Pollution Patterns

in the Ohio River - 1950

Water-quality conditions and changes revealed by a simultaneous sampling of the 963-mile stretch from Pittsburgh to Cairo.

**OHIO RIVER VALLEY
WATER SANITATION COMMISSION**

OHIO RIVER VALLEY
WATER SANITATION COMMISSION
414 WALNUT STREET   CINCINNATI 2, OHIO

TO: The Chairman and
Members of the Commission

A knowledge of water-quality conditions in the Ohio River and its tributaries is of basic importance to the work of the Commission. This was recognized by your authorization of an investigation to provide a baseline of reference for measuring stream-improvement progress.

This investigation involving simultaneous sampling around-the-clock of a 963-mile stretch of the river at 36 points, was conducted on Sept. 18-29. Such an undertaking is unique and was made possible by the participation and intimate coordination of sixteen agencies.

Because of unanticipated freshet conditions during the survey an unusual pattern of pollution movement was obtained that heretofore has not been fully recognized. This finding along with other detailed data on water-quality variations provides a fund of information for current use and future policy decisions.

Respectfully submitted,

Edward J. Cleary

EDWARD J. CLEARY
Executive Director
and Chief Engineer

June 20, 1951

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PARTICIPANTS

The Ohio River Water Quality Survey was made possible by the cooperative efforts of seventeen state, federal and municipal agencies under the general supervision of the Ohio River Valley Water Sanitation Commission.

These agencies and personnel who had a part in this work included:

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J. R. Hoffert	Chief Engineer
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West Virginia: State Water Commission

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State Board of Health

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Wm. Meyer	Sampler
C. L. Ritchie	Sampler

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Edgar Landenberger	Engineer, Cincinnati
Col. Conrad P. Hardy	District Engineer, Pittsburgh
J. H. Dodds	Chief of Operations Div., Pittsburgh
Col. Walter Krueger, Jr.	District Engineer, Huntington
W. C. Steele	Chief of Operations Div., Huntington
Lt. Col. Clarence Bidgood	District Engineer, Louisville
O. H. Bellis	Chief of Operations Div., Louisville

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Water Treatment Plants

Municipal Authority of Borough of West View, Pa.
Parkersburg, W. Va.
Portsmouth, Ohio

Ohio River Valley Water Sanitation Commission:

The Ohio River Water Quality Survey was organized and coordinated by the staff of the Commission. Field data was collated by John E. Kinney, sanitary engineer, aided by William R. Taylor, assistant chemical engineer. The report was written by Mr. Kinney and reviewed by Harold W. Streeter, consultant to the Commission.

RESULTS IN BRIEF

The Ohio River Water Quality Survey of Sept 18-29, 1950 was planned originally to coincide with low-stage river-flow conditions, which previous records had shown are most likely to occur during this month and October. The purpose of the survey was to observe pollution densities under most unfavorable conditions of dilution and temperature, as a baseline for measuring future progress in pollution abatement.

Owing to the vagaries of weather during an exceptionally wet summer-fall season in 1950, the desired flow condition was not attained. It was possible, however, to observe river pollution as affected by a minor rise and fall in stage, that returned to about the same flow levels after the rise as before it started. In some respects, this condition was advantageous. It reflected certain pollution effects -- not attained under uniformly low stages, but met from time to time when minor freshets occur. This condition is accompanied by reduced times of passage of water in the river, and their consequent effects on natural purification.

Coordinated by the Commission staff, the survey was a cooperative undertaking of the health departments of six signatory states -- Pennsylvania, Ohio, West Virginia, Kentucky, Indiana and Illinois. Daily sample collections were facilitated by arrangements with the U. S. Corps of Engineers, utilizing the personnel at the Ohio River locks and dams. Under contract with the Commission, the U. S. Geological Survey District Laboratory at Columbus carried out a series of mineral analyses of samples. The samples were composited from those collected daily at 27 points along the Ohio River proper, and at nine of the major tributaries near their mouths. The Geological Survey under the same contract supplied daily discharge data for all sampling points.

Findings from this survey, which reflect patterns of pollution under freshet conditions, revealed that:

1. The most highly polluted section of the river was found between Huntington and Louisville. Here both average and maximum coliform concentrations exceeded safe limits of loading for water-treatment plants.

In the upper section of the river -- where sewage and industrial pollution is extremely heavy -- the inhibiting effects of free acidity both on bacterial densities and on organic decomposition were clearly discernible. In the section of the river from Dam 47 to the mouth, pollution densities were found at decidedly lower levels than in the upstream sections. This is due to dilution effects of several large tributaries, together with the beneficial action of natural purification in relatively unpolluted stretches of the lower river.

2. Free acidity is evidenced in the lower Allegheny and Monongahela rivers and in the Ohio River as far downstream as a point below Wheeling, despite the faster flows resulting from the minor freshet. The alkalinity of tributary streams in the upper section, as well as in the main river, was found below the normal level for most streams in the upper Ohio Basin.

3. Dissolved oxygen was at favorable levels throughout the entire river except at Louisville, where the average was below 5 ppm at the city's water intake and at Dam 43. In view of flow conditions, this low level in the Louisville area is difficult to explain unless it can be attributed to local pollution effects along the city's waterfront. The 5-day BOD levels were low throughout the river, except immediately below Cincinnati, where an average of 4.6 ppm was observed at Dam 38.

4. In the upper river, a large proportion of the total hardness was found to be of the permanent type, due largely to sulfates originating from mine drainage and steel-mill pollution. In the lower river, the hardness was of the temporary type derived from natural alkaline earth carbonates and bicarbonates.

Chloride levels in the middle section of the river were definitely affected by the salinity of the Muskingum River; chlorides were high also in the Louisville pool and in the river section between Dam 31 and Dam 36.

5. Concentrations of nitrate observed were well below physiologically critical limits. Sodium concentrations, however, reached sufficiently high amounts in some sections of the river to merit further study from the standpoint of health diet significance. Fluorides ranged from 0.1 to 0.6 ppm; these values may be of possible significance in the event of future undertakings of fluoridation of public water supplies taken from the river.

6. Agreement between comparable results obtained by the state laboratories from daily spot-sampling and by the U. S. Geological Survey District Laboratory from composite samples was in general, very good. This indicated that both series of results were fairly representative of pollution conditions prevailing at the time of the survey.

7. Medians and geometric means obtained from the coliform data were indicated as being unreliable at most of the sampling points as measures of bacterial pollution significant from a public-health standpoint. They tended to mask or wholly conceal the effects of high bacterial densities -- which are most important from this standpoint.

Arithmetic averages, although influenced by occasionally very high results, were found to reflect the higher ranges of bacterial content more reliably than the medians or logarithmic means. Arithmetic averages were adopted, therefore, as the standard of expression for all of the bacterial results in this report.

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It would be highly desirable, as a future project, to undertake a resurvey of the river under the settled low-stage conditions originally sought. It would also be desirable as a follow-up step to carry out as a continuing project -- a monitoring survey of the river at a few carefully selected points throughout the year. This survey would aim to ascertain the effects of both normal and abnormal variations in runoff and seasonal changes on the pollution status of the river under both present and future conditions.

BEHIND THE SURVEY

Patterns of water-quality variations in the Ohio River were developed in Sept 1950 following a twelve-day simultaneous sampling of 36 points in six states (Table 1). Although the river had been thoroughly studied in the past, none of these previous surveys had been aimed at the same specific purpose as that which forms the subject of this report.

Purpose -- This survey of the Ohio River was planned as an initial step to:

1. Provide a baseline from which future pollution-abatement progress can be measured.

2. Define the more highly polluted reaches in the river needing primary attention in the abatement campaign of the Commission.

3. Show the sanitary condition of the river as it flows across state boundary lines, and also how and to what extent this condition is affected by major cities and tributaries.

4. Evaluate the various types of pollution as measured by physical, chemical and bacteriological tests -- such as acidity, DO deficiency, coliforms.

5. Standardize analytical techniques among the signatory states.

6. Promote interstate cooperation in field surveys.

Execution -- Under the direction of the Ohio River Valley Water Sanitation Commission six states bordering on the Ohio River -- Pennsylvania, West Virginia, Ohio, Indiana, Illinois and Kentucky -- sampled the river daily in the period Sept 18-29 inclusive.

Personnel were briefed and analytical techniques standardized prior to the field work in a two-day orientation course conducted by the Environmental Health Center of the U. S. Public Health Service. Personnel of the Ohio River Division, U. S. Corps of Engineers, located at locks and dams assisted in the sample collection.

Mineral analyses and hydrometric data were supplied under contract with the U. S. Geological Survey. The laboratory work was done in the district laboratory in Columbus, Ohio; the hydrometric data were prepared in the offices of the district engineers and correlated at the Louisville office.

Daily sanitary-chemical and bacteriological analyses were made at state health-department laboratories. Four states employed trailer laboratories located on the Ohio River; other testing was done at central laboratories or at water-treatment plants.

Survey conditions -- Low-flow conditions are normally experienced in the Ohio River during September and October. Higher river temperatures prevail during September and make that month preferable for pollution studies.

Contrary to normal expectations, flow conditions proved to be abnormal in September, owing to unusually heavy rainfall in the valley. Scheduling of the survey had to be established weeks in advance to give participating agencies time for preparation. Changes in plan at short notice, consequently, were not possible.

The flow pattern that developed, consisting of a sharp rise and fall to the initial stages, provided:

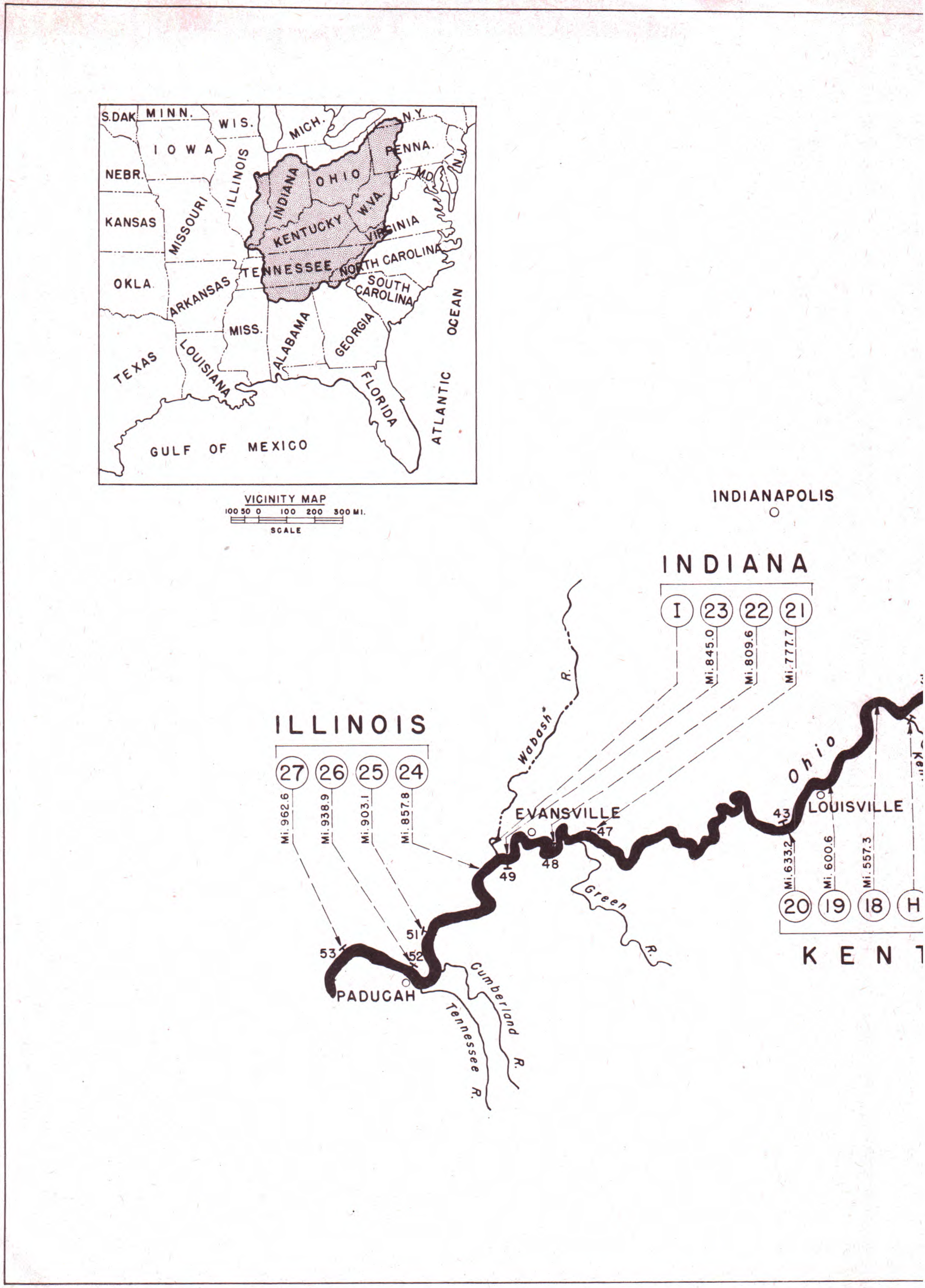
1. Conditions that permitted study of short-term flush-out characteristics in river pools and tributary rivers. Because of high flows occurring in July and August, however, this flush-out effect was not so pronounced as it otherwise might have been.

2. A variation in flow that normally can be expected occasionally from spring through fall during short periods of fairly heavy rainfall.

3. Analyses of coliform, turbidity and mineral content under conditions of variable flows rather than at constant-stage low flow.

4. A variable-flow pattern that permits easier comparison of results from other surveys carried out under similar flow ranges. River surveys can be compared best when general flow conditions are similar.

Data from this survey, though not meeting the requirements originally intended, fulfilled a useful purpose in providing a period of disturbed flow, but otherwise with the same seasonal conditions as had been anticipated for settled low-stage flow. That the river returned, after its rise, to about the same stages as prevailed initially is an added advantage in interpreting the results of the survey. This opportunity to compare the results observed in this survey with those obtainable under a static low-flow condition points to the need for additional data under the latter condition.



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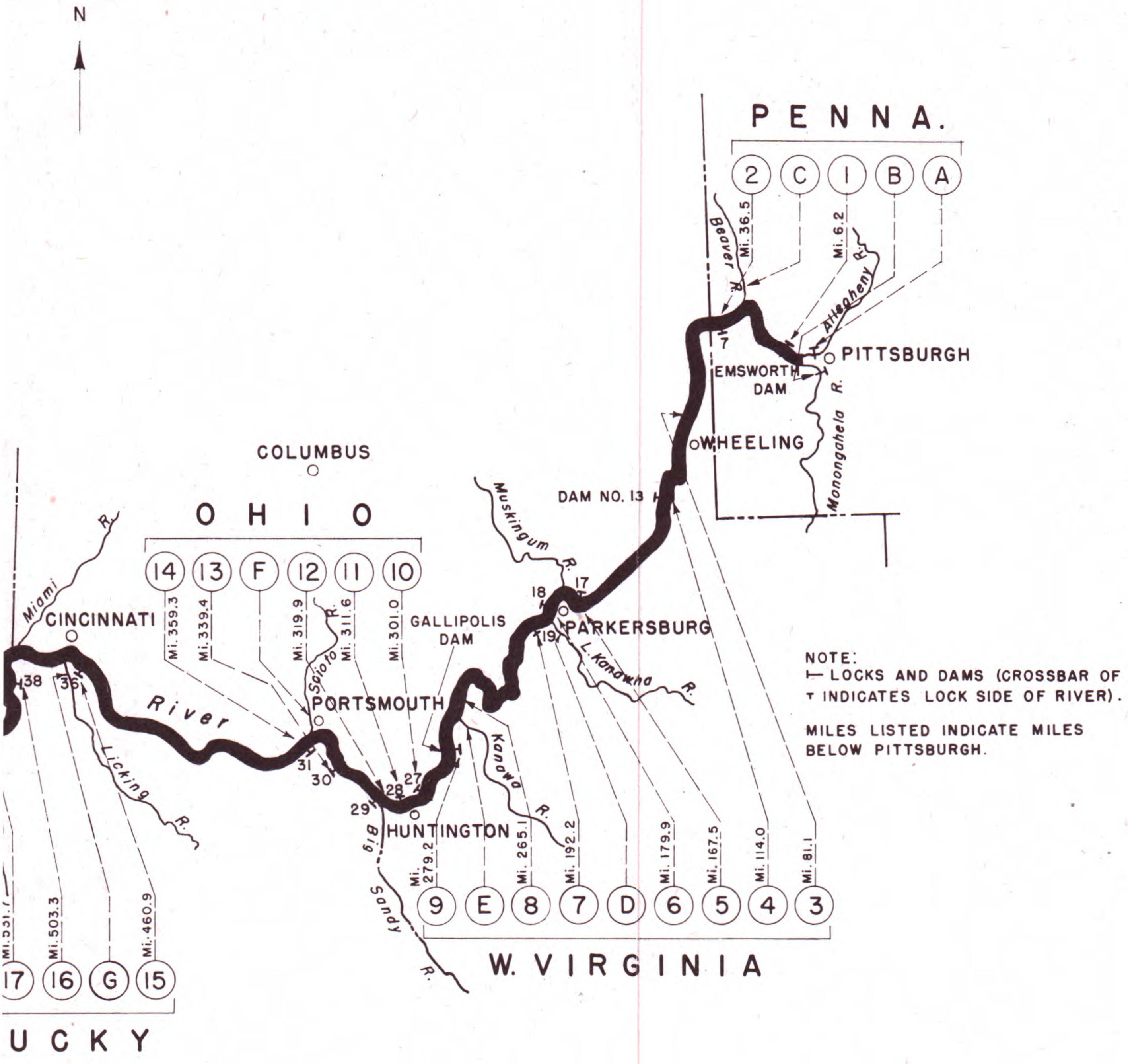


SAMPLING STATIONS
FOR OHIO RIVER
WATER QUALITY STUDY

OHIO RIVER VALLEY WATER SANITATION COMMISSION

HYDROMETRIC DATA

River flows have been averaged (Table 2) in two ways for each station for period of survey:

1. As total discharge in thousand second-feet.

2. In terms of runoff per square mile of drainage area.

Practical use of total discharge can be made in estimating the average daily quantity load of each constituent passing any given sampling point. This can be done by the relation:

$$\text{cfs} \times \text{ppm} \times 5.38 = \text{pounds per day}$$

Use of runoff per square mile permits comparison of analytical data for different streams -- or different points on the same stream -- by making due allowance for similarities or differences in unit-area flow.

To predict possible stream discharges during September, runoff records since 1936 were reviewed by the U. S. Geological Survey. The Huntington (W. Va.) station was selected as a basis for prediction because it provides discharge data independent of other stations.

Approximate median monthly discharge was determined for the Huntington gage for the July-September period for each year. The median is the result which is exceeded by 50% of the results in a given series. The 1941 water year approximated the median (the "water year" adopted by the U. S. Geological Survey extends from September 1st through the ensuing year). Daily discharges for the three-month period of that year, therefore, were plotted as well as those for the three-month periods in 1943 and 1948. Monthly discharge during July and August for those two years was higher than the median; whereas September discharge in both years was lower than the median. Mean discharge during July 1950 was the highest for the period of record.

Analysis of these assembled hydrometric data for the Huntington gage showed:

a. Although high discharge prevailed during the first part of 1950, flows equal to or less than the median could be expected in September;

b. Peak discharges of almost 100,000 cfs during the first part of August, and 80,000 cfs in the latter part of August, have been followed by median or lower monthly discharge during September;

c. Despite maximum daily discharge of 50,000 cfs on Sept 6, 1941 the river reached lower flow conditions during the last fifteen days of the same month;

d. Discharges up to 29,000 cfs were experienced during the period Sept 20-25, 1948 -- a condition that could be experienced again.

It was concluded that a mean discharge ranging as low as 10,000 cfs during the period Sept 18-29, 1950 might be normally anticipated, judging from previous records. Discharge would vary above this figure depending on the amount of precipitation during September.

The flow pattern experienced in Sept 1950, did not conform, however, to these expectations. At Huntington, for example, the discharge ranged from 30,100 to 172,000 cfs. Maximum discharge of 366,000 cfs was measured at Dam 53.

Typical hydrographs are shown in Figs 2 and 3. Daily hydrometric data are recorded in the Appendix.

Discharges and hydrographic comparisons -- Among the comments on the hydrometric data submitted by the U. S. Geological Survey were:

The following sampling points being located at, or very near, gaging stations, discharge for the sampling point was considered equivalent to the discharge at the gaging station: Nos 1, 2, 4, 5, 6, 8, 11, 12, 18, 19, 21, 25, 26, 27, B and C.

For other sampling points, discharge at gaging stations was modified by the discharge from other tributary gaging stations, and by discharge from ungaged inflow areas (usually relatively small). For these ungaged areas discharge was determined from miscellaneous discharge measurements at selected points and runoff factors based on the runoff in surrounding areas.

Daily discharge at established gaging stations was computed by the usual methods involving the gage-height record and rating tables.

A consistency study was first made for the entire period by summations of upstream records at each main Ohio River station compared to the record at that station. This analysis showed that, for the period as a whole, the records were generally well within 5% accuracy, though daily flows occasionally exceeded this limit. The base data were then compared for gross errors by means of discharge hydrographs.

The hydrographs showed a number of minor inconsistencies but these did not necessarily indicate errors. The factors causing the apparent discrepancies result primarily from regulation of lock and dam operation, channel storage, and travel time, which is related to storage. These factors combined with inflowing tributary streams at varying magnitudes of flow, may cause a variety of hydrograph shapes progressively downstream.

The small freshet wave, which progressed downstream during the latter part of September, produced variable hydrograph shapes. Times of travel between main-stem gaging stations and sampling points during this flood period were not an important factor until sampling point No 20 was reached. The following tabulation shows the data used, including main-stem gaging station records, tributary and inflow computed records, and factors in order to determine the daily discharge at sampling points Nos 20-27.

Sampling Point	Method of Discharge Determination
20	Ohio R. at Louisville with 0.4 day travel downstream plus (Salt R. x 1.2).
21	Ohio R. at Owensboro with 0.4 day travel downstream.
22	Ohio R. at Evansville with 0.2 day travel downstream plus inflow.
23	Ohio R. at Evansville with 0.7 day travel downstream plus inflow.
24	Average of sampling sta. No. 23 plus Wabash River at the mouth, and Ohio R. at Golconda with 0.5 day travel upstream minus inflow (Saline and Tradewater rivers).
25	Equivalent to Ohio River at Golconda.
26	Ohio River at Metropolis with 0.25 day travel upstream.
27	Ohio River at Metropolis with 0.25 day travel downstream.

The question was raised concerning the relative plotting of hydrographs for sampling points Nos 23, 24 and 25. It should be noted that inflow from point 21 to 23 was not an important factor, so that the flow crest progressed downstream with slight flattening and broadening of the hydrograph. Between sampling points 23 and 24, however, the Wabash River contributes a large flow thus causing a substantial increase in discharge throughout the freshet. As the flow pattern computed downstream from Sta 23 plus Wabash River to Sta 24 was somewhat different from that which was computed upstream from Golconda minus inflow, it was decided to use the average of these two estimates for Sta 24. The difference probably results from inability to estimate exactly the timing and the effect of flattening of the peak flow curve. However, the resultant average hydrograph for Sta 24 is considered reasonably good.

FIG 2-- OHIO RIVER WATER QUALITY DEFINITION SURVEY

DISCHARGE HYDROGRAPHS

AT

SAMPLING POINTS

MAIN STEM OHIO RIVER

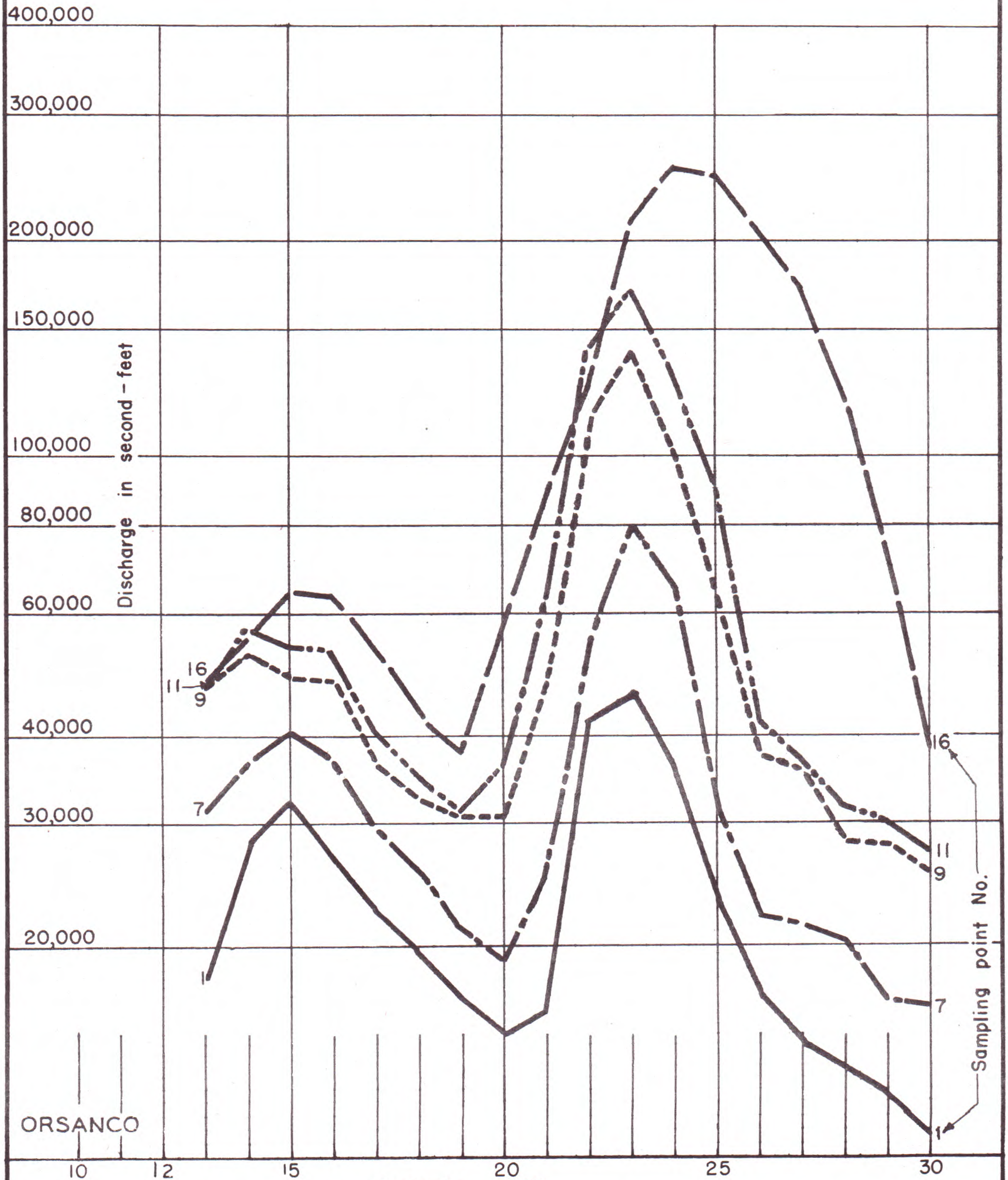


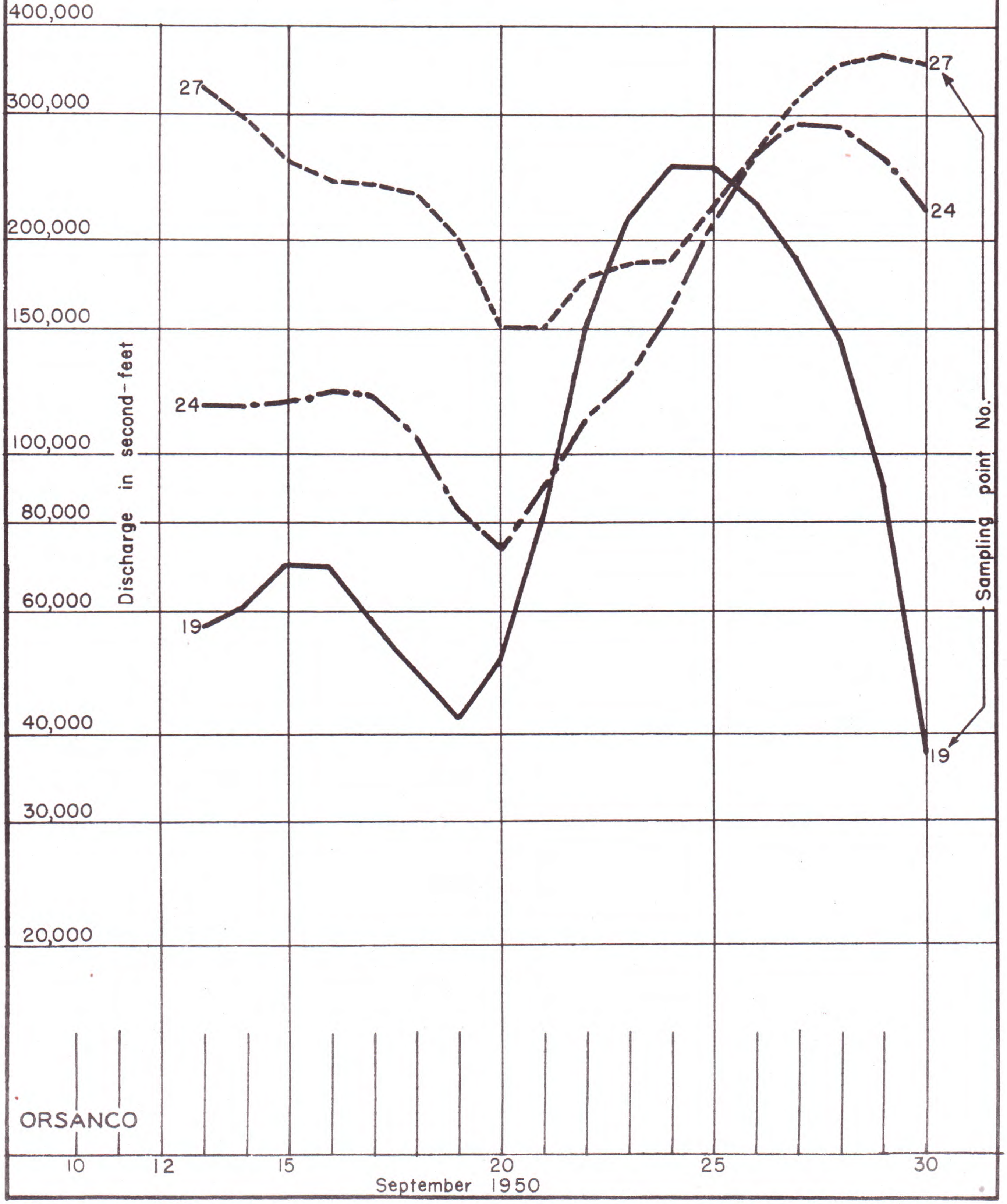
FIG 3--OHIO RIVER WATER QUALITY DEFINITION SURVEY

DISCHARGE HYDROGRAPHS

AT

SAMPLING POINTS

MAIN STEM OHIO RIVER



BACTERIOLOGICAL ANALYSES

Coliform data were obtained from daily samples at each one of the 36 sampling points listed in Table 1, which shows period averages and daily maxima at these points (See Fig 4). Results expressed in terms of "most probable numbers" (MPN), were based on the standard confirmed test, with three tubes planted in each of three or more dilutions in decimal series.

In carrying out the confirmed tests, a record also was made of 24-hr and 48-hr presumptive results. Averages of these results for comparison with those of the confirmed tests are given in Table 3. Methods followed in enumerating coliform organisms were essentially the same as those employed in the Ohio River Pollution Survey of 1939-1940. The results, therefore, are directly comparable with those of the previous survey -- for sampling points having the same locations.

Trend of results -- The coliform data summarized in Table 3 show high bacterial pollution on the Ohio River at Sewickley, just below Pittsburgh, but diminishing sharply at Dam 7, and continuing at relatively lower levels downstream to Gallopolis Dam, some 280 miles below Pittsburgh. This reduction appears to be due mainly to the effect of acidity in the upper section of the river. Owing to the shortened times of flow, the full effect of this acid condition evidently was not exerted until the river had passed some point below Sewickley.

This general picture corresponded to that which had been observed in previous surveys of the upper river: Well-marked decreases in coliform densities below Pittsburgh -- greater than could be attributed to normal self-purification -- were consistently observed.

A sharp increase in coliform densities was shown below Dam 27, resulting mostly from direct sewage pollution in the Huntington-Portsmouth section of the river, augmented by the highly polluted flow of the Scioto River (Sta F).

In the relatively unpolluted stretch extending from Dam 31 to 36, an increase in average coliform numbers was observed, much greater in degree than accountable from intermediate pollution. Under normal low-stage conditions, a marked decrease in bacterial pollution had been consistently noted in previous surveys. In the present case, the increase probably reflected the cumulative effects of channel scouring and shortened times of flow resulting from the rise in the river to a peak discharge of 228,000 cfs at Dam 36.

The relationship between daily variations in discharge and coliform numbers at Dam 36 during the survey period are shown in Fig 5. It will be noted that the greatest increase in coliform numbers coincided with the first stage of the rise in the river on Sept 20, and in advance of the major part of the rise. This is characteristic of increases in bacterial content accompanying freshets in the Ohio.

The rapid decline in coliform numbers following the crest of flow is also a commonly observed phenomenon, probably due to the washing-out effect of the freshet in its initial stages, followed by a dilution influence on the residual bacterial content. The secondary increase observed at Dam 36 on Sept 27 possibly was due to a delayed effect of pollution from the Scioto, which also produced a similar effect at Dam 31 beginning on Sept 25.

Coliform density in the river stretch below Cincinnati -- averaged 210,000 at Dam 38, 94,000 at Dam 39 (30 miles downstream), and 44,000 at Madison Bridge (26 miles below the mouth of the Kentucky River). This would represent a fairly normal picture of the combined effects of dilution and natural purification in this relatively unpolluted stretch of the river, following heavy pollution from the combined sewage of the Cincinnati District.

At Sta 19, located at the Louisville water intake, the average MPN was 211,000 -- practically the same as observed immediately below Cincinnati, despite the marked difference in pollution discharge above these two points. This average included, however, a single day's count of 2,300,000, far out of line with the other results at this point. If this result were omitted, the average would be reduced to 21,000. Although this single high result might be considered as unusual, its potential recurrence cannot be disregarded, in view of the proximity of sewer outfalls and the possibility of backflow in the river during sudden rises in pool stage.

At Dam 43, below the center of Louisville, the average coliform number was 156,000, with a maximum-to-average ratio of 1.9; a result which normally would be expected at this point. The pattern shown at Dam 43 is somewhat different from that for Dam 36 (Fig 6). In this case, the more pronounced inverse relation indicated between coliform densities and river discharge is fairly typical of what would be expected just below a major source of pollution. This is distinguished from a point, such as Dam 36, which is located at the lower end of a 100-mile stretch of river receiving little intermediate sewage pollution.

A markedly lower level of coliform numbers was observed from Dam 43 to Dam 53, near the mouth of the Ohio, except for a slight upturn at Dam 48, below Henderson, and at Shawneetown, below the outlet of the Wabash River.

From Dam 51 to Dam 53, the effects of added dilution and natural purification, with little intermediate pollution, was apparent in the steady decline in coliform densities to relatively low levels.

In the entire stretch of river from Dam 43 downstream, ratios of maximum-to-average coliform numbers were comparatively low, indicating a fair degree of stabilization in the run of the data.

Maximum vs average ratios -- A review of the maximum-to-average ratios shown in Table 3 for each sampling point throughout the length of the river indicates the distribution of variations in these ratios:

Number of Sampling Points	% of Total	Ratio, Maximum to Average
11	31	Equal to or less than 3.0
23	64	Equal to or less than 5.0
32	89	Equal to or less than 6.0
4	11	Greater than 6.0

From these figures it appears that ratios of 5.0 or less were observed at nearly two-thirds of the sampling stations, and ratios of 6.0 or less, at roughly 90% of the points.

Under the variable flow conditions prevailing during the survey, ratios up to 5.0 or 6.0 might be expected. From the run of the data, ratios in excess of 6.0 would seem to be exceptional, and where observed, would indicate the need for further study of local conditions, which might explain this degree of variability. Such conditions might include flushing of tributaries, proximity to sewers and storm overflows, and channel flows as affected by natural runoff and drain regulation.

Four stations with maximum-to-average ratios of 6.0 or over were located near water supply intakes.

Coliform vs enterococci results -- Data supplied by the Illinois Department of Health (Table 8) provided a basis for comparison of the coliform and enterococci numbers observed in the same samples collected at Stas 24, 25, 26 and 27. Although no definite numerical correlation was found between these two indices of sewage pollution the trend of the data indicated in general that high enterococci numbers tended to coincide with high coliform densities. With a relatively low level of bacterial pollution in this stretch of the river, extending from Shawneetown to near the mouth, the effect of surface wash, dilution and natural purification might be expectdd to obscure that of sewage to a greater extent than in upstream sections of the river.

Despite these influences, enterococci nunbers less than 23 per 100 ml were observed in only 6 out of the 48 samples examined, and in these six cases the maximum number of coliforms recorded was 2,400 per 100 ml. It thus appears that sewage pollution predominates even in the lower reaches of the Ohio, and that the coliform group of organisms is a reliable indicator of such pollution both qualitatively and quantitatively.

Medians vs averages -- Comparison of the average and median coliform numbers recorded in Table 3 indicates little numerical correlation between these two variables, except a tendency for both to be high, or low, when the ratio of maximum-to-average counts was low. In some cases, where this ratio exceeded 3.0 or 4.0, the disparity between the two figures was wide, the median failing to show in some cases the effect of increased coliform numbers resulting from the rise in the river.

At fourteen of the 36 sampling points, the median was less than one-half of the corresponding average figure, and in at least ten cases would have led to an erroneous interpretation of the results as indicating conformance, or near-conformanity, to the bacterial-quality objectives recently adopted by the Commission. The weakness of the median in this respect is most apparent when an increase in coliform numbers to much higher levels occurs at some time after the mid-point of a given period of equally-spaced observations. Had the rise in the river occurred a few days later in the present survey, this weakness would have been even more strikingly shown.

The results of the survey have given ample evidence of the advantages of the average over the median in surveys of this type, concerned with evalua-

results: 3/3 in 1 ml, 3/3 in 0.1 ml, 1/3 in 0.01 ml, and 0/3 in 0.001 ml, the three dilutions considered would be 0.1 ml, 0.01 ml, and 0.001ml, as the highest dilution giving a 3/3 result was 0.1 ml. This procedure is in accordance with that given in Standard Methods. It was applied in recording and checking all individual results, both confirmed and presumptive.

The usual precautions regarding sterility of glassware and culture media were carefully observed in carrying out the tests. Samples from the river generally were collected at mid-stream and mid-depth, though some difficulties were experienced during the freshet. Samples intended for bacteriological examination were transported in iced containers to the laboratory and, if not examined immediately on arrival, were stored in the refrigerator until examination.

Number of Sampling Points	% of Total	Ratio, Maximum to Average
11	31	Equal to or less than 3.0
23	64	Equal to or less than 5.0
32	89	Equal to or less than 6.0
4	11	Greater than 6.0

From these figures it appears that ratios of 5.0 or less were observed at nearly two-thirds of the sampling stations, and ratios of 6.0 or less, at roughly 90% of the points.

Under the variable flow conditions prevailing during the survey, ratios up to 5.0 or 6.0 might be expected. From the run of the data, ratios in excess of 6.0 would seem to be exceptional, and where observed, would indicate the need for further study of local conditions, which might explain this degree of variability. Such conditions might include flushing of tributaries, proximity to sewers and storm overflows, and channel flows as affected by natural runoff and drain regulation.

Four stations with maximum-to-average ratios of 6.0 or over were located near water supply intakes.

Coliform vs enterococci results -- Data supplied by the Illinois Department of Health (Table 8) provided a basis for comparison of the coliform and enterococci numbers observed in the same samples collected at Stas 24, 25, 26 and 27. Although no definite numerical correlation was found between these two indices of sewage pollution the trend of the data indicated in general that high enterococci numbers tended to coincide with high coliform densities. With a relatively low level of bacterial pollution in this stretch of the river, extending from Shawneetown to near the mouth, the effect of surface wash, dilution and natural purification might be expectdd to obscure that of sewage to a greater extent than in upstream sections of the river.

Despite these influences, enterococci nunbers less than 23 per 100 ml were observed in only 6 out of the 48 samples examined, and in these six cases the maximum number of coliforms recorded was 2,400 per 100 ml. It thus appears that sewage pollution predominates even in the lower reaches of the Ohio, and that the coliform group of organisms is a reliable indicator of such pollution both qualitatively and quantitatively.

Medians vs averages -- Comparison of the average and median coliform numbers recorded in Table 3 indicates little numerical correlation between these two variables, except a tendency for both to be high, or low, when the ratio of maximum-to-average counts was low. In some cases, where this ratio exceeded 3.0 or 4.0, the disparity between the two figures was wide, the median failing to show in some cases the effect of increased coliform numbers resulting from the rise in the river.

At fourteen of the 36 sampling points, the median was less than one-half of the corresponding average figure, and in at least ten cases would have led to an erroneous interpretation of the results as indicating conformance, or near-conformanity, to the bacterial-quality objectives recently adopted by the Commission. The weakness of the median in this respect is most apparent when an increase in coliform numbers to much higher levels occurs at some time after the mid-point of a given period of equally-spaced observations. Had the rise in the river occurred a few days later in the present survey, this weakness would have been even more strikingly shown.

The results of the survey have given ample evidence of the advantages of the average over the median in surveys of this type, concerned with evaluations of pollution densities having a definite public-health significance, despite the recognized statistical advantages of medians in studying certain other types of natural phenomena.

Surface vs mid-depth sampling -- The standard procedure in the survey involved the collection of all samples at mid-depth. A special comparative study by the Indiana State Board of Health at four of the sampling stations permitted further evaluation of surface vs mid-depth sampling (Tables 6 and 7). These results, though indicating little significant difference in the averages observed at three of the stations, showed a somewhat smoother and more consistent pattern of the daily figures obtained from the mid-depth samples than those derived from the surface sampling.

The few observations thus available tended to support the advantage of mid-depth sampling as a routine procedure, in line with previous observations in the Ohio and other streams.

Confirmed vs presumptive results -- A study of the average 24-hr and 48-hr presumptive results given in Table 3 has shown that agreement with the confirmed averages was closer for the 24-hr figures at 19 sampling points, and for the 48-hr results at 17 stations. Thus an almost even balance was indicated in this respect.

In the section of the river from Dam 27 upstream, however, the 24-hr results corresponded more closely to the confirmed averages at 13 out of 15 stations. In the section below Dam 27, agreement was closer between the 48-hr and confirmed results at 15 out of 21 stations.

With a very few exceptions, the 48-hr results indicated more closely the confirmed numbers at stations where coliform densities were relatively high, whereas the 24-hr figures tended to agree better with those of the confirmed tests when coliform densities were comparatively low.

Without going into a statistical analyses of these deviations, it may be said that neither the 24-hr nor the 48-hr presumptive results -- considered alone -- would appear to provide a very accurate measure of the confirmed results, though in some cases agreement with one or the other was very good. On the whole, the 48-hr presumptive results appeared to run closer to the confirmed results than did the 24-hr figures. If the presumptive test were to be used as a substitute for the confirmed test, the 48-hr period would seem preferable.

Bacteriological methods -- The methods followed in determining coliform bacteria were basically the same as described in Standard Methods for the Examination of Water and Sewage, 9th ed, American Public Health Assn New York, N. Y. (Section 9) paragraphs B and C, pp 194-196. The recorded results were based on the confirmed test, but the results of the 24-hr and 48-hr presumptive gas-former tests were also recorded for purposes of comparison.

In making each test, at least three sample dilutions were made in the usual decimal series. Three tubes of standard lactose broth were planted from each dilution, using the inverted-vial type of fermentation tube. In making up dilutions, sterile phosphate buffered distilled water was used, being contained in cotton-plugged bottles each holding 99 ml of dilution water. Pipettes were of one milliliter capacity graduated accurately to 0.1-ml divisions. Measurements were made from meniscus to meniscus.

Sample portions of 1.0 and 0.1 ml were planted directly without dilution. Plantings of 0.01 and 0.001 ml were made from dilutions of the sample by adding 1.0 and 0.1 ml of the sample to 99 ml of dilution water, and transferring 1 ml of the corresponding dilution mixture to the fermentation tubes. Shaking and mixing techniques were in accordance with the directions of Standard Methods.

Judgment as to the number and amount of dilutions were based on the experience of the operator with water samples from each sampling point. In general, the aim was to select a range of dilutions which would give three positive results in the lowest dilution, and preferably three negative results in the highest dilution.

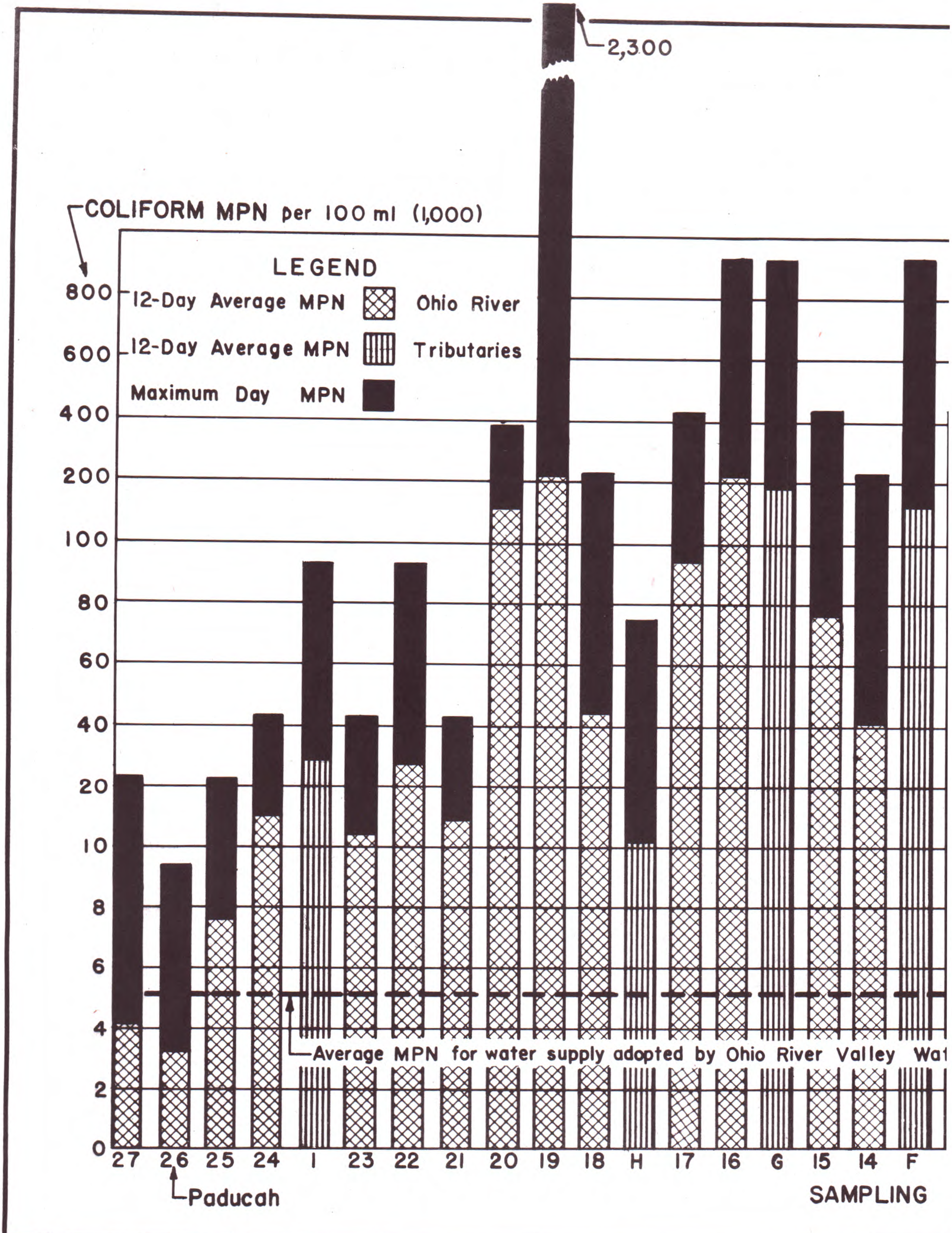
Presumptive test -- After placing the fermentation tubes, suitably racked, in the 37-deg C incubator, any tube showing more than 10% of gas in the inverted vial at 24 hours was recorded as a positive presumptive result. At the end of 48 hours the tubes were read again; tubes showing more than 10% of gas at this time were recorded as 48-hr positive presumptives.

Confirmed test -- As soon as gas in any amount appeared in a tube, a transfer of a 3.0 mm loopful of the liquid was made to standard brilliant-green lactose bile confirmatory medium, also contained in the usual type of fermentation tube. All tubes showing no gas at 24 hours were held over for a 48-hr period so that transplants could be made from tubes developing any gas during the second 24 hours. Any gas formation in the brilliant-green lactose bile medium within 48 hours was recorded as a positive confirmed result.

Interpretation of results -- Enumeration of coliform bacteria from the fermentation tests was in accordance with the "most probable nunber" (MPN) method, using a table after Hoskins (Public Health Reports, Reprint 1621, 1940 revision) and transcribed from Supplement B, Part II of the report on Ohio River Pollution Control (House Document 266, 78th Congress, 1st Session, p 935), prepared by the U. S. Public Health Service.

In recording the results, the highest dilution showing all three tubes positive, together with the next two higher dilutions, were taken as the basis of the MPN enumeration. Thus, in a series giving the following results: 3/3 in 1 ml, 3/3 in 0.1 ml, 1/3 in 0.01 ml, and 0/3 in 0.001 ml, the three dilutions considered would be 0.1 ml, 0.01 ml, and 0.001ml, as the highest dilution giving a 3/3 result was 0.1 ml. This procedure is in accordance with that given in Standard Methods. It was applied in recording and checking all individual results, both confirmed and presumptive.

The usual precautions regarding sterility of glassware and culture media were carefully observed in carrying out the tests. Samples from the river generally were collected at mid-stream and mid-depth, though some difficulties were experienced during the freshet. Samples intended for bacteriological examination were transported in iced containers to the laboratory and, if not examined immediately on arrival, were stored in the refrigerator until examination.



2,300
COLIFORM MPN per 100 ml (1,000)
LEGEND
12-Day Average MPN Ohio River
12-Day Average MPN Tributaries
Maximum Day MPN
800
600
400
200
100
80
60
40
20
10
8
6
4
2
0
Average MPN for water supply adopted by Ohio River Valley Wat
27
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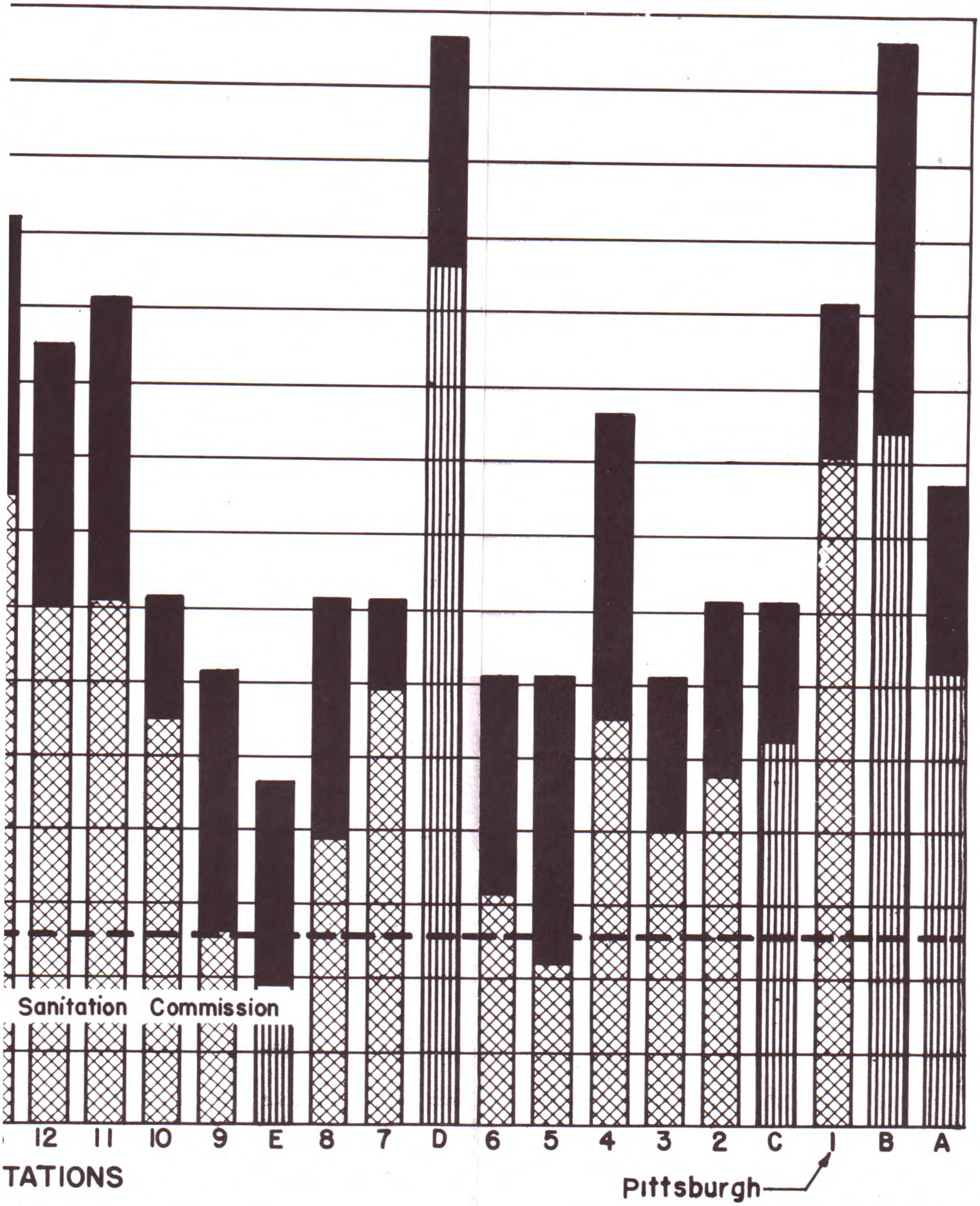
SAMPLING

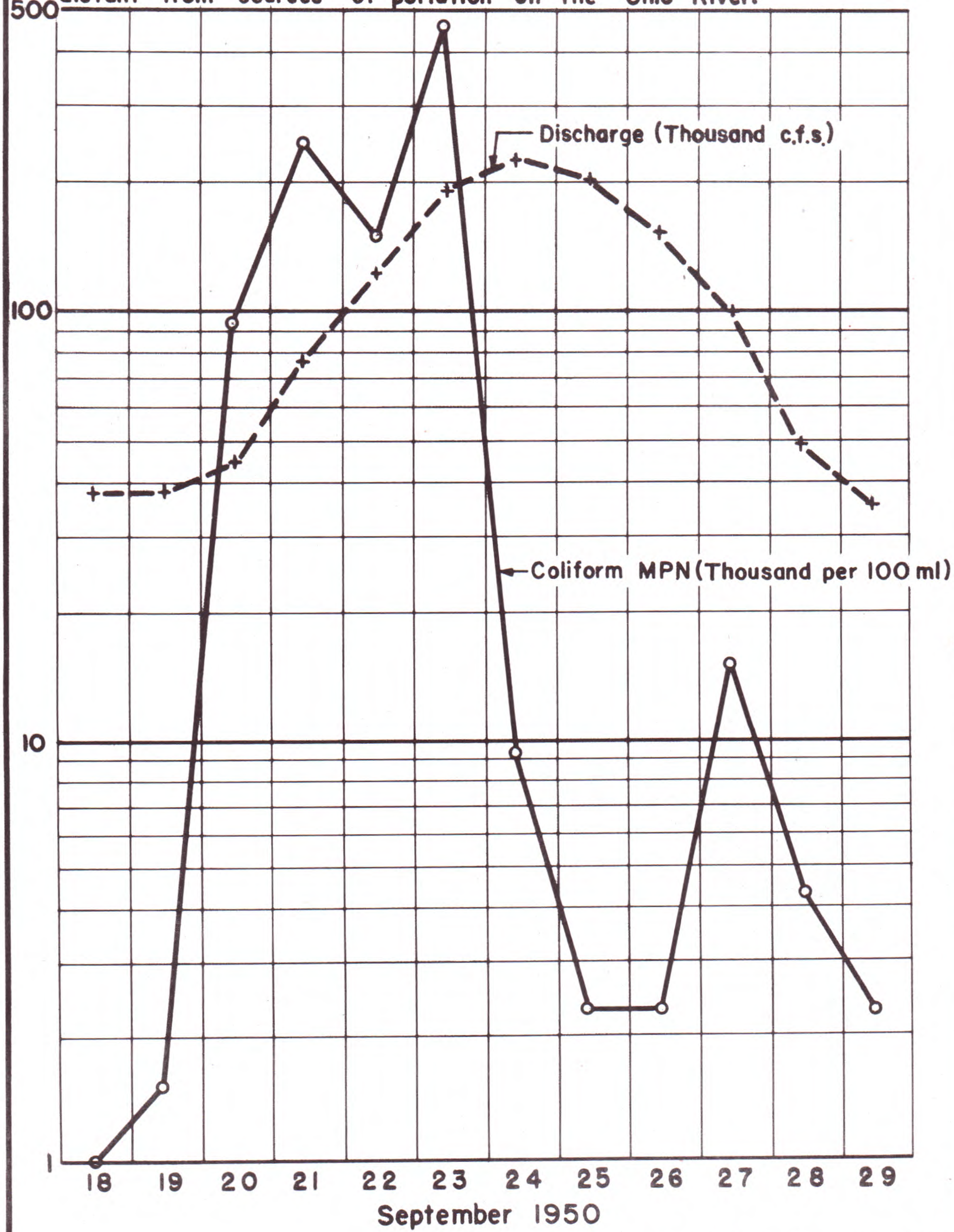
FIG 4-Average and Maximum Coliform Numbers at Survey Sampling Points

Only three sampling stations on the Ohio River gave average coliform numbers that comply with the average of 5,000 MPN recommended by Ohio River Valley Water Sanitation Commission for water supplies.



Ohio River Valley Water Sanitation Commission

Fig 5 - Greatest increase in coliform numbers coincided with first stage of the rise in the river at sampling station No 15 (Dam 36). This coliform - discharge relationship is typical of sampling points distant from sources of pollution on the Ohio River.



Ohio River Valley Water Sanitation Commission

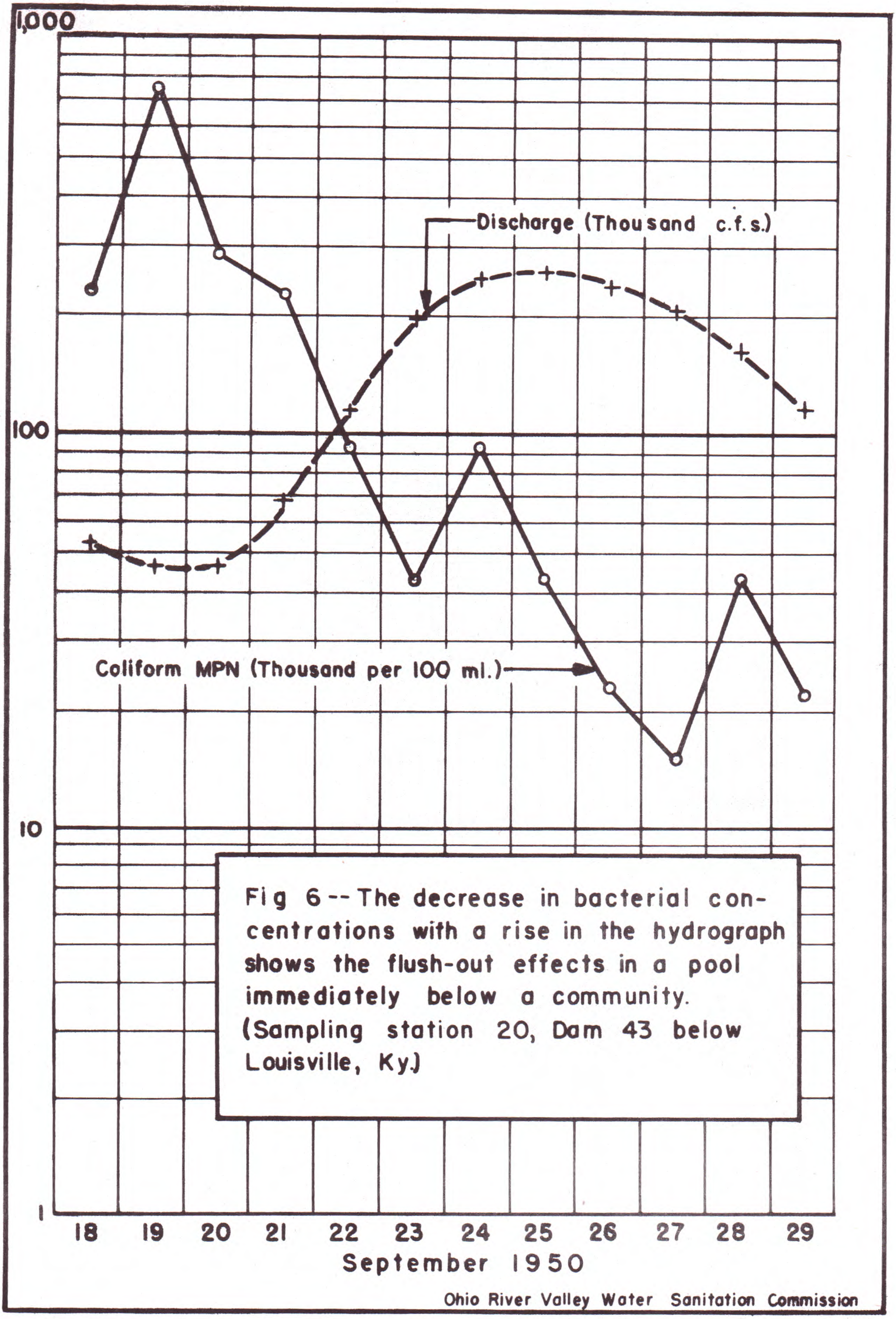


Fig 6 -- The decrease in bacterial concentrations with a rise in the hydrograph shows the flush-out effects in a pool immediately below a community. (Sampling station 20, Dam 43 below Louisville, Ky.)

Ohio River Valley Water Sanitation Commission

SANITARY, CHEMICAL AND MINERAL ANALYSES

Chemical data were obtained from two independent series of observations consisting of:

1. Determinations made on routine samples collected and examined daily at each of the laboratories operated by signatory states. Included were: acidity to phenolphthalein (hot and cold), alkalinity to methyl orange, pH, total solids, turbidity, chlorides, hardness and total iron; dissolved oxygen and 5-day biochemical oxygen demand at 20 deg C. Period averages for the results of these analyses are listed in Table 2, and average and maximum or minimum results for six of the more significant determinations in Table 9.

2. Analyses reported in ionic form obtained from composite samples. This was done at the Columbus, Ohio district laboratory of the U. S. Geological Survey which was under contract with the Commission to do this part of the analytical work, and also to provide the hydrometric data. The weighted average results of these analyses, noted in Table 2 under "Mineral Analysis," afforded a good check on the results which were common to the two series. They also provided a more comprehensive picture of the mineral content of the Ohio and its tributary waters. On the basis of specific conductance of each daily sample, two or more composite samples were prepared for mineral analysis. Specific conductance provides a convenient over-all index of the ionized mineral content of a natural water.

Certain trends, and a few inconsistencies, are to be noted in the results of physical and chemical examinations carried out in the two series above noted. These may best be considered under the heading of each constituent, or group of constituents, with which the analyses have dealt.

Acidity -- Free acidity was recorded at the Monongahela and Allegheny river stations, and on the Ohio to a point below Wheeling, W. Va. In these reaches, alkalinities were lower than normal for non-acid streams in this basin. This lower alkalinity continued downstream as far as Cincinnati.

For the next six stations below Cincinnati (sampled by Kentucky) free acidity was recorded, together with an appreciable increase in alkalinity. Individual daily analyses showed that this free acidity was not experienced every day. Free acidity was recorded in the lower part of the river -- beginning at Louisville and extending to the mouth.

It would seem that the free acidity reported at Sta 15 to 18 is inconsistent with the reported pH above 7, and average alkalinity greater than 45 ppm; and inconsistent with results from stations above and below this stretch.

Alkalinity -- No constant difference is noted in the daily and composite averages for alkalinity. Alkalinities on composite samples were determined with methyl red indicator; the daily samples were determined using methyl orange in accordance with Standard Methods. It has been the experience of the U. S. Geological Survey laboratory that the end-point is seen more readily with methyl red; hence, their use of this indicator.

Composites were analyzed for carbonate and bicarbonate alkalinity. Except for the Wabash River, carbonate alkalinity was absent.

Using the results of the composite samples, a smoother pattern of effects of tributaries with respect to alkalinity is seen than with the averages of daily samples. Particular attention should be given to results from sampling points at Dam 47 and on the Wabash River.

pH -- Average pH was computed by averaging hydrogen-ion concentrations -- so as to integrate the effects of the low pH values -- and then converting to corresponding pH.

This is a departure from the usual method of averaging pH values directly and the reason may be illustrated thus: An arithmetical average of pH 4.0 and pH 6.0 gives pH 5.0; but as pH 4.0 is 100 times as acid as pH 6.0, the average of hydrogen-ion concentrations gives pH 4.3, showing the true effect of the sample with greater acidity.

BOD -- During this survey, the 5-day BOD values observed were relatively low, as is usually experienced at the higher river stages. Highest average BOD (4.6 ppm) was in the Cincinnati pool below the city.

Low BOD at Louisville was observed coincidently with reduced dissolved oxygen. This might be explained by assuming that the BOD in the river, resulting from pollution at Cincinnati, had been satisfied before reaching Louisville, with insufficient reaeration to replenish loss of dissolved oxygen. It also could be explained as being due to the effect of local sludge deposits in the Louisville pool.

Dissolved oxygen -- Lowest values for dissolved oxygen were found at the Louisville water intake and in the pool below Louisville. Minimum daily DO was critical at both of these points during the survey. Other critically low minimum points included the Beaver and Kanawha Rivers.

A check should be made on these points during low-flow stages of the river because past surveys have not indicated that the Louisville pool is the critical stretch of the river from this standpoint.

Chlorides -- Close agreement between the chloride results from daily and composite samples indicate that the compositing gave representative samples.

Substantial increase in chlorides was noted at Dam 18 -- the effect of high salinity in the Muskingum River.

Other increases were noted at the Dam 36 sampling point, an increase that developed between Dams 31 and 36, as well as in the Louisville pool; no obvious reason can be given for these increases.

Study of the daily report forms (Tables 14 to 49) suggests that chloride concentrations in the river, though roughly inversely proportional to the river discharge preceding and during the flow crest, fell sharply to disproportionately low levels immediately after the crest had subsided. The situation at Sta 30, near Haverhill, Ohio, illustrates this as shown:

Discharge 1,000 cfs	Chlorides ppm	Chlorides lbs/day
37.0	40	8,000,000
32.0	35	6,040,000
42.0	33	7,480,000
86.0	13	6,030,000
190.0	8	8,200,000
234.0	10	12,600,000
180.0	7	6,780,000
119.0	10	6,400,000
67.0	13	8,700,000
42.0	11	2,490,000
37.0	14	2,790,000
32.5	14	2,450,000

The weighted average for chlorides from U. S. Geological Survey analyses equals the daily-analysis average so these concentrations may be assumed correct.

This means that the concentration of salts at minimum low flows cannot always be calculated from a knowledge of concentrations at higher flows.

It will be noted that up to the last three days of the sampling period, the total chloride discharge, in pounds per day, remained fairly constant, except for an increase on the day of maximum flow. This would be expected if the inverse relations between flow and chloride concentration should hold. On return of the river to its initial stages, however, a sharp decrease in this total chloride quantity to less than one-half of its previous level was observed. Such behavior would suggest that minor freshets in the river tend to flush out chlorides from various sources, and to reduce them to disproportionately low concentrations after the flushing action has been completed. The same general phenomenon probably affects the concentration of other mineral salts carried by the river.

Fluoride -- Even at the prevailing higher flows, the concentration of fluoride averaged 0.1 to 0.6 ppm at all sampling points. As fluoride was found to be present throughout the full length of the river, any supplementary fluoridation of municipal water supplies should consider the amount of fluorides present in the raw water.

Hardness -- Highest values for hardness for average and daily maximum readings were due to flow from certain tributaries, notably, the Beaver, Muskingum, Scioto, Kentucky and Wabash rivers.

An inverse correlation between hardness and runoff was not consistently apparent, as shown in the data collected at Dam 30, though the trend of the results was somewhat similar to that of the chlorides in its general pattern.

Discharge 1,000 cfs	Hardness ppm
37	146
32	138
42	142
86	57
190	40
234	47
180	46
119	68
67	82
42	84
37	96
32.5	102

Iron -- The most noticeable difference between results from composite and from daily samples was in respect to iron. Composite sample analysis deals only with soluble iron, special precautions being taken to remove colloidal material. This material, primarily silica, contains some iron. Usually filter paper does not remove all of it. The result is that some iron in part of the sediment is measured. The degree of completeness of removal of the sediment before analysis will cause variation in results obtained.

Nitrates -- With the realization that nitrates can cause cyanosis in infants due to methemoglobinemia (blue babies) determination of nitrates should no longer be viewed only as an indicator of the state of nitrification in the river. Latest toxicological data support 10 ppm of nitrate nitrogen as a tolerable limit (about 43 ppm as nitrates). The survey data indicate no present problem in this respect at higher flows in the Ohio.

Sodium -- Sodium has been found to be important in treatment of hypertension cases. In the so-called "salt-free diet," the maximum amount of sodium to be ingested per day, according to some medical authorities, is 200 to 400 milligrams. (Principles of Internal Medicine, T. R. Harrison, Blakeston Co., Philadelphia, 1950, p 1323). The high value for sodium observed in this survey was 38 ppm. For a person drinking 2.5 quarts of water daily, this amount would signify a daily intake of 90 mg of sodium. Thus, ingested water alone would contain about one-half the recommended limit permissible in a low sodium-level diet.

Solids -- Total solids showed an increase through the central portion of the river -- particularly between Dams 30 to 49. This increase appears to be due largely to increased turbidity.

A different pattern is shown by dissolved solids which are not affected by turbidity. Higher results are shown in upper reaches of the river but without consistent trend.

Sulfates -- Sulfate concentrations were highest in the upper river due mainly to the effects of mine drainage and steel-mill wastes. Below Dam 29, the concentrations were diminished gradually to roughly one-third of those observed in the upper reaches of the river.

The good agreement in chlorides between daily and composite samples was not similarly noted for sulfates. The divergence in sulfate averages is probably due to the method of analysis. For analysis of composite samples, a gravimetric procedure (from Hildebrand and Lundell) was used. This more detailed technique included an ionic balance and would be presumably more reliable than the field method (Benzidene method).

Using the USGS laboratory work as a basis, the variation in state analysis work can be noted. Analysis for sulfate is one that requires specialized training and equipment and differences should be expected.

Turbidity -- Although the Ohio River always carries a measurable turbidity, this survey showed substantial increases in turbidity in the middle reach of the river below the Kanawha. Below Dam 39 turbidity levels diminished gradually, but did attain the low degree shown in the upper river. Turbidities observed throughout the river as a whole reflected the influence of increased runoff accompanying the freshet. This is a normal occurrence under the flow conditions prevailing at the time of the survey.

Table 1 -- Location of Sampling Po

Sampling Station No.	Location	Near or At	River Mi. from Source
A	Lock 2, Allegheny River	Pittsburgh, Pa.	--
B	Hayes Station on Monongahela River	Pittsburgh, Pa.	--
1	Sewickley Highway Bridge	Sewickley, Pa.	6.2
C	Eastvale on Beaver River	East of Beaver, Pa.	--
2	Dam No. 7	Below Midland, Pa.	36.5
3	Short Creek Ferry	Above Wheeling, W. Va.	81.1
4	Dam No. 13	At McMechen, W. Va.	96.1
5	Dam No. 17	Above Parkersburg, W. Va.	167.5
6	Dam No. 18	Below Parkersburg, W. Va.	179.9
D	Little Kanawha near mouth	At Parkersburg, W. Va.	--
7	Dam No. 19	Below Parkersburg, W. Va.	192.2
8	Point Pleasant, W. Va. bridge	Above Point Pleasant, W. Va.	265.1
E	Kanawha R. near mouth	Opposite Point Pleasant, W. Va.	--
9	Gallipolis Dam	Gallipolis, Ohio	279.2
10	Dam No. 27	Above Huntington, W. Va.	301.0
11	Dam No. 28	Below Huntington, W. Va.	311.6
12	Dam No. 29	Below Big Sandy River	319.9
13	Dam No. 30	Above Portsmouth, Ohio	339.4
F	Scioto River near mouth	At Portsmouth, Ohio	--
14	Dam No. 31	Below Portsmouth, Ohio	359.3
15	Dam No. 36	Above Cincinnati, Ohio	460.9
G	Licking River near mouth	Opposite Cincinnati, Ohio	--
16	Dam No. 38	Below Cincinnati, Ohio	503.3
17	Dam No. 39	Below Cincinnati, Ohio	531.7
H	Kentucky River near mouth	At Carrollton, Ky.	--
18	Madison Bridge	Above Louisville, Ky.	557.3
19	At Louisville Water Intake	Above Louisville, Ky.	600.6
20	Dam No. 43	Below Louisville, Ky.	633.2
21	Dam No. 47	At Newburg, Ind.	777.7
22	Dam No. 48	Above Evansville, Ind.	809.6
23	Dam No. 49	Below Evansville, Ind.	845.0
I	Wabash near mouth	Below Evansville, Ind.	--
24	Shawneetown Ferry	Shawneetown, Ill.	857.8
25	Dam No. 51	Below Golconda, Ill.	903.1
26	Dam No. 52	Below Paducah, Ky.	938.9
27	Dam No. 53	Above Mound City, Ky.	962.6

*Note: 1 - Major city
2 - Below Major tributary
3 - State line
4 - Near mouth of major tributary

ıts

Drainage Area in Sq. Mi.	Responsibility of Sample Collection	Reason See Note*
11,705	Pennsylvania	4
7,340	Pennsylvania	4
19,500	Pennsylvania	1
3,040	Pennsylvania	4
22,980	Pennsylvania	3
24,650	West Virginia	1
25,170	West Virginia	1
26,950	West Virginia	2
35,600	West Virginia	1,2
2,320	West Virginia	4
37,940	West Virginia	1,2
40,500	West Virginia	1,2
12,200	West Virginia	4
53,510	West Virginia	1,2
53,670	Ohio	1
55,900	Ohio	1
60,750	Ohio	1,2,3
61,670	Ohio	1
6,510	Ohio	4
68,910	Ohio	2
71,110	Kentucky	1,2
3,655	Kentucky	4
82,520	Kentucky	1,2,3
82,910	Kentucky	1,2
6,949	Kentucky	4
90,580	Kentucky	1,2
91,170	Kentucky	1
94,510	Kentucky	1,2
97,710	Indiana	1,2
107,550	Indiana	1,2
107,940	Indiana	3
33,100	Indiana	4
141,160	Illinois	2
143,900	Illinois	1,2
202,800	Illinois	1,2
203,100	Illinois	3

ORSANCO

Table 2 Summary -- Twelve-day Average of Bacteriological, Sanitary Chemical

Ohio River Water Quality Survey (Sept 18

Sampling Station No.	Location	Physical Data: Mean Discharge cfs (1,000)	Mean Discharge cfs per sq mile	Water Temp °C	pH	Bacteriological Data: Confirmed MPN Coliforms per 100 ml (1,000) Average	Maximum	Sanitary Chemical Dat: D O ppm	5-day B O D ppm	Acidity (phen) ppm Hot	Acidity (phen) ppm Cold	M O Alkalinity ppm	Total Solids ppm	Turbidity ppm	Chlor pp
A	Allegheny River •	8.3	0.71	17	6.6	24.5	75.0	8.7	0.6	0.0	4.2	32	242	19	22
B	Monongahela River •	13.0	1.77	19	5.5	88.7	930.0	7.4	0.4	4.2	5.7	16	297	25	7
1	Sewickley	22.7	1.16	19	5.7	81.7	230.0	7.7	0.9	3.8	5.7	22	263	18	17
C	Beaver River	1.5	0.51	19	6.4	14.4	43.0	5.1	1.0	1.4	5.2	39	329	22	23
2	O. R.-Dam 7 •o	24.8	1.08	19	6.0	9.6	43.0	9.1	1.0	2.4	5.0	20	284	15	14
3	O. R.-Above Wheeling •	26.0	1.05	20	6.6	8.0	23.0	8.2	1.1	2.1	2.6	7	281	18	15
4	O. R.-Dam 13 o	26.3	1.04	20	6.8	15.5	93.0	8.0	1.3	-7.0	2.3	11	310	39	13
5	O. R.-Dam 17	27.1	1.00	21	7.9	4.4	23.0	7.6	1.3	-1.0	2.0	9	382	53	20
6	O. R.-Dam 18	30.9	0.87	22	7.2	6.4	23.0	7.8	1.6	-4.0	2.0	18	486	36	66
D	L. Kanawha River	2.8	1.19	20	7.3	321.4	930.0	7.4	2.3	-2.0	2.6	15	250	205	3
7	O. R.-Dam 19	33.6	0.89	22	7.3	18.4	43.0	7.8	2.0	-2.0	2.1	15	446	66	49
8	O. R.-Pt. Pleasant	33.7	0.83	22	7.3	7.9	43.0	7.2	1.6	-2.0	2.0	13	375	50	36
E	Kanawha River	20.2	1.66	21	7.4	3.8	9.3	5.6	1.5	-3.0	2.0	16	203	131	8
9	O. R.-Gallipolis	57.9	1.08	22	7.3	5.3	23.0	6.5	1.0	-2.0	1.9	13	320	102	25
10	O. R.-Dam 27 •	58.6	1.09	21	6.8	11.1	43.0	6.7	1.2	-7.0	2.0	31	337	165	25
11	O. R.-Dam 28	70.2	1.26	21	7.9	40.8	230.0	6.9	1.4	-7.0	2.0	28	362	204	24
12	O. R.-Dam 29 •o	82.3	1.35	21	6.9	39.9	150.0	7.2	1.9	-9.0	1.0	28	277	262	17
13	O. R.-Dam 30 o	91.5	1.48	21	6.8	69.7	430.0	6.9	1.6	-7.0	2.0	27	430	264	17
F	Scioto River	4.2	0.65	20	7.7	161.9	930.0	7.1	3.5	-9.0	2.0	132	530	273	13
14	O. R.-Dam 31 o	104.0	1.50	21	6.9	40.9	230.0	6.8	1.5	-8.0	2.0	28	392	243	19
15	O. R.-Dam 36 ••o	107.0	1.50	21	7.3	76.0	430.0	7.9	2.9	0.7	2.2	47	668	498	26
G	Licking River	13.9	3.79	21	7.3	192.3	930.0	8.2	3.5	0.9	2.9	53	701	458	25
16	O. R.-Dam 38 o	136.7	1.66	20	7.4	209.8	930.0	7.4	4.6	0.8	2.9	50	579	465	25
17	O. R.-Dam 39	137.7	1.66	21	7.3	94.0	430.0	6.8	4.0	0.8	3.1	51	600	498	24
H	Kentucky River	5.4	0.77	21	7.4	11.7	75.0	8.7	2.5	0.4	3.5	93	351	110	7
18	O. R.-Madison	142.7	1.57	21	7.3	44.4	230.0	7.1	3.0	0.9	4.0	69	507	295	21
19	O. R.-Louisville Intake •o	145.0	1.59	22	7.1	211.2	2,300.0	4.3	1.0	0.0	6.8	56	390	157	44
20	O. R.-Dam 43	145.1	1.53	22	7.2	323.8	290.0	4.8	1.5	0.0	6.8	59	595	222	47
21	O. R.-Dam 47	149.0	1.52	21	7.5	9.9	16.5	7.3	1.3	0.0	4.0	125	494	218	28
22	O. R.-Dam 48 •o	149.1	1.38	21	7.5	17.5	28.0	6.4	1.5	0.0	4.0	128	631	272	25
23	O. R.-Dam 49 oo	146.9	1.36	21	7.5	7.4	11.0	6.3	1.2	0.0	4.0	130	556	209	25
I	Wabash River	29.9	0.90	21	7.8	20.7	30.5	7.4	2.9	0.0	1.5	299	241	156	18
24	O. R.-Shawneetown	173.1	1.22	21	7.6	15.1	43.0	7.0	1.3	0.0	8.1	68	443	118	20
25	O. R.-Dam 51 •o	164.7	1.14	21	7.6	7.6	23.0	6.9	1.2	0.0	3.9	74	359	90	21
26	O. R.-Dam 52 o	238.8	1.18	21	7.6	3.3	9.3	7.5	1.3	0.0	3.7	74	346	82	20
27	O. R.-Dam 53 o	233.6	1.15	21	7.6	4.1	23.0	7.3	1.0	0.0	4.0	71	350	82	19

O. R. - Ohio River

• - Indicates source of public water supply near sampling point -- no intermediate pollution.
o - Indicates source of public water supply near sampling point but with some intermediate pollution.

d Mineral Analyses

), 1950)

s	Sulfates ppm	Hardness ppm	Iron ppm	SiO2 ppm	Fe ppm	Ca ppm	Mg ppm	Na ppm	K ppm	CO 3 ppm	HCO3 ppm	SO4 ppm	Cl ppm	F ppm	NO3 ppm	Dis. Solids ppm	Spec. Cond.
				Mineral Analysis - Weighted Average													
	101	110	0.9	5.7	0.11	27	7.0	15	2.7	0	27	86	22	0.2	1.1	188	295
	141	113	1.8	6.7	0.05	27	7.4	13	2.5	0	17	107	9	0.3	1.2	199	294
	121	118	0.9	6.3	0.06	28	8.0	16	4.1	0	16	109	15	0.2	1.2	207	311
	143	154	1.3	6.0	0.07	42	9.4	17	5.6	9	36	130	22	0.6	2.2	269	407
	132	129	0.6	6.7	0.07	33	8.3	17	3.4	0	20	121	16	0.3	1.5	227	338
	136	133	0.7	6.9	0.04	34	9.2	17	2.7	0	22	133	14	0.3	1.8	241	365
	131	128	0.8	6.7	0.05	32	8.6	18	2.8	0	25	126	15	0.3	1.9	238	355
	146	135	0.5	7.3	0.05	38	8.9	23	2.9	0	17	142	19	0.3	3.2	265	407
	130	181	0.4	5.5	0.05	55	10.1	36	3.3	0	44	133	66	0.4	2.1	367	549
	25	38	0.7	6.4	0.05	9	3.1	8	2.3	0	33	22	6	0.2	1.1	80	122
	147	160	0.6	6.2	0.06	46	10.0	30	3.2	0	34	126	48	0.3	2.1	306	476
	142	156	0.5	6.5	0.05	43	9.3	28	3.1	0	26	137	34	0.3	2.7	295	453
	30	56	0.5	7.2	0.04	13	4.8	5	2.0	0	37	25	9	0.1	1.2	92	142
	109	115	0.6	6.7	0.05	31	7.8	19	2.5	0	29	94	23	0.2	2.6	211	338
	97	122	<0.1	7.4	0.06	33	7.3	23	2.9	0	27	101	25	0.4	4.0	222	354
	92	114	<0.1	7.0	0.06	31	7.0	20	2.6	0	26	93	23	0.4	3.9	307	331
	62	84	<0.1	8.3	0.11	22	5.2	16	4.0	0	28	64	19	0.3	2.8	160	201
	64	87	<0.1	6.8	0.06	23	5.9	15	2.5	0	25	70	17	0.4	3.6	175	263
	42	174	<0.1	7.9	0.13	48	16.0	8	3.0	0	171	55	27	0.6	2.8	274	461
	68	95	<0.1	7.3	0.12	27	6.0	17	2.6	0	29	68	19	0.3	4.6	180	297
	60	118	0.5	6.9	0.16	32	7.5	17	2.8	0	49	79	23	0.2	4.9	205	324
	60	110	0.5	6.7	0.09	32	7.3	14	3.1	0	53	73	18	0.2	3.8	195	313
	51	112	0.4	6.8	0.08	31	7.9	15	3.2	0	56	69	19	0.3	2.5	192	308
	57	117	0.4	7.9	0.06	33	7.7	15	3.6	0	63	69	19	0.5	2.0	194	311
	14	107	0.4	7.5	0.10	31	5.5	5	1.8	0	109	17	6	0.2	2.6	136	215
	55	131	0.3	6.8	0.18	35	7.3	13	2.9	0	85	56	18	0.3	2.7	203	308
	60	112	0.1	5.9	0.12	33	7.8	15	3.1	0	63	66	20	0.4	3.0	191	319
	68	120	0.1	5.7	0.17	35	6.7	15	3.1	0	64	71	20	0.3	2.3	202	327
	50	130	0.3	5.8	0.06	36	8.3	16	3.1	0	75	65	22	0.3	2.3	209	338
	50	132	0.4	6.4	0.04	37	7.3	14	3.4	0	76	62	21	0.4	2.5	204	329
	51	131	0.3	6.6	0.04	37	7.9	14	3.3	0	80	62	20	0.4	2.3	202	328
	40	199	0.1	7.8	0.05	50	17.0	10	2.8	3	180	50	14	0.4	1.5	257	418
	44	134	<0.1	6.2	0.05	38	9.0	12	2.6	0	100	58	19	0.4	2.0	207	341
	46	144	<0.1	5.9	0.05	40	9.5	13	2.4	0	94	60	20	0.3	2.0	201	345
	47	142	<0.1	6.1	0.05	39	9.4	13	2.6	0	94	65	20	0.3	2.0	211	346
	43	137	<0.1	6.0	0.05	39	8.4	13	2.6	0	92	58	18	0.4	2.0	202	327

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Table 3 -- Summary of Bacteriological

Ohio River Water Quality Survey -- Sept 1

Sampling Station No.	Location		Coliforms in MPN: Average for Survey Period: Gas Formers 24-hr	48-hr	Confirmed	Median
A	Allegheny River	●	19.7	29.0	24.5	23.0
B	Monongahela River	●	83.9	98.7	88.6	8.4
1	Sewickley		74.3	101.5	81.6	43.0
C	Beaver River	o	9.7	14.0	14.4	10.6
2	O. R. Dam 7	●o	7.9	17.3	9.5	6.8
3	O. R. above Wheeling	●	8.7	10.7	8.0	4.6
4	O. R. Dam 13	o	28.4	28.5	15.4	4.6
5	O. R. Dam 17		5.1	7.4	4.4	0.9
6	O. R. Dam 18		7.8	8.7	6.3	4.2
D	L. Kanawha River		413.7	517.3	321.3	240.0
7	O. R. Dam 19		36.1	42.6	18.4	11.0
8	O. R. Pt. Pleasant		10.2	12.3	7.8	4.4
E	Kanawha River		5.5	6.0	3.8	3.3
9	O. R. Gallipolis		6.5	9.4	5.2	2.4
10	O. R. Dam 27	●	27.9	32.0	11.0	5.9
11	O. R. Dam 28		26.2	41.2	40.8	9.3
12	O. R. Dam 29	●o	35.9	46.0	39.9	12.2
13	O. R. Dam 30	o	49.6	70.6	69.7	43.0
F	Scioto River		73.7	166.0	161.8	43.0
14	O. R. Dam 31	o	31.0	42.6	40.9	29.0
15	O. R. Dam 36	●●o	19.5	75.9	75.9	5.8
G	Licking River		46.7	192.2	192.2	12.2
16	O. R. Dam 38	o	78.9	209.8	209.8	33.0
17	O. R. Dam 39		57.9	99.4	94.0	43.0
H	Kentucky River		11.1	13.7	11.7	2.6
18	O. R. Madison		35.2	46.2	44.3	19.0
19	O. R. Louisville Int.	●o	207.2	216.3	211.2	9.3
20	O. R. Dam 43		135.6	153.0	156.3	68.0
21	O. R. Dam 47		9.8	14.6	14.6	19.0
22	O. R. Dam 48	●o	17.4	27.9	27.9	23.0
23	O. R. Dam 49	oo	7.3	12.0	12.0	7.5
I	Wabash River		20.6	29.5	29.4	19.0
24	O. R. Shawneetown		10.2	17.3	15.0	12.2
25	O. R. Dam 51	●o	6.5	9.1	7.6	4.3
26	O. R. Dam 52	o	2.8	4.6	3.2	2.4
27	O. R. Dam 53	o	2.2	6.3	4.1	2.4

O. R. - Ohio River

● Indicates source of public water supply near sampling point -- no intermediate

o Indicates source of public water supply near sampling point but with some inte

Data

-29, 1950

per 100 ml (1,000)		
Max. day	Ratio Max. to Avg.	Confirmed Avg. less Max. day
75.0	3.1	
930.0	10.5	12.2
230.0	3.0	
43.0	3.0	
43.0	4.5	
23.0	2.9	
93.0	6.0	7.7
23.0	5.2	
23.0	3.6	
930.0	2.9	
43.0	2.4	
43.0	5.5	
9.3	2.4	
23.0	4.3	
43.0	3.9	
230.0	5.6	
150.0	3.8	
430.0	6.2	38.8
930.0	5.8	
230.0	5.6	
430.0	5.7	
930.0	4.9	
930.0	4.4	
430.0	4.6	
75.0	6.4	5.3
230.0	5.2	
2,300.0	10.9	21.3
290.0	1.9	
43.0	2.9	
93.0	3.3	
43.0	3.6	
93.0	3.2	
43.0	2.9	
23.0	3.0	
9.3	2.8	
23.0	5.6	

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Table 4 -- Comparison of Methods for Reporting Coliform Results

Sept. 13-30, 1950

	Indicated Numbers			Most Probable Numbers			
	Arithmetic Means			Arithmetic Means		Geometric Means	Medians
	Presumptive (1)	Gas-Former (2)	Confirmed (3)	Presumptive (4)	Confirmed (5)	Confirmed (6)	Confirmed (7)
Dam 27	7,700	16,500	8,700	10,800	11,400	6,800	5,900
Dam 28	10,000	27,000	26,000	18,200	43,000	10,900	9,300
Dam 29	25,000	36,000	30,000	48,500	41,000	19,500	12,200
Dam 30	48,000	62,000	62,000	65,700	76,000	40,000	43,000
Dam 31	17,000	28,000	28,000	37,200	42,000	19,500	29,000
Averages	21,500	33,900	30,900	36,100	42,700	19,300	19,900

Interpretation: No consistent agreement between 24 - 48 hr gas formers and confirmed coliforms; geometric means and medians of coliform densities indicate about one-half the pollution shown by arithmetic means -- an important consideration in public health evaluations.

Table 5 -- Cities Using Ohio River Directly as Source of Water Supply

Public Water Supply	River Mile from Source	Quality Indicated at: Sampling Stations	Location
Midland, Pa.	36	2*	Dam No. 7
E. Liverpool, Ohio	40	2	Dam No. 7
Toronto, Ohio	59	-	- - -
Weirton, W. Va.	63	-	- - -
Steubenville, W. Va.	65	-	- - -
Wheeling, W. Va.	87	3	Above Wheeling
Bellaire, Ohio	94	4*	Dam No. 13
Sistersville, W. Va.	137	-	- - -
Pomeroy, Ohio	148	-	- - -
Huntington, W. Va.	304	10	Dam No. 27
Ashland, Ky.	320	12	Dam No. 29
Ironton, Ohio	327	12*	Dam No. 29
Portsmouth, Ohio	351	13*	Dam No. 30
Maysville, Ky.	408	14*	Dam No. 31
Cincinnati, Ohio	463	15	Dam No. 36
Covington, Ky.	463	15	Dam No. 36
Newport, Ky.	464	15*	Dam No. 36
Aurora, Ind.	497	16*	Dam No. 38
Louisville, Ky.	601	19	Louisville Int
New Albany, Ind.	608	19*	Louisville Int
Evansville, Ind.	792	-	- - -
Henderson, Ky.	803	22*	Dam No. 48
Mt. Vernon, Ind.	829	22	Dam No. 48
Uniontown, Ky.	840	23*	Dam No. 49
Morganfield, Ky.	844	23*	Dam No. 49
Rosiclare, Ill.	891	25*	Dam No. 51
Golconda, Ill.	903	25	Dam No. 51
Paducah, Ky.	934	26*	Dam No. 52
Cairo, Ky.	977	27*	Dam No. 53

* Physical and chemical quality only; bacterial quality influenced by pollution between sampling point and water intake.

Interpretation: 29 cities use Ohio River as source of water supply; 23 are in vicinity of survey sampling points.

Table 6 -- Average Coliforms (MPN) (1,000) Mid-depth and Surface Sampling

Source: Indiana State Board of Health

Sampling Station No.	24-hr Mid-depth	24-hr Surface	48-hr Mid-depth	48-hr Surface	Confirmed Mid-depth	Confirmed Surface
I	20.6	19.4	29.5	27.5	29.4	27.5
21	9.9	12.2	14.7	26.4	14.7	18.7
22	17.5	17.4	28.0	25.9	28.0	22.9
23	7.4	10.0	12.1	23.7	12.1	23.7

Interpretation: See comment Table 7.

Table 7 -- Daily Confirmed Coliforms (MPNs in 1,000s) Mid Depth and Surface Sampling

Sept 18 to 29, 1950

Source -- Indiana State Board of Health

	Station 21 Dam 47		Station 22 Dam 48		Station 23 Dam 49		Station I Wabash River	
Sept.	Mid depth	Surface	Mid depth	Surface	Mid depth	Surface	Mid depth	Surface
18	23.0	23.0	21.0	23.0	2.3	15.0	0.4	2.3
19	23.0	23.0	9.3	23.0	7.5	9.3	9.3	4.3
20	15.0	15.0	43.0	15.0	4.3	9.3	9.3	2.3
21	23.0	23.0	15.0	43.0	9.3	9.3	4.3	4.3
22	9.3	9.3	93.0	43.0	2.3	9.3	15.0	9.3
23	4.3	4.3	23.0	--	4.3	23.0	43.0	23.0
24	4.3	4.3	23.0	23.0	9.3	93.0	75.0	93.0
25	9.3	9.3	4.3	15.0	4.3	9.3	93.0	93.0
26	43.0	43.0	15.0	43.0	23.0	23.0	23.0	23.0
27	23.0	23.0	23.0	4.3	7.5	43.0	43.0	23.0
28	23.0	2.3	23.0	15.0	43.0	23.0	2.3	23.0
29	23.0	23.0	43.0	4.3	23.0	23.0	43.0	23.0
Total	222.2	178.0	335.6	251.6	140.1	167.1	381.3	346.5
Average	16.5	13.9	28.0	23.4	11.0	24.1	30.5	26.9
Maximum	43.0	43.0	93.0	43.0	43.0	93.0	93.0	93.0
Minimum	4.3	2.3	9.3	4.3	2.3	4.3	.4	.2
Median	23.0	9.3	23.0	23.0	8.4	19.0	23.0	23.0

Interpretation: Except for Sta 23, consistently close agreement between mid-depth and surface sampling. At Sta 23, 4 days showed high surface results.

Table 8 -- Confirmed Coliform-Enterococci Data (MPN/100 ml)

Source -- Illinois Department of Public Health

Station: 1950	No. 24		No. 25		No. 26		No. 27	
Date	Coliform	Enterococci	Coliform	Enterococci	Coliform	Enterococci	Coliform	Enterococci
9/18	4,300	23	4,300	23	1,500	6	2,400	6
9/19	2,400	23	2,400	<4.5	2,400	23	930	<4.5
9/20	9,300	700	2,400	62	4,300	23	2,400	6
9/21	46,000	2,400+	2,400	23	750	2,400+	230	230
9/22	15,000	7,000	4,300	62	2,100	620	930	240
9/23	24,000	2,400	4,300	23	2,400	2,400	4,300	240
9/24	4,300	700	9,300	62	2,400	6	2,400	240
9/25	15,000	240	7,500	240	9,300	62	2,400	700
9/26	9,300	1,300	4,300	62	4,300	240	4,300	700
9/27	24,000	700	24,000	62	4,300	130	2,400	130
9/28	24,000	2,400	4,300	620	4,300	240	24,000	2,400+
9/29	9,300	620	24,000	240	2,400	240	4,300	240

Interpretation: Only 6 of 48 samples had enterococci MPN less than 23/100 ml; no correlation between enterococci and coliform; high enterococci indicate coliforms to be of sewage origin.

Table 9 -- Summary -- Averages and Maxima or Minima of

Ohio River Water Quality Survey -- S

Sampling Station No.	Location	D O ppm Avg.	D O ppm Min.	B O D ppm Avg.	B O D ppm Max.	Turbidit ppm Avg.	M
A	Allegheny River	8.7	8.1	0.6	1.10	19	
B	Monongahela River	7.4	6.0	0.4	1.10	25	
1	Sewickley	7.7	7.1	0.9	2.30	18	
C	Beaver River	5.1	3.9	1.0	1.40	22	
2	O. R. - Dam 7	9.1	8.3	1.0	1.60	15	
3	O. R. - Above Wheeling	8.2	7.0	1.1	2.7	18	
4	O. R. - Dam 13	8.0	7.4	1.3	3.25	39	2
5	O. R. - Dam 17	7.6	6.2	1.3	2.55	53	2
6	O. R. - Dam 18	7.8	6.0	1.6	2.85	36	1
D	L. Kanawha River	7.4	5.7	2.3	4.35	206	5
7	O. R. - Dam 19	7.8	6.6	2.0	4.6	66	2
8	O. R. - Pt. Pleasant	7.2	6.1	1.6	2.35	50	1
E	Kanawha River	5.6	2.1	1.5	3.6	131	4
9	O. R. - Gallipolis	6.5	5.3	1.0	2.05	102	3
10	O. R. - Dam 27	6.7	5.6	1.2	2.4	165	5
11	O. R. - Dam 28	6.9	5.8	1.4	2.6	204	6
12	O. R. - Dam 29	7.2	6.4	1.9	4.8	262	7
13	O. R. - Dam 30	6.9	5.9	1.6	2.5	264	7
F	Scioto River	7.1	4.7	3.5	6.7	273	7
14	O. R. - Dam 31	6.8	5.9	1.5	2.4	243	5
15	O. R. - Dam 36	7.9	6.5	2.9	5.0	498	1,1
G	Licking River	8.2	7.3	3.5	6.8	458	9
16	O. R. - Dam 38	7.4	6.1	4.6	6.8	465	1,1
17	O. R. - Dam 39	6.8	4.6	4.0	5.8	498	1,2
H	Kentucky River	8.7	5.2	2.5	5.5	110	4
18	O. R. - Madison	7.1	4.3	3.0	5.1	295	8
19	O. R. - Louisville Intake	4.3	2.1	1.0	1.6	157	4
20	O. R. - Dam 43	4.8	3.3	1.5	2.9	222	5
21	O. R. - Dam 47	7.3	3.1	1.3	2.0	218	6
22	O. R. - Dam 48	6.4	3.7	1.5	2.0	272	8
23	O. R. - Dam 49	6.3	3.5	1.2	2.2	209	4
I	Wabash River	7.4	5.2	2.9	4.8	156	2
24	O. R. - Shawneetown	7.0	4.2	1.3	1.7	118	4
25	O. R. - Dam 51	6.9	3.9	1.2	1.8	90	4
26	O. R. - Dam 52	7.5	5.1	1.3	2.1	82	3
27	O. R. - Dam 53	7.3	4.2	1.0	1.7	82	3

ignificant Chemical Analyses

pt 18-29, 1950

	Chlorides ppm		Sulfates ppm		Hardness ppm	
x.	Avg.	Max.	Avg.	Max.	Avg.	Max.
	22	35	101	128	110	140
	7	11	141	220	113	135
	17	27	121	136	118	140
	23	26	143	172	154	172
	14	21	132	184	129	156
	15	22	136	192	133	160
	13	19	131	172	128	150
	20	24	146	192	135	154
	66	113	130	182	181	216
	3	9	25	57	38	40
	49	77	147	259	160	186
	36	49	142	250	156	184
	8	17	30	48	56	84
	25	42	109	153	115	158
	25	39	97	149	122	156
	24	37	92	132	114	144
	17	38	62	120	84	145
	17	40	64	135	87	146
	13	23	42	67	174	265
	19	40	68	120	95	140
	26	49	60	121	118	197
	25	43	60	107	110	144
	25	42	51	103	112	173
	24	40	57	121	117	162
	7	19	14	29	107	313
	21	40	55	110	131	285
	44	65	60	82	112	142
	47	67	68	98	120	157
	28	46	50	95	130	145
	25	31	50	89	132	158
	25	34	51	89	131	147
	18	35	40	58	199	241
	20	25	44	70	134	158
	21	27	46	70	144	160
	20	24	47	65	142	154
	19	26	43	72	137	158

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Table 10 -- Drainage Areas at Sampling Points on Main Stem Ohio River

Sampling Station	Drainage Area (Square miles)	Source
1	19,500	Sewickley gaging station.
2	22,980	Montgomery Isl. gag. sta. plus inflow (25)
3	24,650	Bellaire gag. sta. minus inflow (520).
4	25,170	Bellaire gaging station.
5	26,950	St. Marys gaging sta. plus inflow (100).
6	35,600	Parkersburg gaging station.
7	37,940	Parkersburg gag. sta. plus L. Kanawha R. plus inflow (25).
8	40,500	Pomeroy gaging station.
9	53,510	Pt. Pleasant gag. sta. plus Raccoon Creek plus inflow (65).
10	53,670	Sampling Sta. No. 9 plus inflow (160).
11	55,900	Huntington gaging station.
12	60,750	Ashland gaging station.
13	61,670	Ashland gag. sta. plus L. Sandy R. plus inflow (200).
14	68,910	Sampling Sta. No. 13 plus (Tygarts Cr., Scioto R.) plus inflow (390).
15	71,110	Cincinnati gag. sta. minus (Licking R. and L. Miami R.) minus inflow (45).
16	82,520	Cincinnati gag. sta. plus Miami R. plus inflow (550).
17	82,910	Sampling Sta. No. 16 plus inflow (390).
18	90,580	Madison gaging station.
19	91,170	Louisville gaging station.
20	94,510	Sampling Sta. No. 19 plus Salt R. plus inflow (405).
21	97,710	Owensboro gag. sta. plus inflow (510).
22	107,550	Evansville gag. sta. plus inflow (550).
23	107,940	Sampling Sta. No. 22 plus inflow (390).
24	141,160	Golconda gag. sta. minus (Saline R., Tradewater R.) minus inflow (500).
25	143,900	Golconda gaging station.
26	202,800	Metropolis gag. sta. minus inflow (200).
27	203,100	Metropolis gag. sta. plus inflow (150).

Note: The drainage areas at gaging stations are those published in USGS water supply papers. The drainage areas for named tributary streams are those shown in the accompanying list of drainage areas for tributary streams. The drainage areas for inflow areas (shown in parenthesis following "inflow") were determined by outlining the inflow areas on maps and approximately scaling the areas.

Table 11 -- Drainage Areas of Principal Tributary Streams

Stream	Drainage Area (Square miles)	Source
Alleghany R.	11,705	Corps of Engineers
Monongahela R.	7,340	Corps of Engineers
Beaver R.	3,040	Corps of Engineers
Muskingum R.	8,040	USGS & C. of E.
Little Kanawha R.	2,320	Corps of Engineers
Hocking R.	1,200	USGS
Kanawha R.	12,200	Corps of Engineers
Raccoon Cr.	684	USGS
Guyandot R.	1,670	Corps of Engineers
Big Sandy R.	4,281	USGS
Scioto R.	6,510	USGS & C. of E.
Little Sandy R.	723	USGS
Tygarts Cr.	339	USGS
Little Miami R.	1,755	Corps of Engineers
Licking R.	3,655	USGS
Miami R.	5,385	USGS
Kentucky R.	6,949	USGS
Salt R.	2,938	USGS
Green R.	9,222	USGS
Wabash R.	33,100	Corps of Engineers
Saline R.	1,235	Corps of Engineers
Tradewater R.	1,008	USGS
Cumberland R.	18,080	USGS
Tennessee R.	40,900	USGS

Table 12 -- Mean Daily Gage Heights, in feet, for Ohio River gaging stations (1950)

	Sewickley, Pa.				Louisville, Ky. (lower gage)			
Day	June	July	Aug.	Sept.	June	July	Aug.	Sept.
1	4.67	4.26	3.49	3.42	25.20	22.80	18.85	11.30
2	4.91	3.76	3.72	3.57	24.85	18.90	16.35	10.95
3	4.93	3.74	3.93	4.63	23.95	13.50	14.25	14.75
4	5.52	3.74	4.08	4.90	27.30	11.85	13.55	16.20
5	7.14	4.83	3.94	4.39	27.80	13.05	12.95	17.60
6	7.07	5.45	3.75	4.18	28.05	15.35	12.70	18.25
7	6.18	4.74	3.55	3.94	29.55	17.00	12.00	18.55
8	5.56	4.36	3.37	3.71	29.95	18.55	10.95	15.35
9	4.98	4.00	3.37	3.53	28.60	21.85	10.75	10.85
10	4.71	3.75	3.44	3.41	26.05	22.80	10.85	11.95
11	5.04	3.78	3.46	3.32	24.10	20.20	11.10	12.45
12	5.08	3.82	3.45	3.66	21.35	15.25	10.20	12.65
13	4.77	3.64	3.42	4.17	19.45	11.90	10.70	13.65
14	4.49	3.86	3.48	4.78	19.65	13.45	11.00	14.0
15	4.50	4.37	3.48	5.05	19.75	14.40	9.80	14.9
16	4.41	4.09	3.35	4.71	18.75	14.90	10.65	14.8
17	4.20	3.77	3.20	4.46	17.35	14.35	11.50	13.7
18	3.98	3.88	3.15	4.28	16.35	13.40	10.70	12.8
19	3.72	4.00	3.65	4.10	21.90	13.45	10.85	12.1
20	3.85	4.02	3.84	3.96	28.30	14.30	11.80	13.0
21	3.96	4.14	3.61	4.03	31.20	15.90	12.20	16.0
22	3.98	4.86	3.48	5.56	32.50	16.45	11.35	22.2
23	3.82	5.03	3.32	5.82	33.55	17.45	10.85	29.3
24	3.97	4.34	3.26	5.25	33.15	18.60	10.55	33.9
25	4.88	4.21	3.20	4.50	30.90	19.25	9.75	35.1
26	5.88	4.46	3.23	4.11	27.65	18.60	10.10	33.9
27	5.85	4.51	3.19	3.93	24.35	18.25	9.95	30.3
28	5.08	4.20	3.10	3.83	22.95	19.55	10.50	24.9
29	4.81	4.00	3.10	3.75	24.20	19.75	10.60	17.4
30	4.63	3.70	3.26	3.62	24.10	21.15	10.90	11.6
31		3.55	3.30			21.00	11.55	

Note: The locations of Sewickley and Louisville gaging stations correspond to Sampling Points Nos. 1 and 19, respectively. At Sewickley and Louisville discharge is related directly to gage height although rate of change of stage is also a factor at Louisville. For all other main stem Ohio River gaging stations the slope factor between gages enters into the computation of discharge.

Table 13 -- Summary of Daily Discharges at Sampling Points

Sept. 13-30, 1950

Date	Daily discharge, in 1,000 second-feet, at indicated sampling points								
	1	2	3	4	5	6	7	8	9
Sept.									
13	18.0	20.8	21.2	21.5	22.5	25.6	31.6	32.3	46.9
14	28.1	26.2	28.8	29.2	28.2	31.8	36.8	37.4	52.1
15	32.4	33.2	36.4	36.7	34.4	38.2	40.8	41.5	48.5
16	26.4	28.8	30.5	30.7	31.4	35.7	37.0	36.4	48.1
17	22.3	24.5	26.7	26.8	25.4	28.7	29.5	26.9	36.6
18	19.6	21.5	21.6	21.7	22.2	25.4	25.9	24.8	32.3
19	16.9	18.7	19.9	20.0	21.2	20.7	21.0	23.0	30.6
20	15.0	16.8	17.5	17.6	16.9	18.8	19.0	20.9	30.7
21	16.2	18.0	18.1	18.7	23.4	24.7	25.1	26.8	47.0
22	42.2	41.6	44.1	45.3	46.5	50.0	55.2	56.5	116.0
23	46.3	54.3	57.7	58.3	55.5	69.3	79.8	72.2	141.0
24	36.0	39.1	38.6	39.0	45.9	57.0	65.2	67.1	102.0
25	23.1	24.8	25.8	26.1	25.4	28.6	31.8	33.7	64.7
26	17.0	18.6	19.4	19.6	18.3	20.3	22.1	20.9	37.7
27	14.6	16.1	18.3	18.5	18.0	20.1	21.4	22.0	35.9
28	13.2	14.7	16.1	16.2	17.6	19.4	20.3	18.8	28.6
29	12.2	13.6	14.4	14.5	14.1	16.1	16.8	17.1	28.0
30	10.7	12.1	11.4	11.5	15.4	15.8	16.3	16.3	25.1

Date	Daily discharge, in 1,000 second-feet, at indicated sampling points								
	10	11	12	13	14	15	16	17	18
Sept.									
13	45.6	46.6	48.4	48.0	48.0	38.1	47.6	47.8	55.0
14	52.3	56.8	58.0	57.5	57.0	53.2	55.3	55.1	63.5
15	49.4	53.9	55.9	56.5	59.0	58.1	64.8	64.6	70.5
16	48.2	53.5	56.0	56.0	56.0	57.0	63.4	64.7	68.0
17	38.5	41.1	44.7	47.0	45.0	48.3	52.9	54.4	57.0
18	32.9	35.1	34.9	37.0	37.0	38.7	42.9	43.1	45.0
19	30.6	31.2	31.2	32.0	37.0	38.1	37.5	37.5	40.0
20	31.7	36.2	46.7	42.0	52.0	45.0	56.9	54.2	60.0
21	41.4	63.2	80.0	86.0	95.0	76.0	88.4	84.9	90.0
22	105.0	142.0	170.0	190.0	178.0	122.0	125.0	122.0	133.0
23	147.0	172.0	201.0	234.0	239.0	193.0	215.0	209.0	223.0
24	111.0	131.0	158.0	180.0	221.0	228.0	254.0	252.0	264.0
25	71.2	90.6	106.0	119.0	161.0	203.0	247.0	252.0	257.0
26	38.6	42.4	54.0	67.0	100.0	154.0	208.0	216.0	218.0
27	36.4	37.1	38.9	42.0	56.0	100.0	172.0	177.0	178.0
28	29.6	31.9	35.3	37.0	40.0	49.8	122.0	126.0	124.0
29	28.1	30.1	31.1	32.5	32.0	35.8	72.0	78.8	80.0
30	26.3	22.6	21.3	23.5	22.0	32.4	38.0	39.3	39.0

Table 13 (Cont) -- Summary of Daily Discharges at Sampling Points
Sept. 13-30, 1950

Date	19	20	21	22	23	24	25	26	27
	Daily discharge, in 1,000 second-feet, at indicated sampling points								
13	57.0	59.0	60.0	102.0	103.0	117.0	134.0	312.0	328.0
14	61.0	64.0	64.0	102.0	103.0	117.0	129.0	278.0	295.0
15	70.0	68.0	72.0	107.0	105.0	118.0	124.0	246.0	257.0
16	69.0	71.0	77.0	109.0	109.0	122.0	126.0	237.0	242.0
17	58.0	64.0	78.0	103.0	107.0	120.0	125.0	233.0	237.0
18	49.0	53.0	66.0	83.0	93.0	107.0	117.0	223.0	231.0
19	42.0	46.0	54.0	67.0	74.0	83.0	87.0	168.0	200.0
20	51.0	46.0	57.0	64.0	65.0	73.0	68.0	147.0	152.0
21	81.0	68.0	80.0	78.0	70.0	89.0	90.0	162.0	150.0
22	151.0	116.0	105.0	96.0	91.0	112.0	106.0	185.0	176.0
23	214.0	197.0	121.0	112.0	107.0	128.0	113.0	185.0	185,0
24	254.0	245.0	165.0	156.0	129.0	160.0	136.0	200.0	187.0
25	253.0	258.0	220.0	200.0	182.0	215.0	183.0	234.0	220.0
26	226.0	238.0	257.0	242.0	230.0	268.0	238.0	294.0	264.0
27	186.0	201.0	255.0	252.0	252.0	293.0	276.0	339.0	318.0
28	144.0	161.0	233.0	237.0	248.0	289.0	289.0	364.0	354.0
29	89.3	112.0	175.0	202.0	222.0	260.0	273.0	365.0	366.0
30	37.0	56.0	105.0	162.0	187.0	220.0	242.0	343.0	355.0

Date	A	B	C	D	E	F	G	H	I
	Daily discharge, in 1,000 second-feet, at indicated sampling points								
13	7.0	9.10	2.04	5.98	12.6	1.18	5.7	6.1	17.5
14	10.4	16.00	3.12	5.05	14.6	1.14	5.3	7.0	16.2
15	15.5	13.40	2.75	2.60	13.7	.87	6.5	5.3	15.3
16	15.5	9.32	2.25	1.35	10.0	.77	4.2	4.3	14.3
17	15.9	5.26	2.04	.83	6.8	.82	2.4	3.6	13.3
18	14.5	3.54	1.79	.50	6.3	.85	1.6	2.9	12.5
19	12.5	3.28	1.70	.33	5.7	.87	1.2	2.5	11.3
20	10.6	3.58	1.66	.25	6.7	1.70	1.1	2.8	10.5
21	9.1	5.81	1.61	.40	25.2	3.80	1.6	2.5	16.0
22	8.2	32.00	1.63	5.20	62.6	18.00	14.5	7.6	25.0
23	8.6	36.70	1.68	10.50	51.0	7.75	31.5	11.0	32.0
24	7.8	25.10	1.58	8.20	30.4	5.90	33.5	10.3	34.0
25	6.8	13.90	1.47	3.20	17.5	3.65	26.5	7.4	40.0
26	6.1	9.54	1.40	1.83	12.7	2.60	21.5	5.7	44.0
27	5.6	7.78	1.34	1.25	9.0	2.12	18.0	4.7	47.0
28	5.1	7.54	1.33	.87	8.4	1.74	11.5	3.8	46.0
29	4.6	6.82	1.34	.65	7.0	1.47	4.1	3.2	41.0
30	4.0	6.13	1.34	.50	6.1	1.29	2.1	2.7	35.0

Summarized by USGS - Louisville District

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 14

Sampling Station No: A   Location:Allegheny River - Lock 2   Analyzed by: Pennsylvania

Date 1950	D O ppm	B O D ppm	Temp °F	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharge cfs (1,000)
Sept. 18	8.1	0.44	67	15.0	0.0	4.0	40	6.7	212	25	22	88	92	0.7	14.5
19	8.6	0.60	68	43.0	0.0	6.0	35	6.6	252	20	22	84	100	1.3	12.5
20	8.6	0.30	68	15.0	0.0	4.0	26	6.2	218	15	35	80	100	1.2	10.6
21	8.5	0.20	68	23.0	0.0	2.0	52	7.0	223	20	27	84	100	1.4	9.1
22	8.5	0.20	67	23.0	0.0	6.0	33	6.4	195	25	20	80	94	0.7	8.2
23	9.2	1.10	65	75.0	0.0	4.0	40	6.6	210	20	20	100	98	1.2	8.6
24	9.3	0.90	60	15.0	0.0	6.0	35	6.6	210	15	19	96	100	0.6	7.8
25	8.8	0.30	50	23.0	0.0	4.0	28	6.5	244	20	22	96	120	1.3	6.3
26	9.0	1.00	60	1.5	0.0	4.0	28	6.3	275	10	21	125	130	1.2	6.1
27	8.7	1.00	62	23.0	0.0	6.0	23	6.6	280	20	21	124	140	0.6	5.6
28	8.4	0.50	62	15.0	0.0	2.0	22	6.4	295	20	17	126	120	0.6	5.1
29	9.2	0.90	62	23.0	0.0	2.0	24	6.3	285	15	19	128	124	0.5	4.6

NOTE: Sampling point "A" is on Allegheny River Lock 2 located 3,200 ft. below Nadine, Pennsylvania.

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 15

Sampling Station No: B   Location:Hayes Station on Monongahela River   Analyzed by: Pennsylvania

Date 1950	D O p m	B O D ppm	Temp °F	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Dischar cfs (1,000)
Sept. 18	6.8	0.2	71	9.3	8.0	12.0	13	4.9	308	15	8	144	120	0.6	3.5
19	6.2	0.2	74	4.3	4.0	10.0	15	5.3	344	20	11	136	124	1.1	3.3
20	6.2	0.4	72	4.3	6.0	6.0	18	5.5	380	20	10	160	135	1.6	3.6
21	6.0	0.3	73	7.5	6.0	6.0	25	5.7	300	20	8	144	125	1.0	5.8
22	6.8	0.3	67	4.3	8.0	8.0	14	5.5	335	40	7	152	122	2.0	32.
23	6.7	0.3	67	43.0	4.0	4.0	18	6.1	310	60	5	112	90	5.0	36.
24	8.0	0.2	58	15.0	2.0	10.0	14	5.9	340	35	5	220	100	2.5	25.
25	8.8	0.4	58	15.0	0.0	2.0	15	5.8	215	25	5	104	100	1.2	13.
26	9.2	0.4	60	4.3	0.0	2.0	13	5.7	256	15	6	144	100	1.6	9.5
27	8.3	1.1	64	23.0	2.0	4.0	10	5.4	258	15	7	120	112	2.0	7.8
28	7.6	0.6	65	1,100.0	2.0	2.0	20	6.2	250	15	7	128	110	1.2	7.5
29	8.2	0.6	62	4.3	8.0	2.0	17	6.0	265	15	7	125	120	1.2	6.[illegible]

NOTE: (Sampling point "B" is on Monongahela River at Homestead High Bridge about one mile above Hayes Station).

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 16

Sampling Station No: 1 Location: Highway Bridge, Sewickley Analyzed by: Pennsylvania

Date 1950	D O ppm	B O D ppm	Temp °F	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharge cfs (1,000)
Sept 18	7.7	0.4	70	23.0	1.0	4.0	24	6.3	260	15	19	120	116	0.4	19.6
19	7.7	0.6	70	93.0	0.0	8.0	21	6.1	254	20	22	112	118	0.6	16.9
20	7.4	0.6	70	43.0	8.0	12.0	21	5.9	310	20	25	132	138	1.0	15.0
21	7.5	1.3	70	21.0	12.0	10.0	10	5.0	305	15	27	136	140	0.6	16.2
22	7.3	2.3	71	43.0	12.0	10.0	26	6.0	278	20	22	124	122	1.2	42.2
23	7.1	1.3	69	75.0	0.0	4.0	20	5.9	250	25	11	116	120	0.8	46.3
24	7.3	0.2	61	43.0	0.0	6.0	27	6.2	225	25	8	108	104	0.6	36.0
25	8.4	0.6	60	240.0	2.0	2.0	28	6.3	240	15	12	100	112	0.8	23.1
26	8.5	0.7	62	240.0	2.0	2.0	13	5.6	245	20	14	120	110	1.5	17.0
27	8.0	1.0	63	93.0	0.0	4.0	11	5.4	235	15	12	120	94	2.0	14.6
28	8.0	1.2	63	43.0	4.0	4.0	38	6.5	258	15	20	120	122	1.0	13.2
29	7.7	0.9	65	43.0	4.0	2.0	30	6.3	290	10	17	140	136	0.8	12.2

NOTE: (Sampling point "1" is on Ohio River at highway bridge at Sewickley).

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 17

Sampling Station No: C　　Location: Eastvale on Beaver River　　Analyzed by: Pennsylvania

Date 1950	D O ppm	B O D ppm	Temp ^{o}F	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharge cfs (1,000)
ept 18	5.5	1.0	70	23.0	1.0	6.0	36	6.4	260	25	19	116	124	2.0	1.8
19	5.1	1.1	70	4.3	0.0	8.0	38	6.5	366	25	23	120	140	2.0	1.7
20	4.3	0.6	70	4.3	4.0	8.0	42	6.5	300	25	26	132	144	2.0	1.7
21	3.9	0.5	70	4.3	0.0	4.0	46	6.7	290	25	20	132	136	1.2	1.6
22	4.3	0.7	70	12.0	0.0	8.0	40	6.3	285	15	21	124	142	1.1	1.6
23	4.3	0.6	69	9.3	0.0	2.0	35	6.7	310	30	25	148	150	1.2	1.7
24	4.9	1.4	62	2.3	0.0	6.0	43	6.5	350	15	22	168	170	0.8	1.6
25	5.4	1.4	63	15.0	0.0	2.0	38	6.2	330	20	24	144	170	1.1	1.5
26	6.0	1.2	62	43.0	0.0	4.0	35	6.0	380	25	25	172	160	2.5	1.4
27	6.0	1.2	64	23.0	2.0	6.0	35	6.1	345	20	24	150	172	0.8	1.3
28	5.9	1.4	65	9.3	6.0	4.0	40	6.6	370	20	23	160	170	0.6	1.3
29	5.2	1.1	67	23.0	4.0	4.0	38	6.5	345	20	24	155	166	0.6	1.3

NOTE: (Sampling point "C" is on Beaver River ~~at~~ highway bridge at Eastvale, Pennsylvania)

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table. 18

Sampling Station No:2 Location: Dam 7 Analyzed by: Pennsylvania

Date 1950	D O ppm	B O D ppm	Temp °F	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharge cfs (1,000)
Sept 18	8.4	0.4	71	2.3	2.0	10.0	16	5.9	365	15	16	184	156	0.5	21.5
19	8.6	0.3	71	9.3	1.0	6.0	14	5.7	340	10	19	164	156	0.4	18.7
20	8.7	0.5	70	2.1	6.0	4.0	18	6.0	330	15	19	144	138	0.6	16.8
21	8.6	0.7	70	4.3	0.0	4.0	24	6.4	310	15	19	120	134	0.4	18.0
22	8.7	0.9	68	9.3	2.0	8.0	23	5.9	276	20	21	128	128	1.2	41.6
23	8.3	1.6	71	43.0	2.0	4.0	24	5.9	280	20	17	136	126	0.6	54.3
24	9.1	0.8	63	15.0	2.0	4.0	20	5.7	270	20	10	128	124	0.4	39.1
25	9.7	1.1	62	2.3	2.0	4.0	22	6.4	225	15	10	104	108	0.5	24.8
26	9.8	1.4	65	4.3	0.0	4.0	18	6.0	240	15	11	112	112	0.8	18.6
27	9.5	1.1	65	9.3	2.0	6.0	15	5.8	260	15	11	120	120	0.6	16.1
28	9.6	1.3	66	4.3	6.0	2.0	22	6.3	225	15	8	118	122	0.8	14.7
29	9.7	1.3	67	9.3	4.0	4.0	25	6.4	258	10	12	120	120	0.5	13.6

NOTE: Sampling point "2" is at Ohio River Pool No. 7 below Montgomery Allen Dam at Midland, Pennsylvania.

DAILY ANALYSIS REPORT -- OHIO RIVER QUALITY SURVEY

Table 19

Sampling Station No:3 Location:Short Creek Ferry Analyzed by: West Virginia

Date 1950	D O ppm	B O D ppm	Temp °C	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharge cfs (1,000)
Sept. 18	7.7	0.2	23	2.4	1.5	4.0	5	6.6	309	15	16	192	142	0.8	21.6
19	8.1	0.2	23	4.6	1.0	3.0	7	6.6	327	5	19	154	148	0.8	19.9
20	8.2	0.6	22	2.4	1.5	2.0	5	6.3	339	10	18	182	160	0.9	17.5
21	7.9	0.3	23	2.4	3.0	3.0	4	6.2	36	5	18	173	152	1.0	18.1
22	7.9	1.8	21	23.0	1.5	1.0	8	7.0	342	90	18	134	132	0.2	44.1
23	6.5	2.7	20	9.3	- 1	2.5	11	7.1	335	38	22	106	120	0.6	57.7
24	7.0	1.0	19	9.3	- 1	2.5	10	6.9	262	29	14	125	120	Nil	38.6
25	8.7	0.8	18	9.3	-0.5	3	9	6.8	146	15	21	110	120	0.9	25.8
26	9.1	0.7	17	2.4	- 1	3	10	6.8	251	5	4	124	114	0.7	19.4
27	9.3	1.9	20	4.6	- 1	2.5		7.0	547	5	6	125	152	1.0	18.3
28	9.0	2.0	19	4.6	- 1	2.0	9	7.3	257	5	11	106	128	1.0	16.1
29	8.9	1.0	20	23.0	-0.5	3	11	6.7	227	3	11	106	112	1.0	14.4

(Note: Sampling point "3" is on Ohio River at Short Creek, W. Va., 6 miles above Lock and Dam No. 12 at ferry crossing

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 20

Sampling Station No: 4 Location: Lock & Dam 13 Analyzed by: West Virginia

Date 1950	D O ppm	B O D ppm	Temp °C	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharge cfs (1,000)
Sept. 18	7.4	0.2	23	2.4	4	3	6	6.7	292	20	15.5	163.2	135	1.0	21.7
19	7.8	0.1	23	2.4	1.5	3	4	6.5	306	7	18.5	168	148	1.0	20.0
20	8.0	0.9	22	4.6	-0.5	2.5	6	6.6	355	5	19	172.8	150	0.8	17.6
21						No Samples Collected									18.7
22	7.4	2.6	21	723.0	-1	1.5	17	7.3	529	250	13.5	134.4	148	0.7	45.3
23	6.6	3.3	20	110.0	-3	2.5	14	7.1	327	65	18.5	105.6	124	0.3	58.3
24	7.5	2.4	18	24.0	-2	2	14	7.0	282	43	22	124.8	132	Nil	39.0
25	8.1	1.0	19	4.3	-1	2	11	6.8	192	30	11	115.2	120	1.4	26.1
26	9.0	0.8	16	2.4	-1.5	2.5	10	7.0	272	5	4.5	124.8	120	0.8	19.6
27	9.0	1.1	19	4.6	-1	1.5	11	7.2	343	5	4.5	134.4	108	0.8	18.5
28	8.8	1.4	20	2.4	-2.5	2.5	13	7.3	273	3	10.0	96.0	114	0.8	16.2
29	8.9	1.2	20	11.0	-0.5	3	11	6.9	249	5	10.5	106.0	118	1.0	14.5

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 21

Sampling Station No: 5 Location: Lock & Dam 17 Analyzed by: West Virginia

Date 1950	D O ppm	B O D ppm	Temp °C	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharge cfs (1,000)
Sept. 18	6.9	1.4	24	0.4	1	2.5	6	6.7	319	20	21	163.2	146	0.8	22.2
19	7.5	0.7	22	0.4	-0.5	2.5	7	6.6	328	7	23	192.0	148	0.6	21.2
20	7.8	0.5	22	0.9	-2	2.0	8	6.8	330	5	22	144.0	148	0.3	16.9
21	7.8	0.7	23	0.4	-1	2	7	6.8	194	10	20	182.4	130	0.6	23.4
22	7.4	2.6	23	11.0	1.5	1.5	6	6.9	451	105	22	168.0	144	0.2	46.5
23	7.4	1.7	20	24.0	-2	2.5	11	7.1	694	250	16	158.4	154	0.2	55.5
24	6.2	4.3	19	4.3	-1	2.0	12	7.1	441	150	20	115.2	118	Nil	45.9
25	7.2	0.9	19	0.9	-1.5	2.0	13	7.2	251	20	24	110.4	130	0.8	25.4
26	7.9	0.7	20	0.4	---	---	---	---	---	---	---	---	---	---	18.3
27	8.7	1.4	20	4.6	-2	1.5	14	7.4	638	5	23	129.6	120	0.6	18.0
28	8.7	1.0	23	0.4	-3.5	1.5	11	7.3	312	3	18	124.8	130	0.4	17.6
29	8.3	0.3	21	4.6	-1.5	2.0	10	7.0	247	3	14	115.0	122	0.6	14.1

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 22

Sampling Station No: 6 Location:Lock & Dam 18 Analyzed by: West Virginia

Date 1950	D O ppm	B O D ppm	Temp °C	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharge cfs (1,000)
Sept. 18	7.4	1.6	24	4.6	-2	1.5	12.0	1.2	401	20	67.0	182.4	194	0.6	25.4
19	7.7	1.2	23	0.9	-1.5	2	10.0	7.0	399	25	53.0	153.6	178	0.4	20.7
20	7.8	1.2	23	11.0	-2	2.5	11.0	7.1	445	5	44.5	124.8	162	0.2	18.8
21	8.0	1.2	23	2.4	-3	1.0	12.0	7.2	295	3	40.5	135.2	158	0.2	24.7
22	7.4	2.3	23	>23.0	-3.5	2	22.0	7.4	458	105	65.0	144.0	196	0.4	50.0
23	6.0	2.1	20	24.0	-5.5	2	23.5	7.4	537	105	64.0	134.4	210	0.2	69.3
24	7.1	2.9	20	3.9	-7.5	2	30.5	7.5	523	125	85.5	115.2	200	Nil	57.0
25	7.9	1.3	19	0.3	-5.5	1.5	22.5	7.3	462	26	113.5	110.4	216	0.6	28.6
26	8.4	1.4	19	4.6	-4	2.5	20.0	7.3	461	10	90.5	134.4	180	0.6	20.3
27	8.8	1.5	20	2.4	-2.5	3	16.0	7.4	843	3	65.0	115.2	162	0.5	20.1
28	9.2	2.3	22	2.4	-3	2	17.0	7.4	755	5	57.5	100.8	160	0.3	19.4
29	8.4	0.8	24	4.6	-6	1.5	17.0	1.3	349	5	48.0	115.0	158	0.6	16.1

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 23

Sampling Station No: D   Location: Little Kanawha River - Near Mouth   Analyzed by: West Virginia

Date 1950	D O ppm	B O D ppm	Temp °C	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharge cfs (1,000)
Sept.															
18	6.2	2.5	23	230.0	-2	2	14	7.2	190	160	7.0	24	34	0.6	0.5
19	5.7	2.7	22	460.0	-0.5	2.5	15	1.2	214	185	3.0	43.2	37	0.2	0.3
20	6.6	2.0	22	1,100.0	-1.5	3.0	13	7.1	181	142	4.0	57.6	38	0.3	0.3
21	6.3	1.7	21	1,100.0	-3	2.5	14	7.4	---	110	1.5	4.8	39	0.6	0.4
22	7.0	4.4	20	230.0	-1	2.0	16	7.6	513	500	3.5	28.8	38	0.8	5.2
23	9.2	2.0	20	93.0	-1.5	1.5	17	7.5	397	330	9.0	19.2	40	0.8	10.5
24	8.6	1.7	18	24.0	-1	3	16	7.6	264	260	1.0	33.6	38	0.4	8.2
25	8.9	3.8	18	7.5	-1	2.5	16	7.3	97	150	2.0	16.0	40	1.0	3.2
26	8.5	1.7	19	110.0	-2	3.5	14	7.2	256	175	2.0	28.8	38	1.0	1.8
27	8.5	2.0	20	240.0	-1.5	3	14	7.4	Broken-Dish	170	1.0	19.2	38	0.8	1.3
28	7.6	1.9	20	460.0	-1	3	14	7.5	196	160	2.0	9.6	38	0.8	0.9
29	7.2	2.0	19	240.0	-3	3	14	7.1	191	120	5.5	19.2	35	1.4	0.7

(Note: Sampling point "D" is on Little Kanawha River, East St. Bridge, Parkersburg, W. Va. Alt. U. S. route 21, 1.2 mile above mouth of river.)

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 24

Sampling Station No: 7 Location: Lock & Dam 19 Analyzed by: West Virginia

Date 1950	D O ppm	B O D ppm	Temp °C	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharg cfs (1,000)
Sept. 18	7.5	2.3	24	4.6	-2	2	11.0	7.2	382	25	43.0	163.2	174	0.8	25.9
19	7.6	2.7	24	46.0	-0.5	2.5	8.5	6.9	495	50	44.5	153.6	170	0.9	21.0
20															19.0
21	7.9	1.4	24	46.0	-0.5	1.5	11.0	7.3	327	20	41.0	163.2	162	0.6	25.1
22	7.1	2.4	23	46.0	-2	1.5	15.0	7.4	491	295	24.0	105.6	132	0.2	55.2
23	6.7	2.3	22	7.3	-2	2.0	15.0	7.4	477	110	42.0	163.2	164	0.2	79.8
24	6.6	4.6	20	4.3	-3.5	2.0	20.0	7.4	439	105	51.5	115.2	186	Nil	65.2
25	8.0	2.0	20	0.3	-4	-2	17.0	7.3	311	5	47.0	135.2	152	0.6	31.8
26	7.8	0.9	20	4.6	-2.5	3	16.5	7.3	389	34	62.5	115.2	166	0.6	22.1
27	8.7	1.1	20	11.0	-2	2.5	19.5	7.5	484	33	77.0	120.0	168	0.6	21.4
28	8.6	0.9	20	21.0	-3.5	2	17.5	7.5	759	38	63.0	259.2	154	1.0	20.3
29	9.2	2.0	24	24.0	-4	2	17.5	7.3	348	15	45.5	120.0	136	0.6	16.8

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 25

Sampling Station No: 8 Location: Pt. Pleasant Bridge Analyzed by: West Virginia

Date 1950	D O ppm	B O D ppm	Temp ^oC	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharge cfs (1,000)
Sept.															
18	7.3	2.4	24	11.0	-1	2.5	8	7.2	378	20	45.0	182.4	180	0.7	24.8
19	7.6	1.2	23	4.6	-1.5	2.5	12.5	7.1	440	25	49.0	172.8	180	0.2	23.0
20	7.7	1.4	24	11.0	-3	0.5	12.0	7.2	384	25	46.0	250.0	184	0.1	20.9
21	7.8	1.3	23	4.6	-1.5	1.5	12.0	7.3	229	25	44.0	172.8	180	0.2	26.8
22	7.8	2.3	23	11.0	-1	1.5	9.0	7.3	377	80	44.5	153.6	160	0.1	56.5
23	6.3	1.8	22	46.0	-2	1.5	12.0	7.3	313	120	30.0	124.8	132	1.0	72.2
24	6.3	1.9	20	4.3	-2	2	12.0	7.3	354	100	26.0	105.6	124	Nil	67.1
25	6.1	0.5	19	2.1	-1.5	2	12.5	7.05	250	60	24.0	115.2	148	1.0	33.7
26	6.5	1.3	19	1.5	-2	3.5	16.5	7.25	358	42	26.5	124.8	140	0.7	20.9
27	7.8	2.1	20	2.4	-1	2.5	16.5	7.45	394	32	27.5	115.2	136	0.6	22.0
28	7.4	2.0	20	2.4	-2.5	2.0	15.5	7.55	746	41	30.5	91.2	170	0.6	18.8
29	8.3	0.7	23	2.4	-4	2	17	7.4	278	31	38.5	91.0	140	0.4	17.1

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 26

Sampling Station No: E   Location: Kanawha River - Near Mouth   Analyzed by: West Virginia

Date 1950	D O ppm	B O D ppm	Temp °C	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharg cfs (1,000
Sept. 18	4.5	1.5	23	0.09	-5	3.0	22	7.4	186	78	13	38.4	76	0.7	6.3
19	3.5	2.9	23	0.23	-6	2.0	26	7.4	176	33	15	14.4	84	0.2	5.7
20	2.8	0.5	23	0.43	-8	2.0	28	7.6	134	27	14	28.8	80	0.1	6.7
21	3.6	0.9	23	4.6	-7	1.5	25	7.6	57	32	14	38.4	82	0.2	25.2
22	3.6	3.6	22	11.0	-1.5	2.0	19	7.6	349	320	18	48.0	70	0.4	62.6
23	6.0	4.1	20	9.3	-2	1.5	9	7.5	417	410	2	19.2	50	0.8	51.0
24	7.2	1.1	19	9.3	-1.5	2.0	13	7.4	237	275	2	28.8	40	0.1	30.4
25	8.0	0.8	17	4.3	-2	1.0	10	7.1	201	135	1	14.4	36	1.0	17.5
26	7.7	1.1	19	0.23	-1	2.5	11	7.2	156	95	3	48.0	39	0.8	12.7
27	6.6	0.1	19	4.6	1	2.0	9	7.3	158	68	2	48.0	40	0.8	9.1
28	7.4	0.9	20	2.4	-1	2.5	9	7.3	254	57	4	14.4	36	0.7	8.4
29	6.8	0.8	22	2.1	-2	2.0	10	7.3	106	42	9	14.4	39	0.2	7.0

NOTE: (Sampling point "E" is on Kanawha River at Point Pleasant, W. Va. Mason County-Highway Bridge, W. Va. Route 2, 0.2 mile above mouth of river)

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table:27

Sampling Station No:9 Location: Gallipolis Dam Analyzed by: West Virginia

Date	D O ppm	B O D ppm	Temp °C	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharge cfs (1,000)
1950 Sept.															
18	6.5	1.6	24	2.4	-1	1.0	11	7.4	442	100	33.0	153.6	154	1.0	32.3
19	6.5	1.0	24	4.6	-1.5	2.0	11	7.2	288	33	38.5	153.6	158	0.2	30.6
20	6.9	1.2	23	4.6	-3	2.0	15	7.4	339	10	42.0	153.6	152	0.2	30.7
21	6.2	1.2	22	2.4	-4	1.5	18	7.5	297	27	34.5	124.8	144	0.2	47.0
22	5.3	1.8	23	4.6	-2.5	1.5	16	7.6	365	200	27.5	76.8	108	Nil	116.0
23	6.0	2.1	21	24.0	-1	2.0	12	7.4	502	390	19.0	86.4	90	0.8	141.0
24	6.3	1.3	20	15.0	-1.5	---	13	7.2	253	165	14.5	86.4	92	Nil	102.0
25	6.3	0.1	19	910	-2	2.0	12	7.1	317	95	16.5	100.8	100	1.0	64.7
26	7.7	0.6	20	930	-1.5	3.0	12	7.2	268	62	16.0	96.0	96	0.7	37.7
27	6.9	0.2	20	1.5	-1.5	2.5	13	7.4	267	48	17.5	96.0	94	0.6	35.9
28	6.9	0.5	21	1.5	-2	2.0	13	7.4	308	49	19.0	96.0	84	0.4	28.6
29	7.2	0.4	23	2.4	-3.5	1.5	13	7.4	192	40	22.5	86.4	103	0.6	28.0

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

, Table 28

Sampling Station No: 10 Location: Dam No. 27 Analyzed by: Ohio

Date 1950	D O ppm	B O D ppm	Temp °C	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharge cfs (1,000)
Sept 18	6.9	1.4	24	0.9	-4	4	33	6.9	--	25	36	132	145	<0.1	32.9
19	6.7	1.2	23	3.4	-2	3	28	6.9	--	45	37	149	156	<0.1	30.6
20	6.7	0.9	24	2.3	-1	5	25	7.0	345	30	39	135	154	<0.1	31.7
21	6.9	0.8	23	24.0	-8	1	33	6.9	383	100	39	130	147	<0.1	41.4
22	5.9	1.7	22	4.3	-4	1	36	6.9	331	150	27	83	112	<0.1	105.0
23	5.6	2.4	21	9.3	-8	1	31	6.9	572	500	25	72	103	<0.1	147.0
24	6.0	1.4	20	24.0	-6	1	31	7.0	363	300	19	72	96	<0.1	111.0
25	6.3	1.1	20	4.3	-10	1	29	6.6	373	500	19	86	110	<0.1	71.2
26	7.2	0.8	--	4.3	-9	1	33	6.6	333	120	17	79	107	<0.1	38.6
27	7.7	1.4	19	7.5	-9	1	28	6.9	257	75	16	80	114	<0.1	36.4
28	7.0	0.9	19	9.3	-14	2	30	6.9	208	65	14	77	100	<0.1	29.6
29	7.8	0.9	19	43.0	-12	1	30	6.9	207	70	14	70	120	<0.1	28.1

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 29

Sampling Station No: 11 Location: Dam No. 28 Analyzed by: Ohio

Date 1950	D O ppm	B O D ppm	Temp °C	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharge cfs (1,000)
Sept 18	7.1	1.0	26	0.9	-4	4	30	6.9	--	30	37	130	144	<0.1	35.1
19	7.2	1.3	25	2.3	-1	4	30	6.9	--	45	37	132	140	<0.1	31.2
20	6.8	1.7	24	9.3	-3	4	24	6.9	533	270	35	127	144	<0.1	36.2
21	7.0	1.0	23	110.0	-6	1	31	6.9	449	175	37	122	143	<0.1	63.2
22	6.5	2.6	22	9.3	-6	1	40	7.1	491	600	24	72	108	<0.1	142.0
23	5.8	2.2	22	4.3	-9	1	26	6.8	394	400	22	60	88	<0.1	172.0
24	6.5	2.5	19	2.3	-8	1	25	6.8	290	250	16	58	84	<0.1	131.0
25	6.5	1.3	19	24.0	-9	1	23	6.6	419	300	17	81	96	<0.1	90.6
26	6.8	1.1	--	21.0	-8	1	23	6.7	317	150	16	81	97	<0.1	42.4
27	7.5	0.8	20	93.0	-6	1	26	6.9	252	100	14	81	104	<0.1	37.1
28	7.2	1.0	20	1.2	-10	1	30	7.0	234	65	15	79	104	<0.1	31.9
29	7.5	0.8	18	240.0	-10	1	30	7.0	240	60	16	74	110	<0.1	30.1

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 30

Sampling Station No: 12 Location: Dam No. 29 Analyzed by: Ohio

ate 950	D O ppm	B O D ppm	Temp °C	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharge cfs (1,000)
ept 18	7.2	1.6	24	43.0	-4	3	32	6.9	--	35	38	120	145	<0.1	34.9
19	7.1	1.3	24	9.3	-4	3	32	7.1	--	30	35	120	140	<0.1	31.2
20	7.0	2.5	25	110.0	--	--	30	7.1	--	570	27	99	110	<0.1	46.7
21	6.6	4.8	21	150.0	-5	2	31	6.7	210	700	20	44	67	<0.1	80.0
22	6.4	2.4	20	15.0	-5	1	23	6.7	604	600	10	14	41	<0.1	170.0
23	6.9	2.9	20	9.3	-12	1	22	6.8	243	200	9	22	49	<0.1	201.0
24	7.1	1.3	19	2.3	-9	1	23	6.7	363	300	8	36	58	<0.1	158.0
25	6.8	0.5	19	9.3	-10	1	23	6.7	384	275	10	47	68	<0.1	106.0
26	7.8	1.6	--	9.3	-9	1	26	6.7	372	200	10	49	69	<0.1	54.0
27	8.2	1.6	19	3.9	-7	1	29	7.1	245	95	9	61	76	<0.1	38.9
28	7.9	1.2	19	43.0	-10	1	33	7.0	219	65	12	67	94	<0.1	35.3
29	7.4	0.8	19	93.0	-7	1	29	7.0	210	70	13	67	96	<0.1	31.1

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 31

Sampling Station No: 13 Location: Dam No. 30 Analyzed by: Ohio

Date 1950	D O ppm	B O D ppm	Temp °C	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharg cfs (1,000
Sept 18	7.1	1.7	23.5	9.3	- 4	4	35	6.9	--	70	40	130	146	<0.1	37.0
19	7.3	1.5	23.5	9.3	- 4	3	34	7.1	--	35	35	115	138	<0.1	32.0
20	6.8	1.8	23.5	46.0	- 3	3	27	7.1	361	75	33	135	142	<0.1	42.0
21	6.5	1.8	21.0	460.0	- 5	2	30	6.7	914	700	13	31	57	<0.1	86.0
22	6.3	2.5	20.0	23.0	- 5	1	23	6.7	626	600	8	5	40	<0.1	190.0
23	5.9	1.5	20.0	24.0	-10	1	21	6.8	461	500	10	19	47	<0.1	234.0
24	6.4	1.2	17.5	110.0	- 6	1	21	6.6	389	500	7	19	46	<0.1	180.0
25	6.6	1.3	19.5	46.0	-10	1	23	6.5	390	250	10	47	68	<0.1	119.0
26	7.0	1.4	--	23.0	- 9	1	24	6.7	377	150	13	66	82	<0.1	67.0
27	7.6	1.8	19.0	43.0	- 9	1	26	6.8	308	130	11	67	84	<0.1	42.0
28	7.8	1.5	21.0	43.0	-10	1	28	6.9	250	85	14	74	96	<0.1	37.0
29	7.7	1.0	19.0	75.0	- 9	1	29	7.0	223	65	14	64	102	<0.1	32.5

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 32

Sampling Station No: F Location: Scioto River near mouth Analyzed by: Ohio

Date 1950	D O ppm	B O D ppm	Temp °C	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Dischar cfs (1,000
Sept 18	14.5	6.7	24	43.0	-30	- 4	212	8.3	--	50	22	67	264	<0.1	0.9
19	9.0	3.8	21	9.3	-28	2	214	8.1	--	75	23	65	265	<0.1	0.9
20	7.1	3.6	21	240.0	-28	2	191	8.1	466	170	19	61	236	<0.1	1.7
21	6.3	4.6	21	43.0	-35	0	87	7.4	756	500	19	48	135	<0.1	3.8
22	6.6	4.1	19.5	240.0	-17	1	52	7.5	924	700	9	3	72	<0.1	18.0
23	4.7	3.5	19.0	1,100.0	-27	1	66	7.6	685	600	5	3	82	<0.1	7.8
24	5.4	1.6	18.0	75.0	-24	2	71	7.7	307	400	6	14	96	<0.1	5.9
25	5.5	3.2	17.0	43.0	-31	1	107	7.6	380	130	11	42	150	<0.1	3.7
26	5.9	3.8	--	230.0	-14	1	128	7.6	571	250	12	45	163	<0.1	2.6
27	6.8	3.3	19.0	23.0	-10	1	148	7.8	475	175	11	48	200	<0.1	2.1
28	6.6	2.0	19.0	43.0	- 9	1	156	7.8	357	100	9	48	216	<0.1	1.7
29	6.3	1.9	17.0	43.0	-10	1	154	7.8	376	120	9	55	204	<0.1	1.5

(Note: Sampling point "F" near the mouth of the Scioto River is located at U. S. Route No. 52 highway bridge at Portsmouth, Ohio)

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 33

Sampling Station No: 14 Location: Dam No. 31 Analyzed by: Ohio

Date 1950	D O ppm	B O D ppm	Temp °C	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharge cfs (1,000)
Sept 18	6.5	2.0	22.0	2.3	- 3	3	35	6.9	--	80	40	110	140	<0.1	37.0
19	7.4	1.4	22.0	7.5	- 8	3	35	7.1	--	30	36	120	140	<0.1	37.0
20	7.1	1.0	23.5	46.0	- 4	3	30	7.2	335	50	33	115	137	<0.1	52.0
21	6.4	2.4	22.0	240.0	- 8	2	31	6.9	757	500	24	79	102	<0.1	95.0
22	6.3	2.1	19.5	43.0	- 7	1	25	7.1	489	500	12	26	55	<0.1	178.0
23	5.9	1.6	20.0	4.3	-12	1	26	6.9	331	400	10	33	59	<0.1	239.0
24	6.3	0.3	19.0	7.5	- 7	1	22	6.9	321	500	10	32	59	<0.1	221.0
25	6.4	1.2	19.0	46.0	- 9	1	23	6.6	388	300	12	46	71	<0.1	161.0
26	6.7	1.5	--	43.0	- 8	1	24	6.7	406	175	15	67	87	<0.1	100.0
27	7.0	1.9	19.0	9 3	- 8	1	25	6.9	413	200	11	69	90	<0.1	56.0
28	7.8	1.3	21.0	43.0	-12	1	29	7.0	232	90	12	67	94	<0.1	40.0
29	7.7	0.9	19.0	15.0	- 8	1	27	6.9	249	90	13	58	104	<0.1	32.0

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 34

Sampling Station No: 15 Location: Dam No. 36 Analyzed by: Kentucky

Date 1950	D O ppm	B O D ppm	Temp °C	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharge cfs (1,000)
Sept 18	8.2	1.2	23	.9	.3	1.8	63	7.8	463	75	49	121	197	0.1	38.7
19	8.4	2.3	23	1.5	1.7	2.8	41	7.3	371	70	41	101	145	0.1	38.1
20	8.6	1.1	24	93.0	0.3	0.8	38	7.5	511	150	43	111	143	0.9	45.0
21	8.5	4.0	24	246.0	0.8	1.8	64	7.5	1,293	725	28	94	115	0.4	76.0
22	7.5	2.7	23	150.0	1.2	2.1	48	7.7	680	650	25	57	109	8.0	122.0
23	6.7	4.3	21	460.0	0.8	2.3	56	7.3	1,537	1,100	18	39	100	1.4	193.0
24	6.7	5.0	20	9.3	0	1.7	46	7.3	792	1,070	17	43	92	0.8	228.0
25	7.9	3.2	15	2.3	0	2.0	35	7.1	460	670	22	46	166	0.5	203.0
26	6.5	2.4	15	2.3	0.1	1.8	21	7.3	573	552	16	45	74	0.7	154.0
27	8.0	2.6	21	15.0	0.8	2.5	35	7.1	462	500	13	23	74	0.2	100.0
28	8.3	2.8	20	4.3	1.3	2.5	81	7.3	553	270	18	20	102	0.1	49.8
29	9.0	3.7	22	2.3	1.9	4.8	43	7.3	315	150	20	20	97	0.3	35.8

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 35

Sampling Station No: G   Location: Licking River near mouth   Analyzed by: Kentucky

Date 1950	D O ppm	B O D ppm	Temp °C	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharg cfs (1,000)
Sept 18	7.8	1.5	23	.4	1.0	2.0	76	7.9	400	53	33	77	126	0.3	1.6
19	8.4	0.5	23	23.0	0.3	5.3	38	7.1	376	50	39	107	138	0.2	1.2
20	8.7	2.3	23	23.0	0.8	1.0	43	7.5	903	105	43	108	145	0.6	1.1
21	7.9	4.4	23	1,100.0	3.7	4.0	54	7.4	1,353	438	34	89	133	0.4	1.6
22	7.3	5.6	23	150.0	0	3.2	68	7.6	1,497	990	22	85	112	0.8	14.5
23	7.6	6.8	21	1,100.0	1.0	3.0	64	7.3	891	875	18	63	76	0.5	31.5
24	8.3	6.4	19	4.3	0.3	2.0	81	7.1	822	933	21	83	103	1.0	33.5
25	7.9	2.2	15	9.3	0	2.0	26	7.2	595	800	16	25	133	0.7	26.5
26	8.5	1.0	15	15.0	0.4	4.0	22	7.3	370	380	19	31	74	0.2	21.5
27	8.4	4.1	21	1.5	0.3	1.8	48	7.5	415	475	13	16	81	0.1	18.0
28	8.7	4.2	20	240.0	0.8	1.8	76	7.2	414	235	19	13	93	0.5	11.5
29	8.7	2.5	23	9.3	2.5	5.8	39	7.1	375	165	23	21	102	0.2	4.1

(Note: Sampling point "G" is on Licking River at bridge on route 28, in built-up area, east of Covington, Ky. about one mile upstream from Ohio River)

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 36

Sampling Station No: 16 Location: Dam No. 38 Analyzed by: Kentucky

Date 1950	D O ppm	B O D ppm	Temp °C	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharge cfs (1,000)
Sept 18	7.3	1.4	23	23.0	0	1.2	42	7.4	349	50	35	75	131	0.6	42.9
19	7.0	2.2	23	1,100.0	0.4	2.8	42	7.3	354	50	41	90	135	0.4	37.5
20	8.4	5.3	24	1,100.0	1.0	1.5	68	7.5	515	75	42	103	147	0.3	56.9
21	6.4	5.3	23	43.0	1.3	2.5	62	7.6	601	313	34	82	126	0.2	88.4
22	6.3	5.7	23	--	0	5.3	67	7.7	1,500	1,010	21	--	115	0.7	125.0
23	6.1	2.6	22	43.0	2.3	3.8	66	7.5	1,100	900	18	46	102	0.6	215.0
24	6.4	6.2	19	4.3	0	1.0	41	7.4	397	1,137	18	56	81	0.5	254.0
25	8.0	6.8	15	43.0	0	2.5	38	7.2	414	540	17	18	173	0.6	247.0
26	7.3	6.7	15	9.3	0.3	3.0	21	7.3	448	550	17	43	74	0.3	208.0
27	9.1	4.9	21	4.3	0.5	2.0	38	7.3	516	475	13	16	74	0.3	172.0
28	8.1	4.2	21	240.0	1.0	2.0	87	7.3	475	350	15	15	83	0.1	122.0
29	7.9	3.8	22	43.0	2.8	7.0	35	7.2	276	135	26	18	102	0.4	72.0

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 37

Sampling Station No: 17 Location: Dam No. 39 Analyzed by: Kentucky

Date 1950	D O ppm	B O D ppm	Temp °C	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharge cfs (1,000)
Sept															
18	6.7	4.2	23	43.0	0	3.1	44	7.3	365	88	34	87	121	0.4	43.1
19	5.6	--	23	7.5	0.4	3.2	40	7.4	336	50	31	76	119	0.1	37.5
20	8.5	3.0	23	75.0	0	0.3	47	7.3	296	60	38	83	133	0.1	54.2
21	5.6	4.1	23	465.0	1.0	3.2	61	7.3	465	310	40	122	157	0.8	84.9
22	4.6	3.9	23	240.0	2.3	6.5	80	7.4	1,444	1,250	25	70	128	10.0	122.0
23	5.0	3.8	21	43.0	0.4	2.0	71	7.4	1,017	875	17	59	107	1.5	209.0
24	6.5	3.8	15	23.0	0	1.3	41	7.4	820	1,137	15	56	84	0.4	252.0
25	7.1	1.3	14	23.0	0	1.9	37	7.1	870	900	16	30	162	0.8	252.0
26	7.2	3.9	15	43.0	0.3	2.5	22	7.3	514	490	18	45	115	0.2	216.0
27	6.6	3.3	23	93.0	0.4	1.5	37	7.3	473	488	16	28	81	0.1	177.0
28	9.3	5.8	21	75.0	1.3	3.0	89	7.1	327	185	15	15	88	0.1	126.0
29	8.5	4.4	23	43.0	3.4	7.5	46	7.2	272	145	19	15	105	0.2	78.8

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 38

Sampling Station No: H   Location: Kentucky River near mouth   Analyzed by: Kentucky

Date 1950	D O ppm	B O D ppm	Temp °C	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharg cfs (1,000)
Sept 18	6.5	1.3	23	0.0	0	16	289	7.7	474	5	19	30	314	1.4	2.9
19	5.2	--	23	.9	0.4	4.4	60	7.3	393	75	6	4	72	0.2	2,5
20	9.2	0.9	23	9.3	0	3.0	62	7.3	390	70	5	1	74	0.3	2.8
21	9.3	5.2	23	4.3	0.6	4.5	62	7.2	675	100	5	38	67	0.1	2.5
22	8.9	1.0	23	75.0	1.7	3.0	66	7.2	806	138	5	6	69	0.1	7.6
23	8.2	2.1	21	23.0	1.0	2.3	71	7.4	381	400	5	0	83	1.0	11.0
24	9.3	5.5	15	4.3	1.2	4.3	103	7.6	173	258	7	11	89	0.4	10.3
25	8.9	1.7	15	0.4	0	1.8	86	7.4	185	70	7	--	102	0.2	7.4
26	9.3	0.4	21	0.9	0.3	2.5	48	7.4	160	75	7	24	97	0.1	5.7
27	10.1	3.5	22	0.9	0	0	99	7.9	218	70	6	12	105	0.2	4.7
28	9.7	2.8	20	4.3	0	0.5	100	7.5	162	35	7	17	109	0.2	3.8
29	9.5	2.8	23	0.4	0	0	72	7.6	192	25	8	15	107	0.1	3.2

(Note: Sampling point "H" is on Kentucky River at road bridge, 1/8-mile west of Carrollton, Ky. 0.75-mile upstream from mouth)

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 39

Sampling Station No: 18 Location: Madison Bridge Analyzed by: Kentucky

Date 1950	D O ppm	B O D ppm	Temp °C	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharge cfs (1,000)
Sept 18	6.5	1.4	23	0	0	13.8	304	7.4	452	25	19	34	285	0.8	45.0
19	7.1	1.6	23	23.0	0.3	2.0	49	7.6	407	63	31	77	121	0.2	40.0
20	7.3	1.6	23	23.0	0.3	2.0	43	7.2	251	35	31	78	126	0.2	60.0
21	7.3	2.7	23	43.0	1.8	4.4	49	7.2	341	66	41	111	138	0.2	90.0
22	4.3	3.9	23	93.0	0.5	1.3	58	7.5	985	630	30	91	140	0.7	133.0
23	4.6	4.1	21	240.0	1.2	2.8	74	7.8	1,776	825	19	48	133	0.2	223.0
24	9.3	4.8	15	9.3	0	4.8	45	7.4	175	183	6	--	102	0.3	264.0
25	6.8	1.6	16	2.3	0	2.0	31	7.1	198	65	7	--	154	0.2	257.0
26	7.6	0.7	16	43.0	0.3	3.3	21	7.2	416	400	20	49	88	0.3	218.0
27	8.9	4.6	23	2.4	0.3	1.3	52	7.4	367	350	13	29	88	0.3	178.0
28	8.2	4.1	20	15.0	1.5	2.8	68	7.1	239	600	16	20	93	0.1	124.0
29	7.3	5.1	23	4.3	3.6	7.5	41	7.2	482	300	21	15	105	0.3	80.0

(Note: Sampling point "18" is at mid-point of Madison River Bridge over the Ohio River)

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 40

Sampling Station No: 19 Location: Louisville Water Company Intake Analyzed by: Kentucky

Date 1950	D O ppm	B O D ppm	Temp °C	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharge cfs (1,000)
Sept 18	5.0	0.8	23	9.3	0.0	1.5	62	6.8	355	48	65	82	142	0.1	49.0
19	5.5	0.8	23	2.3	0.0	2.0	56	7.0	307	32	63	67	133	0.1	42.0
20	5.3	0.8	23	7.5	0.0	2.5	50	7.2	278	28	57	70	126	0.1	51.0
21	5.6	1.3	24	4.3	0.0	3.0	45	6.8	255	35	58	77	124	0.2	81.0
22	5.2	0.8	23	2,400.0	0.0	3.5	60	7.4	312	42	58	81	131	0.1	151.0
23	2.1	1.2	23	93.0	0.0	4.5	81	7.8	490	125	50	73	140	0.2	214.0
24	2.4	1.6	22	43.0	0.0	5.0	73	7.9	668	400	26	53	109	0.1	254.0
25	3.4	1.5	20	15.0	0.0	28.0	60	7.2	737	370	27	37	83	0.1	253.0
26	3.8	1.2	21	4.3	0.0	9.0	53	7.5	444	280	29	37	90	0.1	226.0
27	4.3	1.2	21	9.3	0.0	13.0	44	7.0	362	225	38	48	86	0.1	186.0
28	4.5	0.1	21	43.0	0.0	5.0	41	7.3	303	165	32	47	88	0.1	144.0
29	4.7	0.3	21	3.9	0.0	4.5	42	7.1	163	135	28	49	86	0.1	89.3

(Note: Sampling point "19" is at Louisville Water Co's intake tower, 40 ft off the Kentucky shore, about 8 miles above Dam No 41)

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 41

Sampling Station No: 20 Location: Dam No. 43 Analyzed by: Kentucky

Date 1950	D O ppm	B O D ppm	Temp °C	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharge cfs (1,000)
Sept 18	4.7	1.5	24	230.0	0.0	3.0	73	7.0	348	52	61	86	140	0.1	53.0
19	4.7	1.5	24	750.0	0.0	2.5	64	6.9	345	33	67	79	142	0.1	46.0
20	4.7	1.2	23	290.0	0.0	7.0	59	7.1	278	38	62	73	157	0.1	46.0
21	6.1	1.0	25	230.0	0.0	4.5	52	6.7	284	38	62	83	126	0.2	68.0
22	5.6	0.8	23	93.0	0.0	4.0	52	7.4	301	43	55	74	126	0.1	116.0
23	3.8	--	23	43.0	0.0	4.0	72	7.8	439	125	67	98	154	0.2	197.0
24	3.3	1.8	22	93.0	0.0	4.5	77	7.9	1,129	400	35	72	130	0.1	245.0
25	3.8	2.9	21	43.0	0.0	18.0	70	7.7	1,421	550	29	49	104	0.1	258.0
26	4.2	1.8	21	23.0	0.0	12.0	60	7.9	951	480	27	46	93	0.1	238.0
27	5.0	1.8	21	15.0	0.0	14.0	48	7.6	745	410	36	55	90	0.1	201.0
28	5.3	1.1	21	43.0	0.0	3.5	40	7.4	537	300	36	52	86	0.1	161.0
29	6.0	0.9	21	23.0	0.0	4.0	38	7.5	366	185	30	49	83	0.1	112.0

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 42

Sampling Station No: 21 | Location: Dam No. 47 | Analyzed by: Indiana

Date 1950	D O ppm	B O D ppm	Temp °C	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharge cfs (1,000)
Sept															
18	7.0	0.8	23	23.0	0	5.0	139	7.6	257	35	30	34	133	0.1	66.0
19	7.7	1.1	23	23.0	0	5.0	142	7.7	259	25	28	34	135	0.0	54.0
20	8.1	1.0	23	15.0	0	3.0	135	7.6	245	15	29	43	141	0.0	57.0
21	7.6	1.0	23	23.0	0	4.0	137	7.7	288	35	27	38	139	0.0	80.0
22	7.4	1.3	21	9.3	0	3.0	122	7.6	334	170	26	54	124	0.1	105.0
23	7.3	1.1	20	4.3	0	2.0	122	7.6	328	110	30	53	143	0.1	121.0
24	7.1	1.7	20	4.3	0	2.0	114	7.5	329	95	31	78	137	0.2	165.0
25	6.3	2.0	18	9.3	0	3.0	101	7.4	413	110	33	95	145	0.5	220.0
26	3.1	1.5	19	43.0	0	3.0	152	7.5	841	400	46	42	135	0.5	257.0
27	3.9	1.3	18	23.0	0	4.0	130	7.4	1,241	500	17	46	129	0.5	255.0
28	4.9	1.4	19	2.3	0	7.0	103	7.2	736	600	17	35	95	0.9	233.0
29	4.8	0.9	18	23.0	0	4.0	106	7.3	659	520	17	40	101	0.4	175.0

Note: Samples taken at mile point 777.2 above Dam 47.

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 43

Sampling Station No: 22 Location: Dam No. 48 Analyzed by: Indiana

Date 1950	D O ppm	B O D ppm	Temp °C	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharge cfs (1,000)
Sept															
18	7.4	1.2	22	21.0	0	5.0	124	7.5	253	35	31	34	124	0.1	83.0
19	7.4	1.1	23	9.3	0	5.0	135	7.6	256	30	24	38	124	0.1	67.0
20	8.0	0.8	23	43.0	0	4.0	135	7.6	238	15	25	38	139	0.0	64.0
21	8.2	1.3	23	15.0	0	4.0	137	7.6	296	35	26	43	147	0.1	78.0
22	7.6	2.0	22	93.0	0	3.0	142	7.6	284	80	27	55	135	0.1	96.0
23	6.9	1.3	21	23.0	0	2.0	122	7.6	389	180	25	55	126	0.2	112.0
24	7.1	1.4	20	23.0	0	3.0	122	7.3	488	210	31	74	143	0.7	156.0
25	6.6	2.0	19	4.3	0	3.0	103	7.3	467	200	28	89	131	0.3	200.0
26	4.1	1.5	20	15.0	0	3.0	134	7.4	959	370	30	58	158	0.5	242.0
27	3.7	1.3	19	23.0	0	4.0	145	7.4	1,317	650	17	42	137	0.8	252.0
28	4.4	1.5	19	23.0	0	7.0	121	7.2	1,196	800	18	34	112	0.9	237.0
29	5.5	2.6	19	43.0	0	5.0	115	7.3	1,433	650	17	37	109	1.0	202.0

Note: Samples taken at mile point 808.5 above Dam 48.

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 44

Sampling Station No: 23   Location: Dam No. 49   Analyzed by: Indiana

Date 1950	D O ppm	B O D ppm	Temp °C	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharge cfs (1,000)
Sept 18	7.2	0.6	22	2.3	0	5.0	127	7.5	241	30	28	35	127	0.1	93.0
19	7.1	0.8	22	7.5	0	5.0	126	7.6	243	45	28	30	124	0.1	74.0
20	7.3	0.5	23	4.3	0	4.0	131	7.6	232	20	24	29	137	0.1	65.0
21	7.9	0.6	23	9.3	0	5.0	139	7.5	267	35	24	42	131	0.2	70.0
22	7.9	1.0	21	2.3	0	3.0	142	7.8	237	60	26	54	131	0.0	91.0
23	7.3	1.1	22	4.3	0	2.0	142	7.6	277	125	25	48	133	0.2	107.0
24	6.5	1.5	20	9.3	0	2.0	117	7.3	361	155	26	72	133	0.2	129.0'
25	6.7	1.5	20	4.3	0	2.0	117	7.4	421	125	29	83	135	0.3	182.0
26	5.4	1.2	21	23.0	0	5.0	106	7.2	784	250	34	89	147	0.5	230.0
27	3.5	2.2	19	7.5	0	3.0	149	7.6	921	440	21	38	131	0.6	252.0
28	4.0	1.3	19	43.0	1	5.0	141	7.4	1,316	460	20	46	139	0.9	248.0
29	4.5	1.6	19	23.0	0	5.0	123	7.3	1,370	750	16	36	101	1.0	222.0

Note: Samples taken at mile point 844.5 above Dam 49.

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 45

Sampling Station No: I   Location: Wabash River near mouth   Analyzed by: Indiana

Date 1950	D O ppm	B O D ppm	Temp °C	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharge cfs (1,000)
Sept 18	9.4	2.9	20	0.4	0	0	358	8.1	371	45	18	43	241	0.1	12.5
19	9.7	3.4	21	9.3	0	0	372	8.3	378	60	22	34	241	0.1	11.3
20	9.7	3.6	23	9.3	0	0	342	7.6	376	45	20	50	241	0.1	10.5
21	8.7	3.6	23	4.3	0	3	355	8.0	389	60	21	48	237	0.1	16.0
22	7.4	4.8	21	15.0	0	0	360	8.0	380	70	17	52	239	0.1	25.0
23	5.7	3.1	23	43.0	0	2	312	8.0	429	170	35	58	234	0.2	32.0
24	5.2	2.7	19	75.0	0	2	262	7.5	524	230	24	52	181	0.2	34.0
25	6.0	2.0	19	93.0	0	3	194	7.6	498	260	11	42	135	0.3	40.0
26	6.5	2.1	19	23.0	0	5	235	7.5	594	270	13	26	153	0.3	44.0
27	6.4	1.9	18	43.0	0	0	257	7.8	506	240	10	20	151	0.3	47.0
28	6.9	1.8	18	2.3	0	2	253	7.6	443	180	12	24	162	0.2	46.0
29	6.7	2.2	18	43.0	0	1	280	7.9	409	190	11	25	167	0.1	41.0

(Note: Sampling point is on Wabash River 27 stream miles above confluence with Ohio River at Fletcher Sibley Ferry (terminus of State Road 62.)

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 46

Sampling Station No: 24 Location: Shawneetown Ferry Analyzed by: Illinois

Date 1950	D O ppm	B O D ppm	Temp °C	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharge cfs (1,000)
Sept 18	8.1	1.5	22	4.3	0	3.5	63	7.6	260	35	20	41	122	<0.1	107.0
19	8.9	0.3	26	2.4	0	3.5	68	7.6	300	35	23	36	133	<0.1	83.0
20	8.6	1.2	24	9.3	0	4.0	76	7.7	287	35	21	35	138	<0.1	73.0
21	8.6	1.2	24	46.0	0	3.5	70	7.6	265	35	21	41	132	0.2	89.0
22	8.2	1.0	22	15.0	0	3.5	89	7.9	308	35	19	46	158	0.1	112.0
23	7.6	1.2	22	24.0	0	4.0	74	7.7	324	40	19	41	142	<0.1	128.0
24	7.4	1.6	17	4.3	0	7.5	72	7.7	440	60	25	48	140	<0.1	160.0
25	7.2	1.7	15	15.0	0	4.5	59	7.5	446	60	23	58	140	<0.1	215.0
26	5.9	0.9	19	9.3	0	3.5	51	7.5	555	75	26	70	140	<0.1	268.0
27	4.2	1.7	18	24.0	0	3.5	69	7.6	720	250	16	43	136	0.3	293.0
28	4.5	1.6	20	24.0	0	3.5	59	7.6	797	350	13	38	122	<0.1	289.0
29	5.2	0.6	19	9.3	0	4.0	58	7.4	620	400	11	25	96	<0.1	260.0

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 47

Sampling Station No: 25 Location: Dam No. 51 Analyzed by: Illinois

Date 1950	D O ppm	B O D ppm	Temp °C	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharge cfs (1,000)
Sept 18	8.1	1.1	22	4.3	0	4.0	71	7.7	270	35	20	48	134	<0.1	117.0
19	8.1	1.4	21	2.4	0	3.0	69	7.7	260	20	21	41	132	<0.1	87.0
20	7.5	0.1	--	2.4	0	3.0	77	7.8	280	25	21	38	150	<0.1	68.0
21	8.8	1.1	24	2.4	0	3.0	77	7.7	305	40	22	42	150	<0.1	90.0
22	8.2	1.2	22	4.3	0	3.5	81	7.9	280	40	19	42	142	<0.1	106.0
23	7.9	0.9	22	4.3	0	3.0	78	7.8	326	25	20	45	146	<0.1	113.0
24	7.5	1.3	19	9.3	0	6.5	89	7.6	385	35	23	44	160	<0.1	136.0
25	6.8	1.8	16	7.5	0	4.5	71	7.5	410	60	24	50	150	<0.1	183.0
26	6.5	0.8	21	4.3	0	4.0	59	7.5	487	70	23	60	138	<0.1	238.0
27	5.0	1.3	22	24.0	0	3.5	64	7.6	576	150	27	70	156	<0.2	276.0
28	3.9	1.4	21	4.3	0	4.0	74	7.6	445	175	14	34	140	<0.1	289.0
29	4.3	1.2	20	24.0	0	4.0	68	7.5	767	400	12	28	132	<0.1	273.0

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 48

Sampling Station No: 26 Location: Dam No. 52 Analyzed by: Illinois

Date 1950	D O ppm	B O D ppm	Temp °C	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharge cfs (1,000)
Sept 18	7.8	0.8	21	1.5	0	4.0	71	7.6	280	30	19	48	132	<0.1	223.0
19	8.0	1.2	25	2.4	0	3.0	69	7.7	230	30	19	39	134	<0.1	168.0
20	8.4	0.9	23	4.3	0	3.5	74	7.8	240	25	19	41	134	<0.1	147.0
21	8.6	1.3	--	0.8	0	3.5	73	7.7	240	25	20	43	136	<0.1	162.0
22	8.6	1.4	22	2.1	0	3.5	81	7.9	255	35	18	37	140	<0.1	185.0
23	8.0	1.3	23	2.4	0	3.5	80	7.8	315	30	20	41	142	<0.1	185.0
24	8.9	1.9	20	2.4	0	3.5	85	7.7	320	35	22	46	152	<0.1	200.0
25	7.6	2.1	19	9.3	0	3.5	81	7.6	405	60	22	44	154	<0.1	234.0
26	6.9	1.4	21	4.3	0	3.5	70	7.6	418	60	24	58	152	<0.1	294.0
27	6.7	1.2	21	4.3	0	3.5	60	7.4	374	80	22	62	136	<0.2	339.0
28	5.3	0.8	19	4.3	0	4.0	65	7.6	710	375	23	65	150	<0.1	364.0
29	5.1	0.8	21	2.4	0	4.0	77	7.5	360	200	12	29	140	<0.1	365.0

DAILY ANALYSIS REPORT -- OHIO RIVER WATER QUALITY SURVEY

Table 49

Sampling Station No: 27 Location: Dam No. 53 Analyzed by: Illinois

Date 1950	D O ppm	B O D ppm	Temp °C	Confirmed M P N (1,000)	Acidity to phen ppm Hot	Acidity to phen ppm Cold	M O Alkalinity ppm	pH	Total Solids ppm	Turbidity ppm	Chlorides ppm	Sulphates ppm	Hardness ppm	Iron ppm	Discharge cfs (1,000)
Sept 18	8.3	1.4	--	2.4	0	4.5	71	7.7	275	45	20	41	128	<0.1	231.0
19	8.2	1.0	22	0.9	0	3.5	70	7.7	275	35	17	43	130	<0.1	200.0
20	8.2	0.8	22	2.4	0	3.5	68	7.7	220	30	17	36	124	<0.1	152.0
21	8.4	0.7	22	0.2	0	3.5	67	7.6	220	25	14	26	112	<0.1	150.0
22	8.3	1.0	22	0.9	0	3.5	73	7.8	217	25	15	31	128	<0.1	176.0
23	7.9	0.7	22	4.3	0	3.5	81	7.8	306	25	18	36	144	<0.1	185.0
24	8.1	0.9	19	2.4	0	6.0	73	7.7	293	20	19	36	136	<0.1	200.0
25	7.7	1.7	21	2.4	0	3.5	85	7.7	306	20	22	46	156	<0.1	234.0
26	6.4	0.7	19	4.3	0	4.0	64	7.6	413	70	22	53	148	<0.1	294.0
27	6.4	1.2	18	2.4	0	4.0	57	7.6	439	150	23	55	134	<0.2	339.0
28	5.5	1.3	21	2.4	0	4.0	62	7.5	527	180	26	72	158	<0.1	364.0
29	4.2	0.8	22	4.3	0	4.0	76	7.5	701	350	14	29	140	<0.1	365.0