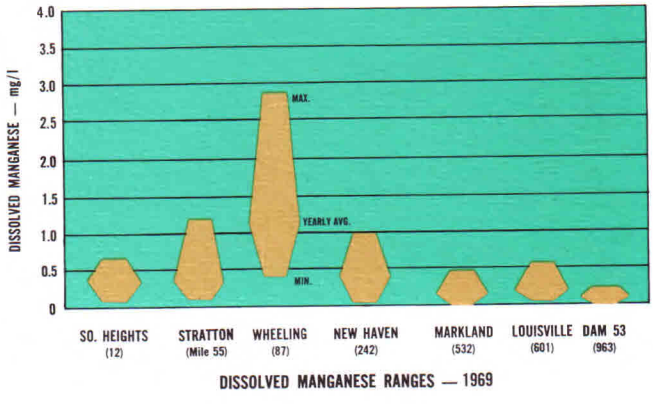
NITRATE—The accompanying chart shows maximum monthly-average, yearly-average, and minimum monthly-average values of nitrate concentrations at monitoring locations on the Ohio River during 1969. Values ranged from 1.6 mg/l at South Heights to 22.0 mg/l at Louisville. All values during the year were well below 45 mg/l, the limiting value for drinking water recommended by the U. S. Public Health Service.



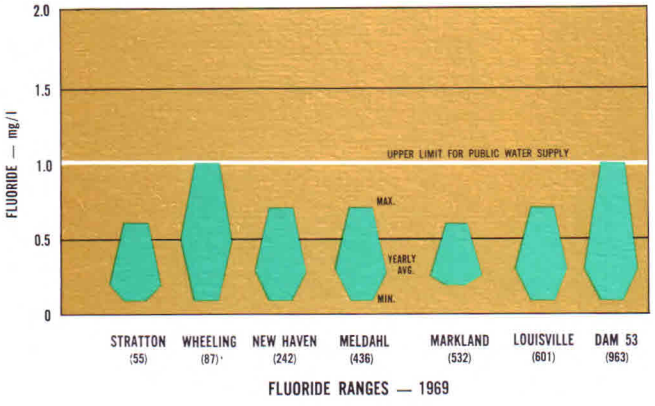
NITRATE (NO_3) RANGES — 1969



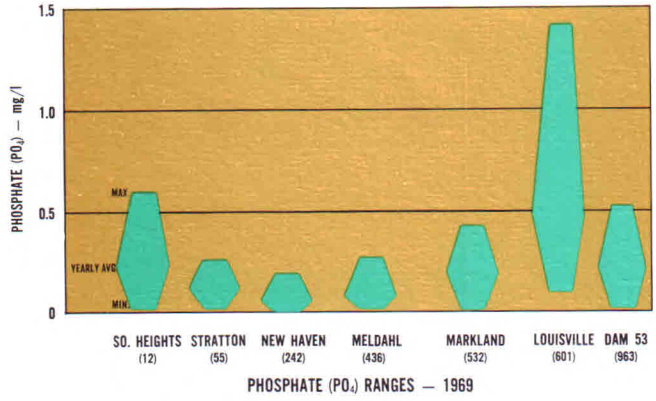
DISSOLVED IRON RANGES — 1969



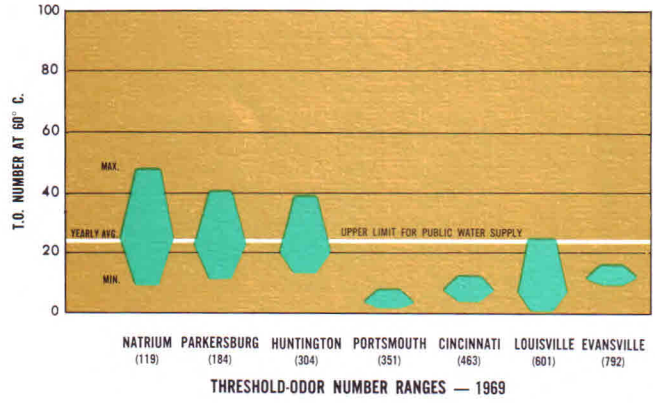
DISSOLVED MANGANESE RANGES — 1969



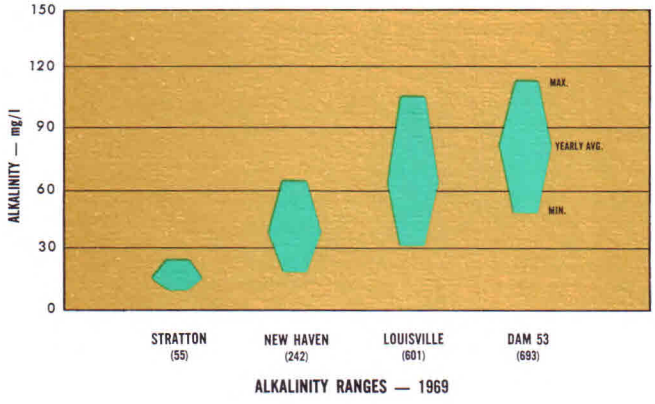
FLUORIDE RANGES — 1969



PHOSPHATE (PO_4) RANGES — 1969



THRESHOLD-ODOR NUMBER RANGES — 1969



ALKALINITY RANGES — 1969

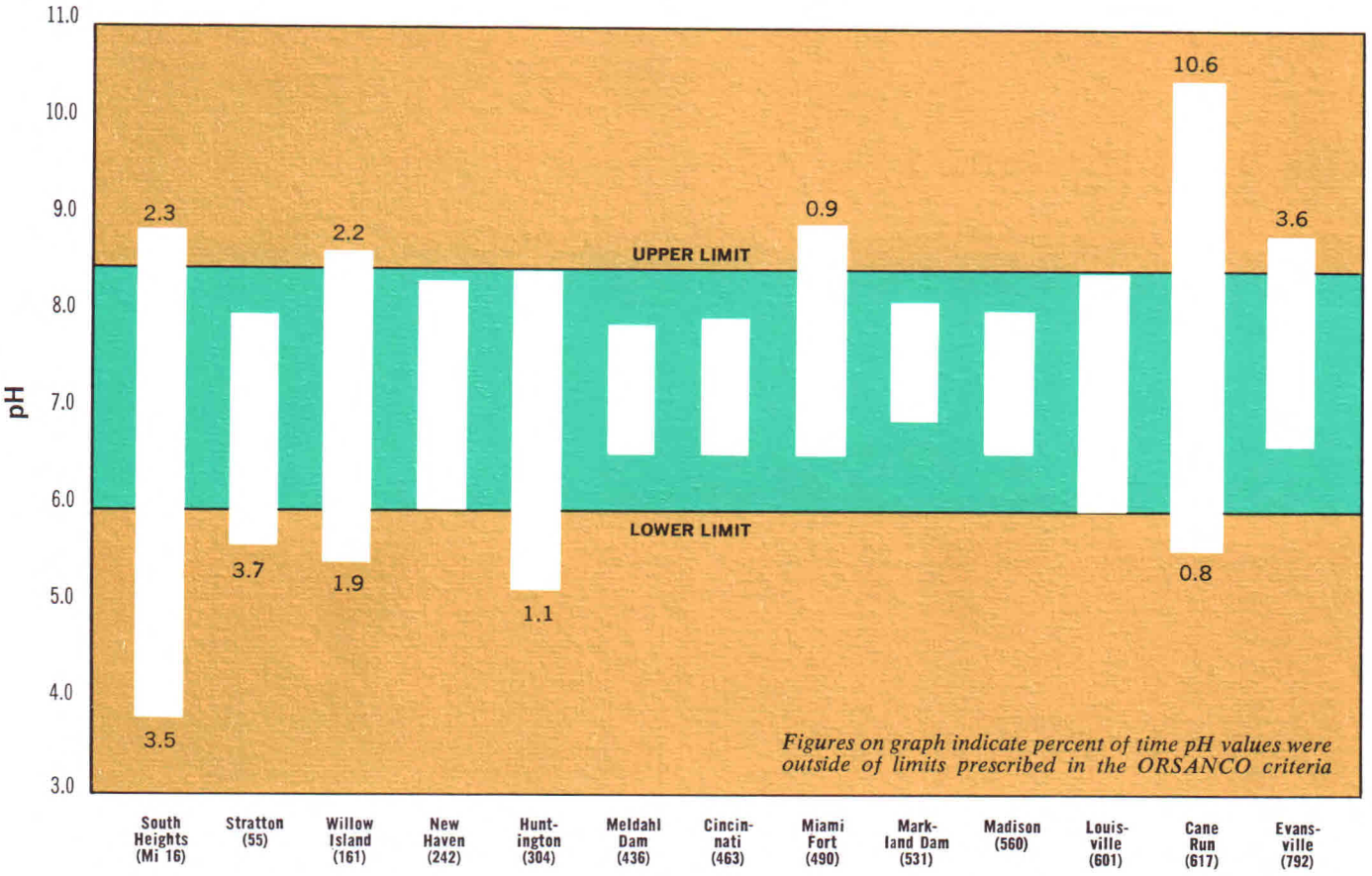
FLUORIDE—Data on fluoride concentrations is available from the ORSANCO Water-Users Committee station at Wheeling, where analyses are made daily, and from USGS-ORSANCO cooperative stations at Stratton, Wheeling, New Haven, Meldahl Dam, Markland Dam, Louisville and Dam 53, where analyses are made two or three times a month.

Ranges in concentrations at these stations during 1969 are shown in the accompanying graph. The highest value recorded during the year was 1.0 mg/l (at Wheeling and Dam 53), which value coincides with the upper limit specified in the ORSANCO criteria for public water supply. The highest monthly-average value recorded was 0.8 mg/l (at Wheeling).

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 0.01 mg/l (at New Haven and Markland Dam) to 1.4 mg/l (at Louisville). This range in concentration is essentially the same as that observed for the past several years.

THRESHOLD-ODOR CONDITIONS — The accompanying chart shows maximum monthly-average, yearly-average, and minimum monthly-average values of threshold-odor measurements at seven locations. 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, Louisville and Evansville. At other stations, threshold-odor numbers of 24 or less were observed as follows: 98 percent of the time at Parkersburg; 84 percent of the time at Huntington; and 79 percent of the time at Natrium.

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: 17 mg/l at Stratton (mile 55), 38 mg/l at New Haven (242), 64 mg/l at Louisville (601) and 84 mg/l at Dam 53 (963).



pH RANGES as measured at ORSANCO Robot Monitor Stations — 1969

Low levels of alkalinity in the upper river can be attributed in large part to the influence of acid mine drainage, particularly that from tributary streams. For example, the yearly-average concentration of 17 mg/l in the Ohio River at Stratton may be compared with yearly-average values of 13 mg/l in the Allegheny River (at Oakmont) and 10 mg/l in the Monongahela River (at South Pittsburgh).

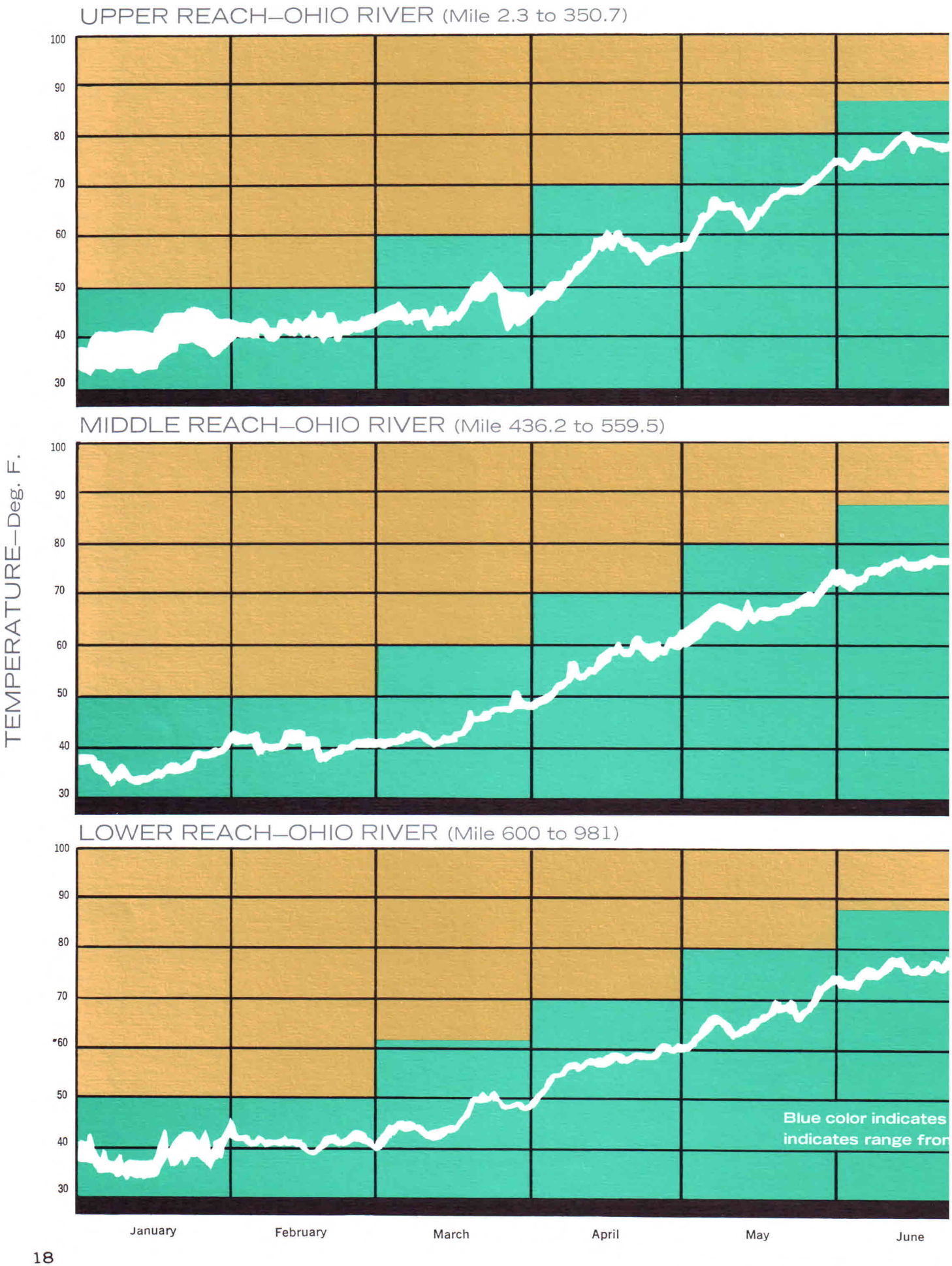
pH CHARACTERISTICS — The accompanying graph shows ranges in pH values along the Ohio River during 1969. Ninety-nine percent of all values were within the desired range of 6.0 to 8.5, as prescribed in the ORSANCO criteria.

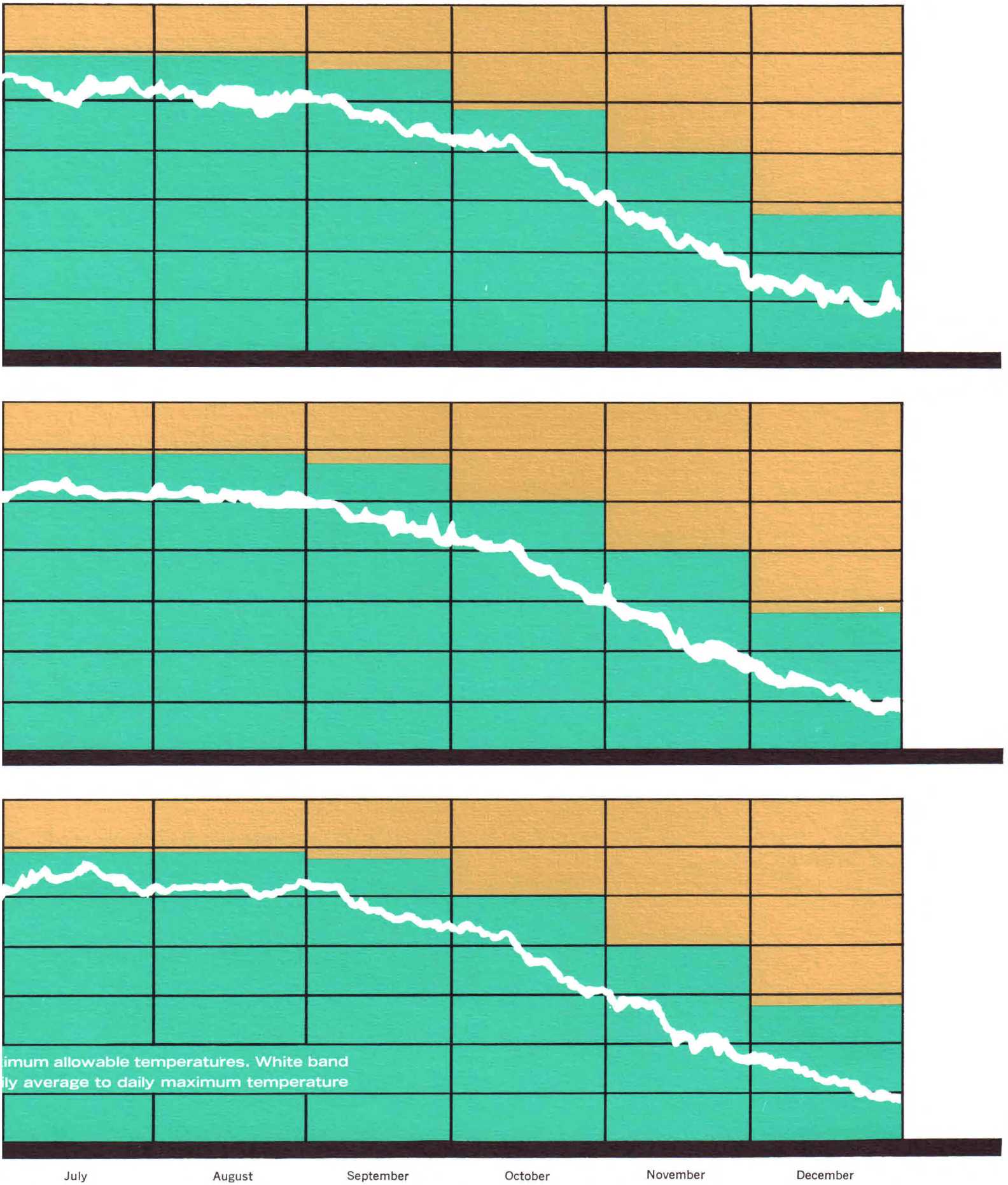
In the upper portion of the river, pH values tend to be on the low side of the desired range. This tendency is attributed, for the most part, to the influence of mine drainage. At some stations in the lower portion of the river, values tend toward the high side of the desired range. This latter tendency may be attributed to industrial operations and algal conditions.

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

The accompanying graphs show temperature conditions in the Ohio River during 1969, as recorded by robot monitor units at 17 locations and by readings taken by the USGS and the Water Users Committee at 19 locations. The graphs show maximum hourly and daily-average readings in each of three reaches of the river. Values shown reflect composited data from


UPPER REACH–OHIO RIVER (Mile 2.3 to 350.7)
MIDDLE REACH–OHIO RIVER (Mile 436.2 to 559.5)
LOWER REACH–OHIO RIVER (Mile 600 to 981)
TEMPERATURE–Deg. F.
100
90
80
70
60
50
40
30
January
February
March
April
May
June
Blue color indicates
indicates range fro



IS IN THE OHIO RIVER—1969

all monitor stations within each of the three reaches. Also plotted on the graphs are maximum-allowable temperatures as set forth in the foregoing table.

As may be seen from the graphs, temperature readings in 1969 were within prescribed maximum-allowable limits at all times. The minimum differential between observed temperature (maximum hourly value) and allowable temperature was 1.0 deg. F., which differential was observed in the lower reach of the river on two days (July 18 and 19). A differential of 1.2 deg. F. was recorded in the upper reach of the river on one day (June 30). Differentials between observed and allowable temperatures throughout the year varied from these minimum values to a maximum of 33.1 deg. F. (November 29 in the upper reach of the river).

RADIOACTIVE SUBSTANCES — During 1969 analyses on levels of radioactivity were made by the federal Environmental Protection Agency on 269 samples of Ohio River water. Results of these analyses, expressed in terms of picocuries per liter or pc/1 (equivalent to micro-microcuries per liter), are summarized as follows:

	Dissolved	Suspended	Total
Beta	0 to 65	0 to 24	0 to 67
Alpha	0 to 3	0 to 8	0 to 8

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

The data available indicates that radioactivity levels in all samples on the Ohio River were within levels specified in the criteria. No information is available on activity from dissolved strontium-90 during 1969.

OTHER CHEMICAL CONSTITUENTS—Results of analyses made on other chemical constituents in 1969 are summarized in the following paragraphs. For those constituents for which ORSANCO criteria or USPHS drinking water standards have been established, findings reveal that concentrations in the river were, with a few exceptions of minor significance, well below criteria or standards specifications.

ARSENIC: 147 samples analyzed; no detectable amounts of arsenic in 128 samples; concentrations in the other 19 samples were all below 0.050 mg/1, the upper limit specified in ORSANCO criteria.

BARIUM: 44 samples analyzed; highest concentration observed was 0.12 mg/l; limiting value for barium specified in ORSANCO criteria is 1.0 mg/l.

CADMIUM: 121 samples analyzed; no detectable amount of cadmium in 74 samples; concentrations in 44 samples were reported to be less than 0.02 mg/1, and in three samples concentrations were reported to be less than 0.01 mg/1; limiting value for cadmium specified in ORSANCO criteria is 0.01 mg/l.

CHROMIUM: 111 samples analyzed for total chromium; all samples showed concentrations of 0.01 mg/l or less; since the analyses measured both trivalent and hexavalent forms of chromium, it is evident that levels of hexavalent chromium were well below the limit of 0.05 mg/l specified in ORSANCO criteria.

COPPER: 111 samples analyzed; 108 samples contained concentrations of 0.01 mg/l or less; 3 samples contained concentrations of 0.60 mg/l, 0.21 mg/l and 0.18 mg/l; limiting value for copper specified in USPHS Drinking Water Standards is 1.0 mg/l.

LEAD: 111 samples analyzed; all samples contained concentrations of less than 0.05 mg/l, except one, which contained 0.08 mg/l; no detectable quantities of lead in 54 samples; limiting value for lead specified in ORSANCO criteria is 0.05 mg/l.

SILVER: 38 samples analyzed; concentrations in all samples less than 0.002 mg/1; limiting value for silver specified in ORSANCO criteria is 0.05 mg/l.

ZINC: 111 samples analyzed; concentrations ranged from 0.01 to 0.43 mg/l and averaged 0.03 mg/l; two samples contained 0.43, 0.38 and all remaining samples had concentrations of 0.18 mg/1 or less; limiting value for zinc specified in USPHS Drinking Water Standards is 5.0 mg/1.

BERYLLIUM: 44 samples analyzed; concentrations in all samples less than 0.02 mg/l.

BORON: 44 samples analyzed; concentrations ranged from 0.046 mg/l to 0.25 mg/l.

COBALT: 67 samples analyzed; no detectable amount of cobalt in any sample.

CYANIDE AND SELENIUM: Analyses for these constituents were discontinued a few years ago because concentrations consistently were found to be so low as to be of no practical significance.

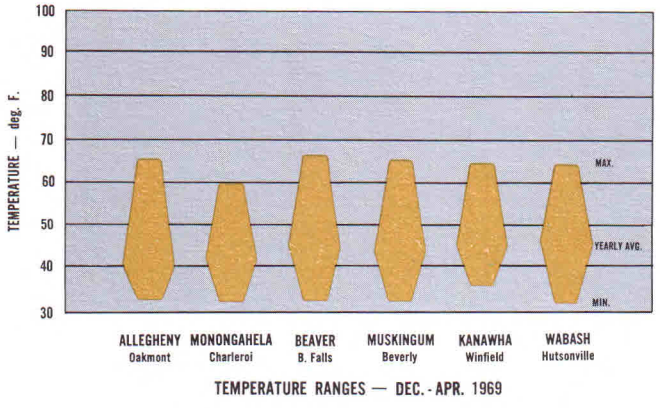
NICKEL: 111 samples analyzed; concentrations in all samples less than 0.02 mg/1, except one that measured 0.03 mg/l.

STRONTIUM: 44 samples analyzed; concentrations ranged from 0.042 mg/l to 0.30 mg/l.

VANADIUM: 37 samples analyzed; concentrations in all samples less than 0.04 mg/l.

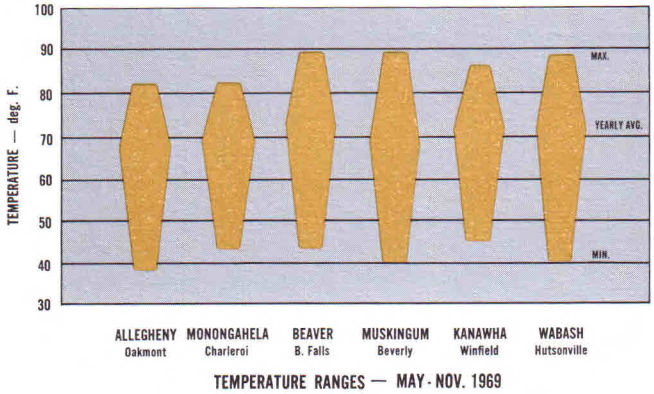
QUALITY CONDITIONS IN TRIBUTARIES

In general, quality conditions in tributary streams during 1969 were similar to those 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. The Allegheny in 1969 continued to show an improvement in conditions that began after completion of the Kinzua Reservoir in 1967.

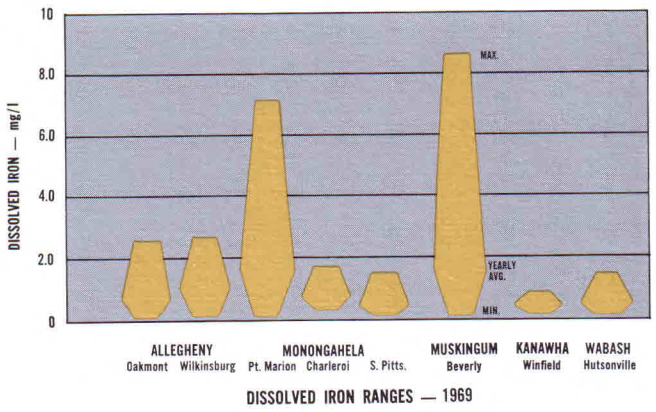


TEMPERATURE RANGES — DEC.-APR. 1969

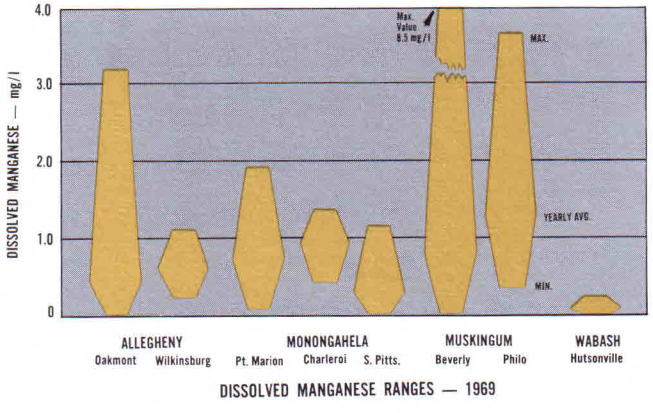
TEMPERATURE—Recordings of temperature were made during 1969 at six ORSANCO robot monitor stations located on tributaries. Ranges in temperatures at the several stations, which are shown in the accompanying chart, were as follows: 33 to 82 deg. at Oakmont on the Allegheny, 32 to 82 deg. at Charleroi on the Monongahela, 33 to 89 deg. at Beaver Falls on the Beaver, 33 to 89 deg. at Beverly on the Muskingum, 36 to 87 deg. at Winfield on the Kanawha, 32 to 88 deg. at Hutsonville on the Wabash. Thus, all temperature readings were within limits recently established by ORSANCO for the Ohio River main stem (see page 35).



TEMPERATURE RANGES — MAY-NOV. 1969



DISSOLVED IRON RANGES — 1969

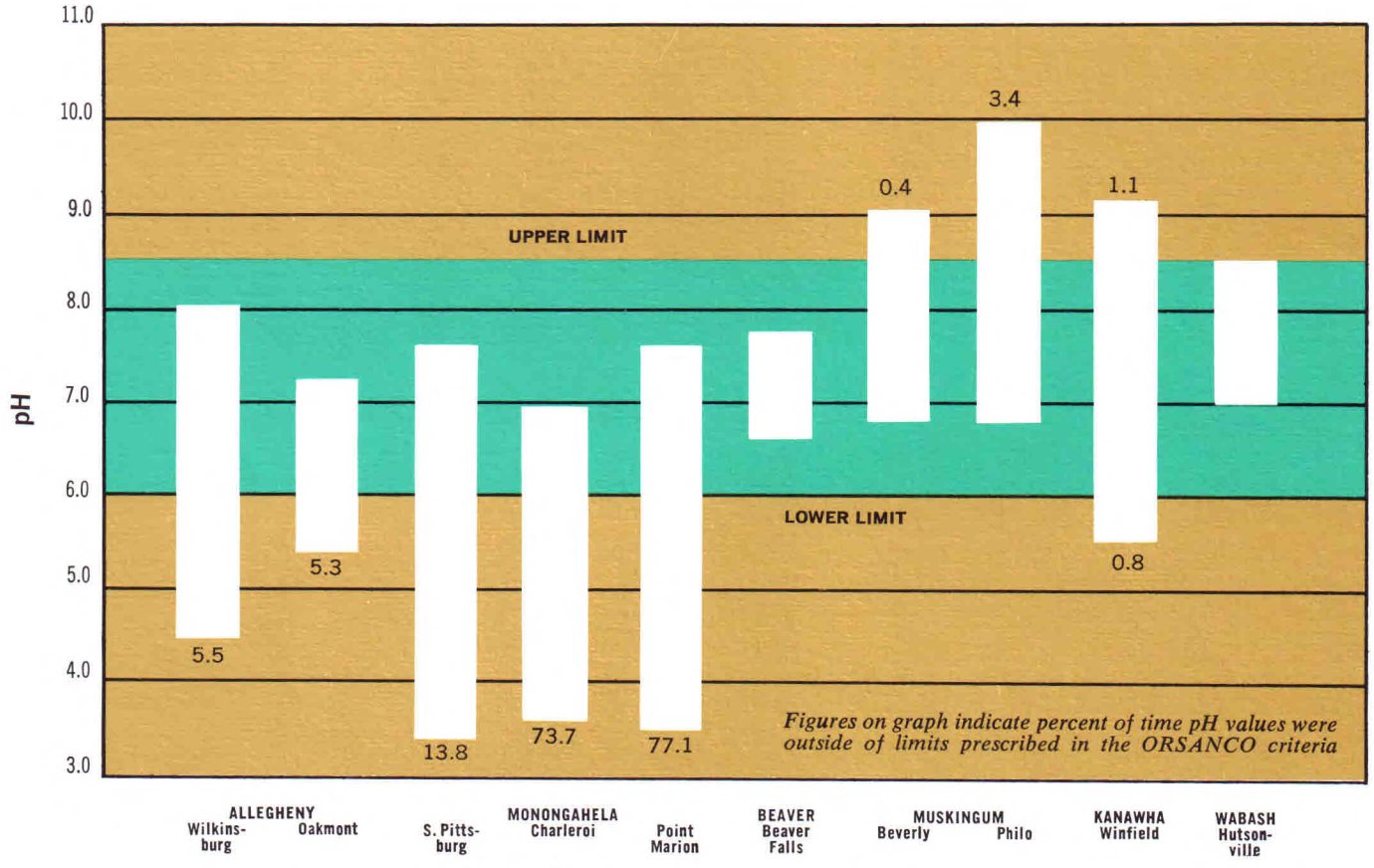


DISSOLVED MANGANESE RANGES — 1969

pH CHARACTERISTICS—The accompanying chart shows ranges in pH values in ten tributaries. Also shown on the chart are percentages of time pH values were outside the desired range of 6.0 to 8.5.

With the exception of the Monongahela River, pH characteristics in the tributaries were generally suitable for aquatic life. The Monongahela River is characterized by low pH levels, which, for the most part, are attributable to the influence of mine drainage.

IRON—The accompanying graph summarizes ranges in dissolved-iron concentrations during 1969. Except on the Muskingum River, levels of dissolved iron in the tributaries were slightly lower in 1969 than in the previous year.



pH RANGES — 1969

MANGANESE—Concentrations of dissolved manganese in 1969 are shown in the accompanying chart. Concentrations ranged from 0.01 mg/l to 8.50 mg/l. Average levels of manganese in 1969 were, in general, slightly less than corresponding levels in 1968.

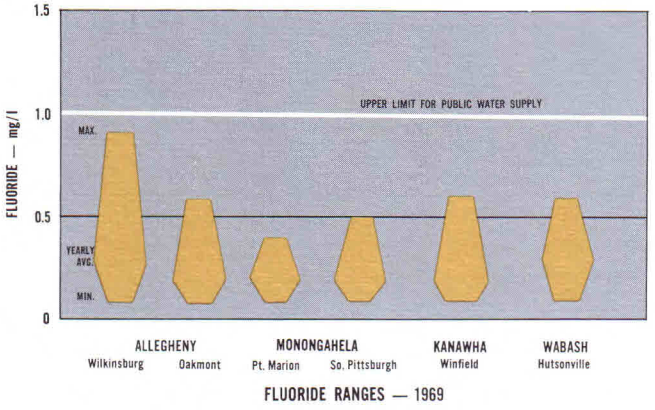
COLIFORM DENSITY— Coliform densities were measured at Wilkinsburg on the Allegheny River, at South Pittsburgh on the Monongahela River, and at Beaver Falls on the Beaver River.

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	8	5	0
Number of months in which 80 percent or more of daily values were less than 5,000 per 100 ml	7	5	0
Number of months in which 95 percent or more of daily values were less than 20,000 per 100 ml	10	7	0
Maximum monthly—average value (coliforms per 100 ml)	12,100	20,300	125,700
Yearly—average value (coliforms per 100 ml)	4,100	6,800	40,700

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:

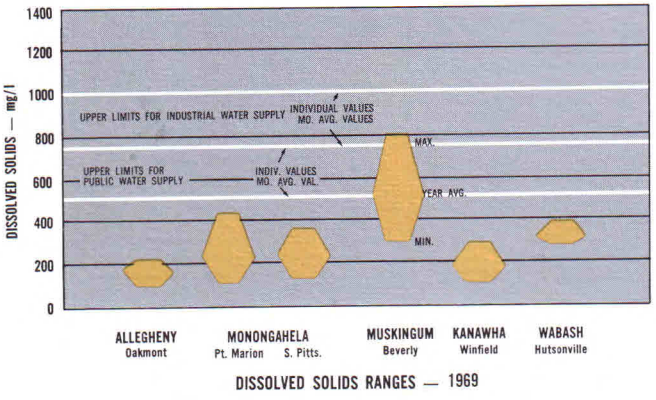
	Wilkinsburg	So. Pittsburgh	Beaver Falls
Number of months in which average coliform counts did not exceed 1,000 per 100 ml	1	1	0
Number of months in which 80 percent or more of daily values were less than 1,000 per 100 ml	0	0	0
Number of months in which all daily values were less than 2,400 per 100 ml	1	0	0
Maximum monthly—average value (coliforms per 100 ml)	8,700	12,300	125,700
Seasonal—average value (coliforms per 100 ml)	3,400	9,400	53,400



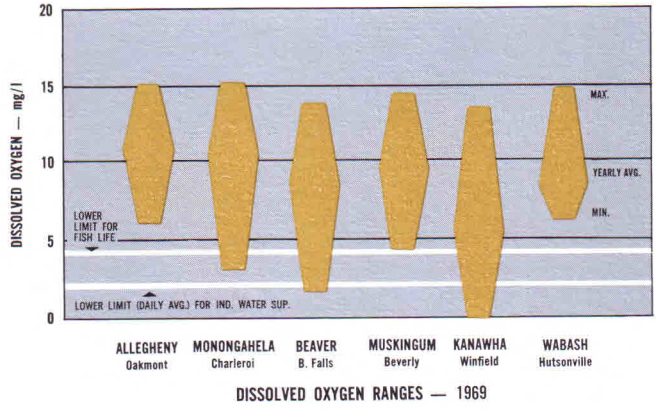
FLUORIDE RANGES — 1969

FLUORIDE—Ranges in fluoride concentrations in tributaries during 1969 are shown in the accompanying graph. The highest concentration observed was 0.9 mg/1, which value was recorded at Wilkinsburg on the Allegheny River. Ranges in concentration observed in 1969 are essentially the same as those observed in the past several years.

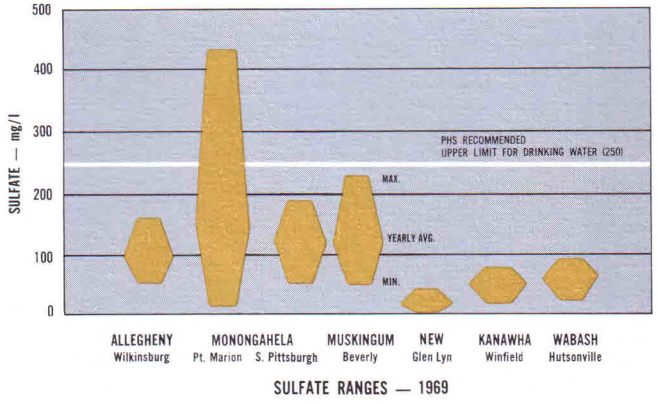
DISSOLVED SOLIDS—Ranges in dissolved-solids concentrations at some tributary stations during 1969 are shown in the accompanying chart. The minimum value recorded was 66 mg/1 on the Allegheny River at Kinzua, and the maximum value recorded was 804 mg/1 on the Muskingum River at Beverly. Taken collectively, the data shows that the dissolved solids criterion for public water supply was met 95 percent of the time, and that the industrial water supply criterion was met 100 percent of the time.



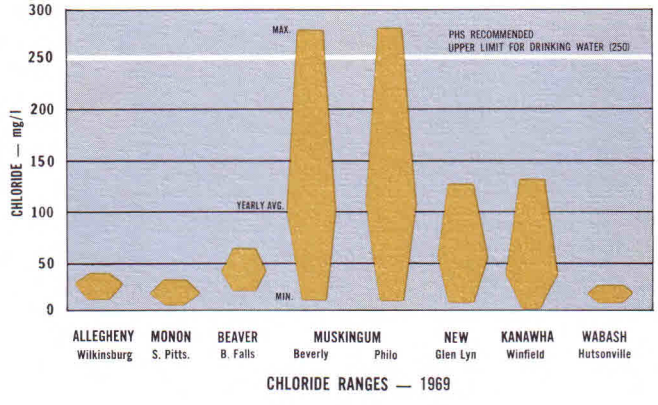
DISSOLVED SOLIDS RANGES — 1969



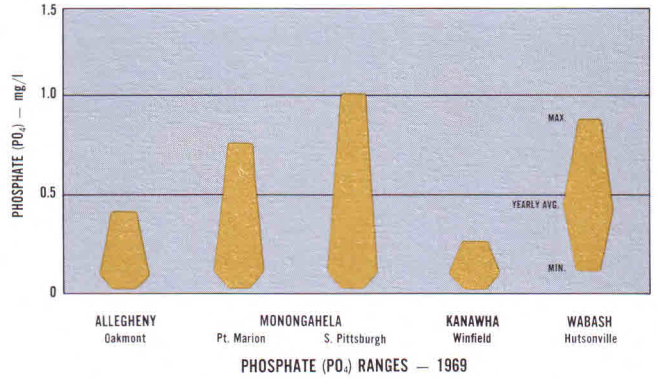
DISSOLVED OXYGEN RANGES — 1969



SULFATE RANGES — 1969



CHLORIDE RANGES — 1969



PHOSPHATE (PO_4) RANGES — 1969

DISSOLVED OXYGEN—The accompanying chart shows ranges of DO levels during 1969 at six tributary locations. Hourly values ranged from zero on the Kanawha River (one-tenth of one percent of the time) to 15.1 mg/l on the Allegheny River. Taken collectively, the data show that DO criteria adopted by ORSANCO were met 80 percent of the time on tributaries.

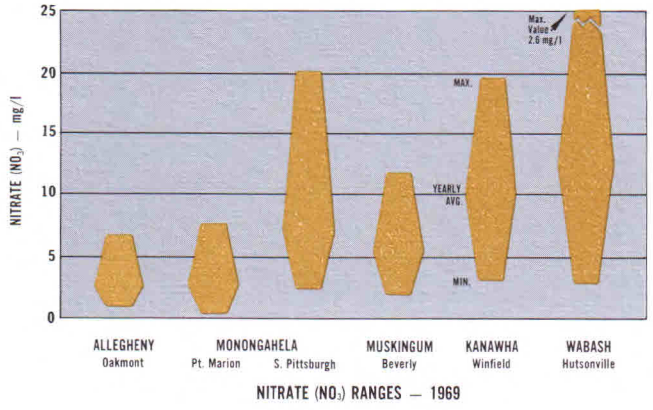
SULFATE—Ranges in sulfate concentration during 1969 are shown in the accompanying chart. The range was from a minimum of 2 mg/l on the New River at Glen Lyn, to a maximum of 438 mg/l on the Monongahela River at Point Marion.

CHLORIDE—The accompanying chart shows chloride concentrations at eight sampling stations on tributaries. Ninety-nine percent of all values were below 250 mg/1, the recommended upper limit for drinking water in USPHS standards. Only on the Muskingum River, and only occasionally, did chloride concentrations exceed 250 mg/1.

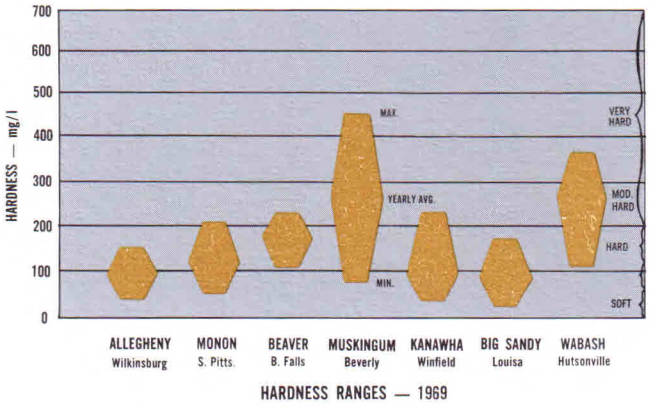
PHOSPHATE—Concentrations of phosphate observed in tributaries in 1969 are summarized in the accompanying chart. Values ranged from 0.01 mg/1 (on the Allegheny and Monongahela rivers) to 1.00 mg/1 (on the Monongahela).

NITRATE—Concentrations of nitrate during 1969 are shown in the accompanying chart. Values ranged from a minimum of 0.3 mg/1 at Point Marion on the Monongahela River to a maximum of 26.0 mg/l at Hutsonville on the Wabash River. All values were well below the limiting value of 45.0 mg/l established for drinking water by the U. S. Public Health Service.

HARDNESS—Ranges in hardness levels at 14 sampling locations are shown in the accompanying chart. Findings show that hardness concentrations in tributaries ranged from "soft" to "very hard" on the basis of designations adopted by the U. S. Geological Survey (see page 12).



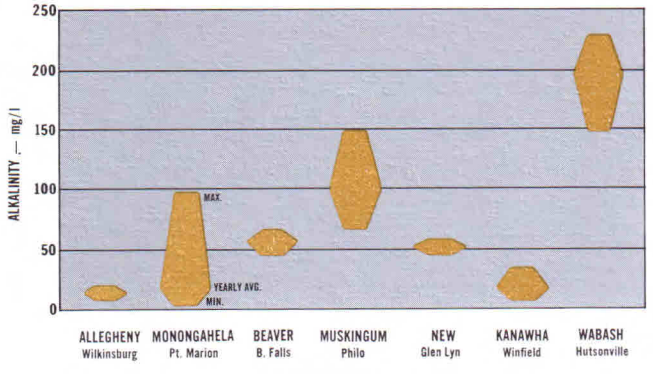
NITRATE (NO_3) RANGES — 1969



HARDNESS RANGES — 1969

ALKALINITY—During 1969 alkalinity concentrations in tributaries ranged from 1 to 228 mg/1. The accompanying chart shows maximum monthly-average, yearly-average and minimum monthly-average values of alkalinity at ten monitor locations on seven tributaries.

Tributary	Station	Alkalinity mg/l Max.	Avg.	Min.
Allegheny	Wilkinsburg	20	16	13
	Oakmont	26	13	16
Monongahela	So. Pittsburgh	47	10	1
	Point Marion	95	21	1
Beaver	Beaver Falls	63	55	44
Muskingum	Beverly	133	84	66
	Philo	142	100	70
Kanawha	Winfield	33	23	16
New	Glen Lyn	53	49	44
Wabash	Hutsonville	228	180	143



ALKALINITY RANGES — 1969

OTHER CHEMICAL CONSTITUENTS—Limiting concentrations for heavy metals are defined in ORSANCO criteria and U. S. Public Health Service standards. The following table shows limits that have been prescribed, together with maximum concentrations (in mg/l) observed during 1969 at USGS-ORSANCO stations on the Allegheny and Monongahela Rivers:

Constituent	Specified Limit	Allegheny River at Oakmont	Monongahela River at So. Pittsburgh
Arsenic	0.05	0.00	0.00
Cadmium	0.01	0.00	0.00
Chromium	0.05	0.01	0.01
Cobalt	*	0.00	0.01
Copper	1.00	0.02	0.10
Lead	0.05	0.02	0.01
Nickel	*	0.04	0.03
Zinc	5.00	0.12	0.17

*Not specified

Samples from the Scioto, Little Miami, Licking, Great Miami and Kentucky rivers, which were analyzed by the federal Environmental Protection Agency, showed the following maximum concentrations: barium 0.08 mg/l; arsenic less than 0.05 mg/l; cadmium less than 0.02 mg/l; chromium less than 0.01 mg/l; lead less than 0.04 mg/l; and silver less than 0.002 mg/l. Cadmium data were not definitive with respect to meeting ORSANCO criteria or USPHS standards. However, all values for the other constituents were within prescribed limits.

TALLY FOR THE VALLEY

AN INVENTORY OF POLLUTION-CONTROL FACILITIES at sewered communities and at those industrial installations that discharge wastewaters directly to streams in the district is compiled annually from information submitted by the states signatory to the Ohio Valley Compact. The status for the year ending June 30, 1970, is summarized in the accompanying tabulations. Following are salient findings revealed by the inventory.

Municipal Status—Treatment facilities now in operation serve 95 percent of the 11,600,000 sewered population in the 154,000 square miles encompassed by the compact district. New facilities under construction for 23 communities will serve an additional 40,000 persons. In addition, improvements are under construction at existing facilities for 33 communities whose population totals 470,000.

Along the main stem of the Ohio River there are now 130 plants that provide sewage treatment for 286 communities whose population totals 3,600,000. This past year only one treatment plant (serving a community of 3,300) was placed under construction. Meantime, ten communities with a combined population of 16,500 have not yet begun construction of treatment works.

One fact made apparent by the inventory is the difficulty experienced by state regulatory agencies in promoting treatment plant installations by small communities. Presently there are 277 communities (with an average population of 1,850) that lack treatment works. Last year the number was 295, and the year before it was 303. While the pollution load from these places aggregates less than 5 percent of that from the entire district, in many cases these discharges may be significant in terms of local impact.

Industrial Status—Of the 1,817 industries that discharge wastewaters directly to streams in the district, 83 percent (1,514) are complying at least with ORSANCO minimum control requirements. All but 115 of these 1,514 establishments are also complying with additional requirements imposed by individual state pollution-control agencies.

STATUS OF MUNICIPAL AND INSTITUTIONAL SEWAGE-TREATMENT FACILITIES–July 1, 1970

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	67 297,605	166 1,195,299	206 1,323,359	8 81,330	279 2,118,145	251 1,331,405	43 125,004	117 661,263	1,137 7,133,410	64.0 61.5
Treatment provided, improvements needed	7 24,109	62 612,996	4 7,770	6 16,600	93 1,291,019	99 1,413,615	34 71,088	2 1,139	307 3,438,336	17.3 29.6
Treatment provided, improvements under construction	2 9,420	7 37,200			19 411,749	2 2,670	2 5,150	1 2,000	33 468,189	1.8 4.0
New treatment works under construction		7 6,302	1 450	1 8,480	3 5,217	8 16,510	1 530	2 2,580	23 40,069	1.3 0.4
No treatment; construction not started	7 8,370	52 48,358	4 4,967	1 1,150	20 20,237	102 265,173	9 9,635	82 162,084	277 519,974	15.6 4.5
TOTAL	83 339,504	294 1,900,155	215 1,336,546	16 107,560	414 3,846,367	462 3,029,373	89 211,407	204 829,066	1,777 11,599,978	100.0 100.0

STATUS OF INDUSTRIAL WASTE CONTROL FACILITIES – July 1, 1970

STATUS	ILL.	IND.	KY.	N.Y.	OHIO	PA.	VA.	W.VA.	TOTAL	% OF TOTAL
Complying with ORSANCO minimum requirements	28	240	157	17	285	539	46	202	1,514	83.3
Control currently acceptable	28	215	150	12	256	512	44	182	1,399	77.0
Control facilities inadequate, improvements in progress	4	19			20	15		26	84	4.6
New control facilities under construction	2				2	3		11	18	1.0
Improvements or new control facilities being planned	5	36	1	16	56	26	1	46	187	10.3
No effective action	6	10	11	4	27	39	6	26	129	7.1
Number of Industries	45	280	162	32	361	595	51	291	1,817	100.0

What has been a matter of concern to the Commission is the continued reporting of certain industries that are behind schedule in meeting state requirements and even the minimum standards prescribed by ORSANCO. The inventory reveals that 129 establishments are in this category of "no effective action." Last year the number was 75. Part of this increase presumably reflects state re-evaluation of the current adequacy of existing control facilities.

Type of Sewage Treatment—In view of the requirement by the Federal Water Quality Office that all sewage discharges ultimately must receive biological (so-called "secondary") treatment, and the recently adopted ORSANCO standards calling for high-degree treatment, it is of interest to report on the status of type of treatment already provided.

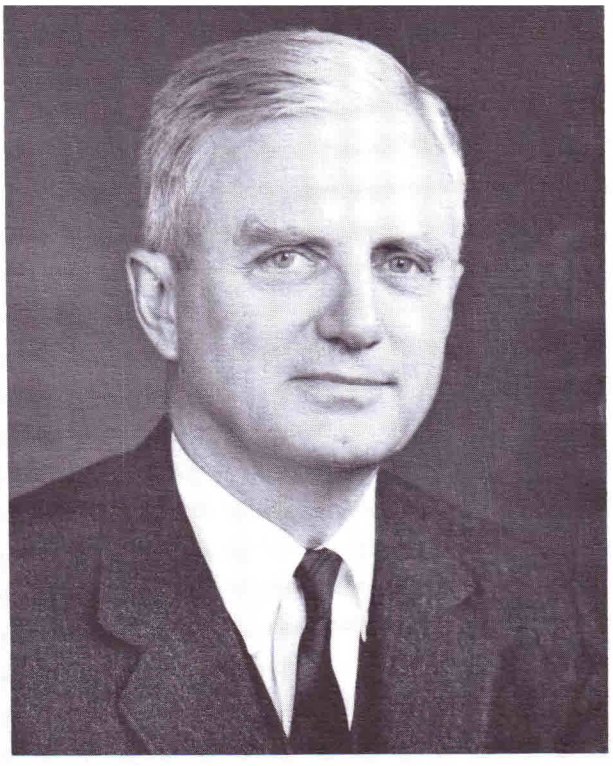
Such information may be derived from the accompanying tabulation of river-basin status. Here is inventoried the sewered population along the mainstem of the Ohio River and on each of the major tributaries, and with it the percentage of population served by each type of treatment.

An analysis of this data reveals that on the tributaries almost three-quarters of the sewered population is already provided with facilities for secondary treatment. Another 21 percent is served with primary treatment works. And some 7 percent have no facilities whatsoever.

For the entire district embraced by the compact, which includes the main stem of the Ohio River, the picture that emerges with respect to the type of treatment facilities provided, is this: 49 percent of the population is served by secondary, 25 percent by intermediate, and 21 percent by primary treatment plants.

Basin	Sewered Population (thousands)	Type of Treatment Provided (Percent of Population) None	Primary	Intermediate	Secondary
Ohio main stem	3,618	0.5	37.7	58.9	2.9
Allegheny	754	15.4	37.5	15.9	31.2
Monongahela	716	32.9	17.9	23.1	26.1
Beaver	682	0.2	12.0	54.8	32.0
Muskingum	512	1.4	23.8	5.0	69.8
Little Kanawha	11	17.6	12.5		69.9
Hocking	87	2.6	2.2		95.2
Kanawha	397	8.3	31.8		59.9
Guyandot	23	9.2	45.6		45.2
Big Sandy	66	26.5	25.4		48.1
Scioto	834	0.4	1.7	1.3	96.6
Little Miami	169	0.5	0.7		98.8
Licking	48	0.9			99.1
Miami	921	0.3	1.6	5.5	92.6
Kentucky	154		14.4		85.6
Salt	90				100.0
Green	117	0.7	3.4		95.9
Wabash	1,834	3.1	8.8	0.6	87.5
Cumberland	98		5.2		94.8
Tennessee	112	7.0	28.8		64.2
Minor tributaries	347	6.7	21.0	1.3	71.0
Total	11,600	4.6	21.2	25.0	49.2

ADMINISTRATIVE AFFAIRS



Chairman Lyle W. Hornbeck

EXECUTION OF THE OHIO RIVER VALLEY WATER SANITATION COMPACT is the responsibility of 27 commissioners. Each of the eight signatory states is represented by three commissioners appointed by the Governor of the state. Federal interests are represented by three commissioners appointed by the President of the United States. Administration of Commission affairs is conducted by a staff of fourteen persons headquartered in Cincinnati. A roster of the commissioners, officers and staff is given on the inside front cover.

Chairmanship of ORSANCO is rotated annually among the states. For the fiscal year beginning July 1, 1970, Lyle W. Hornbeck was elected to serve as chairman. Mr. Hornbeck, a lawyer, is associated with the firm of Bond, Schoeneck and King in Syracuse. He was appointed in 1961 to serve as one of the three commissioners representing the State of New York.

Dr. Emmett W. Arnold was elected to serve with Mr. Hornbeck as vice chairman. When Dr. Arnold's tenure as Ohio Director of Health terminated in January 1971, Raymond H. Fuller was elected to succeed him as vice-chairman.

Mr. Fuller, one of the three commissioners representing the State of Ohio, is associated with Burgess and Niple, Ltd., a firm of consulting engineers in Columbus, Ohio.

Tenure of commissioners appointed to represent the signatory states varies from four to six years. Several changes have occurred during the past year.

Membership Changes—Dr. Russell E. Teague retired as Kentucky Director of Health on September 1, 1970, after nineteen years as an ORSANCO commissioner. Dr. Teague has the unique distinction of representing both Pennsylvania (1951-1955) and Kentucky (1956-1970). He served as chairman of the Commission in 1958-1959.

Dr. Teague is succeeded by Dr. William P. McElwain, who as state health commissioner of Kentucky serves ORSANCO ex officio. Dr. McElwain holds the degree of Master of Public Health from Johns Hopkins University.

Organizational changes in New York State placed responsibility for water pollution control in a newly established Department of Environmental Conservation, effective July 1, 1970. The law provides that the Commissioner of this new department, Mr. Henry L. Diamond, shall serve as a representative to ORSANCO. Thus, Mr. Diamond succeeds Dr. Hollis S. Ingraham, who served in that capacity since 1963.

Dr. Thomas A. Gardner was appointed acting director of health for Ohio to succeed Dr. Arnold. Dr. Gardner has been with the Ohio Department of Health since 1951, after being awarded the degree of Master of Public Health from the University of North Carolina.

On January 19, 1971, legislation in Pennsylvania established a Department of Environmental Resources to consolidate the environmental protection functions previously performed by several departments and

agencies. Dr. Maurice K. Goddard was appointed by Governor Milton J. Shapp to head the new department and to serve as a member of ORSANCO. Dr. Goddard was formerly State Secretary of Forests and Waters and served as a member of the Pennsylvania Sanitary Water Board for sixteen years.

Dr. Goddard succeeds Dr. Ellsworth B. Browneller, who as Pennsylvania Director of Health was an ex officio member of ORSANCO during 1970.

Mr. E. Blackburn Moore of Virginia served as an ORSANCO commissioner from 1948 to 1960 and again from 1962 until his retirement in 1970. He is succeeded by Mr. Andrew M. McThenia, Jr.

Mr. McThenia, a member of the Virginia Water Pollution Control Board, is Professor of Law at Washington and Lee University. He also holds a Bachelor of Science degree in geology.

Mr. Luther N. Dickinson completed six years of service as a commissioner representing West Virginia in July 1970. He was succeeded by Mr. Ulyssus B. Yeager.

Mr. Yeager, a consulting engineer, was for twenty-eight years a fuel engineer with a major coal company.

Dr. Blucher A. Poole retired in November 1970 as technical secretary of the Indiana Stream Pollution Control Board. However, he will continue to represent Indiana as a member of ORSANCO.

Mr. Perry Miller, who succeeded Dr. Poole as technical secretary of the Indiana board, has been named to represent Indiana on the ORSANCO Engineering Committee.

A vacancy in Commission membership was created by the resignation of Mr. Carl L. Klein, Assistant Secretary of the Interior, on October 18, 1970. Appointment of a successor to Mr. Klein is pending.

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 1970 was $182,000. In addition, the Commission received a federal grant of $172,023 under the Federal Water Pollution Control Act.

Advisory Committees—Since 1950 when the Commission established a group of industry advisory committees, it has received assistance from some 250 waste-control specialists. These committees include representation from major chemical, coal, metal-finishing, petroleum, electric power, pulp and paper, and steel companies operating in the Ohio Valley.

Also advising the Commission since 1952 is a distinguished group of aquatic-life specialists. This committee is engaged in matters relating to water-quality criteria, investigation of fish-kills and the appraisal of aquatic inventory data.

A Water Users Committee, consisting of managers of municipal and industrial water supply systems in the Ohio Valley, has served since 1952 as a primary component of the regional monitoring and surveillance program conducted by the Commission.

CHAIRMEN OF ORSANCO ADVISORY COMMITTEES

(as of March 1, 1971)

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

Chemical Industry Committee — LOUIS W. ROZNOY, Olin Corporation, Stamford, Connecticut

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 — ROBERT F. ANDRES, The Dayton Power and Light Company, Dayton, Ohio

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

Steel Industry Action Committee — JOHN E. BARKER, Armco Steel Corporation, Middletown, Ohio

Water Users Committee — DONALD L. GLASS, Louisville Water Company, Louisville, Kentucky

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, 1970.

OHIO RIVER VALLEY WATER SANITATION COMMISSION

STATEMENT OF REVENUES COLLECTED AND EXPENSES PAID
YEAR ENDED JUNE 30, 1970

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. Department of Interior (Grant by authority of Federal Water Pollution Control Act)		172,023.00
Sale of publications		970.07
Interest earned on bank deposit		3,907.96
Miscellaneous income		400.00
Total revenues collected		$359,301.03
Expenses paid:		
From general funds	$197,127.78	
From federal funds	174,960.18	
Total expenses paid		372,087.96
Excess of expenses paid over revenues collected (Authorized budget of $200,000.00 provides for $18,000.00 to be used from available resources)		$ 12,786.93

STATEMENT OF RESOURCES JUNE 30, 1970

	General Funds	Federal Funds	Total
Available resources for period to June 30, 1969	$ 20,648.80	$ 38,612.80	$ 59,261.60
Transfer to general funds of federal funds earned in prior years	34,978.54	(34,978.54)	.....
Add: Revenues collected:			
Annual Budget—July 1, 1969 to June 30, 1970	182,000.00		182,000.00
U. S. Department of Interior		172,023.00	172,023.00
Sale of publications	970.07		970.07
Interest earned on bank deposit	3,907.96		3,907.96
Miscellaneous income	400.00		400.00
	242,905.37	175,657.26	418,562.63
Less: Expenses paid:			
July 1, 1969 to June 30, 1970	197,127.78	174,960.18	372,087.96
Available resources at June 30, 1970 before encumbrances	$ 45,777.59	$ 697.08	$ 46,474.67
Encumbered resources at June 30, 1970	14,075.50		14,075.50
Available resources at June 30, 1970	31,702.09	697.08	32,399.17

The above amount of $46,474.67 is comprised as follows:		
Cash on deposit with The Central Trust Company		$ 42,764.66
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	$ 2,457.81	
Hospitalization	441.20	2,899.01
Total		$ 46,474.67

OHIO RIVER VALLEY WATER SANITATION COMMISSION

STATEMENT OF POLICIES

(Adopted May 15, 1970)

WHEREAS: The eight states signatory to the Ohio River Valley Water Sanitation Compact (ORSANCO), having displayed the initiative more than two decades ago to devise an instrumentality for regional coordination, have clearly and continuously demonstrated its usefulness in advancing mutual aspirations and undertakings for the abatement and prevention of water pollution; and

WHEREAS: This fruitful experience has revealed further opportunities to enhance the utility of ORSANCO as an interstate compact agency and as a creative influence in promoting the concept and practice of regional water-quality management; and

WHEREAS: Review of the posture and functions of ORSANCO has been a matter of continuing study; and

WHEREAS: In view of changing conditions and circumstances, the Commission recognizes the need for a restatement of its policies;

NOW, THEREFORE, BE IT RESOLVED: That the commissioners of the Ohio River Valley Water Sanitation Commission subscribe to and set forth the following policies for guidance in carrying out the provisions of the Compact:

1. The mission of the Ohio River Valley Water Sanitation Compact Commission is to take whatever action that may be within its power and to coordinate and supplement efforts of the signatory states to place and maintain the interstate waters of the Ohio River Basin in a condition satisfactory for a source of public and industrial water supplies, suitable for recreational and agricultural usage, favorable for maintaining fish and other aquatic life, free from unsightly or malodorous nuisances due to floating solids, debris or sludge deposits, and adaptable to other beneficial uses.

2. In the pursuit of its mission the Commission will be guided by the principle that discharges of sewage, industrial waste or other substances from any source including agricultural, dredging, mining, recreational and transportation activities within any of the signatory states shall not injuriously affect any of the previously defined uses of the interstate waters of the Ohio River Basin which are intended to be protected by the compact. Toward this end, the Commission will promulgate water quality criteria, prescribe and enforce, in accord with the compact provisions, appropriate standards for the treatment or modification of wastewater and other discharges, and otherwise promote implementation of management and custodial functions relating to the installation and operation of pollution-control facilities. Secondary treatment of sewage and an equivalent treatment of other damaging waste discharges are imperative if the true objectives of the compact with respect to water quality standards are to be achieved. The minimum requirements for this level of treatment shall be the elimination of 75 to 85 percent of the oxygen consuming ingredients before discharging into streams, and as otherwise defined by the Commission.

3. The Commission will take appropriate action to prevent the creation of any new sources of pollution within the ORSANCO district. Pollution is defined as an alteration of the physical, chemical or biological characteristics of water in such a manner as to render it harmful or detrimental to human, animal, plant or aquatic life, or which otherwise would impair the usefulness or public enjoyment of the water.

4. Realization of the objectives of the interstate compact will be accomplished primarily by applying the resources of the Commission so as to encourage and supplement the efforts of the regulatory

agencies of the signatory states. The Commission will, however, when necessary, in accordance with the provisions of the compact, initiate legal action to secure compliance with its objectives.

5. The Commission will rely upon the states to furnish data on the location, amounts and characteristics of wastewater discharges, together with information on the status of compliance by municipalities and industries with standards and requirements established by the Commission. In connection with any regulatory actions, the Commission will supplement this information with its own investigations where necessary.

6. To insure maximum return from investments by public and private entities for the installation of pollution-control facilities, the Commission regards the conduct of performance-auditing of these facilities as of highest priority. Accordingly, the Commission will participate with the states in undertaking a uniform program for inspection and surveillance of plants and rivers.

7. The Commission will continue to support improvement and expansion of its monitoring and data-evaluation capabilities, which it regards as a fundamental regional-service undertaking. The Commission will continue to issue to state and federal agencies and to responsible parties assessments of quality conditions based on data acquired through its monitoring system. Within existing staff and data-processing capabilities, special data evaluation studies may be made for state and federal agencies and other interested parties on a reimbursable basis. Within its capability and in the interests of uniformity, the ORSANCO staff will provide consultation services to the member states and federal agencies on automatic monitoring equipment.

8. Recognizing with appreciation the contributions made over the past 20 years by advisory committees representing water-user, aquatic life, and generic industrial groups, the Commission will continue to foster these valued relationships.

9. The Commission asserts that water quality considerations are critical factors in the planning and operation of water resource facilities in the Ohio River Basin. To further this objective, the Commission will broaden its channels of communication and participation with agencies involved in water resources planning and development.

10. From time to time and as resources permit, the Commission may undertake such additional regional-service, research and demonstration projects that its signatory states, federal representatives, or advisory committees may recommend as conducive to the achievement of regional goals.

11. The Commission will continue its practice of disseminating information to the public.

OHIO RIVER VALLEY WATER SANITATION COMMISSION

An interstate agency representing: Illinois · Indiana · Kentucky · New York · Ohio · Pennsylvania · Virginia · West Virginia. Headquarters: 414 Walnut Street, Cincinnati, Ohio 45202

Notice of Requirements (Standards Number 1-70 and 2-70) Pertaining to Sewage and Industrial Wastes Discharged to the Ohio River

*Issued*_____ *to*_____

_____

You are hereby notified that on November 13, 1970, the Ohio River Valley Water Sanitation Commission, acting in accordance with and pursuant to authority contained in Article VI of the Ohio River Valley Water Sanitation Compact, established, subject to revision as changing conditions require, the attached standards for the modification or treatment of all sewage from municipalities or other political subdivisions, public or private institutions, corporations, or watercraft, and for the modification or treatment of all industrial wastes discharged or permitted to flow into the Ohio River from the point of confluence of the Allegheny and Monongahela rivers at Pittsburgh, Pennsylvania, designated as Ohio River mile point 0.0, to Cairo Point, Illinois, located at the confluence of the Ohio and Mississippi rivers, and being 981.0 miles downstream from Pittsburgh, Pennsylvania.

Under terms and provisions of the Ohio River Valley Water Sanitation Compact all sewage from municipalities or other political subdivisions, public or private institutions, corporations or watercraft and all industrial wastes discharged or permitted to flow into the Ohio River will be required to be modified or treated to the extent specified in the attached standards.

As one of the municipalities, subdivisions, institutions or corporations subject to the provisions of the Ohio River Valley Water Sanitation Compact, you are herewith called upon to consult with the

_____

not later than_____regarding waste-control facilities and procedures that will be required to achieve compliance with these standards.

_____
Chairman

_____
Executive Director and Chief Engineer

Commissioners for

_____

_____

_____

DEFINITIONS AND PROCEDURES FOR APPLICATION OF POLLUTION CONTROL STANDARDS NOS. 1-70, 2-70

The following definitions and application procedures are incorporated as part of Pollution Control Standards Nos. 1-70, 2-70:

(a) "Sewage" means the water carried human or animal wastes from residences, buildings, industrial, commercial or governmental establishments, public or private institutions, watercraft and floating facilities, or other places, together with such groundwater infiltration and surface-waters as may be present. The admixture with sewage, as defined, of industrial wastes, as hereinafter defined, shall also be regarded as sewage;

(b) "Industrial waste," other than cooling water, means any liquid, gaseous, solid material or waste substance or combination thereof including garbage, refuse, decayed wood, sawdust, shavings, bark, sand, lime, cinders, ashes, offal, oil, tar, dyestuffs, acids, chemicals, heat and all discarded matter resulting from any process or operation, including storage and transportation, manufacturing, commercial, agricultural and government operations, or from the development and recovery of any natural resources;

(c) "Cooling water" means water used as a heat transfer medium to which no process, waste or other materials, exclusive of chlorine, are added intentionally or unintentionally prior to discharge;

(d) "Substantially complete removal" means removal to the lowest practicable level attainable with current technology;

(e) Methods for determining waste constituents and characteristics shall be those set forth in the most recent edition of "Standard Methods for the Examination of Water and Wastewater," prepared and published jointly by the American Public Health Association, American Water Works Association, and the Water Pollution Control Federation, except that such other methods may be used as are approved by the Commission.

POLLUTION CONTROL STANDARD NO. 1-70

All sewage from municipalities or political subdivisions, public or private institutions, or installations, or corporations, or watercraft, and all industrial wastes, other than cooling water as hereinafter defined, discharged or permitted to flow into the Ohio River from the point of confluence of the Allegheny and Monongahela rivers at Pittsburgh, Pennsylvania, designated as Ohio River mile point 0.0, to Cairo Point, Illinois, located at the confluence of the Ohio and Mississippi rivers, and being 981.0 miles downstream from Pittsburgh, shall be so treated or otherwise modified as to provide for:

A. Substantially complete removal of settleable solids;

B. Substantially complete removal of oil (in whatever state, including free, emulsified, dispersed and dissolved oils), debris, scum, and other floating materials;

C. Reduction of suspended solids, dissolved solids and other materials to such degree that the discharge will not produce turbidity, color or odor in the river, or impart taste to potable water supplies, or cause the tainting of fish flesh;

D. Reduction of any and all constituent materials to such a degree that the concentration thereof, singly or in combination, in any discharge is not harmful to human health, and reduction of the following chemicals to such a degree that the concentrations thereof in any discharge do not exceed (1) the limits specified in the tabulation below or (2) such lower limits as may be required for compliance with subparagraph (E) of this Pollution Control Standard No. 1-70:

	Limiting concentration (mg/l)
Inorganic chemicals	
Arsenic	0.05
Barium	1.0
Cadmium	0.01
Chromium (hexavalent)	0.05
Lead	0.05
Mercury	0.005
Selenium	0.01
Silver	0.05
Organic chemicals	
Cyanide	0.2
Pesticides	
Aldrin	0.017
Chlordane	0.003
DDT	0.042
Dieldrin	0.017
Endrin	0.001
Heptachlor	0.018
Heptachlor epoxide	0.018
Lindane	0.056
Methoxychlor	0.035
Organic phosphates plus carbamates (as parathion equivalent cholinesterase inhibition)	0.1
Toxaphene	0.005
Herbicides	
2,4-D plus 2,4,5-T plus 2,4,5-TP	0.1

E. Reduction of any material or, if necessary, all materials contained in any discharge which singly or in combination are toxic or harmful to aquatic life to such a degree or degrees that the calculated concentration(s) of such material or materials in the river does not exceed one-twentieth of the 96-hour median tolerance limit (96-hr. TL_m) for aquatic life;

F. Reduction of radioactive materials to such degree that (1) concentrations of *unidentified* radionuclides in the discharge do not exceed (a) 30 pc/l or (b) limiting values specified by the Atomic Energy Commission for water in which certain radionuclides are known to be absent, as set forth in Column 2, Table II, Paragraph 3.C, Notes to Appendix B, Title 10, Chapter 1, Code of Federal Regulations (January 1, 1970), or (2) concentrations of *identified* radionuclides in the discharge do not exceed limiting values for water specified by the Atomic Energy Commission, as set forth in Column 2, Table II, Appendix B, Title 10, Chapter 1, Code of Federal Regulations (January 1, 1970);

G. Reduction of fecal coliform bacteria to such degree that (1) during the months of May through October fecal coliform density in the discharge does not exceed 200 per 100 ml as a monthly geometric mean (based on not less than ten samples per month), nor exceed 400 per 100 ml in more than ten percent of the samples examined during a month, and (2) during the months of November through April the density does not exceed 1,000 per 100 ml as a monthly geometric mean (based on not less than ten samples per month), nor exceed 2,000 per 100 ml in more than ten percent of the samples examined during a month;

H. Control of hydrogen ion concentration to such degree that the pH is not less than 5.0 nor greater than 9.0;

I. Reduction in 5-day biochemical-oxygen-demand load (pounds per day) of not less than 92 percent (as a monthly-average value), provided, however, that a lesser degree of reduction may be applied, but not less than 85 percent (monthly-average value), if as a result the biochemical-oxygen-demand (BOD) load does not exceed that amount which will increase the BOD of the river, on a calculated basis, by more than 0.05 milligrams per liter at flows equal to or exceeding "critical" flow values specified in the following table:

River Reach		Critical flow in cfs*
From	To	
Pittsburgh (mi. 0.0)	Willow Is. Dam (161.7)	6,600
Willow Is. Dam (161.7)	Gallipolis Dam (279.2)	7,700
Gallipolis Dam (279.2)	Meldahl Dam (436.2)	9,900
Meldahl Dam (436.2)	McAlpine Dam (605.8)	12,100
McAlpine Dam (605.8)	Uniontown Dam (846.0)	14,300
Uniontown Dam (846.0)	Smithland Dam (918.5)	20,000
Smithland Dam (918.5)	Cairo Point (981.0)	48,500

*Minimum 7-day flow once in ten years.

J. Reduction of heat content to such degree that the aggregate heat-discharge rate from the municipality, subdivision, institution, installation or corporation, as calculated on the basis of discharge volume and temperature differential (temperature of discharge minus average upstream river temperature), does not exceed the amount calculated by the following formula, provided, however, that in no case shall the aggregate heat-discharge rate be of such magnitude as will result in a calculated increase in river temperature of more than 5 deg. F.;

Allowable heat-discharge rate (Btu/sec) =
62.4 × river flow (cfs) × (T_A − T_R) × 90%

Where:

T_A = Allowable maximum temperature (deg. F.) in the river as specified in the following table:

	T_A		T_A
January	50	July	89
February	50	August	89
March	60	September	87
April	70	October	78
May	80	November	70
June	87	December	57

T_R = River temperature (daily average in deg. F.) upstream from the discharge

River flow = measured flow but not less than critical flow values specified in the following table:

River Reach		Critical flow in cfs*
From	To	
Pittsburgh, Pa. (mi. 0.0)	Willow Is. Dam (161.7)	6,500
Willow Is. Dam (161.7)	Gallipolis Dam (279.2)	7,400
Gallipolis Dam (279.2)	Meldahl Dam (436.2)	9,700
Meldahl Dam (436.2)	McAlpine Dam (605.8)	11,900
McAlpine Dam (605.8)	Uniontown Dam (846.0)	14,200
Uniontown Dam (846.0)	Smithland Dam (918.5)	19,500
Smithland Dam (918.5)	Cairo Point (981.0)	48,100

*Minimum daily flow once in ten years.

All cooling water from municipalities or political subdivisions, public or private institutions, or installations, or corporations discharged or permitted to flow into the Ohio River from the point of confluence of the Allegheny and Monongahela rivers at Pittsburgh, Pennsylvania, designated as Ohio River mile point 0.0 to Cairo Point, Illinois, located at the confluence of the Ohio and Mississippi rivers, and being 981.0 miles downstream from Pittsburgh, Pennsylvania, shall be so regulated or controlled as to provide for reduction of heat content to such degree that the aggregate heat-discharge rate from the municipality, subdivision, institution, installation or corporation, as calculated on the basis of discharge volume and temperature differential (temperature of discharge minus upstream river temperature) does not exceed the amount calculated by the following formula, provided, however, that in no case shall the aggregate heat-discharge rate be of such magnitude as will result in a calculated increase in river temperature of more than 5 deg. F.:

Allowable heat-discharge rate (Btu/sec) =
$62.4 \times$ river flow (cfs) $\times (T_A - T_R) \times 90\%$

Where:

T_A = Allowable maximum temperature (deg. F.) in the river as specified in the following table:

	T_A		T_A
January	50	July	89
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Gallipolis Dam (279.2)	Meldahl Dam (436.2)	9,700
Meldahl Dam (436.2)	McAlpine Dam (605.8)	11,900
McAlpine Dam (605.8)	Uniontown Dam (846.0)	14,200
Uniontown Dam (846.0)	Smithland Dam (918.5)	19,500
Smithland Dam (918.5)	Cairo Point (981.0)	48,100

*Minimum daily flow once in ten years.

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: 518-457-6533

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