ORSANCO

1964

ORSANCO network of monitor stations on the Ohio River and some major tributaries provides means for continuous checking of water-quality conditions. Bacterial, chemical and radioactivity characteristics are measured. Details of the operation and a summary of findings are given in the river-quality appraisal section of this report.

The Commissioners of the

OHIO RIVER VALLEY WATER SANITATION COMMISSION

an interstate compact agency
created jointly 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

SIXTEENTH ANNUAL REPORT 1964

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

SIXTEEN EVENTFUL YEARS

Today, 99 percent of the sewage emanating from communities along the 1,000 miles of the Ohio River is piped into purification plants. Sixteen years ago all of this effluvia was poured untreated into the river. To visualize what these treatment facilities are handling in terms of quantity, here is a comparison: If this sewage flow had to be conveyed away in railroad tank cars for disposal, it would require a train 350 miles in length every day.

Matching this progress in clean-up efforts on the main stem of the river has been the installation of sewage-treatment facilities on tributaries of the Ohio. Throughout the entire drainage district there are now more than 1,300 communities — with a total population of 10,700,000 — provided with purification plants. What this means is that 94 out of every hundred persons connected to a sewer system in the Ohio Valley has made an investment in pollution abatement. How much? The total is about one billion dollars — averaging $100 for every man, woman and child!

Another goal of this regionally coordinated crusade for clean streams initiated in 1948 by eight states has been the curbing of industrial-waste pollution. There are more than 1,700 industrial establishments whose effluents are discharged directly into streams of the Ohio Valley district. Today, 90 percent are recorded as complying at least with minimum interstate requirements — and some are rated as doing even better.

These are the salient facts that emerge from the 16th annual inventory of pollution control compiled by the member states of the Ohio River Valley Water Sanitation Commission, sometimes known as ORSANCO. These states are pledged by a compact, approved by the Congress of the United States, "faithfully to cooperate in the control of future pollution in, and the abatement of existing pollution from, the waters of the Ohio River Valley."

The record eloquently testifies to the manner in which this pledge is being honored. And one of the signatories to the compact — the State of Illinois — proudly reported this year to its sister states that all of its sewered municipalities along the Ohio River had now completed installation of treatment works. Thus, efforts of the Sanitary Water Board of Illinois have given that state the distinction of being the first to achieve 100 percent compliance with a major goal of the interstate agreement.

In pursuit of their self-inspired mission, the states are under no illusion, however, that the great strides forward in stream clean-up permit any slackening of pace. Their inventory also reveals that achievement in promoting control of remaining sources of untreated waste discharge is somewhat short of aspirations. Currently they are concerned with obtaining construction timetables from 372 communities and 172 industries that have not yet complied with requirements. Most of these represent relatively minor sources of pollution and many are catalogued as "hardship" cases. Nevertheless, in the long-range plan adopted by the Commission it was contemplated that schedules for all delinquents should be established not later than 1965. This is one of the goals toward which the states are working.

Perhaps of even greater concern is how to cope with the increasing burden of inspection of new treatment facilities. Each year the number of plants increases. And today there are some 1,300 municipal installations and 1,600 industrial control works whose operation lays claim for periodic inspection. Budgetary and other constraints on staffing have always imposed handicaps on state regulatory agencies in handling this task. Meantime, evidence of faulty operation of facilities is accumulating and with it the recognition that this may deny full realization of clean-stream benefits that should accrue from the construction investments already made.

The Commission is exploring ways to deal with the necessities for inspection. But as one commissioner philosophically observed: "Had the states been less effective in getting treatment plants built we wouldn't have this problem to face. It's like the traffic situation — the more roads you build the more policemen you need to patrol them."

Supplementing the multitudinous duties carried out by the signatory states in advancing pollution control within their individual jurisdictions are activities of mutual regional interest that have been assigned to the staff of the Commission. Of paramount importance, and growing more so since its establishment in 1951, is the ORSANCO river-quality monitor network. Coupled with this basic service is the conduct of an interstate hazard-alert program to deal with accidental spills, and the performance of aerial surveillance of river conditions.

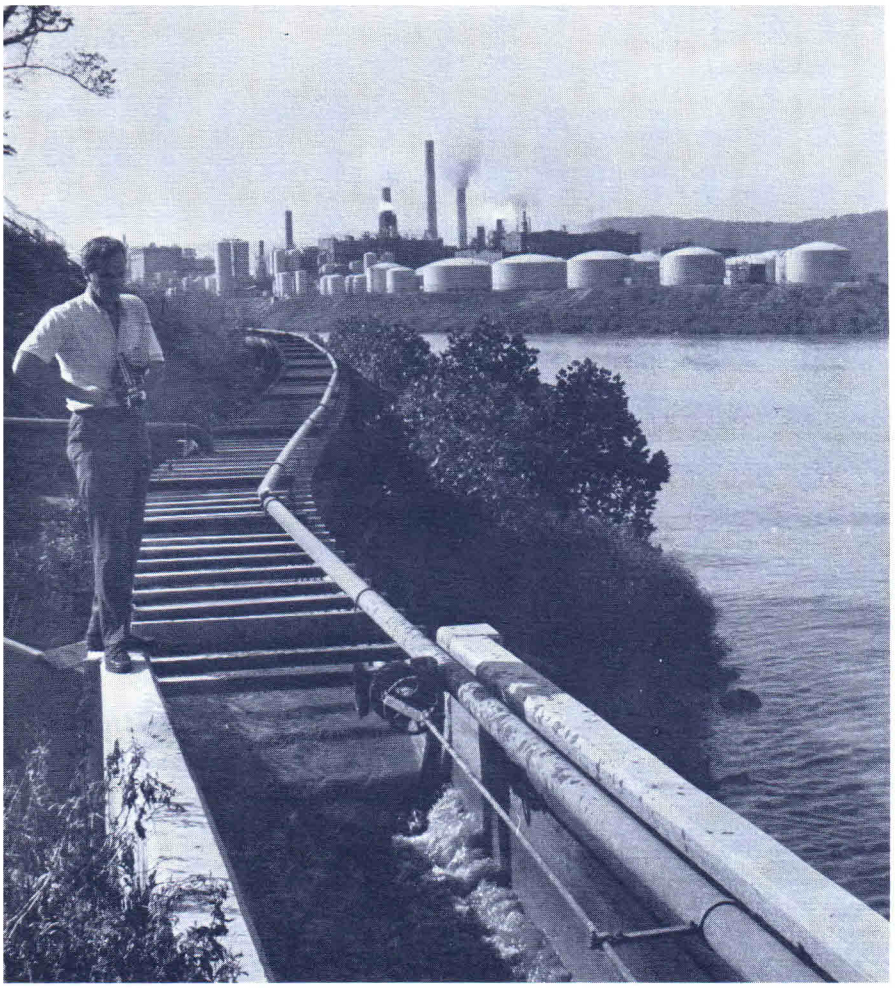
Other undertakings assigned to the Commission staff include administration of advisory-committee relationships, execution of public-affairs activity, development of documentary films and participation in federal-state water-resources planning.

Details on these activities and related matters are summarized in the following pages. In addition, one section of the report is devoted to a resumé of river-quality measurements and their significance.

RIVER QUALITY APPRAISAL

Thirteen years ago ORSANCO inaugurated the practice of systematically compiling and evaluating changes in river quality at various places throughout the valley. Initially, data assembly was facilitated by enlisting the aid of managers at municipal waterworks and industrial intakes. Soon thereafter a cooperatively-financed contract was made with the U. S. Geological Survey to supplement this service. Today, this manually operated component of the monitor network provides quality data from 38 locations in the Ohio Valley.

Meanwhile, the ORSANCO staff envisioned possibilities of developing an automatic system for maintaining 24-hour-a-day vigilance on river-quality variations. The commissioners supported this notion by authorizing a modest outlay of funds. Four years ago the idea became a reality. In September 1960, the ORSANCO ROBOT MONITOR system was placed in operation and thus introduced both the concept of continuous monitoring as well as the "hardware" for doing it.



Progress in cleanup of the Kanawha River in West Virginia is symbolized in this view of a shoreline conduit collecting chemical wastes from a vast industrial operation. The waste waters are conveyed to a treatment plant for cleansing prior to discharge into the river.

The ORSANCO electronic-sentinel system consists of multiple sensor units, telemetry equipment and transcribers for read-out of results directly on typewriter and punched tape. Eight of these units are connected by leased-wire circuits with headquarters in Cincinnati; four others are equipped with on-site recorders. Six of the monitors are situated on the Ohio River main stem, and six are located on tributaries. Every hour on the hour an automatic timer activates the transmitter sitations, which then report on river conditions.

While developing the tools to automate the acquisition of quality data, staff attention was also directed to satisfying a subsidiary requisite for diagnosing the behavior of rivers — namely, securing daily information on quantity and velocity of flow. Enlisted in this endeavor were the capabilities of the U. S. Weather Bureau. At Cincinnati the bureau maintains a River Forecast Center whose activities were primarily oriented to the prediction of floods. By adaptation of techniques employed for this service the U. S. Weather Bureau has made it possible to furnish ORSANCO each morning with a measure of the flow for that day as well as a forecast of expected conditions for the next three days at selected points on the Ohio River and some of its tributaries. This is a unique and invaluable service that paves the way for regional water-quality management. Among other things it permits the ORSANCO staff to evaluate the influence of spills immediately, and to develop knowledge on correlating quality changes with flow variations.

To facilitate appraisal of the data being compiled — which averages some 47,000 items monthly — a program for electronic computer processing has been devised. Some of the findings from this array of information on river conditions, and an interpretation of its significance to the interstate pollution-control efforts, are given in this report beginning on page 16.

Aside from the current usefulness of the river-quality evaluation project, the undertaking may be regarded as significant for future conduct of pollution-control endeavors. It is providing a demonstration of the application of new tools and techniques for the management of water quality, which at present is a concept rather than a practice.

MONONGAHELA RIVER CONFERENCE

On December 17-18, 1963, the Secretary of the federal Department of Health, Education and Welfare called a conference in Pittsburgh with representatives of the Ohio River Valley Water Sanitation Commission and the States of Pennsylvania, West Virginia and Maryland with respect to pollution control in the Monongahela River Basin. The conference technique, as conceived by its supporters when it was included in the Federal Water Pollution Control Act, was intended to provide an administrative procedure to expedite consultation and coordination among state and federal interests. However, it is being employed by the federal authorities within the framework of a formal proceeding conducted as a public hearing rather than a conference.

The commissioners of ORSANCO were puzzled why the Ohio Valley was selected as a locale for such a proceeding at a time when the federal agency apparently was burdened with pollution problems in many other parts of the nation where interstate compacts do not exist for their resolution. In brief, the commissioners concluded that whatever the motive for this action, it could not be be construed as favorably disposed to the encouragement of interstate-compact relationships. Their views were summarized in a formal statement by Chairman Joseph R. Shaw who said, in part:

"If there is any reason for the Secretary of the Department of Health, Education and Welfare to feel uninformed or dissatisfied with any aspect of the Ohio Valley program, why was this not disclosed at a regular meeting of the Commission? The Department has its own representative — in the person of the Surgeon General of the Public Health Service — serving as a member of this Commission. The Surgeon General or his representative has participated in meetings of ORSANCO since its organization 15 years ago, and has had a voice in development of the interstate program.

"In calling this conference, the Acting Secretary of the Department of Health, Education and Welfare, in a letter dated October 14, 1963, wrote as follows:

> 'The purpose of the conference, as specified by Section 8 (c) (3) of the Federal Water Pollution Control Act, is to consider the occurrence of pollution of interstate waters subject to abatement under the Act; the adequacy of measures taken toward abatement of the pollution; and the nature of delays, if any, being encountered in abating pollution.'

"These items of consideration," said Chairman Shaw, "insofar as they relate to waters within the Ohio Valley district, are documented in the minutes and records of ORSANCO and in annual reports prepared for the Governors of the signatory states. Such information is — and always has been — readily available to the Department of Health, Education and Welfare through its own representative on the Commission.

"It is difficult to understand, therefore, why the Department has not availed itself of these well-established channels of communication and the meetings conducted regularly by the Commission, to express its interests. The fact that the Department has chosen not to exercise its prerogatives under the interstate compact — a course of action that seems inconsistent with the declared policy of Congress — is the greatest single source of confusion that enshrouds these proceedings."

Presentation of statements and reports at the Monongahela conference were conducted in open forum and occupied almost two days. Following this the conferees, representing ORSANCO, Pennsylvania, West Virginia, Maryland and the Department of Health, Education and Welfare, unanimously agreed on the following conclusions and recommendations:

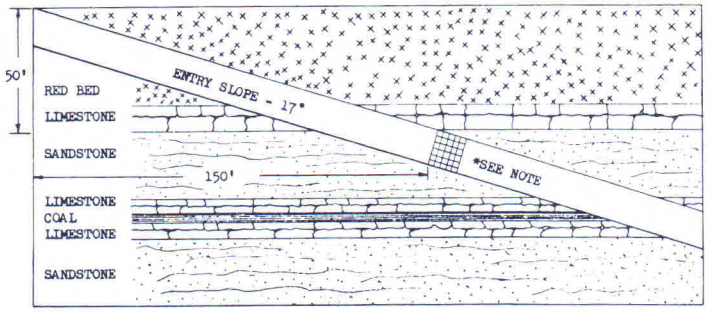
- Pollution of an interstate nature exists in the Monongahela River Basin which adversely affects municipal and industrial water supplies, fish and wildlife, and recreation, such as fishing, boating, swimming, and navigation.

- The States of West Virginia, Pennsylvania, Maryland and the Ohio River Valley Water Sanitation Commission have made appreciable progress in water pollution abatement and have presented acceptable programs for the control of industrial and municipal wastes.

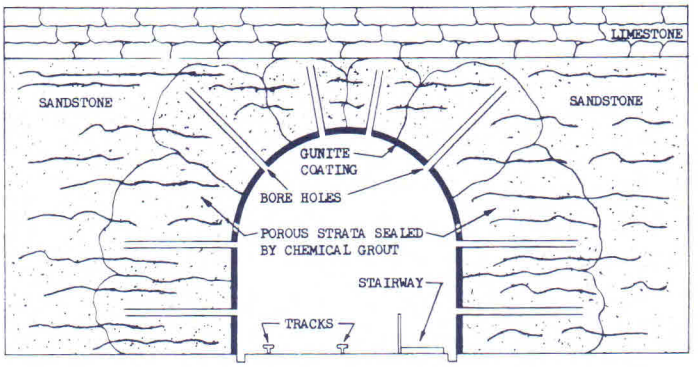
- Cognizance is taken of Pennsylvania's program to abate pollution from such sources by the end of 1966. Commensurate programs have been developed by West Virginia and Maryland. It is recog-

A CASE HISTORY OF CONTROL OF ACID MINE-DRAINAGE

from the ORSANCO Coal Industry Advisory Committee handbook



Side view — entry slope



Front view — 150 feet down entry slope

CHEMICAL GROUTING TO PREVENT INFLOW OF WATER

The hatched area shown in side view indicates where excessive water seepage occurred. The front view diagram provides details on chemical grouting.

Mining Method: Underground Mining. **Location:** Western Pennsylvania, Upper Freeport Seam.

Results Achieved: Inflow of water into mine stopped. This in turn eliminated severe icing conditions on the walls and ceiling of the mine slope near the entry. This resulted in improved safety conditions and in substantial savings in time and material. The method would be useful to control mine drainage.

Description: Water leakage occurred along the plane of intersection of the mine entry with water-bearing strata. Holes were drilled in the roof and ribs of the entry. First, water containing Calcocid Uranine dye, a fluorescent yellow-green color, was pumped into these holes to locate the leakage; then chemical grout was pumped into the holes to seal off the water.

No coal seams were encountered in the drilling. The rock types present were typical of strata overlying coal measures and included claystone, fossil shales and fine-grained sandstones.

American Cyanamid Company's AM-9 is a dry-powder mixture of two acrylic monomers that is applied as an aqueous solution. When catalyzed a crosslinked polymer is formed that renders soil and rock formations impermeable to water.

Because solutions of AM-9 retain the same density and viscosity as water until the point of its instantaneous gelation, they could be pumped into the areas located by the dye in the same time intervals. The gel-time of the grout was set so that the leaky channels would be completely sealed. The use of 220 gallons of 10 percent AM-9 pumped into 15 bore holes was sufficient to eliminate the entry of water into the roof and ribs of the mine.

nized that court action may necessarily modify this program and that economically depressed communities in the Basin may have to depend on outside financial assistance.

- The establishment of a technical committee consisting of representatives of West Virginia, Pennsylvania, Maryland, the Ohio River Valley Water Sanitation Commission and the Federal Government to explore the means of abating pollution caused by coal-mine drainage is recommended. This committee will be charged with determining the amount of pollution from such mines. The committee also will be charged with developing a remedial program, including a cost estimate.

This technical committee on mine drainage control in the Monongahela Basin was activated in January, 1964. For details on its work see page 12.

MINE ACID CONTROL

In his statement at the Monongahela conference the chairman of ORSANCO, Mr. Joseph R. Shaw, expressed the hope that the discussion would focus on accelerating action for the control of mine-acid drainage. He said that the Commission had consistently sought to dispel the psychology of defeatism with respect to this problem that had shrouded both the coal industry and research organizations. And then he recounted these endeavors:

"First, it should be noted that in 1950 the Commission devoted a substantial part of its 2nd Annual Report (pp 29-34) to the Governors of the signatory states to an appraisal of the mine-acid problem, to an analysis of the legal position with regard to control, and to the possibilities of promoting corrective action.

"How baffling the problem was regarded then is revealed by the fact that some of the states actually exempted mine drainage from regulatory control because, in their view, means were not available to deal with it. Meantime, the Commonwealth of Pennsylvania was addressing itself in vigorous fashion to the matter. Not only did it support scientific research, but more importantly the Pennsylvania Sanitary Water Board promoted the application of practices at mining operations that minimized the effects of mine drainage.

"In developing its action program the Commission decided, among other things, that it would invite leaders of the coal industry to participate in seeking solutions. This brought about the establishment in 1951 of the ORSANCO Coal Industry Advisory Committee. In addition, the Commission sought to enlist the collaboration of two federal agencies — the Public Health Service and later the Bureau of Mines. On July 12, 1956, a resolution was adopted by the Commission petitioning the Surgeon General of the Public Health Service to consider inauguration of investigations looking toward the prevention, reduction and control of acid mine drainage. It was hoped that this petition might influence the Public Health Service to give cognizance to the problem in its expanding research programs. Meantime, possibilities of participation by the Bureau of Mines were explored.

"Nothing fruitful emerged from either of these efforts. In retrospect, it appears that while the Public Health Service had money for research, matters other than the mine-acid problem were given a higher priority; and although the Bureau of Mines displayed interest, it had virtually no funds for this purpose.

"Unwilling to be deterred by this unsatisfactory state of affairs, the Engineering Committee of ORSANCO began gathering evidence that suggested possibilities of doing something to curb the indiscriminate discharge of mine drainage. Much of this evidence came from observations in Pennsylvania and Indiana, where the state regulatory agencies and the coal operators had tackled the problem on an empirical basis and had achieved some success. In brief, the ORSANCO committee concluded that pollution from active mines could be ameliorated by: (1) Reducing entry of water into mines through diversion of surface streams and by sealing crevices; (2) Minimizing contact time of water with acid-forming materials in a mine; (3) Exercising greater care in disposal of gob and other refuse materials; (4) Proportioning drainage discharges from the mines with flow of water in the stream, as opposed to the common practice of pumping intermittent "slugs" of acid water; and (5) Employment of adequate closure procedures immediately following termination of mining activities.

"In developing these concepts, the Engineering Committee had the benefit of review and finally the unanimous endorsement of their application by the ORSANCO Coal Industry Advisory Committee. On the

recommendation of both committees, the Commission incorporated these practices in a control measure that was adopted by the eight states in 1960. To expedite application of these measures three developments may be noted:

- The Commission denied recognition of acid mine drainage as qualifying for blanket exemption from pollution control laws. Thus, for the first time agreement was reached by the ORSANCO states and representatives of the coal industry that practical means were available to ameliorate the problem. In the history of regulatory practice this is indeed a significant development.

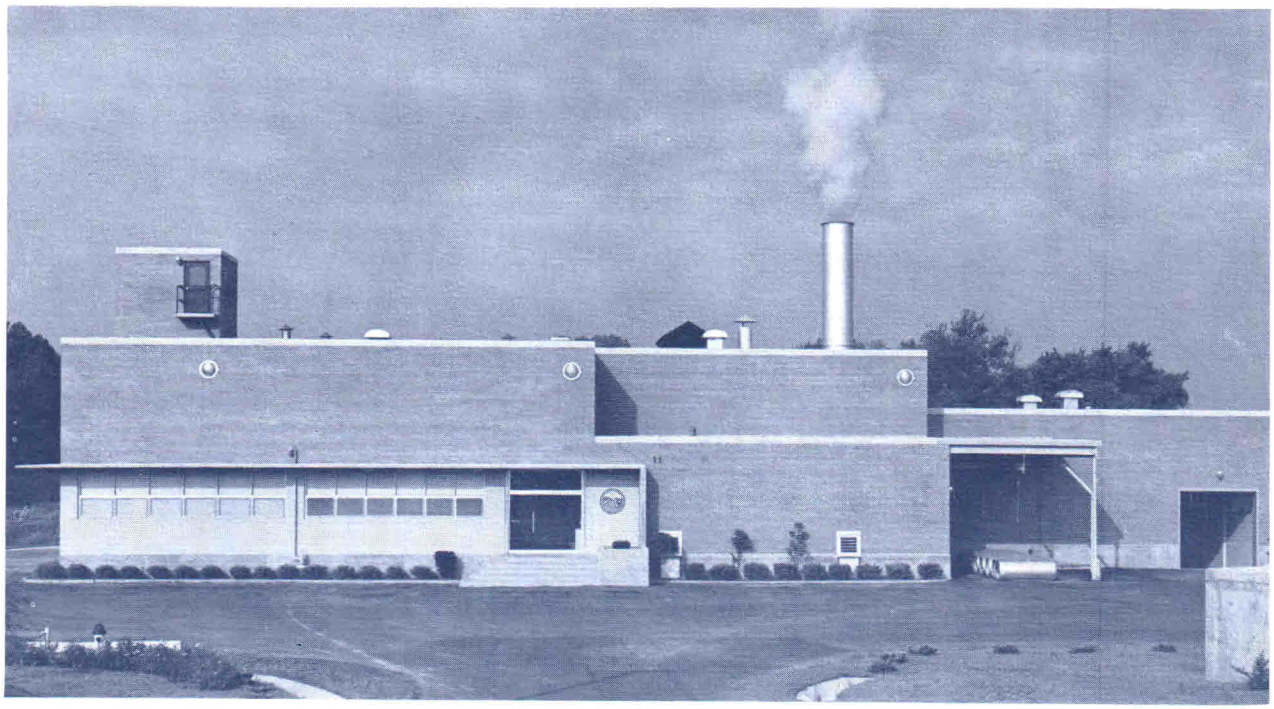
- The Commission then authorized its staff to conduct "curbstone clinics" for state agency personnel to develop familiarity with the application of corrective measures under field conditions.

- And finally, the ORSANCO Coal Industry Advisory Committee volunteered to promote field demonstration projects to aid mine operators in complying with the ORSANCO directives. In addition, the coal committee is developing a handbook for publication by the Commission that describes how situations at various types of mines may be dealt with. (This handbook was published in March 1964. It is titled: *Principles and Guide to Practices in the Control of Acid Mine-Drainage, supplemented with case histories.* Already thousands of copies have been distributed to mine operators.)

"Meantime, a documentary film titled *Coal and Water* has been produced by ORSANCO. This portrays the problems associated with acid mine-drainage and the steps that can be taken to ameliorate them."

Mr. Shaw concluded his summary with this comment: "While all of this represents a good start in coming to grips with drainage from active mines, the Commission is under no illusions about the problem of dealing with so-called abandoned mines. Despite conflicting opinions that have been aired before the Engineering Committee of ORSANCO, there seems to be some basis for belief that a program of sealing abandoned workings, where possible, may offer at least a partial remedy. Records disclose that during the mid-Thirties, when federal funds were available

On September 10, 1964, the commissioners of ORSANCO joined with the citizens of Huntington, W. Va. in the dedication of sewage-treatment facilities at the last major source of municipal pollution on the Ohio River. Pictured here is the service and sludge-processing building of the treatment works which cost $2½ million. Interceptor sewers and pumping stations cost an additional $6 million.



to provide employment and men were engaged on a mine-sealing program, there was a substantial reduction in acid conditions in some streams. These seals were not maintained when the work-relief program was discontinued."

Recommendations of the conferees at the Monongahela conference in establishing a joint committee of state and federal representatives to furnish a contemporary appraisal of mine-drainage control was regarded as providing additional momentum to the endeavors promoted by the ORSANCO states.

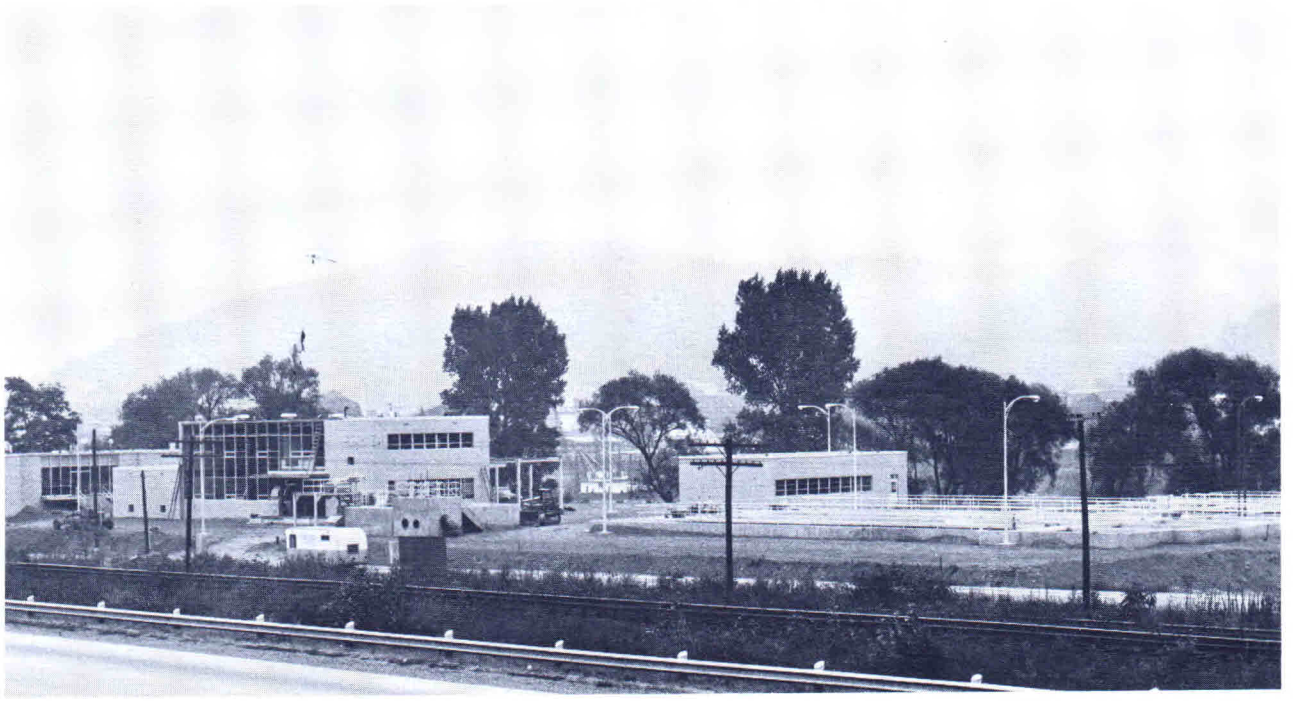
PUBLIC AFFAIRS ACTIVITIES

In June of 1964 the Commission completed its fourth year on the production and distribution of "spot" announcements used as public-service features by 349 radio and 51 television stations in the Ohio Valley. Every thirteen weeks during this period a new set of messages was provided to these 400 stations, each designed to promote citizen understanding and support for the eight-state crusade for clean streams. The most recent set was focussed toward prevention of stream littering.

At the end of this year the Commission decided to terminate, at least temporarily, this component of its public-affairs program. It was noted that the U. S. Department of Health, Education and Welfare recently inaugurated a similar program on a nationwide basis. Since this overlapped in part what ORSANCO was doing on a regional basis, it was felt that the Commission could use its limited funds to better advantage in other endeavors. The staff is continuing, however, to assist radio and television stations in development of local programs relating to advancement of pollution control.

In the development of documentary films, seven of which have been completed, attention has now turned to production of an educational film for employees of industrial plants. Tentatively titled *Good Housekeeping,* the purpose of the film is to reveal how carelessness in a plant may contribute to stream pollution and what can be done by individual employees to guard against such occurrences. Since the film is

Four communities in Ohio — Martin's Ferry, Bellaire, Bridgeport and Brookside — joined together for the financing and operation of this central sewage-treatment plant on the upper Ohio River. Completed early in 1964 by the Belmont County Sewer Authority No. 1, the treatment works cost $1.2 million, and the investment in interceptor sewers was $6 million.



intended primarily for use by industries, the Commission believed it to be appropriate for member companies of the ORSANCO Industry Advisory Committees to share in the cost of production. Within four months after this sentiment had been voiced individual subscriptions from companies produced the desired amount of $10,000.

The Commission had already invested $5,000 in preliminary work on the film and this year budgeted an additional $8,000 to continue its production. With the contributions made by industry members early completion is assured. Since it is intended that companies will use the film for in-plant training to stimulate exercise of personal responsibility for preventing pollution, a manual will be written to accompany the film to aid in making an effective presentation. Among other things, the manual will outline how discussion may be oriented to relate the incidents portrayed in the film with situations that may prevail in the plant where it is shown.

ANTI-LITTER CAMPAIGN

There is probably no more tangible evidence of the improved cleanliness of the Ohio River and many of its tributaries than the intensification of use of the streams for recreational boating and fishing. For example, the Outdoors Editor of *The Cincinnati Enquirer*, in his column on July 12, 1964, enthusiastically wrote: "More and more reports are being received about record catches of bass from the Ohio River; now we have a report about a good-sized one — a smallmouth that weighed 3½ pounds."

Another index of the growing popularity of recreation on the rivers is the number of boat-regatta notices issued by the U. S. Coast Guard. A review of records maintained by ORSANCO shows that 22 regattas were conducted in 1959. However, for the seven-month period of April to October 1964, the number was 52. This represents a 140 percent increase in five years. Thirty-three of these events in 1964 took place on the Ohio River and 19 were held in tributary waters.

Recreational use has laid claim for renewed efforts against littering of the waterways with garbage and other refuse from boats and marinas. There has long been a federal statute (Title 33 U. S. Code 407) forbidding this practice, which creates unsightliness as well as hazards to boaters and swimmers.

ORSANCO has been working with the U. S. Coast Guard for several years on this matter. As with other pollution-control endeavors, the philosophy of the Commission is that compliance can best be furthered by generating public support. Thus, for the past two summers Commission-sponsored radio and television spot announcements have been built around the theme: *"Don't be a River-Litter Lout."* This year the Commission conducted an educational campaign using posters and news-releases.

Funds were authorized for the production of 2,400 large posters (22 in. by 26 in.) and 2,000 miniature facsimiles (8½ in. by 11 in.), as shown in the accompanying illustration. The total cost was $1,115. Patrol personnel of the Coast Guard assisted in distributing the large poster to boat clubs, marinas, landings, terminals and other river-front facilities. The commercial vessel operators undertook distribution of 1,000 of the miniatures for posting on boat bulletin boards. Miniatures were also distributed by the Outboard Boating Club of America among its membership.

The campaign has evoked greater official and public cognizance of the river-litter problem. Among other things, it has promoted installation of receptacles at marinas and fueling docks to facilitate disposal of trash from pleasure boats.

SEWAGE FROM FLOATING FACILITIES

Looking to the time when treatment facilities will have been completed for all municipal discharges, the Commission has taken steps to curb sewage pollution from towboats, pleasure craft and other floating facilities. Toward this end the states authorized publication of a notice of intent. In it they announced that effective January 1, 1967, they will undertake enforcement of measures in the compact district to prevent discharge of inadequately treated sewage from all watercraft, river terminals and marinas.

The object of this advance notice is to furnish an incentive for builders of commercial and pleasure craft to incorporate suitable devices in new boats under construction, and to provide a reasonable time for conversions to be made on existing boats. Acting on a suggestion from the Commission, the American

Waterways Operators Association has sponsored formation of a committee of barge-line operators, builders of marine equipment and pleasure-boat interests to promote compliance. ORSANCO will utilize the services of this committee in drafting a manual on compliance guide lines.

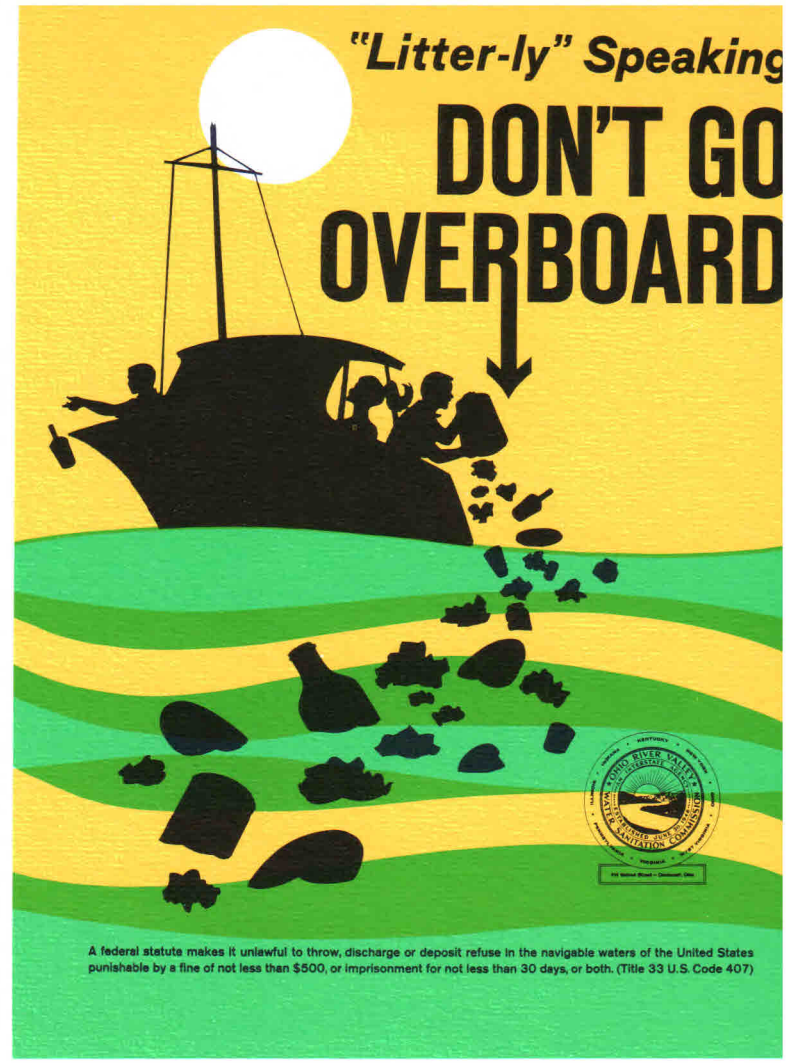
ADVISORY COMMITTEE ACTIVITIES

One of the distinguishing characteristics of Commission operations has been the continuity of advisory-committee relationships and the contribution made by these groups. Many aspirations and needs of the Commission — considering limitations imposed by its budget — would be slow in fulfillment without the generous allotment of time and talent provided by 218 members of the eight committees that were invited many years ago to volunteer their services. Following is a brief review of committee activities.

Aquatic-Life — Since its establishment in March 1952, the Aquatic-Life Advisory Committee has produced three reports on criteria of water quality with respect to maintaining a favorable environment for fish and aquatic organisms. Because of wide interest in the findings of this authoritative committee, the Commission has released its reports for publication. (See *Sewage Works Journal,* March 1955, pp 321-331; May 1956, pp 678-690 and its successor, *Journal of the Water Pollution Control Federation,* Jan. 1960, pp 65-82).

The committee also produced a 24-page handbook on the practical aspects of conducting fish-kill investigations. In addition, it guided initial development of a three-year appraisal of aquatic-life resources in the Ohio River. This project was executed by the Potamological Institute of the University of Louisville, under the combined sponsorship of the Commission and the Commonwealth of Kentucky.

Water Users — Inauguration of the ORSANCO monitor network was made possible by the assistance of eleven managers of public and private waterworks. They were organized in January 1952 as a committee to provide the Commission with daily reports on water-quality observations at strategic points in the valley. Today there are 21 members. In addition to providing analytical and other data on river conditions, the committee participates in comparative evaluation of analytical techniques and in the conduct of ORSANCO hazard-and-alert operations.



Designed by ORSANCO, this poster was distributed throughout the Ohio Valley to enlist citizen support in preventing the littering of streams. Patrol personnel of the U.S. Coast Guard assisted in distributing copies of the poster to some 2,000 marinas, terminals and river-front facilities.

Currently the Water Users Committee is writing a manual outlining methods of dealing with unusual river-quality conditions based on the long-time experience of some of its members with situations in the Ohio Valley. Another project on which the committee is engaged is an evaluation of water treatment costs with relation to changes in river-quality. For this purpose information is being extracted from long-term records available at five waterworks.

Industry Committees — Six groups representing the steel, chemical, metal-finishing, petroleum, coal and paper industries are intimately identified with the ORSANCO program, some of them since 1950. Their establishment stemmed from an early request

of the Commission to industry managers in the Ohio Valley for their participation in development of waste-control measures. This endeavor has been furthered by committee assignments concerned with assembly of technical data, evaluation of control proposals and promotion of compliance.

In May 1964, the commissioners met with all the industry committees for an entire day. The purpose was to formally acknowledge Commission appreciation for their many accomplishments during the past fourteen years, and to exchange views on future activities. Industry participants stated that the committee relationships had been productive and expressed the hope they might even be enhanced. In particular they were concerned with the complexities of tailoring control requirements to conform with regional needs and they looked for leadership in application of this concept.

Expressing the belief that if state agencies could schedule inspection visits more frequently, the better would be results from the operation of waste-control facilities, the industry representatives said they were prepared to support this view before state legislatures if invited to do so, when budget appropriations were under discussion. With respect to comprehensive planning of water resources by federal agencies the committee members urged ORSANCO and the signatory states to seek active participation in the planning deliberations.

FEDERAL PROGRAM ACTIVITIES

Two comprehensive water-planning programs are underway in the Ohio Basin, and a third project concerned with mine-drainage control has recently been activated.

The broadest endeavor is that of the Corps of Engineers, Department of the Army. This project embraces all aspects of water resources and related land development. A coordinating committee has been established by the Corps. Its membership includes representatives from six federal agencies and eleven states in the basin. ORSANCO has been invited to attend meetings as an observer. In addition, a staff member of ORSANCO has been appointed to serve on a subcommittee on water-quality standards.

Another major planning project is being conducted under auspices of the Public Health Service unit of the Department of Health, Education and Welfare. This undertaking stems from a provision in the amended Federal Water Pollution Control Act, which directs the Secretary of HEW to develop a comprehensive plan for water-pollution control in all river basins, including the Ohio. The Ohio River basin project was initiated in 1962 and its completion is expected in 1970. To aid the federal planners in compiling information relevant to their task, the ORSANCO commissioners have formally authorized exchange of its inventory records on the names and locations of municipalities and industries, as well as analytical data and studies on quality variations and trends in streams of the district. In turn the federal planners have been providing the Engineering Committee of the Commission with periodic reports on their activities.

A mine-drainage appraisal project is also under the purview of the Department of Health, Education and Welfare. This activity stems from a recommendation developed at the Monongahela conference (see p. 5). The recommendation called for appointment of a technical committee to explore means of abating pollution caused by coal mine drainage. The five-man committee, composed of representatives from Maryland, Pennsylvania, West Virginia, the U. S. Public Health Service and ORSANCO, is charged with determining the amount of pollution from active and abandoned mines in the Monongahela basin and with development of a remedial program, including a cost estimate.

To assemble data for the Monongahela mine-drainage committee, a staff anticipated to number ten people is being recruited and financed by the federal agency. The budget for the first year of a projected three-year field survey and laboratory program will be about $160,000. Headquarters for the project have been established at the Wheeling, W. Va., field station of the Public Health Service's Ohio River basin comprehensive planning project.

TALLY FOR THE VALLEY

Each year the signatory states compile an inventory of the status of waste-control installations of communities and industries in the compact district. It is from this detailed information that the Commission assesses progress in reaching goals established by the compact. A summary of the situation for the year ending July 1, 1964, is shown in the accompanying tabulations. An analysis of the inventory leads to the following conclusions:

Municipal Status — Treatment works serving 90 percent of the 11,350,000 sewered population in the valley are now in operation. Facilities to serve another 4 percent are under construction. On the main stem of the Ohio River, the comparable status is: Treatment plants serving 96 percent in operation and another 3 percent under construction. Along the Illinois stretch of the Ohio this year marked achievement of 100 percent treatment of all sewage entering the river.

Throughout the district construction was started by 105 communities on facilities to serve 236,000. Improvements to existing plants were placed under construction in 41 communities (total population 438,000). Completed were new plants in 78 municipalities (population 346,000) and improvements at 22 existing plants serving 113,000 people.

Industrial Status — Establishments discharging waste effluents directly to streams in the valley total 1,730. Of this number there are 1,552 (92 percent) now listed as complying at least with minimum interstate requirements. And 1,421 of these are meeting additional requirements to serve local necessities as prescribed by the regulatory agencies in the states where they are located.

For example, in West Virginia, the state is engaged on a two-stage corrective program with industries on the Kanawha River. The first phase, which is now completed, required in addition to compliance with ORSANCO minimum requirements, the reduction of 40 percent of oxygen-consuming wastes. Further control measures have been specified by the state on which compliance agreements are expected to be fulfilled by the end of 1966.

Similar situations prevail in all the other signatory states where local conditions on tributaries have evidenced the need for requiring higher degrees of treatment. These actions by the states thus have paved the way for compliance with future regionally tailored control requirements when these are prescribed by the Commission.

DEALING WITH DELINQUENTS

In May 1963 the Commission adopted a recommendation of its planning committee that "construction time-tables" be established for all communities and industries that had not yet installed appropriate pollution-control facilities. It was concluded then that it would be reasonable for this to be accomplished within a period of two years. At that time the states listed 552 communities (combined population 961,000) that lacked treatment facilities, and 267 industries not yet complying with minimum interstate requirements.

INDUSTRIAL WASTE-CONTROL FACILITIES — July 1, 1964

STATUS	ILL.	IND.	KY.	N. Y.	OHIO	PA.	VA.	W. VA.	TOTAL	% of TOTAL
Control currently acceptable	11	203	152	18	302	507	43	185	1,421	82.1
Control facilities inadequate, improvements in progress	0	0	7	0	9	1	1	6	24	1.4
Control provided but not adequate	7	25	17	8	61	35	5	18	176	10.2
New control facilities under construction	0	13	5	0	0	4	0	8	30	1.8
Planning treatment facilities or preparing to connect to municipal sewers	0	20	1	8	2	25	1	11	68	3.9
No action by company	0	0	0	6	0	2	1	2	11	0.6
Total number of industries	18	261	182	40	374	574	51	230	1,730	100.0
Complying with ORSANCO minimum requirements	18	251	163	20	355	507	46	192	1,552	89.7

MUNICIPAL AND INSTITUTIONAL SEWAGE-TREATMENT FACILITIES — July 1, 1964

Number of communities (top number) and population served (bottom number)

STATUS	ILL.	IND.	KY.	N. Y.	OHIO	PA.	VA.	W. VA.	TOTAL	% of TOTAL
Control currently acceptable	**64** 333,065	**159** 1,164,500	**196** 1,205,908	**7** 33,487	**288** 3,276,676	**264** 2,478,250	**33** 121,351	**71** 529,968	**1,082** 9,143,205	**63.5** 80.3
Treatment provided, improvements under construction	**0** 0	**8** 567,507	**6** 41,527	**3** 53,767	**7** 31,131	**0** 0	**0** 0	**3** 24,732	**27** 718,664	**1.6** 6.3
Treatment provided, improvements needed	**2** 12,353	**12** 53,000	**12** 26,135	**4** 10,805	**22** 146,221	**16** 88,609	**23** 19,226	**8** 8,933	**99** 365,282	**5.8** 3.2
New treatment works under construction	**3** 5,619	**15** 18,044	**27** 54,580	**0** 0	**16** 210,374	**23** 82,491	**9** 20,370	**27** 99,373	**120** 490,851	**7.0** 4.3
No treatment; construction not started	**2** 2,680	**80** 92,498	**21** 26,475	**4** 11,493	**40** 60,818	**118** 284,560	**26** 28,425	**86** 139,469	**377** 646,418	**22.1** 5.9
Total	**71** 353,717	**274** 1,895,549	**262** 1,354,625	**18** 109,552	**373** 3,725,220	**421** 2,933,910	**91** 189,372	**195** 802,475	**1,705** 11,364,420	**100.0** 100.0

The latest assessment of the situation from reports submitted by the states in September 1964 shows that one-third of these 552 are no longer in the "delinquent" category. For the remaining 372 communities construction timetables have been approved thus far for 33 communities. More than half of the delinquent communities have a population of less than 1,100 and most are classified as "hardship" cases because of their limited financial resources.

With respect to non-complying industries, the current situation is that these have also been reduced by one-third — there are now 172 listed in this category as contrasted with 272 a year ago. Construction timetables have been established with 40 of the 172 not yet complying.

COMPLIANCE PROCEEDINGS

Under the enforcement provisions (Article IX) of the compact, the states authorize the Commission, under certain conditions, to issue orders for compliance from municipalities or industries. The Commission may seek enforcement of these orders through any court of general jurisdiction or any United States District Court in any of the signatory states.

Thus far the Commission has intervened in six interstate cases involving municipalities in four states. (For details see 1963 Annual Report, p 16). In only one situation — that of Middleport, Ohio — has it been necessary for ORSANCO to proceed as far as conduct of a formal public hearing before obtaining action. Guided by the recommendations of its hearing board, the Commission on May 14, 1964, ordered installation of sewage-treatment facilities by the Village of Middleport to be completed not later than April 30, 1966. Financing and construction phases of the project have now been scheduled by the Middleport authorities to conform with the deadline date.

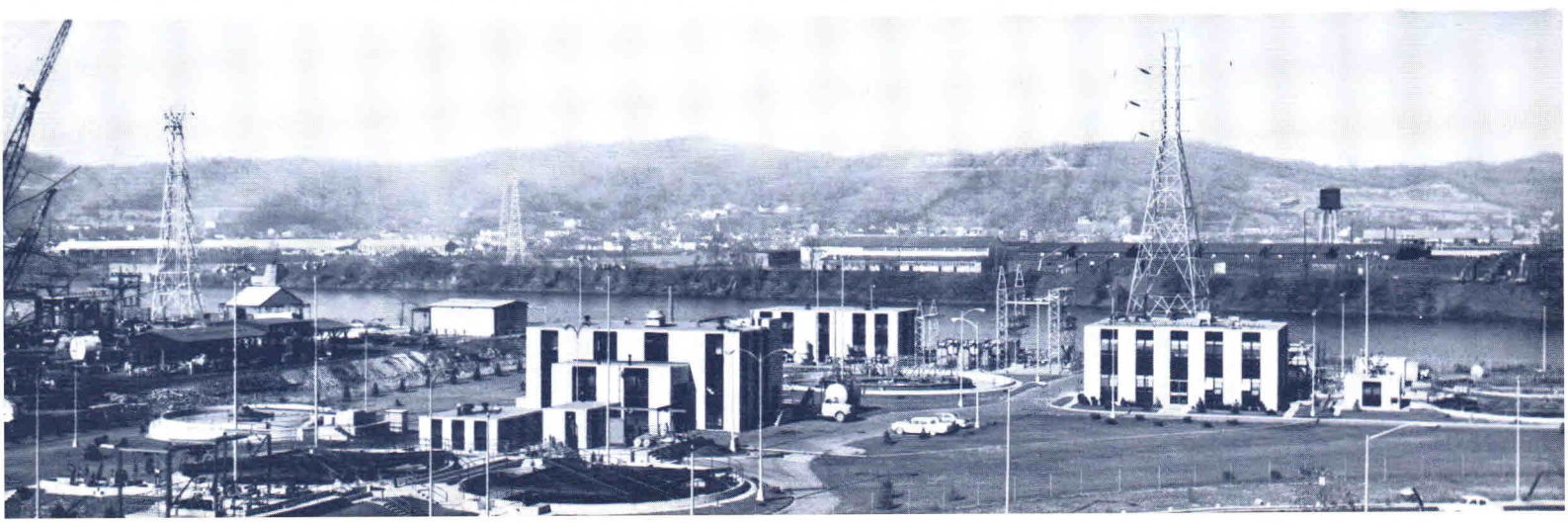
FEDERAL AID PROGRAM

The Federal Water Pollution Control Act in 1956 authorizes grants-in-aid to municipalities for construction of sewers and treatment plants. Each state recommends eligibility and priority of communities for such aid, the number of grants in any state being limited to its allotment of federal funds. In September 1962, this grant program was supplemented with further federal financial aid authorized under the Public Works Acceleration Act.

Grants made available in the Ohio Valley from these programs during fiscal year 1963-64 aided in the construction of 173 projects, the estimated cost of which totals $61,120,000. The federal contribution was $24,560,000. A yearly summary of allocations that have been made since 1956 is shown in the accompanying tabulation. This summary was prepared from prior records and recent data from the June 30, 1964, Project Register of the U. S. Public Health Service. The designation WPC means grants emanating from the Water Pollution Control Act; APW indicates grants under the Public Water Acceleration Act.

Year	No. of Projects	Estimated Cost of Projects	Federal Grants
1956-57	30	$13,846,400	$3,616,200
1957-58	51	27,421,300	5,907,900
1958-59	47	29,298,300	6,564,300
1959-60	46	24,464,100	5,557,400
1960-61	46	21,733,300	4,787,500
1961-62	67	29,726,600	6,892,000
1962-63			
WPC	71	27,695,600	6,417,100
APW	38	12,996,200	6,343,200
WPC & APW	20	12,260,800	5,868,600
1963-64			
WPC	57	23,608,400	6,097,500
APW	98	26,927,500	12,466,200
WPC & APW	18	10,582,000	5,994,700
Total	589	$260,560,500	$76,512,600

In an unusual joint venture this treatment facility was designed, built and is operated by the Union Carbide Chemical Company although it is owned by the City of South Charleston (W. Va.). The $5.3 million plant treats both municipal and industrial wastes.



RIVER QUALITY APPRAISAL

A water-control program must be concerned with the invisible as well as the visible manifestations of pollution. Where conditions exist that are offensive to sight and smell there is no need for scientific appraisal to justify corrective action. But for an assessment of the invisible aspects of quality impairment, reliance must be placed on the assembly and interpretation of data relating to bacteriological, chemical and radioactive characteristics. This is the reason why the Commission has regarded monitoring of river quality to be of paramount importance.

Without continual diagnosis of river conditions — and without an understanding of causes of change and the potentialities for influencing it — the prescription of pollution-control remedies would be a hit-or-miss affair. Furthermore, without knowledge of conditions before and after the remedies are applied, a control agency has no assurance of the appropriateness of its decisions.

Diagnosing the behavior of a river is no simple matter. It involves compilation of quality data, the collection of which in itself is costly and time-consuming. And then it calls for the exercise of diligence and skill in determining what the data reveals. Through cooperative arrangements with other agencies, and more recently with the application of the ORSANCO Robot Monitor system, the cost of data assembly has been minimized. Meantime, development of techniques for data evaluation, including the adaptation of electronic-computer technology to such efforts, has enhanced staff capability in the art of diagnosis.

The information presented in this section on quality conditions is but a summary of many detailed investigations. It provides the factual basis from which an appraisal has been made regarding the "invisible" characteristics of quality in various stretches of the Ohio River and some of its tributaries.

DATA COMPILATION — The ORSANCO quality-monitoring network includes several integrated components. During 1963 these components included:

17 stations operated on a voluntary basis by managers of municipal and private water-treatment plants. Fourteen are located on the Ohio River main stem; others are on the Allegheny, Monongahela and New rivers. The stations supply data on chemical and bacteriological characteristics. This service, inaugurated in 1951, is coordinated under the auspices of the ORSANCO Water Users Committee.

11 stations operated under contract arrangements with the U. S. Geological Survey. Six are on the Ohio River, and five on tributaries. Data from these stations supplements that from locations monitored by the Water Users Committee and, in addition, includes analyses for mineral constituents that are not routinely measured at water-treatment plants. Operating costs for these stations are borne on a 50-50 matching basis by the Geological Survey and the Commission.

12 robot monitor units installed and maintained by ORSANCO, six of which are located on the Ohio River and six on tributaries.

These electronic sentinels, located at certain strategic points in the compact district, provide data every hour on the following quality characteristics: Dissolved oxygen, chloride, pH, conductivity, oxidation-reduction potential, temperature and solar radiation.

15 stations operated under contract with the University of Louisville for measurement of radioactivity. Nine are on the Ohio River and six on tributaries. Through this undertaking a check is maintained on radioactivity levels in river water, and equally important, on the potentiality of radioactivity "buildup" in river muds, biota and fish.

Locations of all the monitor stations from which data is obtained are shown on the map reproduced on the inside front cover of this report.

In addition to compilation of data on water-quality characteristics, complementary information is assembled on river-flow variations. The primary contributor is the U. S. Geological Survey, which maintains a network of stream-gaging stations throughout the Ohio Valley. Records from these stations, some of which cover a period of 36 years, are employed for frequency-of-occurrence studies (a statistical analysis to determine how often flows of varying magnitude may occur), as well as for assessing relationships between flow and quality characteristics.

Supplementary flow information is obtained by the Commission through a unique arrangement with the U. S. Weather Bureau. Each day the Cincinnati office of the bureau furnishes to ORSANCO telephoned forecasts on river flow for twelve locations along the Ohio River and its tributaries. These forecasts not only provide an estimate of flow for the current day, but they include flow predictions for the next three days as well. Moreover, the forecasts provide velocity-of-flow information by means of which time-of-travel estimates may be made.

This daily service, which was inaugurated in 1959, has enhanced ORSANCO capabilities in diagnosing quality conditions and provides an essential "tool" for the practice of quality management. It permits prompt integration of flow information with quality data from the robot-monitor system. And it makes practicable the application of the concept of proportional discharge of waste effluents tailored to hydrologic variability for more efficient control. Furthermore, the daily flow estimates permit determination of the concentration of constituents when evaluating potential hazards associated with accidental spills.

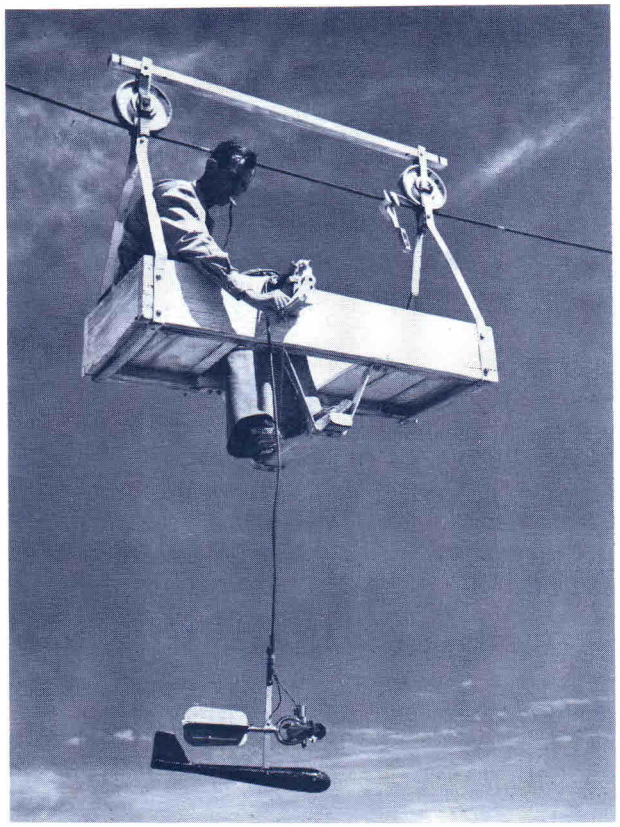
RIVER FLOW — The calendar year 1963 could be characterized as unusually "dry." However, the pattern of variability during the year was one that ranged from extremes of flood conditions in the spring to extreme-drought flows in the autumn season.

Conditions in the Cincinnati stretch of the Ohio River typify those experienced throughout the 981-mile length of the river. Here flood stage occurred in March and the river remained in flood for 21 consecutive days — the longest such period on record at Cincinnati.

Except for the month of March the flows throughout the year were "deficient." This means that the flow for each month was less than the average flow for that month during prior years of record. This situation was evidenced not only at Cincinnati, but at most of the Ohio River gaging stations as well.

Minimum flows at Cincinnati occurred in October, following a period of 48 days without rain — the longest consecutive dry period since 1895. The minimum monthly-average flow was 6,400 cfs, which is the second lowest monthly-average flow in twenty years. This flow is analogous to a drought-flow condition that has an expectancy of occurrence of about once in thirteen years.

It is of interest to note that flow records for the Ohio River show the occurrence of rather severe droughts in cycles of about eleven years. Since 1927, when continuous recording of low flows in the Ohio River was initiated, periods in which droughts of greatest severity occurred were 1930-31, 1941-42, 1952-53, and now 1963-64.



Obtaining velocity measurements is not always a simple matter. Sometimes it is necessary to ride high above the waterway on a specially installed cableway and car.

Flow conditions in 1963 contrasted sharply with those prevailing in 1962. At Cincinnati, for example, yearly-average flows in 1962 and 1963 were 92,600 and 76,500 cfs, respectively. These values may be compared with a yearly-average flow over the past twenty years of 94,200 cfs. In terms of minimum flow conditions, the 1962 value (monthly-average) was 11,230 cfs compared with 6,400 cfs in 1963. In short, 1963 was a year of drought whereas 1962 was not.

Because of the different patterns in flow for the two years, it might be expected that quality conditions in 1963 would differ considerably from those in 1962. Such was not the case, however. Quality conditions are influenced by many factors, some of which are counteracting. As a general rule, deficiencies in flow volume produce impairment in quality conditions, simply because there is less water available for dilution. This rule might be expected to apply particularly to mineral constituents, the concentration of which is affected by dilution. However, an evaluation of monitor data for the Ohio River reveals that such a conclusion must be tempered with an appreciation of the potency of other influences as, for example, the release of water from reservoirs built for flood control and low-flow augmentation. Such dilution water may not always be beneficial, however, because stored water on occasion may acquire characteristics that impair river quality.

With respect to organic constituents, river quality at certain places may actually be enhanced under low-flow conditions. When low flows occur river velocity is reduced, with consequent longer travel-time between points of waste discharge and downstream monitor stations. Because natural purification forces have a longer time to exert their influence, quality characteristics measured in terms of bacterial counts and organic constituents are better than those recorded during periods of high flow. Furthermore, lack of rainfall reduces the amount of surface runoff to a stream, and this runoff is generally high in bacterial and organic constituents.

It appears from data compiled during the years 1962 and 1963 that these various counteracting forces acted in such a way as to produce about the same net effect on overall quality conditions in each of these years.

CRITERIA EMPLOYED — An appraisal of Ohio River quality characteristics is presented in the following sections. This evaluation is based on a comparison of observed quality ranges with certain standards and criteria that are regarded as authoritative. Standards and criteria used for this purpose include:

(a) Public Health Service Drinking Water Standards, 1962 (Public Health Service *Publication No. 956,* U. S. Government Printing Office). These are referred to hereafter as PHS standards.

(b) Recommendations of the Ohio River Committee in a report to the Congress of the United States in 1943 (*House Document No. 266, 78th Congress, 1st Session,* U. S. Government Printing Office, 1944). Appointed by direction of the President, the Ohio River Committee undertook "the most complete and comprehensive examination ever made of the sanitary conditions of a major river." The views of the committee reflect an appraisal of five years of data compiled by the U. S. Public Health Service and the Corps of Engineers.

(c) ORSANCO *Bacterial-Quality Objectives for the Ohio River.* In 1951 the Commission adopted the following objectives as a guide in specifying treatment requirements for sewage discharges and as a yard-stick for evaluating sanitary conditions: (1) For water supply purposes the monthly arithmetical average "most probable number" of coliform organisms at river intakes should not exceed 5,000 per 100 ml in any month; and (2) for recreational purposes the monthly arithmetical average "most probable number" of coliform organisms in the river should not exceed 1,000 per 100 ml during any month of the recreation season.

(d) Recommendations of the ORSANCO Aquatic-Life Advisory Committee (*Journal Water Pollution Control Federation* (formerly *Sewage and Industrial Wastes Journal*), vol. 27, pp. 321-331, March 1955; vol. 28, pp 678-690, May 1956; vol. 32, pp 65-82, January 1960).

Following is a list of abbreviations and definitions used in subsequent sections that deal with individual quality characteristics:

mg/l: Milligrams per liter. This unit of measure is equivalent to a concentration of about one pound in 120,000 gallons of water.

MPN per 100 ml: Most probable number (of coliform organisms) per 100 milliliters.

$\mu\mu$c/l. Micro-microcurie per liter. A micro-microcurie is one trillionth (10^{-12}) of a curie, or 2.22 disintegrations per minute. A curie is that amount of any radioactive isotope in which the number of atoms disintegrating per second is 37 billion.

Btu: British thermal unit. A Btu is the amount of heat required to raise the temperature of one pound of water at maximum density one degree Fahrenheit.

ALKALINITY AND pH — Alkalinity is essentially a measure of carbonates and bicarbonates in water. The presence of the latter is considered beneficial to most water uses.

In the upper section of the river (first 161 miles), alkalinity levels are low. For example, the range in monthly-average values at Wheeling (mile 87) in 1963 was 2 to 22 mg/l, with a yearly average of 11 mg/l.

Beginning at Parkersburg (mile 190), alkalinity concentrations downstream became progressively higher. Data reported for 1963 reveals the following annual averages: 22 mg/l at Parkersburg; 40 mg/l at Cincinnati (mile 463); 60 mg/l at Evansville (mile 792).

The pH (hydrogen-ion concentration) of a stream is an indicator of its acid or alkaline character. A pH of 7.0 indicates neutrality. The lower the pH value, the greater is the degree of acidity. However, bicarbonates may be present in water with a pH as low as 4.3. Therefore, the term alkalinity as used in the preceding paragraphs does not necessarily indicate that the pH of a water is greater than 7.0.

Variations in pH in 1963 reflected the same general pattern as that revealed by alkalinity measurements. Furthermore, comparison of 1963 findings with prior data shows that in recent years there have been no significant changes either in the pattern of alkalinity and pH variations or in the ranges of values encountered in the several river stretches.

The Aquatic-Life Advisory Committee made the following observations regarding pH; (a) ". . . . . Studies indicate that hydrogen-ion concentration probably does not affect fish adversely between pH 5 and pH 9;" and (b) ". . . . . Insofar as possible, pH values [should] be maintained between 6.5 and 8.5 to maintain the productivity of the water for aquatic life." The extent to which these criteria were met in 1963 is summarized as follows:

River stretch	Percent of observations in indicated range	
	pH 5 to 9	pH 6.5 to 8.5
S. Heights (mi. 16) to Willow Is. (161)	99.8	65.8
Parkersburg (190) to Evansville (792)	100.0	93.0

CHLORIDE — In no stretch of the river did monthly-average chloride concentrations in 1963 exceed 250 mg/l, the limiting value for potable supplies recommended in the PHS standards.

Chloride content is highest in the stretch between Parkersburg (mile 190) and Portsmouth (mile 351). The highest monthly-average value recorded in this stretch in 1963 was 191 mg/l at Parkersburg, and the yearly-average value for the stretch was 98 mg/l.

Yearly average values in other stretches were: 28 mg/l between Weirton (mile 62) and Willow Island (mile 161); 36 mg/l between Cincinnati (mile 463) and Evansville (mile 792.)

Chloride-ion concentrations show a wide spread between maximum and minimum values, especially in the Parkersburg-Portsmouth stretch. The range, which was in the ratio of 8 to 1 at Portsmouth in 1963, demonstrates that opportunities do exist for reducing peak chloride concentrations by advancing the practice of discharging waste loads in proportion to stream flow. This is the objective of the chloride-control regulatory measure adopted by ORSANCO in 1958.

Evaluation of trends in chloride content of the Ohio River must be made with due regard for the influence of hydrological cycles. Therefore, in selecting different periods of time to be used for comparative purposes it is important that these periods exhibit similar short-term hydrographs and that they occupy the same relative positions in the long-term hydrological cycle.

Previous historical periods with hydrological conditions similar to those during the autumn of 1963 (when chloride is highest) are the autumn seasons of 1952 and 1953. Data from Huntington was used for chloride-level comparisons during these periods, because the Huntington station furnishes the only record, in the area of highest chloride content, extending as far back as 1952. This data reveals that maximum monthly-average chloride concentrations during the years in question (which maximums occurred in the month of November in each case) were as follows: 112 mg/l in 1952, 126 mg/l in 1953, 106 mg/l in 1963. It appears, therefore, that under similar flow conditions maximum chloride concentrations have remained at about the same level of magnitude as they were in 1952 and 1953.

COLIFORMS — Coliform-bacteria levels in most stretches of the Ohio River are within the "desirable" range when matched against established criteria for sources of potable water supplies. The basis for this conclusion is an appraisal of conditions in 1963 with those criteria set forth by the Ohio River Committee.

In its 1943 report to the Congress of the United States the Ohio River Committee stated that if the coliform content of river water exceeded a count of 20,000 MPN per 100 ml, expressed as a monthly average, the river water should be regarded as "unsuitable." The "desirable" category was established as a count not exceeding 5,000.

When ORSANCO inaugurated its program in 1948 for river clean-up, it selected the 5,000 MPN category as the objective. At that time coliform counts as high as 1,000,000 were found on occasion in some stretches of the river.

Coliform data for 1963 show that the objective of 5,000 or less was virtually attained at five of the seven monitor stations. At no time, at any of the sampling stations, did monthly-average coliform counts exceed the 20,000 maximum of the Ohio River Committee. At the five stations — Wheeling, Huntington, Portsmouth, Cincinnati and Louisville — monthly-average concentrations in the "desirable" range of 5,000 or less were attained 87 percent of the time. In terms of yearly averages, counts were less than 5,000 at all five stations.

At another station, Evansville, the coliform counts came quite close to meeting the objective. The yearly-average value was only 6,100; and during five months counts were below 5,000.

The river stretch monitored at Weirton is the only one where the 5,000 objective has not yet been achieved. Although there has been a marked decrease in coliform densities at Weirton in the past five years, in 1963 there was only one month in which the average concentration was less than 5,000. Even so, the yearly-average count was only 10,000, or just half of the maximum limit prescribed by the Ohio River Committee.

With regard to river quality for bathing and other recreational purposes, the Ohio River Committee suggested that water of "desirable" quality could be defined as one in which the maximum coliform count did not exceed 1,000 MPN per 100 ml. This limiting value was formally adopted by the Commission as one of its goals. In 1963, this goal of 1,000 MPN or less during the recreational season was being surpassed or approached in several stretches. For example, during the three months of June through August, monthly-average counts at Wheeling ranged from 220 to 440, with an average of 290; the range at Cincinnati for the period was 520 to 600, with an

average of 570, and the range at Huntington was 370 to 1,230, with an average of 800. Averages during the recreation season at other stations were: 1,700 at Portsmouth, 2,500 at Louisville, 5,200 at Evansville, and 6,900 at Weirton.

DISSOLVED OXYGEN — Dissolved-oxygen (DO) concentrations in a river vary over a wide range during the course of a year, depending on changes in flow and temperature conditions. During 1963, maximum monthly-average values of 13 to 15 mg/l were recorded in February, when flow was high and temperature at a minimum. With diminished flows and the normal increase in temperatures that occurred during the spring and summer, the DO concentrations showed decreases. Minimum monthly-average values of 2.5 to 6.0 mg/l were recorded in August.

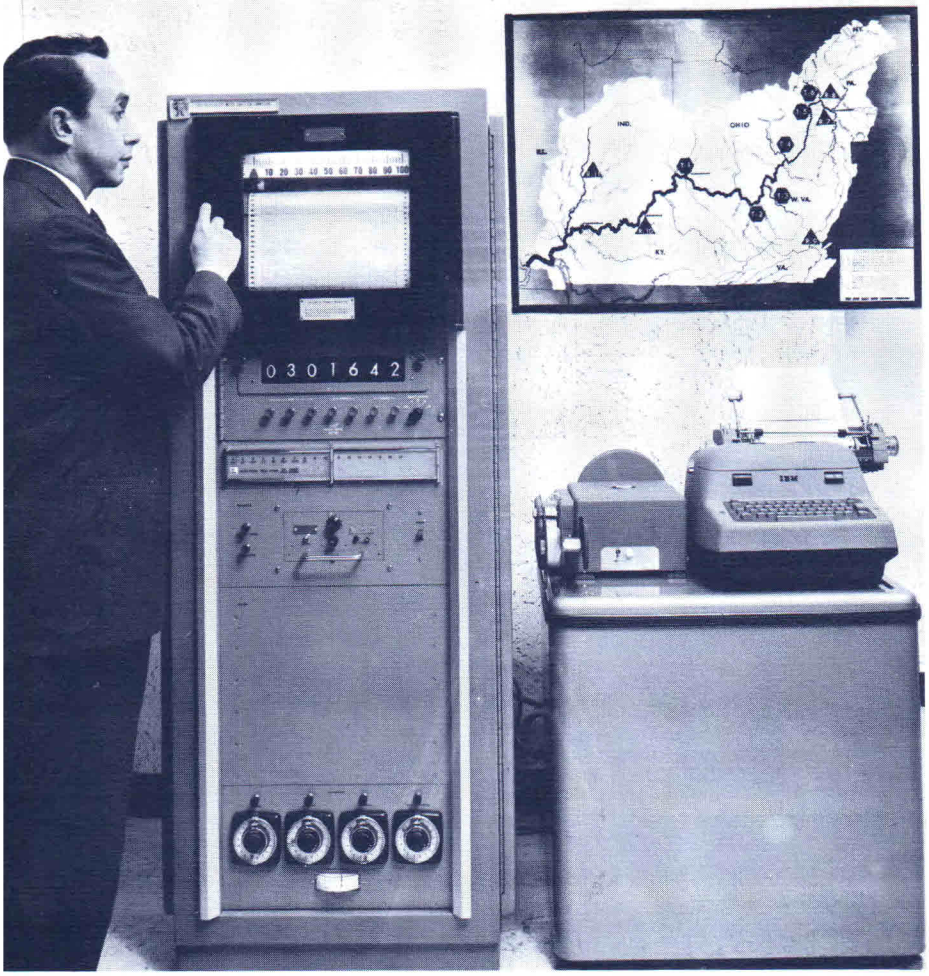
Although professional viewpoints are not fixed regarding optimum levels of dissolved oxygen, the opinion of the Ohio River Committee in its 1943 report to Congress was this: "In general it may be said that a 5 parts-per-million minimum is desirable, except where local conditions may be favorable to allowing a 4 parts-per-million minimum in limited zones immediately below fairly isolated sources of pollution." The committee further recommended that the minimum daily-average DO concentration should be not less than 3.0 parts-per-million. (For all practical purposes one part per million is equivalent to one milligram per liter, which is the designation employed by ORSANCO.)

Data in 1963 from four stations where DO was monitored continuously (East Liverpool, Huntington, Cincinnati, Louisville) reveal the following condi-

OHIO RIVER QUALITY SCOREBOARD — 1963

(Values in mg/l and ranges in terms of monthly averages, except as noted.)

Constituent	Mile 16 — 161		Mile 190 — 351		Mile 463 — 560		Mile 601 — 963	
	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
Alkalinity (as $CaCO_3$)	34	2	57	17	65	29	114	13
Calcium	60	40	62	43	60	40	30	27
Chloride	84	11	191	9	106	11	73	14
Coliform (MPN/100 ml)	16,000	210	7,100	650	5,500	300	14,000	330
Conductivity (micromhos)	607	189	950	197	899	235	750	242
Dissolved Oxygen	14.9	5.0	14.0	2.5	13	4.8	9.4	5.9
Fluoride	0.8	0.0	0.6	0.0	0.5	0.0	0.4	0.1
Hardness, Total (as $CaCO_3$)	255	79	272	61	210	83	232	91
Hardness, Non-Carb (as $CaCO_3$)	242	46	248	37	162	54	172	30
Iron	2.4	0.48	—	—	—	—	2.6	.18
Magnesium	16	10	12	8	13	9	—	—
Manganese	4.7	0.30	—	—	0.27	0.01	—	—
Methylene-Blue Active Substance	0.26	0.03	0.1	0	0.1	0	—	—
Nitrate	6.3	2.0	7.7	2.9	10.0	2.9	6.0	2.0
Odor (threshold-odor number)	3	2	51	4	468	48	28	2
Oxidation-Reduction Potential (mv)	352	91	574	400	333	178	—	—
pH (units-hourly)	10.8	4.6	9.5	5.5	8.2	6.3	8.5	6.5
Phosphate	0.75	0.08	0.14	0.08	0.25	0.12	0.49	0.13
Radioactivity, Beta (daily, $\mu\mu$c/l)	41.2	3.9	43.2	4.3	11.5	0.0	63.1	0.0
Solids (total dissolved)	400	146	450	128	425	134	229	140
Sulfate	289	81	395	38	183	52	129	30
Temperature (deg. F.)	83	35	82	33	82	34	83	34
Turbidity (units)	325	9	371	10	1,301	5	482	3
Flow (Sewickley, Huntington, Cincinnati, Louisville gages) (cfs)	170,000	3,900	283,000	7,000	404,000	7,000	484,000	7,900



This is the nerve center of the ORSANCO robot-monitor system in Cincinnati. Every hour on the hour the telemeter unit (left) interrogates robot monitors in various locations along the river. Each monitor responds in sequence to report quality conditions. A data-logger (right) transcribes information in tabular form through an automatically operated typewriter, and also makes a punched tape for computer processing of data. Here the equipment is being adjusted by William L. Klein, chemist-biologist of the ORSANCO staff.

tions: Monthly-average values were greater than 4.0 mg/l for 98 percent of the time. With respect to minimum values, there were no daily recordings less than 3.0 mg/l at either East Liverpool or Louisville. Daily values less than 3.0 mg/l occurred on occasion in one month at Cincinnati and on occasion during three months at Huntington.

Places in the Ohio River where maintenance of desired dissolved-oxygen levels can be regarded as a matter of concern with respect to interstate control requirements are the stretch between the mouth of the Kanawha River and Huntington, and a short stretch below the Cincinnati metropolitan area. The situation in the reach monitored at Huntington is attributable to the influence of the Kanawha River, a tributary which is at times devoid of any oxygen.

To obtain additional data on DO conditions in the stretch below Cincinnati, a monitor was installed in June 1964 at Miami Fort, some 17 miles below the major sewage-treatment-plant outfalls in the metropolitan area. With installation of this new monitor, it has been possible to obtain hourly comparisons of downstream dissolved-oxygen conditions with those recorded at the regular monitor station located at the Cincinnati waterworks intake, which is 27 miles upstream from Miami Fort.

Records from the Miami Fort station indicate that dissolved-oxygen levels have fallen below those specified by the Commission (4.0 mg/l) for this stretch. Values as low as one mg/l have occurred on occasion. However, with the exception of only four days in August 1963, daily average values above Cincinnati have been 4.0 mg/l or higher. It might be noted that the sewage-treatment facilities in the metropolitan area of Cincinnati have not been capable at all times of meeting the performance requirements that were specified by the Commission prior to their construction.

DISSOLVED SOLIDS — From the standpoint of total dissolved-solids content, quality conditions could be rated as within acceptable limits prescribed in the PHS standards. The latter specify that the concentration of dissolved-solids in water used for potable purposes preferably should not exceed 500 mg/l.

In 1963 monthly-average concentrations of dissolved solids in the Ohio River ranged from 128 to 450 mg/l. These concentrations were similar in magnitude to those during the past several years.

Only in the river stretch monitored at Huntington, and only at one time during 1963, did daily values of dissolved solids exceed the PHS recommended limit of 500 mg/l. For a period of one week in the month of November concentrations in that stretch ranged between 500 and 600 mg/l.

With respect to quality requirements for industrial and other water uses, it is not appropriate to generalize on dissolved-solids levels that would be rated as desirable or acceptable. Regarding aquatic life, for example, the Aquatic-Life Advisory Committee makes this observation: The "presence of [dissolved solids] in favorable concentrations is essential for the growth, reproduction and well-being of aquatic organisms. For peak productivity these materials must be present in optimum concentrations." However the committee suggests no numerical limits, and recommends that the suitability of dissolved-solids levels be evaluated by means of bioassay techniques.

With regard to water for industrial use, requirements on dissolved-solids concentrations vary over a wide spectrum. Feed water for high-pressure boilers, which is required only in relatively small quantities, must be virtually free of dissolved solids. On the other hand, almost any concentration can be tolerated in water used for cooling purposes, which use accounts for about 90 percent of present industrial-water requirements on the Ohio.

FLUORIDE — It is recommended in the PHS standards that the content of fluoride in drinking water be maintained in the range of 0.8 to 1.7 mg/l. Most waters are deficient in this respect and require the addition of a fluoride compound to achieve the recommended range, which is stated to be effective in reducing tooth decay in young children.

In the stretch of the Ohio River monitored at Wheeling, the maximum monthly-average concentration of fluoride in 1963 was 0.8 mg/l, a value which is just at the lower level of the recommended optimum range. In other stretches, the highest monthly-average values observed varied from 0.4 to 0.6 mg/l; throughout the year, fluoride content varied between these high values and zero.

In brief, at some stations and at various times during the year, concentrations of fluoride were approaching values considered optimum for dental health. Ranges in fluoride in 1963 were not significantly different from those observed in previous years.

HARDNESS — Total hardness in the Ohio River averages about 145 mg/l. In 1963, the range, in terms of monthly-average concentrations was 61 to 272 mg/l. Maximum and minimum values have remained fairly uniform from year to year.

Opinion varies widely on how much hardness can be tolerated before a water supply becomes unsatisfactory from the standpoint of domestic use. The City of Louisville, for example, which is the only municipality on the Ohio River that is equipped with water-softening facilities, processes river water as the need arises in order to maintain hardness levels in finished water at 110 mg/l or less. Municipalities in some areas of the country, however, use water having concentrations of hardness in excess of 500 mg/l.

There is no universal criterion indicating the ranges of hardness that might be considered suitable or desirable in water used for industrial purposes. As is the case with total dissolved solids, acceptable limits of hardness vary widely depending on specific industrial uses.

About 85 percent of the total hardness in the upper river may be classified as non-carbonate, or "permanent" hardness. This high percentage is attributable, for the most part, to the effects of mine drainage.

The ratio of non-carbonate to total hardness remains relatively constant as far down river as Parkersburg. Below this point streams tributary to the Ohio contribute alkaline constituents and bring about a gradual reduction in this ratio. Although total-hardness concentrations in the lower river (below Evansville) may be about the same as those upstream, non-carbonate hardness in the lower river generally constitutes only 50 to 60 percent of the total.

IRON AND MANGANESE — At various times the concentrations of iron and manganese are at undesirable levels in some stretches. The amounts are highest at the head of the river. Sources of iron and manganese in that area include steel-industry opera-

QUALITY SCOREBOARD FOR TRIBUTARIES — 1963

(Data from robot monitor stations. Ranges in terms of monthly averages except for pH. Flow based on United States Weather Bureau forecasts.)

Constituent	ALLEGHENY R. (Oakmont, Pa.)		MONONGAHELA R. (Charleroi, Pa.)		BEAVER R. (Beaver Falls, Pa.)		MUSKINGUM R. (Beverly, Ohio)		KANAWHA R. (Winfield, W. Va.)		WABASH R. (Sullivan, Ind.)	
	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum
Chloride (mg/l)	45	10	9	3	42	28	526	71	120	18	28	16
Conductivity (micromhos)	556	155	631	202	674	350	1,448	454	722	68	703	476
Dissolved Oxygen (mg/l)	11.6	4.9	13.2	5.0	10.2	4.0	12.7	3.5	10.9	0	10.0	5.9
pH (units-hourly)	8.5	4.8	6.5	3.0	11.5	5.0	8.8	6.7	12.0	4.4	10.8	6.9
Temperature (deg. F.)	79.8	34.1	77.3	33.2	81.8	34.9	87.4	38.0	83.0	39.9	80.7	35.5
Flow (cfs)	61,000	1,300	43,000	610	11,000	700	28,000	1,000	73,000	2,000	33,000	1,000

tions and mine drainage, as well as stored water released from flood-control reservoirs. In the upper reach of the river (first 90 miles) monthly-average concentrations of iron ranged from 0.33 to 2.40 mg/l in 1963. Monthly-average concentrations of manganese in the same reach were 0.06 to 4.70 mg/l. Limits recommended in PHS standards for treated water are 0.30 mg/l for iron and 0.05 mg/l for manganese.

Yearly-average concentrations of iron and manganese at Wheeling (mile 87) in 1963 were 1.20 and 0.90 mg/l, respectively. These values compare with averages for the past five years of 1.40 and 1.20 mg/l.

Quality-impairment problems associated with the higher levels of iron and manganese include incrustation of pipes, staining of laundry and plumbing fixtures and objectionable taste.

METHYLENE-BLUE ACTIVE SUBTANCE — The test for methylene-blue active substance (MBAS), which measures surface-active agents, is an indicator of the apparent concentration of synthetic detergents. Detergents have been regarded as the most important single contributor of surfactant materials found in streams.

Heretofore, the principal surface-active agent in household synthetic detergents has been alkyl benzene sulfonate (ABS), and concentrations have been reported in terms of that measure. However, the detergent industry is gradually discontinuing the use of the ABS component and replacing it with linear alkylate sulfonate (LAS).

Since ABS and LAS react with methylene-blue dye in the same way, results reported by the test procedure include the combined apparent concentrations of both components.

The range in the concentration of MBAS in individual samples analyzed in 1963 was 0.00 to 0.36 mg/l. Thus, there were no samples that exceeded the 0.50 mg/l limiting value for ABS recommended in PHS standards. The highest monthly-average value recorded in 1963 was 0.26 mg/l.

The range in individual samples in 1963, 0.00 to 0.36 mg/l, is essentially the same as that observed during the past several years.

NITRATES AND PHOSPHATES — There has been no apparent increase in nitrates nor in phosphates in the Ohio River in recent years. In 1963 the monthly-average levels of nitrates (NO_3) ranged from 2.0 to 10.0 mg/l. Phosphates (as PO_4) were 0.08 to 0.75 mg/l. These levels are of the same order of magnitude as concentrations measured since 1954, when monitoring for these constituents was initiated.

Nitrates and phosphates are recognized as having a "fertilizer" influence on the productivity of aquatic plant life. However, there is virtually no data establishing any direct correlation between concentrations of these substances and the abundance and variety of aquatic life. The following conclusion is expressed in a 1962 ORSANCO report titled, *Aquatic-Life Resources of the Ohio River*, which contains findings from a three-year study conducted by the University of Louisville under contract with the Commission

and the Commonwealth of Kentucky: "Large quantities of phosphates or nitrates generally contribute to the initiation of plankton blooms, although no direct relationship has been demonstrated during the study."

With respect to nitrates, the limiting value for potable water supplies recommended in PHS standards is 45 mg/l. The maximum observed value on any sample in 1963 was 13.0 mg/l.

RADIOACTIVITY — Levels of radioactivity in the Ohio River in 1963 were far below the maximum permissible limit of 1,000 micro-microcuries per liter ($\mu\mu$c/l) of gross beta activity specified in PHS standards.

Gross beta activity for water samples ranged from zero to 63 $\mu\mu$c/l. The range in 1962 was 2 to 172 $\mu\mu$c/l.

Radioactivity assays are also made on plankton, fish and silt samples taken routinely from several locations. These measurements provide information relating to possible accumulation of radioactivity in river sediments or in the biota through ingestion. Findings in 1963 and 1962 are tabulated below. Although there are numerical differences in the ranges for the two years, the differences are not regarded as significant.

	Gross beta activity	
	1963	1962
Plankton	0 to 1.3 $\mu\mu$c/l	0 to 2.4 $\mu\mu$c/l
Fish	0 to 50 $\mu\mu$c/g	0 to 380 $\mu\mu$c/g
Silt	0 to 205 $\mu\mu$c/g	1 to 71 $\mu\mu$c/g

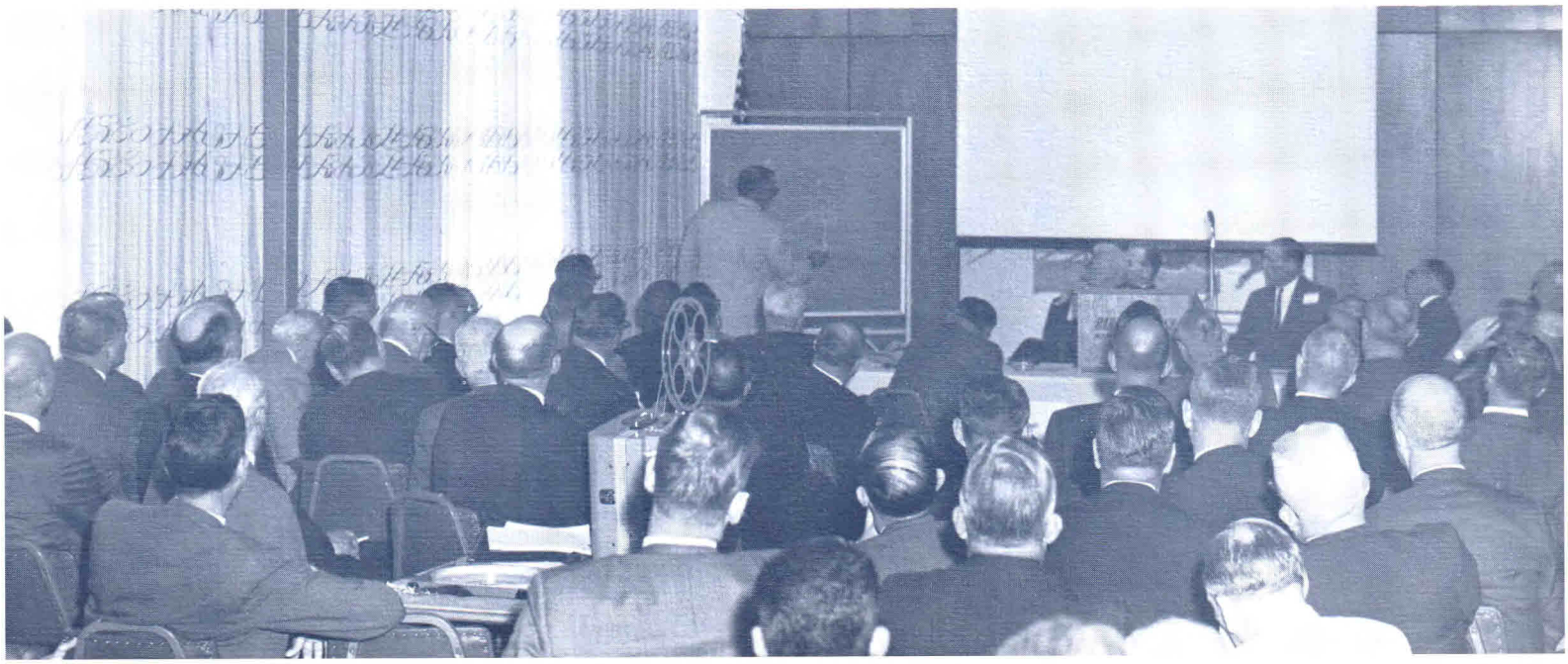
SULFATE — In 1963 monthly-average concentrations of sulfate salts were less than 250 mg/l in all areas and at all times except during a few months in the stretch between Power, W. Va. (mile 80) and Parkersburg (mile 190).

A concentration of 250 mg/l is the recommended limit for potable water supplies set forth in PHS standards. On the basis of records from all monitor stations, 97 percent of the monthly-average values of sulfate did not exceed this limit.

TEMPERATURE — Heat loads of considerable magnitude are discharged to the Ohio River. However, temperature recordings at monitor-station locations in 1963 do not suggest that so-called thermal "pollution" constitutes a current problem with respect to the effect of elevated temperatures on fish and other aquatic life. This appraisal reflects conclusions reached by the ORSANCO Aquatic-Life Advisory Committee on temperature tolerance, which were stated as follows:

"The Committee recommends that, in order to maintain stream conditions capable of producing an annual harvestable fish crop comparable to that produced in natural waters of the particular area under consideration, waste discharges be so controlled that the temperature of the receiving water: (1) Shall not be raised above 93 deg. F. at any place or at any time; (2) shall not be raised above 73 deg. F. at any place or at any time during the months of December through April."

One of the group sessions at the joint meeting of the commissioners with the representatives of its industry advisory committee members on May 13, 1964. Purpose of the meeting was to review fourteen years of activity and to lay plans for future endeavors.



River temperatures recorded at the monitor stations in 1963 were well within the recommended limits. The maximum daily temperature, which was observed at Louisville (mile 601), was 87 deg. F. The maximum in the Ohio River during the months December 1962 through April 1963, which occurred at Evansville (mile 792), was 64 deg. F.

The range in river temperatures in terms of monthly-average values was as follows: Minimum of 33 deg. F., which occurred in January at Ravenswood (mile 221), and maximum of 83 deg. F., which occurred in July at Natrium (mile 119) and also at Louisville. This range is essentially the same as that observed in prior years.

The primary source of heat loads going to the Ohio River is the discharge of water used for cooling purposes from power plants. An ORSANCO study has revealed that some 20 billion gallons of river water are pumped through such plants each day for cooling needs (see *Jour.* American Water Works Association, pp 683-686, June 1963). On the basis of an average increase of 10 deg. F. in the temperature of this water, a value which has been reported by some power plants, the total heat load returned to the Ohio River, may be estimated to be about 1,600 billion Btu per day. This is equivalent to the heat available from about 70,000 tons of coal per day, and amounts to a thermal load of 88,000 Btu per day per capita.

IN SUMMARY

Findings from a comparison of quality conditions in the Ohio River in 1963 with previously cited standards and criteria that are regarded as authoritative may be summarized as follows:

Chloride: Better than PHS standards for potable water.

Coliforms: Meeting recommendations of the Ohio River Committee that monthly-average concentrations in river water should not exceed 20,000 MPN per 100 ml. The "desirable" range of 5,000 MPN per 100 ml or less for water supply purposes, which was recommended by the committee and which has been adopted as a goal by ORSANCO, was attained 100 percent of the time in the stretch monitored at Wheeling; the 5,000 range was attained 67 percent of the time at Louisville, and 92 percent of the time at Portsmouth and Cincinnati. Areas in which average counts during the recreation season did not exceed 1,000 MPN, the limiting value for bathing water recommended by the Ohio River Committee and also a goal of ORSANCO, include those monitored at Wheeling, Huntington and Cincinnati.

Dissolved oxygen: The Ohio River Committee recommended a monthly average concentration not less than 5.0 mg/l as desirable, but noted that a minimum of 4.0 mg/l might be considered satisfactory in some areas. Monthly average concentrations were greater than 5.0 mg/l 90 percent of the time, and greater than the 4.0 mg/l limit 98 percent of the time.

Dissolved solids: Meeting PHS standards for potable water in all stretches and at all times except for one week during the year at Huntington, when daily values ranged between 500 and 600 mg/l.

Fluoride: Within limits recommended in PHS standards for potable water.

Iron and manganese: Concentrations greater than limiting values cited in PHS standards for potable water.

Methylene Blue Active Substance: Better than PHS standards for ABS in potable water.

Nitrates: Better than PHS standards for potable water.

pH: Within the range of 5.0 to 9.0, which is considered satisfactory for aquatic life, 99 percent of the time in the stretch upstream from Parkersburg; within the 5.0 to 9.0 range all of the time downstream from Parkersburg.

Radioactivity: Far below the limiting value cited in PHS standards for potable water.

Sulfate: Within limits recommended in PHS standards for potable water 97 percent of the time.

Temperature: Within range considered satisfactory for aquatic life.

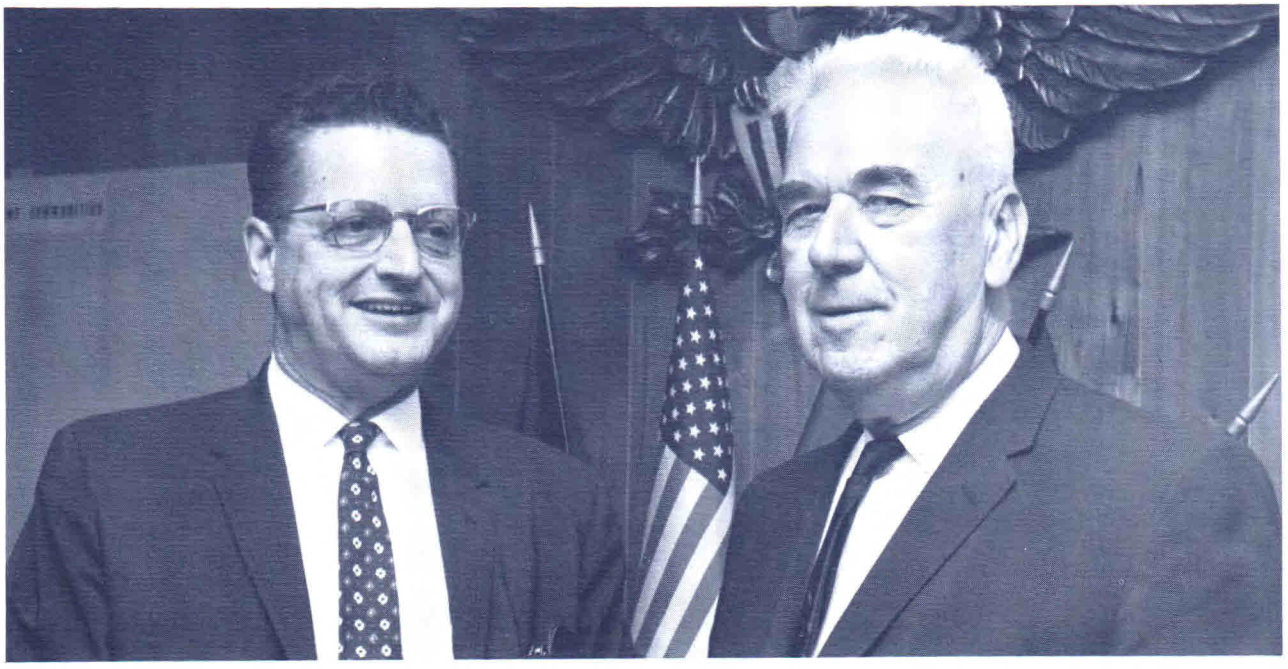
ADMINISTRATIVE AFFAIRS

Chairmanship of the Commission is rotated annually among the states. During the year ending June 30, 1964, Joseph R. Shaw, one of the three commissioners representing the State of New York, served as chairman. Mr. Shaw, a lawyer by profession, is president of the Associated Industries of New York State.

Barton A. Holl, a commissioner for Ohio, was elected chairman for the year beginning July 1, 1964. Mr. Holl, president of the Logan Clay Products Company, has long been identified with matters relating to policy and administration of water pollution control. In 1944 he was one of the four Ohio delegates who participated in negotiations that resulted in enactment of the Ohio River Valley Water Sanitation Compact. He has been a member of the State of Ohio Water Pollution Control Board since its establishment in 1951. In 1962 Mr. Holl began a two-year term as president of the Ohio Chamber of Commerce.

Elected to serve as vice-chairman of the Commission was Dr. A. C. Offutt, health commissioner of the State of Indiana. Dr. Offutt has been an ORSANCO commissioner since 1954. Continuing to serve as officers are: F. H. Waring, secretary; Verna B. Ballman, treasurer; Edward J. Cleary, executive director and chief engineer; Leonard A. Weakley, legal counsel.

Chairman Holl, right, and vice-chairman Offutt elected to take office on July 1, 1964.



The Commission is composed of twenty-seven members, three from each of the eight states, appointed by the Governor, and three appointed by the President of the United States to represent the Army Corps of Engineers, the Public Health Service and the Department of the Interior.

There were no changes in the membership of the Commission during the year. One member and a past-chairman, Blucher A. Poole, was honored by the President of the United States in an appointment to the National Water Pollution Control Advisory Board.

Staff — During most of the period covered by this report staff affairs were administered by Robert K. Horton in the capacity of acting director. Edward J. Cleary, executive director and chief engineer, was on leave-of-absence to accept a fellowship with Resources For The Future, Inc., in Washington, D. C. Here he was engaged on studies relating to the economic aspects of water-pollution and in preparing a case history on the operations of ORSANCO.

Thomas R. Crabtree who aided in execution of the Commission's public affairs and information services for two years resigned on July 1, 1964, to accept a similar assignment with an industrial organization.

Financial — Appropriations from the member states for operation of the Commission have totalled $130,000 annually since 1955; prior to this the annual budget was $100,000. The contribution from each state represents a prorating of a weighted average, one-half of which is computed in proportion to population and the other in proportion to land area in the compact district. Under this allocation the respective percentages are: New York 1.10; Virginia 3.50; Illinois 5.10; West Virginia 11.35; Pennsylvania 15.20; Indiana 18.10; Kentucky 20.75 and Ohio 24.90.

In 1956 administrative grants-in-aid to state and interstate agencies became available under provisions of the Federal Water Pollution Control Act. For fiscal 1963-64, the period covered in this report, the grant to ORSANCO was $105,019. Since 1957 the federal grants have averaged $104,400 annually.

An accounting of receipts and expenditures is shown in the financial report on page 31.

CONTRACT PROJECTS

Certain activities of the Commission requiring special skills and facilities are carried out through contractual arrangements. For the year ending June 30, 1965, the Commission authorized these contracts:

Water Quality Monitoring — Through a cooperative agreement with the U. S. Geological Survey analyses of river samples are furnished from several locations on the Ohio River and tributaries. This project was initiated in 1950 and has been continued under annual contracts since that time. Funds provided by the Commission, amounting to $10,000, are matched dollar-for-dollar by the Geological Survey.

Radioactivity Investigations — Continuing an activity that was initiated in February 1959, The Potamological Institute of the University of Louisville assembles and evaluates information on the accumulation of radioactive materials by fish, aquatic organisms and in river sediments at selected stations along the Ohio River. For this service $5,000 has been allocated.

Public Affairs — An educational film on "good housekeeping" practices in industrial plants to prevent water pollution is under production by Stuart Finley, Falls Church, Va. An amount of $8,000 was budgeted from Commission funds for script development and some film footage. The film is being completed with contributions totalling $10,000, which were subscribed by industrial plants in the Ohio River Valley, represented on the ORSANCO Industry Advisory Committees.

MEMBERS OF THE COMMISSION

ILLINOIS

Maurice E. Gosnell, Gosnell & Benecki
Clarence W. Klassen, Chief Sanitary Engineer
Franklin D. Yoder, M.D., Director of Public Health

INDIANA

A. C. Offutt, M.D., State Health Commissioner
Blucher A. Poole, Stream Pollution Control Board
Joseph L. Quinn, Jr., The Hulman Company

KENTUCKY

Minor Clark, Department of Fish and Wildlife Resources
J. O. Matlick, Commissioner of Conservation
Russell E. Teague, M.D., State Health Commissioner

NEW YORK

Lyle W. Hornbeck, Bond, Schoeneck and King
Hollis S. Ingraham, M.D., State Health Commissioner
Joseph R. Shaw, Associated Industries of New York State, Inc.

OHIO

Emmett W. Arnold, M.D., Director of Health
Hudson Biery, Ohio Valley Improvement Association (ret.)
Barton Holl, Logan Clay Products Company

PENNSYLVANIA

Karl M. Mason, Department of Health
Marion K. McKay, Sanitary Water Board
Charles L. Wilbar, Jr., M.D., Secretary of Health

VIRGINIA

E. Blackburn Moore, State Water Control Board
William H. Singleton, State Water Control Board
Ross H. Walker, State Water Control Board

WEST VIRGINIA

N. H. Dyer, M.D., State Health Commissioner
W. W. Jennings, State Water Commission
Bern Wright, Division of Water Resources

UNITED STATES GOVERNMENT

Edwin E. Abbott, Corps of Engineers
Raymond E. Johnson, Fish and Wildlife Service
Luther L. Terry, M.D., Public Health Service

officers

Barton Holl, Chairman
A. C. Offutt, M.D., Vice-chairman
Fred H. Waring, Secretary
Verna B. Ballman, Treasurer
Edward J. Cleary, Executive Director and Chief Engineer
Leonard A. Weakley, General Counsel

staff

Edward J. Cleary, Executive Director and Chief Engineer
Robert K. Horton, Assistant Director
William L. Klein, Chemist-Biologist
Robert J. Boes, Chemical Engineer
David A. Dunsmore, Assistant Engineer
Verna B. Ballman, Office Manager

Secretaries: Ruth C. Bergmeyer, Alice F. Courtney, Jane W. Renaldo, Grace B. Ziegler

COMMISSION COMMITTEE ASSIGNMENTS

(for year ending June 30, 1964)

Executive Committee

Chairman	Barton Holl
Vice-chairman	A. C. Offutt, M.D.
Past-chairman	Joseph R. Shaw
Illinois	Clarence W. Klassen
Indiana	Blucher A. Poole
Kentucky	J. O. Matlick
New York	Hollis S. Ingraham, M.D.
Ohio	Emmett W. Arnold, M.D.
Pennsylvania	Karl M. Mason
Virginia	Ross H. Walker
West Virginia	Bern Wright
Federal	Raymond E. Johnson

Audit

J. O. Matlick, *Chairman*
Karl M. Mason
Emmett W. Arnold, M.D.

Bylaws

Hudson Biery, *Chairman*
M. K. McKay
Maurice E. Gosnell

Pension Trust

Barton Holl
Robert K. Horton
Clarence W. Klassen

Long-Range Planning

C. L. Wilbar, Jr., M.D., *Chairman*
Blucher A. Poole
Joseph R. Shaw

Finance

Ross H. Walker, *Chairman*
Joseph R. Shaw
Blucher A. Poole
Barton Holl
A. C. Offutt, M.D.

Engineering Committee

Illinois	Clarence W. Klassen, *Chairman*
Indiana	Blucher A. Poole
Kentucky	Ralph C. Pickard
New York	M. H. Thompson
Ohio	George Eagle
Pennsylvania	Karl M. Mason
Virginia	A. H. Paessler
West Virginia	Bern Wright
Corps of Engineers	Will Brewer
Dept. of Interior	Raymond E. Johnson
U.S.P.H.S.	Gordon McCallum
Secretary	F. H. Waring
Staff	Robert K. Horton

ORSANCO DOCUMENTARY FILMS

Following is a list of ORSANCO films produced to illustrate various aspects of pollution abatement in the Ohio Valley. These 16 mm movies, in color and with sound, may be borrowed for group showings by addressing the state agencies listed on the inside back cover, or by request to Commission headquarters.

GOOD RIDDANCE This fast-moving, omnibus film depicts the progress made and the tasks that still remain in curbing water pollution in the Ohio Valley. This offers a general introduction on the regional crusade for clean streams undertaken by eight states. (29½ minutes)

BEARGRASS CREEK The story of what can happen to a stream when people along its banks disregard their obligation to prevent pollution. Of particular interest is the work being done by the University of Louisville in conducting the ORSANCO-sponsored study of aquatic-life resources. (29½ minutes)

OIL ON THE RIVER Beginning with the story of the discovery of oil in the Ohio Valley, this film shows the unhappy consequence of carelessness in handling, transportation, storage and use of oil products and then depicts preventive measures. (20½ minutes)

CRISIS ON THE KANAWHA A portrayal of industrial growth and the failure to keep pace with it in terms of river protection is the opening theme of this film. Then follows a detailed description of the remedial steps that are being taken to deal with the situation. (22 minutes)

RIVER WATCHERS Safeguarding streams from pollution hazards calls for constant vigilance. This is the story of the sentinels in the eight states who are engaged in checking sewage plant operations, aerial surveillance, virus identification, sampling of streams, forecasting river flow and evaluating the results from robot monitors. (18½ minutes)

THE FIRST FIFTEEN YEARS ORSANCO commissioners describe progress in the fifteen-year crusade for clean streams in the Ohio Valley. A highlight of the film is a visit to The Kettering Laboratory where toxicity studies are documented. (26 minutes)

COAL AND WATER A penetrating look at pollution problems created by the coal industry and the steps being taken to solve those problems. Included is a description of sealing operations in an underground mine to curb acid mine-drainage. (23 minutes)

CHAIRMEN OF INDUSTRY AND ADVISORY COMMITTEES

(as of December 1, 1964)

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

Chemical Industry Committee — J. FLOYD BYRD, Procter and Gamble Co., Cincinnati, Ohio

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

Metal-Finishing Industry Action Committee — C. L. PRICHARD, Arvin Industries, Inc., Columbus, Indiana

Petroleum Industry Committee — ALEX S. CHAMBERLAIN, Louisville Refining Company, Louisville, Kentucky

Pulp and Paper Industry Committee — W. C. MATHEWS, Mead Corporation, Chillicothe, Ohio

Steel Industry Action Committee — W. P. MCSHANE, Pittsburgh Steel Company, Monessen, Pennsylvania

Water Users Committee — GEORGE W. WHETSTONE, U. S. Geological Survey, Columbus, Ohio

FINANCIAL REPORT

The following information relative to revenues collected and expenses paid, and statement of resources, was taken from the Audit Report of Wm. H. Mers and Company, Certified Public Accountants, for the year ended June 30, 1964.

OHIO RIVER VALLEY WATER SANITATION COMMISSION

STATEMENT OF REVENUES COLLECTED AND EXPENSES PAID
YEAR ENDED JUNE 30, 1964

Revenues collected:			
From signatory states:			
State of Illinois			$ 6,630.00
State of Indiana			23,530.00
Commonwealth of Kentucky			26,975.00
State of New York			1,430.00
State of Ohio			32,370.00
Commonwealth of Pennsylvania			19,760.00
Commonwealth of Virginia			4,550.00
State of West Virginia			14,755.00
			130,000.00
From U. S. Department of Health, Education and Welfare (Grant by authority of Federal Water Pollution Control Act)			105,019.00
Sale of publications			216.48
Interest earned on bank deposit			2,614.94
Total revenues collected			237,850.42
Expenses paid:			
From state funds:			
From authorized budget of $130,000.00	$128,759.98		
From $13,150.00 encumbered at June 30, 1963	7,150.00		
		$135,909.98	
From federal funds:			
From authorized budget of $105,019.00	97,468.02		
From $16,200.00 encumbered at June 30, 1963	12,600.60		
		110,068.62	
Total expenses paid			245,978.60
Excess of expenses paid over revenues collected			$ 8,128.18

STATEMENT OF RESOURCES JUNE 30, 1964

	State Funds	Federal Funds	Total
Available resources for period to June 30, 1963	$ 45,675.85	$ 19,418.93	$ 65,094.78
Add: Revenues collected:			
Annual budget — July 1, 1963 to June 30, 1964	130,000.00		130,000.00
U. S. Department of Health, Education and Welfare		105,019.00	105,019.00
Sale of publications	216.48		216.48
Interest earned on bank deposit	2,614.94		2,614.94
	178,507.27	124,437.93	302,945.20
Less: Expenses paid:			
July 1, 1963 to June 30, 1964	135,909.98	110,068.62	245,978.60
Available resources for period to June 30, 1964 before encumbrances	42,597.29	14,369.31	56,966.60
Balance of encumbered funds at June 30, 1964:			
Radioactivity monitor	6,000.00		6,000.00
Computer time and programming		3,599.40	3,599.40
Available resources at June 30, 1964 after encumbrances	$ 36,597.29	$ 10,769.91	$ 47,367.20

The above amount of $56,966.60 is comprised as follows:		
Cash on deposit with The Central Trust Company		$ 54,864.97
Cash on deposit with American Airlines, Inc.		425.00
Cash on deposit with Ohio Bureau of Workmen's Compensation		120.00
Petty cash on hand		200.00
Accounts receivable:		
Advances for employees:		
Employees' pension trust	$ 1,195.63	
Hospitalization	161.00	1,356.63
Total		$ 56,966.60

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