Relationships Between Ohio River Water Quality and Drinking Water Quality

ORSANCO

Ohio River Valley Water Sanitation Commission

RELATIONSHIPS BETWEEN OHIO RIVER WATER QUALITY AND DRINKING WATER QUALITY FOR SELECTED PROVISIONS OF THE SAFE DRINKING WATER ACT

Ohio River Valley Water Sanitation Commission
Cincinnati, Ohio

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1.0 INTRODUCTION

1.1 OBJECTIVE

The objective of this survey is to identify instances in which public water supplies, using the Ohio River as a source, experience difficulty meeting selected provisions of the federal Safe Drinking Water Act, and to evaluate relationships between Ohio River and drinking water quality under such circumstances.

Finished water quality data from all water treatment plants using the Ohio River as a surface water supply are presented and compared to certain requirements of the federal Safe Drinking Water Act (maximum contaminant levels). Secondly, Ohio River water quality data from Commission monitoring stations are presented and compared to the same requirements. These comparisons are conducted for a number of water quality parameters including cadmium, lead, benzene, carbon tetrachloride, 1,2-dichloroethane, trichloroethylene, tetrachloroethylene, 1,2-dichloropropane, and total trihalomethanes over the period from 1986 through 1988. Although Safe Drinking Water Act requirements apply to drinking water, comparisons of Ohio River water quality to these requirements has been undertaken to evaluate the river's suitability as a water source.

The Commission classifies the entire river as a source for potable water, not just at the point of withdrawal of drinking water intakes. As such, the entire river should be maintained suitable for use as a source for drinking water. MCLs are one way in which ORSANCO can evaluate the Ohio River's suitability as a source of drinking water. U.S. EPA-established water quality criteria for the protection of human health are more restrictive than MCLs. Instream contaminants identified to impair the Ohio River's use as a source for providing treated drinking water will be given the highest priority during the Commission's intensified Ohio River segment investigations conducted under its Toxic Substances Control Program.

1.2 BACKGROUND

The Ohio River Valley, because of its water, energy and transportation resources, is now and will continue to be an attractive location for many industries. As such, the existing and potential presence of toxic substances in its surface waters is of primary concern to the Ohio River Valley Water Sanitation Commission. In addition, the Ohio River provides a source of drinking water to nearly three million people from communities of all sizes having facilities with varying levels of water treatment sophistication.

In recognition of the special concerns raised by the multiple and competing uses of the river, the Commission has established a Toxic Substances Control Strategy. The goal of the strategy is:

> To protect and enhance the water quality of the Ohio River Basin so that the designated uses of public health and aquatic life, and as a source of supply for potable uses after reasonable treatment, will not be adversely impacted by toxic substances.

A total of thirty Water Treatment Plants (WTPs) serve 29 communities along the Ohio River (Louisville, Kentucky has two facilities) with populations ranging in size from 1,000 to 800,000 people. These communities combined use more than 500,000,000 gallons of river water on a daily basis. Table 1 identifies each of the water treatment plants using Ohio River surface water, the intake mile point (Pittsburgh is at M.P. 0.0), pumping rates and approximate population served. Table 2 summarizes the number of water treatment plants by state and by population served.

1.3 SAFE DRINKING WATER ACT

The federal Safe Drinking Water Act (SDWA) was enacted in 1974 with a significant amendment occurring on June 19, 1986. Through this Act, the federal government was authorized for the first time to establish national drinking water regulations. These regulations apply to public water supplies as defined by the Act. Key elements of the Act include a process to promulgate national drinking water quality regulations, procedures for states to assume primacy, procedures for obtaining variances and exemptions, and enforcement provisions.

A primary provision of the national drinking water regulations is the promulgation of maximum levels of certain water quality parameters (organic and inorganic chemicals; microbiological; and radionuclides) permissible in drinking water for public water supplies; they are called maximum contaminant levels (MCLs). Maximum contaminant levels are enforceable. A MCL is developed following two basic steps. A maximum contaminant level goal (MCLG) is established at a concentration for which no known or anticipated adverse health effects will occur. MCLGs are human health goals and are not enforceable. A MCL is then established for that parameter as close as is feasibly possible to the MCLG, where feasibility is a function of technology and cost.

The Safe Drinking Water Act, as amended in 1986, requires the U.S. Environmental Protection Agency to establish additional MCLs and MCLGs for 83 water quality parameters by June 19, 1989 (not all have been promulgated to date). MCLs and MCLGs are proposed prior to enactment as final standards.

TABLE 1

OHIO RIVER PUBLIC DRINKING WATER INTAKES

MILE POINT	ST	INTAKE	PUMPING RATE IN MGD	POPULATION SERVED
4.5	PA	WEST VIEW	20.0	200,000
8.6	PA	ROBINSON TOWNSHIP	2.0	10,400
36.2	PA	MIDLAND	3.1	7,000
40.2	OH	EAST LIVERPOOL	3.0	18,000
59.1	OH	TORONTO	0.7	7,400
65.1	WV	WEIRTON	2.0	30,000
65.2	OH	STEUBENVILLE	6.5	40,000
86.8	WV	WHEELING	8.0	70,000
137.1	WV	SISTERSVILLE	0.2	2,000
304.2	WV	HUNTINGTON	15.0	120,000
319.7	KY	ASHLAND	7.0	29,000
327.0	OH	IRONTON	2.0	15,000
350.8	OH	PORTSMOUTH	6.0	50,400
408.5	KY	MAYSVILLE	1.3	13,000
462.8	OH	CINCINNATI	124.0	800,000
462.9	KY	KENTON CO WATER (FT. THOMAS)	20.0	175,000
463.5	KY	NEWPORT	8.0	84,000
594.5	KY	LOUISVILLE	125.0	350,000
600.6	KY	HENDERSON	125.0	350,000
609.0	IN	MT. VERNON	4.5	40,000
791.5	IN	MORGANFIELD	30.0	140,000
803.2	KY	UNIONTOWN	5.0	42,000
829.2	IN	STURGIS	2.0	8,000
839.9	KY	ROSICLARE	1.8	200,000
842.5	KY	GOLCONDA	0.1	10,400
871.3	KY	PADUCAH	0.3	7,000
891.3	IL	CAIRO	0.2	1,800
902.5	IL	EAST LIVERPOOL	0.1	1,000
935.5	KY	TORONTO	6.5	55,000
977.8	IL	WEIRTON	1.4	6,000
		TOTAL	530.7	2,883,800

TABLE 2

SUMMARY OF PUBLIC WATER SUPPLIES USING THE OHIO RIVER

STATE	# OF PWS	POPULATION SERVED		
		>10,000	3,300-10,000	<3,300
ILLINOIS	3	0	1	2
INDIANA	3	2	1	0
KENTUCKY	10	10	1	0
OHIO	6	5	1	0
PENNSYLVANIA	3	2	1	0
WEST VIRGINIA	4	3	0	1
TOTAL	30	22	5	3

Proposed standards are not enforceable. Interim MCLs were established for 26 parameters starting in 1974 upon enactment of the Safe Drinking Water Act. All interim primary drinking water regulations became primary drinking water regulations through the June 19, 1986 amendments.

Table 3 shows the parameters studied in this survey with their current regulations. Cadmium, lead, total trihalomethanes, benzene, carbon tetrachloride, 1,2-dichloroethane and trichloro-ethylene have final MCLs and MCLGs. Tetrachloroethylene and 1,2-dichloropropane have proposed MCLs and MCLGs; unless standards are reproposed, these values will become final.

TABLE 3

PROPOSED, INTERIM AND FINAL MCLs AND MCLGs
(as of February 1989)

CONTAMINANT (μg/L)	MCL	MCLG	PROPOSED MCL	PROPOSED MCLG
CADMIUM	10 (Interim)	None	5	5
LEAD	50 (Interim)	None	5	0
BENZENE	5	0	None	None
CARBON TETRACHLORIDE	5	0	None	None
1,2-DICHLOROETHANE	5	0	None	None
TRICHLOROETHYLENE	5	0	None	None
TETRACHLOROETHYLENE	None	None	5	0
1,2-DICHLOROPROPANE	None	None	5	0
TOTAL THMs	100	----	----	----

SDWA information obtained from Fact Sheet - Drinking Water Regulations Under the Safe Drinking Water Act, February 1989.

Concerning compliance with the Safe Drinking Water Act, finished water samples with parameter concentrations greater than the corresponding MCL do not necessarily indicate a violation of the Safe Drinking Water Act. For the VOCs investigated in this report, the MCL is to be applied to the annual average of four quarterly samples. The MCL for total trihalomethanes applies to the running average of the last four quarterly samples.

Compliance monitoring requirements of the SDWA for volatile organic compounds in finished water have been established for three classes of water utilities based on population served. A compli-ance monitoring timetable for the three classes of facilities is as follows.

Size	VOC Quarterly Sampling Completed By
>10,000	December 31, 1988
3,300-10,000	December 31, 1989
<3,300	December 31, 1991

Of the 30 water treatment facilities using the Ohio River, 22 are in the largest class, five are in the middle class and three are in the smallest class. The amount of VOC data is therefore greatest for the 22 largest facilities; the three utilities in the smallest class are not yet required to monitor levels of volatile organic compounds in their finished water.

2.0 SCOPE

This study focuses in on two inorganics, six individual volatile organic chemicals (VOCs) and total trihalomethanes (chloroform, bromoform, bromodichloromethane, and dibromochloro-methane). The two inorganics are cadmium and lead. The six VOCs are benzene, carbon tetrachloride, 1,2-dichloroethane, trichloro-ethylene, tetrachloroethylene and 1,2-dichloropropane. Total trihalomethane concentration is the sum of the concentrations of the four trihalomethanes. These parameters along with their proposed, interim and/or final regulatory levels are listed in Table 3.

Six of the contaminants were identified as parameters of concern in the 1987 Commission report; The Presence of Toxic Substances in the Ohio River: An Assessment of the Results of Stream Monitoring from 1976 to 1985 on the Ohio River and Certain Major Tributaries. That work identified cadmium, lead, benzene, carbon tetrachloride, 1,2-dichloroethane, and trichloroethylene as instream parameters with concentrations, at times, greater than their respective drinking water standards (MCL). Two additional unregulated VOCs were identified as occasionally having concentra-tions greater than the proposed MCLs or MCLGs in the Ohio River; tetrachloroethylene and 1,2-dichloropropane. The trihalomethanes were included in this study because of their known production during the disinfection process. In addition, three of the trihalomethanes are frequently detected in the Ohio River and often exceed stream criteria.

The parameters considered in this survey may not be the only parameters present in the Ohio River for which MCLs have been proposed or established. Vinyl chloride has an MCL but is not monitored by the Commission.

Every water treatment plant using the Ohio River as a surface water source is included in this survey (see Table 1). Data for this report are compiled from 1986 through 1988 for both Ohio River raw water and finished drinking water. Commission monitoring data have been used to characterize Ohio River levels of the parameters considered.

3.0 DATA

3.1 DATA GATHERING

State officials were contacted and requests were submitted for finished water data on the parameters of concern for the WTPs in their jurisdiction. Information on treatment schemes was also requested. In addition, each public water supply received a written request for finished water data. They were also asked to review general information concerning their facility in order to identify errors relating to treatment schemes, chemical additions, etc. Unit process flow diagrams were also requested.

Instream parameter concentrations were obtained from the Commission's Organics Detection System and Manual Sampling network for 1986 through 1988. The Organics Detection System generates daily parameter concentrations for VOCs. Manual sampling network provides monthly sample results for the inorganics of concern. These data were retrieved from the U.S. EPA's STORET computer data base using SAS for simple statistical analyses.

3.2 DATA ANALYSIS

Data are presented for both raw and treated Ohio River water. Tables are prepared for each parameter of concern and summarized over the period from 1986 through 1988. Tables contain sampling location with Ohio River mile point, number of samples taken, number of samples with detectable concentrations, maximum concentration, average concentration of the detections (non-detections are excluded from the averaging), and number of samples greater than the MCL.

For benzene, carbon tetrachloride, 1,2-dichloroethane and trichloroethylene, finished water samples with concentrations greater than the MCL does not necessarily represent a violation of the Safe Drinking Water Act. Compliance with VOC MCLs is based upon the annual average of four quarterly samples. The MCL for total trihalomethanes, however, applies to the running average of the last four quarterly samples and is only applicable to public water supplies serving populations of 10,000 or more. An individual sample with a total trihalomethane concentration greater than the MCL therefore does not represent a violation of the Safe Drinking Water Act. For tetrachloroethylene and 1,2-dichloropro-pane, proposed MCLs and MCLGs exist. Samples exceeding proposed limits do not represent violations of the Safe Drinking Water Act.

Detection of a certain water quality parameter in a sample results in a measured concentration of that parameter. No detection of a parameter does not indicate the absence of that parameter since detections are in part a function of analytical instrumentation sensitivity. The number of detections reported is not only a function of the parameter's concentration, but also of the detector sensitivity. Detection limits are a function of analytical instrumentation and methodology and may vary between laboratories or within the same laboratory over time.

The detection limit for organic chemicals from the Commission's Organics Detection System is 0.1 μg/L. The detection limits for cadmium and lead from the Commission's manual monitoring stations are 1.0 μg/L and 5.0 μg/L, respectively. In review of finished water data, the detection limits for organics were generally in the range of 0.5 μg/L to 1.0 μg/L. In comparison, the raw water data generally has lower detection limits than finished water data for the parameters studied in this report. There are instances in which the finished water detection limit is five to ten times greater than a detected concentration in the raw water. The result is that finished water data cannot be evaluated with the same accuracy as the Ohio River instream data.

3.3 OHIO RIVER INSTREAM DATA

TABLES 4 THROUGH 12

Ohio River Instream Concentrations for 1986 through 1988
with Comparison to Drinking Water Maximum Contaminant Levels.

OHIO RIVER INSTREAM LEVELS FOR 1986 THROUGH 1988

CADMIUM

MILE POINT	STATION	TOTAL # OF SAMPLES	TOTAL # OF DETECTIONS	MAX CONC	AVG CONC	# SAMPLES EXCEEDING MCL
15.2	SOUTH HEIGHTS	36	0	<1.0	---	0
40.2	EAST LIVERPOOL	35	0	<1.0	---	0
86.8	WHEELING	27	2	1.0	1.0	0
137.1	HANNIBAL L&D	36	1	2.0	---	0
161.8	WILLOW ISLAND	36	5	4.0	2.2	0
203.9	BELLEVILLE	36	2	3.0	2.2	0
260.0	ADDISON	34	0	<1.0	---	0
279.2	GALLIPOLIS	36	13	4.0	1.5	0
306.9	HUNTINGTON	36	2	1.0	1.0	0
319.7	ASHLAND	27	3	1.0	1.0	0
350.7	PORTSMOUTH	26	2	2.0	1.5	0
408.5	MAYSVILLE	25	0	<1.0	---	0
462.8	CINCINNATI	35	1	1.0	---	0
490.0	NORTH BEND	36	1	2.0	---	0
531.6	MARKLAND	35	2	1.0	1.0	0
600.6	LOUISVILLE	36	1	1.0	---	0
625.9	WEST POINT	35	0	<1.0	---	0
720.7	CANNELTON	36	6	1.0	1.0	0
791.5	EVANSVILLE	36	5	1.0	1.0	0
846.0	UNIONTOWN L&D	36	7	1.0	1.0	0
918.5	SMITHLAND L&D	36	1	1.0	---	0
952.3	JOPPA	35	4	8.0	2.8	0

* *AVG & MAX concentrations reported in ug/l.*

** *--- Indicates not applicable or not available.*

*** *AVG concentration is the average of detected samples.*

OHIO RIVER INSTREAM LEVELS FOR 1986 THROUGH 1988

LEAD

MILE POINT	STATION	TOTAL # OF SAMPLES	TOTAL # OF DETECTIONS	MAX CONC	AVG CONC	# SAMPLES EXCEEDING MCL
15.2	SOUTH HEIGHTS	36	20	18.0	10.9	0
40.2	EAST LIVERPOOL	36	21	24.0	12.8	0
86.8	WHEELING	26	12	16.0	11.3	0
137.1	HANNIBAL L&D	35	21	14.0	10.3	0
161.8	WILLOW ISLAND	35	17	12.0	10.6	0
203.9	BELLEVILLE	35	20	20.0	12.5	0
260.0	ADDISON	36	23	28.0	12.5	0
279.2	GALLIPOLIS	36	30	84.0	26.1	5
306.9	HUNTINGTON	36	19	24.0	11.9	0
319.7	ASHLAND	27	11	26.0	12.4	0
350.7	PORTSMOUTH	26	10	34.0	13.4	0
408.5	MAYSVILLE	25	13	20.0	12.5	0
462.8	CINCINNATI	35	24	28.0	12.8	0
490.0	NORTH BEND	36	20	20.0	11.3	0
531.6	MARKLAND	35	19	18.0	11.6	0
600.6	LOUISVILLE	36	21	18.0	11.1	0
625.9	WEST POINT	35	24	28.0	12.9	0
720.7	CANNELTON	36	22	36.0	15.4	0
791.5	EVANSVILLE	36	28	28.0	13.9	0
846.0	UNIONTOWN L&D	36	23	22.0	13.0	0
918.5	SMITHLAND L&D	36	30	68.0	15.7	1
952.3	JOPPA	35	21	24.0	13.0	0

* *AVG & MAX concentrations reported in ug/l.*

** *--- Indicates not applicable or not available.*

*** *AVG concentration is the average of detected samples.*

TABLE 5

OHIO RIVER INSTREAM LEVELS FOR 1986 THROUGH 1988

BENZENE

MILE POINT	STATION	TOTAL # OF SAMPLES	TOTAL # OF DETECTIONS	MAX CONC	AVG CONC	# SAMPLES EXCEEDING MCL
4.5	WEST VIEW	402	79	1.5	0.2	0
40.2	EAST LIVERPOOL	331	149	18.1	0.8	6
86.8	WHEELING	480	32	4.6	1.2	0
190.3	PARKERSBURG	129	8	0.7	0.3	0
306.9	HUNTINGTON	484	79	1.1	0.2	0
350.7	PORTSMOUTH	237	19	0.5	0.2	0
462.8	CINCINNATI	355	39	0.3	0.1	0
600.6	LOUISVILLE	541	5	0.9	0.3	0
791.5	EVANSVILLE	366	45	0.7	0.2	0
935.5	PADUCAH	320	0	<0.1	---	0

* *AVG & MAX Concentrations reported in ug/l.*

** *< indicates sample is below dection limit.*

*** *--- indicates not applicable or not available.*

**** *AVG concentration is the average of detected samples.*

OHIO RIVER INSTREAM LEVELS FOR 1986 THROUGH 1988

CARBON TETRACHLORIDE

MILE POINT	STATION	TOTAL # OF SAMPLES	TOTAL # OF DETECTIONS	MAX CONC	AVG CONC	# SAMPLES EXCEEDING MCL
4.5	WEST VIEW	1022	0	<0.1	---	0
40.2	EAST LIVERPOOL	558	3	9.1	4.0	1
86.8	WHEELING	995	7	0.4	0.2	0
190.3	PARKERSBURG	288	0	<0.1	---	0
306.9	HUNTINGTON	871	6	5.4	1.6	1
350.7	PORTSMOUTH	704	0	<0.1	---	0
462.8	CINCINNATI	1076	4	0.2	0.1	0
600.6	LOUISVILLE	1084	1	0.4	0.4	0
791.5	EVANSVILLE	1092	1	0.1	0.1	0
935.5	PADUCAH	822	10	3.4	0.6	0

* *AVG & MAX Concentrations reported in ug/l.*

** *< indicates sample is below dection limit.*

*** *--- indicates not applicable or not available.*

**** *AVG concentration is the average of detected samples.*

OHIO RIVER INSTREAM LEVELS FOR 1986 THROUGH 1988

1,2-DICHLOROETHANE

MILE POINT	STATION	TOTAL # OF SAMPLES	TOTAL # OF DETECTIONS	MAX CONC	AVG CONC	# SAMPLES EXCEEDING MCL
4.5	WEST VIEW	1022	4	0.5	0.3	0
40.2	EAST LIVERPOOL	558	7	0.3	0.2	0
86.8	WHEELING	995	2	0.5	0.3	0
190.3	PARKERSBURG	288	0	<0.1	---	0
306.9	HUNTINGTON	871	0	<0.1	---	0
350.7	PORTSMOUTH	704	20	1.3	0.5	0
462.8	CINCINNATI	1076	3	0.7	0.4	0
600.6	LOUISVILLE	1084	0	<0.1	---	0
791.5	EVANSVILLE	1092	0	<0.1	---	0
935.5	PADUCAH	822	668	26.7	5.0	230

* *AVG & MAX Concentrations reported in ug/l.*

** *< indicates sample is below dection limit.*

*** *--- indicates not applicable or not available.*

**** *AVG concentration is the average of detected samples.*

TABLE 8

OHIO RIVER INSTREAM LEVELS FOR 1986 THROUGH 1988

TRICHLOROETHYLENE

MILE POINT	STATION	TOTAL # OF SAMPLES	TOTAL # OF DETECTIONS	MAX CONC	AVG CONC	# SAMPLES EXCEEDING MCL
4.5	WEST VIEW	1022	3	0.5	0.4	0
40.2	EAST LIVERPOOL	558	7	0.5	0.2	0
86.8	WHEELING	995	24	2.5	0.3	0
190.3	PARKERSBURG	288	0	<0.1	---	0
306.9	HUNTINGTON	871	9	3.0	0.6	0
350.7	PORTSMOUTH	704	3	0.3	0.2	0
462.8	CINCINNATI	1076	9	0.2	0.1	0
600.6	LOUISVILLE	1084	1	0.1	---	0
791.5	EVANSVILLE	1092	3	0.3	0.3	0
935.5	PADUCAH	822	3	1.9	1.0	0

* *AVG & MAX Concentrations reported in ug/l.*

** *< indicates sample is below dection limit.*

*** *--- indicates not applicable or not available.*

**** *AVG concentration is the average of detected samples.*

TABLE 9

OHIO RIVER INSTREAM LEVELS FOR 1986 THROUGH 1988

TETRACHLOROETHYLENE

MILE POINT	STATION	TOTAL # OF SAMPLES	TOTAL # OF DETECTIONS	MAX CONC	AVG CONC	# SAMPLES EXCEEDING MCL
4.5	WEST VIEW	1022	46	1.8	0.4	0
40.2	EAST LIVERPOOL	558	21	2.1	0.5	0
86.8	WHEELING	995	57	1.8	0.3	0
190.3	PARKERSBURG	288	6	9.7	2.9	1
306.9	HUNTINGTON	871	32	0.9	0.2	0
350.7	PORTSMOUTH	704	118	10.6	0.5	1
462.8	CINCINNATI	1076	12	0.5	0.1	0
600.6	LOUISVILLE	1084	34	0.9	0.2	0
791.5	EVANSVILLE	1092	8	0.3	0.1	0
935.5	PADUCAH	822	10	2.3	0.5	0

* *AVG & MAX Concentrations reported in ug/l.*

** *< indicates sample is below dection limit.*

*** *---- indicates not applicable or not available.*

**** *AVG concentration is the average of detected samples.*

OHIO RIVER INSTREAM LEVELS FOR 1986 THROUGH 1988

1,2-DICHLOROPROPANE

MILE POINT	STATION	TOTAL # OF SAMPLES	TOTAL # OF DETECTIONS	MAX CONC	AVG CONC	# SAMPLES EXCEEDING MCL
4.5	WEST VIEW	1022	0	<0.1	---	0
40.2	EAST LIVERPOOL	558	0	<0.1	---	0
86.8	WHEELING	995	3	0.7	0.4	0
190.3	PARKERSBURG	288	1	0.1	0.1	0
306.9	HUNTINGTON	871	2	0.1	0.1	0
350.7	PORTSMOUTH	704	0	<0.1	---	0
462.8	CINCINNATI	1076	0	<0.1	---	0
600.6	LOUISVILLE	1084	0	<0.1	---	0
791.5	EVANSVILLE	1092	0	<0.1	---	0
935.5	PADUCAH	822	0	<0.1	---	0

* *AVG & MAX Concentrations reported in ug/l.*

** *< indicates sample is below dection limit.*

*** *--- indicates not applicable or not available.*

**** *AVG concentration is the average of detected samples.*

OHIO RIVER INSTREAM LEVELS FOR 1986 THROUGH 1988

TOTAL TRIHALOMETHANES

MILE POINT	STATION	TOTAL # OF SAMPLES	TOTAL # OF DETECTIONS	MAX CONC	AVG CONC	# SAMPLES EXCEEDING MCL
4.5	WEST VIEW	1022	57	21.5	1.1	0
40.2	EAST LIVERPOOL	558	368	34.6	1.7	0
86.8	WHEELING	995	814	9.6	0.9	0
190.3	PARKERSBURG	288	8	2.4	1.2	0
306.9	HUNTINGTON	871	297	10.0	0.7	0
350.7	PORTSMOUTH	704	341	1.9	0.4	0
462.8	CINCINNATI	1076	515	2.3	0.3	0
600.6	LOUISVILLE	1084	271	0.9	0.2	0
791.5	EVANSVILLE	1092	693	10.1	0.3	0
935.5	PADUCAH	822	293	4.4	0.3	0

* *AVG & MAX Concentrations reported in ug/l.*

** *< indicates sample is below dection limit.*

*** *--- indicates not applicable or not available.*

**** *AVG concentration is the average of detected samples.*

TABLE 12

3.4 TREATED DRINKING WATER DATA

TABLES 13 THROUGH 21

Drinking Water Concentrations for 1986 through 1988
with Comparison to Maximum Contaminant Levels

MONITORING RESULTS FOR TREATED DRINKING WATER
FROM OHIO RIVER WATER TREATMENT FACILITIES
1986 – 1988
CADMIUM

RIVER MILE	FACILITY	SAMPLES	DETECTIONS	MAX	AVG	# > MCL
4.5	WEST VIEW	3	3	80 0	28.6	1
8.6	ROBINSON TOWNSHIP	3	0	<0.5	---	0
36.2	MIDLAND	3	0	<5.0	---	0
40.2	EAST LIVERPOOL	2	0	<1.0	---	0
59.1	TORONTO	3	0	<1.0	---	0
65.1	WEIRTON	0	---	---	---	---
65.2	STEUBENVILLE	4	0	<1.0	---	0
86.8	WHEELING	3	0	<0.1	---	0
137.1	SISTERSVILLE	4	0	<0 1	---	0
304.2	HUNTINGTON	5	0	<0.2	---	0
319.7	ASHLAND	5	1	1.0	---	0
327.0	IRONTON	4	0	<1.0	---	0
350.8	PORTSMOUTH	3	0	<0.5	---	0
408.5	MAYSVILLE	4	1	1.0	---	0
462.8	CINCINNATI	3	0	<1.0	---	0
462.9	KENTON COUNTY	7	0	<1.0	---	0
463.5	NEWPORT	3	0	<1.0	---	0
594.5	LOUISVILLE	119	1	2.0	---	0
600.6	LOUISVILLE	118	---	2.0	---	0
609.0	NEW ALBANY	3	0	<2.0	---	0
791.5	EVANSVILLE	3	0	<2.0	---	0
803.2	HENDERSON	2	0	<1.0	---	0
829.2	MT. VERNON	1	0	<2.0	---	0
839.9	MORGANFIELD	3	0	<1.0	---	0
842.5	UNIONTOWN	1	0	<1.0	---	0
871.3	STURGIS	2	0	<1.0	---	0
891.3	ROSICLARE	3	0	<3.0	---	0
902.5	GOLCONDA	2	0	<3.0	---	0
935.5	PADUCAH	3	0	<1.0	---	0
977.8	CAIRO	5	0	<3.0	---	0

* *MAX and AVG concentrations in ug/l.*

** *AVG concentration is the average of detected samples.*

*** *--- indicates missing data or not applicable.*

**** *Catagory #>MCL is no. of samples greater than max contam. level.*

MONITORING RESULTS FOR TREATED DRINKING WATER
FROM OHIO RIVER WATER TREATMENT FACILITIES
1986 - 1988
LEAD

RIVER MILE	FACILITY	SAMPLES	DETECTIONS	MAX	AVG	# > MCL
4.5	WEST VIEW	3	1	31.0	---	0
8.6	ROBINSON TOWNSHIP	3	2	30.0	19.0	0
36.2	MIDLAND	3	0	<10.0	---	0
40.2	EAST LIVERPOOL	2	0	<7.0	---	0
59.1	TORONTO	3	1	4.0	---	0
65.1	WEIRTON	0	---	---	---	---
65.2	STEUBENVILLE	4	1	5.5	---	0
86.8	WHEELING	3	0	<1.0	---	0
137.1	SISTERSVILLE	4	1	2.0	---	0
304.2	HUNTINGTON	5	0	<5.0	---	0
319.7	ASHLAND	11	2	7.0	4 5	0
327.0	IRONTON	4	3	8.0	5.7	0
350.8	PORTSMOUTH	3	0	<7.0	---	0
408.5	MAYSVILLE	4	1	1.0	---	0
462.8	CINCINNATI	3	0	<5.0	---	0
462.9	KENTON COUNTY	7	0	<1.0	---	0
463.5	NEWPORT	3	0	<1.0	---	0
594.5	LOUISVILLE	116	---	5.4	---	0
600.6	LOUISVILLE	122	---	4.3	---	0
609.0	NEW ALBANY	3	0	<10.0	---	0
791.5	EVANSVILLE	3	0	<10.0	---	0
803.2	HENDERSON	2	0	<5.0	---	0
829.2	MT. VERNON	1	0	<6.0	---	0
839.9	MORGANFIELD	3	0	<1.0	---	0
842.5	UNIONTOWN	2	0	<1.0	---	0
871.3	STURGIS	2	0	<1.0	---	0
891.3	ROSICLARE	3	0	<5.0	---	0
902.5	GOLCONDA	2	0	<5.0	---	0
935.5	PADUCAH	3	0	<1.0	---	0
977.8	CAIRO	5	0	<5.0	---	0

* *MAX and AVG concentrations in ug/l.*

** *AVG concentration is the average of detected samples.*

*** *--- indicates missing data or not applicable.*

**** *Catagory #>MCL is no. of samples greater than max. contam level.*

***** *< Indicates sample is below detection level.*

TABLE 14

MONITORING RESULTS FOR TREATED DRINKING WATER
FROM OHIO RIVER WATER TREATMENT FACILITIES
1986 – 1988
BENZENE

RIVER MILE	FACILITY	SAMPLES	DETECTIONS	MAX	AVG	# > MCL
4.5	WEST VIEW	4	0	<0.5	---	0
8.6	ROBINSON TOWNSHIP	6	0	<5.0	---	0
36.2	MIDLAND	0	---	---	---	---
40.2	EAST LIVERPOOL	1	0	<1.0	---	0
59.1	TORONTO	18	14	8.7	4.1	3
65.1	WEIRTON	13	1	4.0	---	0
65.2	STEUBENVILLE	4	0	<1.0	---	0
86.8	WHEELING	4	0	<0.5	---	0
137.1	SISTERSVILLE	0	---	---	---	---
304.2	HUNTINGTON	5	0	<1.0	---	0
319.7	ASHLAND	5	0	<1.0	---	0
327.0	IRONTON	4	0	<1.0	---	0
350.8	PORTSMOUTH	4	0	<1.0	---	0
408.5	MAYSVILLE	4	0	<1.0	---	0
462.8	CINCINNATI	26	5	0.5	0.3	0
462.9	KENTON COUNTY	4	0	<1.0	---	0
463.5	NEWPORT	5	0	<1.0	---	0
594.5	LOUISVILLE	29	0	<0.5	---	0
600.6	LOUISVILLE	64	0	<1.0	---	0
609.0	NEW ALBANY	1	0	<1.0	---	0
791.5	EVANSVILLE	3	0	<1.0	---	0
803.2	HENDERSON	4	0	<1.0	---	0
829.2	MT. VERNON	0	---	---	---	---
839.9	MORGANFIELD	5	0	<1.0	---	0
842.5	UNIONTOWN	0	---	---	---	---
871.3	STURGIS	0	---	---	---	---
891.3	ROSICLARE	2	0	<1.0	---	0
902.5	GOLCONDA	2	0	<1.0	---	0
935.5	PADUCAH	5	0	<1.0	---	0
977.8	CAIRO	8	0	<1.0	---	0

* *MAX and AVG concentrations in ug/l.*

** *AVG concentration is the average of detected samples.*

*** *--- indicates missing data or not applicable.*

**** *Category #>MCL is no. of samples greater than max. contam. level.*

TABLE 15

MONITORING RESULTS FOR TREATED DRINKING WATER
FROM OHIO RIVER WATER TREATMENT FACILITIES
1986 – 1988
CARBON TETRACHLORIDE

RIVER MILE	FACILITY	SAMPLES	DETECTIONS	MAX	AVG	# > MCL
4.5	WEST VIEW	4	0	<0.5	---	0
8.6	ROBINSON TOWNSHIP	6	0	<5.0	---	0
36.2	MIDLAND	0	---	---	---	---
40.2	EAST LIVERPOOL	1	0	<0.5	---	0
59.1	TORONTO	3	0	<0.5	---	0
65.1	WEIRTON	13	0	<1.0	---	0
65.2	STEUBENVILLE	4	0	<0.5	---	0
86.8	WHEELING	4	0	<5.0	---	0
137.1	SISTERSVILLE	0	---	---	---	---
304.2	HUNTINGTON	5	0	<1.0	---	0
319.7	ASHLAND	5	0	<1.0	---	0
327.0	IRONTON	4	0	<0.5	---	0
350.8	PORTSMOUTH	4	0	<0.5	---	0
408.5	MAYSVILLE	4	0	<1.0	---	0
462.8	CINCINNATI	33	1	0.1	---	0
462.9	KENTON COUNTY	4	0	<1.0	---	0
463.5	NEWPORT	5	0	<1.0	---	0
594.5	LOUISVILLE	38	3	0.4	0.3	0
600.6	LOUISVILLE	74	0	<1.0	---	0
609.0	NEW ALBANY	1	0	<0.5	---	0
791.5	EVANSVILLE	3	0	<0.5	---	0
803.2	HENDERSON	4	0	<1.0	---	0
829.2	MT. VERNON	0	---	---	---	---
839.9	MORGANFIELD	5	0	<1.0	---	0
842.5	UNIONTOWN	0	---	---	---	---
871.3	STURGIS	0	---	---	---	---
891.3	ROSICLARE	2	0	<1.0	---	0
902.5	GOLCONDA	2	0	<1.0	---	0
935.5	PADUCAH	5	0	<1.0	---	0
977.8	CAIRO	21	0	<1.0	---	0

* *MAX and AVG concentrations in ug/l.*

** *AVG concentration is the average of detected samples.*

*** *--- indicates missing data or not applicable.*

**** *Catagory #>MCL is no. of samples greater than max. contam. level.*

***** *< Indicates sample is below detection level.*

TABLE 16

MONITORING RESULTS FOR TREATED DRINKING WATER
FROM OHIO RIVER WATER TREATMENT FACILITIES
1986 - 1988

1,2-DICHLOROETHANE

RIVER MILE	FACILITY	SAMPLES	DETECTIONS	MAX	AVG	# > MCL
4.5	WEST VIEW	4	0	<0 5	---	0
8.6	ROBINSON TOWNSHIP	6	0	<5.0	---	0
36.2	MIDLAND	0	---	---	---	---
40.2	EAST LIVERPOOL	1	0	<0.5	---	0
59.1	TORONTO	3	0	<0.5	---	0
65.1	WEIRTON	13	0	<1.0	---	0
65.2	STEUBENVILLE	4	0	<0.5	---	0
86.8	WHEELING	4	0	<2.0	---	0
137.1	SISTERSVILLE	0	---	---	---	---
304.2	HUNTINGTON	5	0	<1.0	---	0
319.7	ASHLAND	5	0	<1 0	---	0
327.0	IRONTON	4	0	<0.5	---	0
350.8	PORTSMOUTH	4	0	<0.5	---	0
408.5	MAYSVILLE	4	0	<1.0	---	0
462.8	CINCINNATI	33	0	<0.3	---	0
462.9	KENTON COUNTY	4	0	<1.0	---	0
463.5	NEWPORT	5	0	<1.0	---	0
594.5	LOUISVILLE	33	0	<0.5	---	0
600.6	LOUISVILLE	74	0	<1.0	---	0
609.0	NEW ALBANY	1	0	<0.5	---	0
791.5	EVANSVILLE	3	0	<0.5	---	0
803.2	HENDERSON	4	0	<1.0	---	0
829.2	MT. VERNON	0	---	---	---	---
839.9	MORGANFIELD	5	0	<1.0	---	0
842.5	UNIONTOWN	0	---	---	---	---
871.3	STURGIS	0	---	---	---	---
891.3	ROSICLARE	2	0	<1.0	---	0
902.5	GOLCONDA	2	0	<1.0	---	0
935.5	PADUCAH	206	160	18.9	2.5	36
977.8	CAIRO	21	4	1.0	1.0	0

* *MAX and AVG concentrations in ug/l.*

** *AVG concentration is the average of detected samples.*

*** *--- indicates missing data or not applicable.*

**** *Catagory #>MCL is no. of samples greater than max contam. level.*

TABLE 17

MONITORING RESULTS FOR TREATED DRINKING WATER
FROM OHIO RIVER WATER TREATMENT FACILITIES
1986 - 1988
TRICHLOROETHYLENE

RIVER MILE	FACILITY	SAMPLES	DETECTIONS	MAX	AVG	# > MCL
4.5	WEST VIEW	4	0	<0.5	---	0
8.6	ROBINSON TOWNSHIP	6	0	<5.0	---	0
36.2	MIDLAND	0	---	---	---	---
40.2	EAST LIVERPOOL	1	0	<0.5	---	0
59.1	TORONTO	3	0	<0.5	---	0
65.1	WEIRTON	13	0	<1.0	---	0
65.2	STEUBENVILLE	4	0	<0.5	---	0
86.8	WHEELING	4	0	<2.0	---	0
137.1	SISTERSVILLE	0	---	---	---	---
304.2	HUNTINGTON	5	0	<1.0	---	0
319.7	ASHLAND	5	0	<1.0	---	0
327.0	IRONTON	4	0	<0.5	---	0
350.8	PORTSMOUTH	4	0	<0.5	---	0
408.5	MAYSVILLE	4	1	0.6	---	0
462.8	CINCINNATI	33	0	<0.2	---	0
462.9	KENTON COUNTY	4	1	0.5	---	0
463.5	NEWPORT	5	0	<1.0	---	0
594.5	LOUISVILLE	36	3	5.5	1.9	1
600.6	LOUISVILLE	74	0	<1.0	---	0
609.0	NEW ALBANY	1	0	<0.5	---	0
791.5	EVANSVILLE	3	0	<0.5	---	0
803.2	HENDERSON	4	1	0.7	---	0
829.2	MT. VERNON	0	---	---	---	---
839.9	MORGANFIELD	5	0	<1.0	---	0
842.5	UNIONTOWN	0	---	---	---	---
871.3	STURGIS	0	---	---	---	---
891.3	ROSICLARE	2	0	<1.0	---	0
902.5	GOLCONDA	2	1	1.0	---	0
935.5	PADUCAH	5	0	<1.0	---	0
977.8	CAIRO	21	0	<1.0	---	0

* *MAX and AVG concentrations in ug/l.*

** *AVG concentration is the average of detected samples.*

*** *--- indicates missing data or not applicable.*

**** *Catagory #>MCL is no. of samples greater than max contam level*

***** *< Indicates sample is below detection level.*

TABLE 18

MONITORING RESULTS FOR TREATED DRINKING WATER
FROM OHIO RIVER WATER TREATMENT FACILITIES
1986 - 1988

TETRACHLOROETHYLENE

RIVER MILE	FACILITY	SAMPLES	DETECTIONS	MAX	AVG	# > MCL
4.5	WEST VIEW	4	0	<0.5	---	0
8.6	ROBINSON TOWNSHIP	6	0	<5.0	---	0
36.2	MIDLAND	0	---	---	---	---
40.2	EAST LIVERPOOL	1	0	<0.5	---	0
59.1	TORONTO	3	0	<0.5	---	0
65.1	WEIRTON	0	---	---	---	---
65.2	STEUBENVILLE	4	0	<0.5	---	0
86.8	WHEELING	4	0	<4.0	---	0
137.1	SISTERSVILLE	0	---	---	---	---
304.2	HUNTINGTON	5	0	<1.0	---	0
319.7	ASHLAND	5	0	<1.0	---	0
327.0	IRONTON	4	0	<0.5	---	0
350.8	PORTSMOUTH	4	0	<0.5	---	0
408.5	MAYSVILLE	4	0	<1.0	---	0
462.8	CINCINNATI	33	0	<0.2	---	0
462.9	KENTON COUNTY	4	0	<1.0	---	0
463.5	NEWPORT	5	0	<1.0	---	0
594.5	LOUISVILLE	248	0	<0.5	---	0
600.6	LOUISVILLE	274	0	<1.0	---	0
609.0	NEW ALBANY	1	0	<2.0	---	0
791.5	EVANSVILLE	3	0	<0.5	---	0
803.2	HENDERSON	4	0	<1.0	---	0
829.2	MT. VERNON	0	---	---	---	---
839.9	MORGANFIELD	5	0	<1.0	---	0
842.5	UNIONTOWN	0	---	---	---	---
871.3	STURGIS	0	---	---	---	---
891.3	ROSICLARE	2	0	<1.0	---	0
902.5	GOLCONDA	2	0	<1.0	---	0
935.5	PADUCAH	5	0	<1.0	---	0
977.8	CAIRO	21	0	<1.0	---	0

* *MAX and AVG concentrations in ug/l.*

** *AVG concentration is the average of detected samples.*

*** *--- indicates missing data or not applicable.*

**** *Catagory #>MCL is no. of samples greater than max. contam. level.*

MONITORING RESULTS FOR TREATED DRINKING WATER
FROM OHIO RIVER WATER TREATMENT FACILITIES
1986 - 1988
1,2-DICHLOROPROPANE

RIVER MILE	FACILITY	SAMPLES	DETECTIONS	MAX	AVG	# > MCL
4.5	WEST VIEW	4	0	<0.5	---	0
8.6	ROBINSON TOWNSHIP	6	0	<5.0	---	0
36.2	MIDLAND	0	---	---	---	---
40.2	EAST LIVERPOOL	1	0	<0.5	---	0
59.1	TORONTO	3	0	<0.5	---	0
65.1	WEIRTON	0	---	---	---	---
65.2	STEUBENVILLE	4	0	<0.5	---	0
86.8	WHEELING	4	0	<2.0	---	0
137.1	SISTERSVILLE	0	---	---	---	---
304.2	HUNTINGTON	3	0	<1.0	---	0
319.7	ASHLAND	5	0	<1.0	---	0
327.0	IRONTON	4	0	<1.0	---	0
350.8	PORTSMOUTH	4	0	<0.5	---	0
408.5	MAYSVILLE	4	0	<1.0	---	0
462.8	CINCINNATI	3	0	<0.5	---	0
462.9	KENTON COUNTY	4	0	<1.0	---	0
463.5	NEWPORT	5	0	<1.0	---	0
594.5	LOUISVILLE	29	0	<0.5	---	0
600.6	LOUISVILLE	74	0	<1.0	---	0
609.0	NEW ALBANY	1	0	<1.0	---	0
791.5	EVANSVILLE	3	0	<0.5	---	0
803.2	HENDERSON	4	0	<1.0	---	0
829.2	MT. VERNON	0	---	---	---	---
839.9	MORGANFIELD	5	0	<1.0	---	0
842.5	UNIONTOWN	0	---	---	---	---
871.3	STURGIS	0	---	---	---	---
891.3	ROSICLARE	0	---	---	---	---
902.5	GOLCONDA	0	---	---	---	---
935.5	PADUCAH	5	0	<1.0	---	0
977.8	CAIRO	15	4	1.0	1.0	0

* *MAX and AVG concentrations in ug/l.*

** *AVG concentration is the average of detected samples.*

*** *--- indicates missing data or not applicable.*

**** *Catagory #>MCL is no. of samples greater than max. contam level*

***** *< Indicates sample is below detection level.*

TABLE 20

MONITORING RESULTS FOR TREATED DRINKING WATER
FROM OHIO RIVER WATER TREATMENT FACILITIES
1986 - 1988
TOTAL TRIHALOMETHANES

RIVER MILE	FACILITY	SAMPLES	DETECTIONS	MAX	AVG	# > 100 ug/l
4.5	WEST VIEW	10	10	69 0	31.1	0
8.6	ROBINSON TOWNSHIP	6	3	17.0	13.0	0
36.2	MIDLAND	0	---	---	---	---
40.2	EAST LIVERPOOL	13	13	112.3	61.8	2
59.1	TORONTO	10	10	66.1	30.2	0
65.1	WEIRTON	14	8	81.0	57.4	0
65.2	STEUBENVILLE	15	15	151.0	63.9	3
86.8	WHEELING	12	12	127.8	53.7	1
137.1	SISTERSVILLE	0	---	---	---	---
304.2	HUNTINGTON	48	48	119.0	70.2	3
319.7	ASHLAND	37	37	162 0	62.0	4
327.0	IRONTON	17	17	145.6	59.0	3
350.8	PORTSMOUTH	4	4	31.2	22.4	0
408.5	MAYSVILLE	16	16	133.0	76.3	4
462.8	CINCINNATI	32	32	128.4	50.5	1
462.9	KENTON COUNTY	120	120	130.0	57.4	6
463.5	NEWPORT	19	19	192.0	70.3	6
594.5	LOUISVILLE	269	---	---	33.5	---
600.6	LOUISVILLE	326	---	---	26.7	---
609.0	NEW ALBANY	48	48	90.7	44.5	0
791.5	EVANSVILLE	36	36	168.3	74.6	7
803.2	HENDERSON	4	4	113.0	55.8	1
829.2	MT. VERNON	0	---	---	---	---
839.9	MORGANFIELD	5	5	106.0	70.6	1
842.5	UNIONTOWN	0	---	---	---	---
871.3	STURGIS	0	---	---	---	---
891.3	ROSICLARE	2	2	233.0	227.0	2
902.5	GOLCONDA	2	2	87.0	57.5	0
935.5	PADUCAH	---	---	64.6	---	0
977.8	CAIRO	37	37	112.0	47.6	1

* *MAX and AVG concentrations in ug/l.*

** *AVG concentration is the average of detected samples.*

*** *--- indicates missing data or not applicable.*

**** *Catagory #>100 ug/l is no. of samples greater than 100 ug/l.*

4.0 SUMMARY OF OHIO RIVER INSTREAM CONDITIONS

4.1 CADMIUM

No instream samples from the Commission's manual monitoring stations had concentrations greater than the MCL of 10 μg/L during 1986 through 1988. The highest instream concentration was 8.0 μg/L at Joppa (M.P. 952.3). Cadmium was detected most frequently at Gallipolis (M.P. 279.2) with an average concentration of 13 detections equaling 1.5 μg/L. Instream levels at Joppa have exceeded the proposed MCL; this may be a future concern should the proposed MCL be promulgated.

4.2 LEAD

Five samples from Gallipolis and one sample from Smithland L&D had concentrations of lead greater than the MCL of 50 μg/L. The maximum instream concentration was 84.0 μg/L which occurred at Gallipolis. Lead was detected most frequently at both Gallipolis and Smithland L&D with average concentrations of the detections equaling 26.1 μg/L and 15.7 μg/L respectively. Instream levels at all Commission manual monitoring locations have exceeded the proposed MCL; this may be a future concern should the proposed MCL be promulgated.

4.3 BENZENE

Six samples from East Liverpool had concentrations of benzene greater than the MCL of 5.0 μg/L. The Commission's spills data base indicates that these six samples were taken during a spill event. The maximum concentration was 18.1 μg/L while the average of 149 detections was 0.8 μg/L.

4.4 CARBON TETRACHLORIDE

One sample from East Liverpool and one sample from Huntington had instream carbon tetrachloride concentrations greater than the MCL of 5.0 μg/L. The greatest concentration was 9.1 μg/L at East Liverpool. Carbon tetrachloride was detected most frequently at Paducah with an average of 10 detected samples equaling 0.6 μg/L.

4.5 1,2-DICHLOROETHANE

Two hundred and thirty samples from Paducah had instream 1,2-dichloroethane concentrations greater than the MCL of 5.0 μg/L. These concentrations are the result of a ground water/soil contamination problem on the Tennessee River just upstream from its confluence with the Ohio River. The maximum concentration reached 26.7 μg/L, while the average of 668 detections equaled the MCL value of 5.0 μg/L.

4.6 TRICHLOROETHYLENE

No instream samples had concentrations greater than the MCL of 5.0 μg/L. The maximum instream trichloroethylene concentration was 3.0 μg/L at Huntington. Trichloroethylene was detected most frequently at Wheeling with an average of 24 detections equaling 0.3 μg/L.

4.7 TETRACHLOROETHYLENE

One sample from Parkersburg and one sample from Portsmouth had concentrations of tetrachloroethylene greater than the proposed MCL of 5.0 μg/L. The maximum instream concentration was 10.6 μg/L at Portsmouth. Tetrachloroethylene was most often detected at Portsmouth; 118 detections had an average concentration of 0.5 μg/L.

4.8 1,2-DICHLOROPROPANE

No instream samples had concentrations of 1,2-dichloropropane greater than the proposed MCL of 5.0 μg/L. The maximum instream concentration was 0.7 μg/L at Wheeling. 1,2-dichloropropane was most frequently detected at Wheeling; three detections had an average concentration of 0.4 μg/L.

4.9 TOTAL TRIHALOMETHANES

No instream samples had total trihalomethane concentrations greater than 100 μg/L. The maximum instream concentration was 34.6 μg/L at East Liverpool. Trihalomethanes are detected instream at most Ohio River locations with the notable exception of Parkersburg. Trihalomethanes were detected instream at Parkersburg seven times less frequently than any other monitoring location. The greatest average of detections was 1.7 μg/L at East Liverpool.

5.0 SUMMARY OF DRINKING WATER QUALITY BY PARAMETER

5.1 CADMIUM

The MCL of 10 μg/L for cadmium was exceeded once at West View with a maximum concentration of 80.0 μg/L. Cadmium was also detected most frequently at West View. Cadmium was also detected at Ashland, Maysville and Louisville. Cadmium currently has no MCLG.

5.2 LEAD

No lead samples had concentrations greater than the MCL of 50.0 μg/L. The greatest lead concentration was 31.0 μg/L at West View. Lead was detected most frequently at Ironton; the average of three detections was 5.7 μg/L. Lead was also detected at Robinson Township, Toronto, Steubenville, Sistersville, Ashland, and Maysville. Lead currently has no MCLG.

5.3 BENZENE

Three benzene samples at Toronto had concentrations greater than the MCL; the maximum concentration was 8.7 μg/L. Benzene was also detected most frequently at Toronto; the average of 14 detections was 4.1 μg/L. Benzene was also detected at Weirton and Cincinnati. All detected samples represent concentrations greater than the MCLG of zero.

5.4 CARBON TETRACHLORIDE

No samples reported had concentrations of carbon tetrachloride greater than the MCL of 5.0 μg/L. The maximum concentration was 0.4 μg/L at Louisville. Carbon tetrachloride was detected most frequently at Louisville; the average of three detections was 0.3 μg/L. Carbon tetrachloride was also detected once at Cincinnati. All detections represent concentrations greater than the MCLG of zero.

5.5 1,2-DICHLOROETHANE

Thirty-six samples at Paducah had concentrations greater than the MCL for 1,2-Dichloroethane; the maximum concentration was 18.9 μg/L. 1,2-Dichloroethane was detected most frequently at Paducah; the average of 160 detections was 2.5 μg/L. 1,2-Dichloroethane was not detected at any other water treatment plants. All detections represent values greater than the MCLG of zero.

5.6 TRICHLOROETHYLENE

One sample at Louisville had a concentration greater than the MCL for trichloroethylene; the maximum concentration was 5.5 μg/L. Trichloroethylene was detected most frequently at Louisville; the average of three detections was 1.9 μg/L. Trichloroethylene was also detected at Maysville, Kenton County, Henderson, and Golconda. All detections represent values greater than the MCLG of zero.

5.7 TETRACHLOROETHYLENE

No samples had concentrations greater than the proposed MCL of 5.0 μg/L; tetrachloroethylene was not detected at any water treatment plants.

5.8 1,2-DICHLOROPROPANE

No samples had concentrations of 1,2-dichloropropane greater than the proposed MCL of 5.0 μg/L; 1,2-dichloropropane was only detected at Cairo; the average of four detections was 1.0 μg/L. All detections represent values greater than the proposed MCLG of zero.

5.9 TOTAL TRIHALOMETHANES

The MCL for total trihalomethanes is 100 μg/L. This MCL applies to the running average of the last four quarterly samples such that any one concentration greater than the MCL does not necessarily represent a violation of the MCL standard for trihalomethanes. This MCL only applies to public water supplies serving populations of 10,000 people or more.

Samples with concentrations greater than 100 μg/L are as follows: East Liverpool (2), Steubenville (3), Wheeling (1), Huntington (3), Ashland (4), Ironton (3), Maysville (4), Cincinnati (1), Kenton County (6), Newport (6), Evansville (7), Henderson (1), Morganfield (1), Rosiclare (2), and Cairo (1). The maximum total trihalomethane concentration was 233.0 μg/L at Rosiclare. The lowest average of detections was 13.0 μg/L at Robinson Township. There is no health goal established for total trihalomethanes.

6.0 SUMMARY OF FINISHED WATER MCL EXCEEDANCES VERSUS OHIO RIVER WATER QUALITY

Table 22 summarizes all finished water samples with parameter concentrations greater than current MCLs. Ohio River water quality from Commission monitoring stations are presented for those instan-ces. Table 23 presents a comparison of finished water to Ohio River water for instances in which finished water total trihalomethanes were greater than 100 μg/L.

Cadmium was detected three times in the finished water at West View; one sample was greater than the MCL. Cadmium was not detected in the Ohio River at the nearest station to West View from 1986 to 1988. Numerous hypotheses could explain the presence of cadmium in the treated water while being absent from Ohio River samples 11 miles downstream. The ambient monitoring sampling location may be inappropriate for the identification of water quality conditions at the West View intake, or the sampling times may have randomly occurred at times of low cadmium concentrations.

Benzene was detected 14 times in the finished water at Toronto; six of these exceeded the MCL. All finished water detections at Toronto coincide with an April 1988 spill to the Ohio River which contained benzene. Benzene is detected frequently in the Ohio River at the Commission's monitoring station located 19 miles upstream from Toronto. This station had six samples with benzene concentrations greater than the MCL; they all also coincided with an April 1988 Ohio River spill containing benzene.

1,2-Dichloroethane is detected frequently in the finished water at Paducah; these samples include 36 which are greater than the MCL with a maximum concentration almost four times the MCL. Two hundred thirty Ohio River samples from Paducah had 1,2-dichloroethane concentrations greater than the MCL with a maximum concentration of more than five times the MCL. The average concentration of 668 Ohio River detections at Paducah from 1986 to 1988 equals the MCL for 1,2-dichloroethane. The source of 1,2-dichloroethane in such concentrations is known to originate from a soils and groundwater contaminated site on the Tennessee River just upstream from its confluence with the Ohio River.

Trichloroethylene was detected three times in the finished water at Louisville; one of those detections was greater than the MCL. Trichloroethylene was detected in the Ohio River once with a concentration well below that of the finished water sample.

Finished water total trihalomethane concentrations greater than 100 μg/L occurred numerous times at approximately one half of the water treatment plants surveyed. One finished water concentration greater than 100 μg/L does not constitute a violation of the federal Safe Drinking Water Act. The MCL for total

SUMMARY OF FINISHED WATER MCL EXCEEDANCES VS. OHIO RIVER INSTREAM CONDITIONS

SAMPLE TYPE	PARAMETER	RIVER MILE	TREATMENT PLANT	# SAMPLES > MCL	MAX CONC	NO. OF DETECTIONS	AVG. OF DETECTIONS
FINISHED WATER	CADMIUM	4.5	WEST VIEW	1	80	3	28.6
OHIO RIVER DOWNSTREAM		15.2		0	<1.0	0	---
OHIO RIVER UPSTREAM	BENZENE	40.2		6	18.1	149	0.8
FINISHED WATER		59.1	TORONTO	3	8.7	14	4.1
OHIO RIVER DOWNSTREAM		86.8		0	4.6	32	1.2
FINISHED WATER	1,2-DICHLOROETHANE	935.5	PADUCAH	36	18.9	160	2.5
OHIO RIVER @ INTAKE		935.5		230	26.7	668	5.0
FINISHED	TRICHLOROETHYLENE	594.5	LOUISVILLE	1	5.5	3	1.9
OHIO RIVER DOWNSTREAM		600.6		0	0.1	1	---

* *AVG & MAX Concentrations reported in ug/l.*

** *< indicates sample is below dection limit.*

*** *--- indicates not applicable or not available.*

**** *Finished water samples highlighted.*

TABLE 22

SUMMARY OF FINISHED WATER TOTAL TRIHALOMETHANE CONCENTRATIONS GREATER THAN 100 ug/l
VS.
OHIO RIVER INSTREAM CONDITIONS

SAMPLE TYPE	RIVER MILE	TREATMENT PLANT	# SAMPLES > MCL	MAX CONC	NO. OF DETECTIONS	AVG. OF DETECTIONS
FINISHED WATER	40.2	E. LIVERPOOL	2	112.3	13	61.8
OHIO RIVER @ INTAKE	40.2		0	34.6	368	1.7
OHIO RIVER UPSTREAM	40.2		0	34.6	368	1.7
FINISHED WATER	65.2	STEUBENVILLE	3	151.0	15	63.9
FINISHED WATER	86.8	WHEELING	1	127.8	12	53.7
OHIO RIVER DOWNSTREAM OR @ INTAKE	86.8		0	9.6	814	0.9
OHIO RIVER UPSTREAM OR @ INTAKE	306.9		0	10.0	297	0.7
FINISHED WATER	306.9	HUNTINGTON	3	119.0	48	70.2
FINISHED WATER	319.7	ASHLAND	4	162	37	62.0
FINISHED WATER	327.0	IRONTON	3	145.6	17	59.0
OHIO RIVER DOWNSTREAM	350.7		0	1.9	341	0.4
OHIO RIVER UPSTREAM	350.7		0	1.9	341	0.4
FINISHED WATER	408.5	MAYSVILLE	4	133.0	16	76.3
OHIO RIVER DOWNSTREAM	462.8		0	2.3	515	0.3
OHIO RIVER UPSTREAM OR @ INTAKE	462.8		0	2.3	515	0.3
FINISHED WATER	462.8	CINCINNATI	1	128.4	32	50.5
FINISHED WATER	462.9	KENTON COUNTY	6	130.0	120	57.4
FINISHED WATER	463.5	NEWPORT	6	192.0	19	70.3
OHIO RIVER UPSTREAM OR @ INTAKE	791.5		0	10.1	693	0.3
FINISHED WATER	791.5	EVANSVILLE	7	168.3	36	74.6
FINISHED WATER	803.2	HENDERSON	1	113.0	4	55.8
FINISHED WATER	839.9	MORGANFIELD	1	106.0	5	70.6
FINISHED WATER	891.3	ROSICLARE	2	233.0	2	227.0
OHIO RIVER DOWNSTREAM	935.5		0	4.4	293	0.3
OHIO RIVER UPSTREAM	935.5		0	4.4	293	0.3
FINISHED WATER	977.8	CAIRO	1	112.0	37	47.6

* *AVG & MAX Concentrations reported in ug/l.*

** *Finished water samples highlighted.*

TABLE 23

trihalomethanes applies to the running average of the last four quarterly samples for public water supplies serving populations of 10,000 or more. No violations of the MCL for total trihalomethanes were observed. Trihalomethanes are detected frequently in the Ohio river, but typically in concentrations averaging less than 1.0 μg/L.

7.0 CONCLUSIONS

Two instances were identified for which high concentrations of a certain parameter in the Ohio River corresponded with a finished water sample greater than the MCL; benzene at the Toronto water treatment plant and 1,2-dichloroethane at the Paducah water treatment plant. The benzene occurrence at Toronto was spill related while conditions relating to 1,2-dichloroethane at Paducah are continuing. Two other finished water samples with concentrations greater than the MCL were identified with no corresponding levels in the Ohio River, which is not to say that high corresponding levels were not present.

In general, it appears that water treatment facilities are providing water with concentrations below their MCLs for the parameters surveyed. although trihalomethanes do appear to be present at relatively high concentrations in the finished water of several water supplies. It also appears that, in general, the Ohio River is quite suitable as a raw water source for the parameters surveyed. There are instances where these conclusions do not apply.

Instream lead levels may present difficulties for water treatment facilities if the proposed MCL is promulgated. Lead concentrations three times or greater than the proposed MCL have been found at every Commission monitoring location on the Ohio River.

The most significant case of adverse raw water impacts on finished water quality involves 1,2-dichloroethane in the Paducah area. The Kentucky Division of Water is actively pursuing abatement of this contamination at the source.

8.0 RECOMMENDATIONS

Based on the observations and conclusions derived in this report, the following recommendations are suggested:

1. The Commission should continue to review its monitoring programs and emerging Safe Drinking Water Act regulations in light of MCLs established for new parameters.

2. Instream monitoring should be initiated for any new parameters with MCLs that are not currently being evaluated to further determine the river's suitability as a water source.

3. As new MCLs are established for currently monitored parameters, the Commission should evaluate instream data to identify parameters of concern for future studies similar to this one.

4. Instream parameters with concentrations greater than the MCL should be included in the Commission's intensified segment investigations of toxics. Instances in which instream levels exceed the MCL are outlined in tables 4 through 12.

5. For instances in which the MCL has been exceeded in finished water, modelling should be performed, accounting for a particular water treatment plant's removal capabilities, to determine the approximate instream level of a particular parameter that will result in a finished water MCL exceedance. This could be done for water treatment plants on an individual basis for parameters with finished water MCL exceedances.

6. Lead characteristics in the Ohio River should be further examined in light of the proposed MCL. Measurements of total and dissolved lead would provide information on treatability, as dissolved lead is more difficult to remove. Water supplies might then know what levels of lead removal to expect and determine if the proposed MCL will create future difficulties.

7. Ambient monitoring for cadmium in the Ohio River should be conducted at the West View intake to investigate sources of high cadmium levels in West View's finished water. If no unusual cadmium levels are found instream and West View is still experiencing high finished water concentrations, then West View may wish to investigate internal sources. If high Ohio River levels are found, then a full investigation of potential sources should be undertaken along with a re-examination of ORSANCO's location of ambient monitoring in the West View area.

APPENDIX A

WATER TREATMENT PLANT TREATMENT SCHEMES

The following tables present general information regarding each treatment plant included in this survey along with treatment schemes indicating the unit processes and chemical additions. The following paragraphs provide a brief description of information found in the following tables.

Mile point indicates the location of the WTP by the number of river miles downstream from the head, which occurs at the confluence of the Allegheny and Monongahela Rivers in Pittsburgh, Pennsylvania. Intake depth refers to the depth below river level that the intake is located. This depth will vary with varying river pool stages. Plant capacity refers to the volume of water that can be treated; this value is expressed as MGD (million gallons per day). Storage capacity is the quantity of treated drinking water that can be reserved and it is expressed as volume in millions of gallons. Storage capacity is valuable during instances in which treatment facilities must cease operation, which may occur for a variety of reasons. Average production is the average quantity of water treated expressed as MGD and this value will be somewhat less than plant capacity, which is the maximum quantity of water that can be treated and also expressed as MGD.

Concerning treatment schemes, the treatment process is presented along with chemical additives. The treatment process begins with "raw" Ohio River water entering the plant from the river intake and ends with treated water in the distribution system which transports the potable water to its customers. In between are the unit processes that treat the raw water, and these processes are marked with a Y (yes) or a N (no) indicating whether the treatment plant employs that particular process.

Settling is a process used to remove suspended solids in the raw water. The raw water collects in a settling basin where gravity acts to "settle out" the larger suspended particles. After primary settling which removes the larger suspended particles, rapid mixing is employed to quickly and homogeneously disperse coagulant for the coagulation process. Coagulation is the process by which particulates are destabilized and aggregated, thus enhancing particulate removal above that of gravity or primary settling. Coagulants such as alum and polymer are rapidly mixed throughout the water just prior to flocculation. Flocculation is the transport process by which small particles group together to form larger particles. These larger particles can then be removed by gravity settling or to enhance filtration. Sedimentation is similar to gravity or primary settling, although several techniques may be employed to enhance particle removal. Filtering is typically accomplished using a granular media such as sand. Filtering usually follows coagulation, flocculation and sedimentation, and it removes finer particulate matter than gravity settling techniques. Chlorine is usually added as a disinfectant, and the clearwells function as holding tanks prior to distribution along with providing chlorine contact time.

The following is a brief description of typical substances added during the treatment process. Alum and polymers are coagulants used to destabilize dissolved solids and are added prior to filtering. Chlorine along with copper sulfate is used as algicides or disinfectants. Fluoride is added to treated water to prevent tooth decay. Powder activated carbon (PAC) is an adsorbent used to remove organic contaminants.

UTILITY NAME: **Neville Island Treatment Plant**
OWNER: **West View Water Authority**

MILE POINT:	4.5	STATE: PA COUNTY:	Allegheny
INTAKE DEPTH (ft):	15	POPULATION SERVED:	200,000
PLANT CAPACITY (MGD):	40	AVG. PRODUCTION (MGD):	20
STORAGE CAPACITY:	34.3 MG 1.8 days		
CONTACT:	Joe Dinkel	PLANT PHONE:	412-931-3292
ADDRESS:	Neville Island Treat. Plt. Pittsburgh, PA 15225	ALT. PHONE:	412-331-4723

COMMENTS: Wells as secondary source

TREATMENT

PROCESS	Y/A		
River		CHEMICALS:	ferric chloride, lime, potassium permanganate soda ash, chlorination (pre- and post-), and fluoridation
Settling			
Rapid Mix	Y		
Flocculation	Y	COMMENTS:	GAC filters used.
Sedimentation	Y		
Filters	Y		
Clearwell			
Distribution			

UTILITY NAME: **Robinson Township**
OWNER: **Robinson Township Municipal Authority**

MILE POINT:	8.6	STATE: PA COUNTY:	Allegheny
INTAKE DEPTH (ft):	15	POPULATION SERVED:	10,400
PLANT CAPACITY (MGD):	3.0	AVG. PRODUCTION (MGD):	2.0
STORAGE CAPACITY:	1.8 MG 0.9 days max.		
CONTACT:	Chuck Neil	PLANT PHONE:	412-264-9520
ADDRESS:	Station St. & Louis Av. Pittsburgh, PA 15225	ALT. PHONE:	412-787-2333

COMMENTS: Wells as secondary source

TREATMENT

PROCESS	Y/A		
River		CHEMICALS:	potassium permanganate, PAC, coagulant, chlorination, and fluoridation
Settling			
Rapid Mix	Y		
Flocculation	Y	COMMENTS:	
Sedimentation	Y		
Filters	Y		
Clearwell			
Distribution			

UTILITY NAME: **Midland**
OWNER: **Municipal Authority of the Borough of Midland**

MILE POINT:	36.2	STATE: PA COUNTY:	Beaver
INTAKE DEPTH (ft):	15	POPULATION SERVED:	7,000
PLANT CAPACITY (MGD):	4.4	AVG. PRODUCTION (MGD):	3.1
STORAGE CAPACITY:	4.5 MG 1.5 days avg. use		
CONTACT:	Dick McCaffie	PLANT PHONE:	412-643-4920
ADDRESS:	10th St. & Railroad Ave. Midland, PA 15059	ALT. PHONE:	---

COMMENTS: ---

TREATMENT

PROCESS	Y/A		
River		CHEMICALS:	$FeSO_4$, $CaCO_3$, $KMnO_4$, (PAC)
Settling			
Rapid Mix	Y	COMMENTS:	Anthracite coal and rapid sand
Flocculation	Y	CHEMICALS:	Both pre- and post- Cl_2
Sedimentation	Y		
Filters	Y		
Clearwell			
Distribution			

UTILITY NAME: **East Liverpool Water Treatment Plant**
OWNER: **City**

MILE POINT:	40.2	STATE: OH COUNTY:	Columbiana
INTAKE DEPTH (ft):	Variable	POPULATION SERVED:	18,000
PLANT CAPACITY (MGD):	5.0	AVG. PRODUCTION (MGD):	3.0
STORAGE CAPACITY:	7 MG in system		
CONTACT:	Bob Disch	PLANT PHONE:	216-385-5050
ADDRESS:	2220 Michigan Avenue East Liverpool, OH 43920	ALT. PHONE:	216-386-4377

COMMENTS: ---

TREATMENT

PROCESS	Y/A		
River		CHEMICALS:	potassium permanganate, alum, PAC, sodium hydroxide, pre- and post-chlorination
Settling	N		
Rapid Mix	Y		
Flocculation	Y	COMMENTS:	Anthracite and sand in rapid sand filters
Sedimentation	Y		
Filters	Y		
Clearwell	Y		
Distribution			

UTILITY NAME: **Toronto Water Department**
OWNER: **City of Toronto**

MILE POINT:	59.1	STATE: OH COUNTY:	Jefferson
INTAKE DEPTH (ft):	19.5	POPULATION SERVED:	7,000
PLANT CAPACITY (MGD):	1 5	AVG. PRODUCTION (MGD):	0.7
STORAGE CAPACITY:	3 MG		
CONTACT:	George Wise	PLANT PHONE:	614-537-2591
ADDRESS:	P.O. Box 352 Toronto, OH 43964	ALT. PHONE:	614-537-2428

COMMENTS: Test well 70,000-80,000 GPD for secondary source.

TREATMENT

PROCESS	Y/A		
River		CHEMICALS:	alum, lime, PAC, chlorination (pre- and post-), and fluoridation
Settling	Y		
Rapid Mix	Y	COMMENTS.	Rapid sand filters.
Flocculation			
Sedimentation	Y		
Filters	Y		
Clearwell	Y		
Distribution			

UTILITY NAME: **Weirton Water Treatment Plant**
OWNER: **City of Weirton**

MILE POINT:	65.1	STATE: WV COUNTY:	Brooke
INTAKE DEPTH (ft):	4.0	POPULATION SERVED:	30,000
PLANT CAPACITY (MGD):	4.5	AVG. PRODUCTION (MGD):	2.0
STORAGE CAPACITY:	.3 MG 2.5 MGD city		
CONTACT:	Larry Coxen	PLANT PHONE:	304-797-8566
ADDRESS:	Station 3031 Birch Drive Weirton, WV 26062	ALT. PHONE:	304-797-8593

COMMENTS: Also on groundwater.

TREATMENT

PROCESS	Y/A		
River		CHEMICALS.	ferric sulfate, lime, soda tripolyphosphate, chlorination (pre- and post-), and fluoridation
Settling	N		
Rapid Mix	Y		
Flocculation	Y	COMMENTS:	Dual media (anthracite/sand) filters
Sedimentation	Y		
Filters	Y		
Clearwell	Y		
Distribution			

UTILITY NAME: **Steubenville Water Works**
OWNER: **City**

MILE POINT:	65.2	STATE: OH COUNTY:	Jeffersonville
INTAKE DEPTH (ft):	18	POPULATION SERVED:	40,000***
PLANT CAPACITY (MGD):	10.0	AVG. PRODUCTION (MGD):	6.5
STORAGE CAPACITY:	2 MG C.W. (1 MG, 2x350 TG) - in city		
CONTACT:	James McMinimum	PLANT PHONE:	614-283-6040
ADDRESS:	1565 University Blvd. Steubenville, OH 43952	ALT. PHONE:	614-282-0845

COMMENTS: ---

****With satellites.*

TREATMENT

PROCESS	Y/A		
River		CHEMICALS:	lime, alum, copper, sulfate (optional), chlorination (pre- and post-), and fluoridation
Settling	Y		
Rapid Mix	Y		
Flocculation	Y	COMMENTS:	6/3 lined, rainwater, reservoir, rapid sand filters
Sedimentation	Y		
Filters	Y		
Clearwell	Y		
Distribution			

UTILITY NAME: **Wheeling Water Treatment Plant**
OWNER: **City of Wheeling**

MILE POINT:	86.6	STATE: WV COUNTY:	Ohio
INTAKE DEPTH (ft):	4	POPULATION SERVED:	70,000
PLANT CAPACITY (MGD):	14	AVG. PRODUCTION (MGD):	8.0
STORAGE CAPACITY.	5 MG		
CONTACT:	Phil Kowalski	PLANT PHONE:	304-234-3834
ADDRESS:	N. 13th & Richland Av. Wheeling, WV 26003	ALT. PHONE:	304-234-3835

COMMENTS: ---

TREATMENT

PROCESS	Y/A		
River		CHEMICALS:	ferric sulfate, lime, potassium permanganate, PAC, chlorination (pre- and post), chlorine dioxide, polymers (with ferric sulfate and lime), sodium triphosphate and fluoridation
Settling	Y		
Rapid Mix	Y		
Flocculation	Y		
Sedimentation	Y	COMMENTS.	Rapid sand filters.
Filters	Y		
Clearwell	Y		
Distribution			

UTILITY NAME: **Sistersville Municipal Water**
OWNER: **Community of Sistersville**

MILE POINT:	137.1	STATE: WV COUNTY:	Tyler
INTAKE DEPTH (ft):	8	POPULATION SERVED:	2,000
PLANT CAPACITY (MGD):	2.2	AVG. PRODUCTION (MGD):	0.2
STORAGE CAPACITY:	400,000 planning another 600,000 in spring 1989		
CONTACT:	Gene Patterson	PLANT PHONE:	304-652-6361
ADDRESS:	200 Diamond Square Sistersville, WV 26175	ALT. PHONE:	304-652-1214

COMMENTS: Plant was built in 1898. Plans are being made for new plant.

TREATMENT

PROCESS	Y/A		
River		CHEMICALS:	lime, alum, potassium permanganate, PAC, calgon, chlorination (pre- and post-), soda ash, and fluoridation
Settling			
Rapid Mix	N		
Flocculation	Y	COMMENTS.	Rapid sand filter
Sedimentation	Y		
Filters	Y		
Clearwell			
Distribution			

UTILITY NAME: **Huntington Division**
OWNER: **West Virginia-American Water Company**

MILE POINT:	304.2 & 306.9	STATE: PA COUNTY:	Cabell
INTAKE DEPTH (ft):	15	POPULATION SERVED:	120,000
PLANT CAPACITY (MGD):	20.0	AVG. PRODUCTION (MGD):	15.0
STORAGE CAPACITY:	10.2 MG in plant and distribution system		
CONTACT:	Tom Holbrook	PLANT PHONE:	304-525-8193
ADDRESS:	P.O. Box 525 Huntington, WV 25710	ALT. PHONE:	304-529-7802

COMMENTS: ----

TREATMENT

PROCESS	Y/A		
River		CHEMICALS:	ferric sulfate, lime, potassium permanganate, PAC, polymer, zinc phosphate, chlorination (pre- and post-), and fluoridation
Settling	N		
Rapid Mix	Y		
Flocculation	Y	COMMENTS:	GAC filters
Sedimentation	Y		
Filters	Y		
Clearwell	Y		
Distribution			

UTILITY NAME: **Ashland Water Works**
OWNER: **City of Ashland**

MILE POINT:	319.7	STATE: KY COUNTY:	Boyd
INTAKE DEPTH (ft):	4 Variable	POPULATION SERVED:	29,000
PLANT CAPACITY (MGD):	12.0	AVG. PRODUCTION (MGD):	7.0
STORAGE CAPACITY:	Expanding		
CONTACT:	Charles Riggs	PLANT PHONE:	606-327-2058
ADDRESS:	Ashland Utilities Dept. Ashland, KY 41101	ALT. PHONE:	606-327-2006

COMMENTS: Raw water reserve of 25 MG

TREATMENT

PROCESS	Y/A		
River		CHEMICALS:	alum, lime, PAC, chlorination (pre- and post-), and fluoridation
Settling	Y		
Rapid Mix	Y	COMMENTS:	Presettling in 25 MG raw water
Flocculation	Y		
Sedimentation	Y		
Filters	Y		
Clearwell	Y		
Distribution			

UTILITY NAME: **Ironton Water Supply**
OWNER: **City of Ironton**

MILE POINT:	327.0	STATE: OH COUNTY:	Lawrence
INTAKE DEPTH (ft):	18+12'below	POPULATION SERVED:	15,000
PLANT CAPACITY (MGD):	4	AVG. PRODUCTION (MGD):	2.0
STORAGE CAPACITY:	6 MG Fin		
CONTACT:	Wendell Jenkins	PLANT PHONE:	614-532-3412
ADDRESS:	P.O. Box 704 Ironton, OH 45638	ALT. PHONE:	614-532-3353

COMMENTS: ---

TREATMENT

PROCESS	Y/A		
River		CHEMICALS:	alum, lime, PAC, potassium permanganate, sodium chlorite, chlorination (pre- and post-), and fluoridation
Settling	Y		
Rapid Mix	N		
Flocculation	Y	COMMENTS:	600,000 gallon presettling, mixing occurs in-pipe, rapid sand filters
Sedimentation	Y		
Filters	Y		
Clearwell	Y		
Distribution			

UTILITY NAME: **Portsmouth Water Treatment Plant**
OWNER: **City of Portsmouth**

MILE POINT:	350.8	STATE: OH COUNTY:	Scioto
INTAKE DEPTH (ft):	18	POPULATION SERVED:	50,000
PLANT CAPACITY (MGD):	16.0	AVG. PRODUCTION (MGD):	6
STORAGE CAPACITY:	22 MG Reservoir		
CONTACT.	John Sayler	PLANT PHONE:	614-456-6855
ADDRESS:	P.O. Box 1304 Portsmouth, OH 45662	ALT. PHONE:	614-354-7515

COMMENTS: ---

TREATMENT

PROCESS	Y/A		
River		CHEMICALS:	alum, lime, potassium permanganate, soda ash, zinc, orthophosphate, optional PAC, chlorination (post), and fluoridation
Settling	Y		
Rapid Mix	Y		
Flocculation	Y		
Sedimentation	Y	COMMENTS	They have two flash mixes with a presettling between them.
Filters	Y		
Clearwell	Y		
Distribution			

UTILITY NAME: **Maysville Utility Commission**
OWNER: **City of Maysville**

MILE POINT:	408.5	STATE: KY COUNTY:	Mason
INTAKE DEPTH (ft):	12	POPULATION SERVED:	13,000
PLANT CAPACITY (MGD):	2.8	AVG. PRODUCTION (MGD):	1.3
STORAGE CAPACITY:	3.6 MG		
CONTACT:	Kenneth Crump	PLANT PHONE:	606-564-3531
ADDRESS:	City P.O. Box I Maysville, KY 41056	ALT. PHONE:	606-564-4046

COMMENTS: Plant built in 1954 - updates.

TREATMENT

PROCESS	Y/A		
River		CHEMICALS:	alum, lime, potassium permanganate, PAC, chlorination (pre- and post-), and fluoridation
Settling	N		
Rapid Mix	Y		
Flocculation	Y	COMMENTS:	New dual media filters, rapid mixing, flocculation and sedimentation done in baffled chambers
Sedimentation	Y		
Filters	Y		
Clearwell	Y		
Distribution			

UTILITY NAME: **Cincinnati Water Works**
OWNER: **City of Cincinnati**

MILE POINT:	462.8	STATE: OH COUNTY:	Hamilton
INTAKE DEPTH (ft):	24	POPULATION SERVED:	800,000
PLANT CAPACITY (MGD):	235	AVG. PRODUCTION (MGD):	125.9
STORAGE CAPACITY:	184.8		
CONTACT:	Jack DeMarco	PLANT PHONE:	513-352-4651
ADDRESS:	5651 Kellogg Avenue Cincinnati, OH 45228	ALT. PHONE:	513-231-7825

COMMENTS: —

TREATMENT

PROCESS	Y/A		
River		CHEMICALS:	alum, polymer, lime, fluoride, ferric sulfate, pre- and post-chlorine, PAC
Settling	Y		
Rapid Mix	Y		
Flocculation	Y	COMMENTS:	
Sedimentation	Y		
Filters	Y		
Clearwell	Y		
Distribution			

UTILITY NAME: **Ft. Thomas Treatment Plant**
OWNER: **Kenton County Water District No. 1**

MILE POINT:	462.9	STATE: KY COUNTY:	Campbell
INTAKE DEPTH (ft):	25	POPULATION SERVED:	175,000
PLANT CAPACITY (MGD):	33.0	AVG. PRODUCTION (MGD).	24.0
STORAGE CAPACITY:	6.5 MG		
CONTACT:	Bari Joslyn	PLANT PHONE:	606-441-0482
ADDRESS:	700 Alexandria Pike Ft. Thomas, KY 41075	ALT. PHONE:	606-291-5666

COMMENTS: —

TREATMENT

PROCESS	Y/A		
River		CHEMICALS:	alum, lime, potassium permanganate, coagulant aid, chlorination (pre- and post-), and fluoridation
Settling	Y		
Rapid Mix	Y		
Flocculation	Y	COMMENTS:	Multimedia filters
Sedimentation	Y		
Filters	Y		
Clearwell	Y		
Distribution			

UTILITY NAME: **Newport Water Works**
OWNER: **City of Newport**

MILE POINT:	463.6	STATE: KY COUNTY:	Campbell
INTAKE DEPTH (ft):	22	POPULATION SERVED:	85,000
PLANT CAPACITY (MGD):	10.5	AVG. PRODUCTION (MGD):	8.0
STORAGE CAPACITY:	40 MG 4 days avg.		
CONTACT:	David N. Bloesing	PLANT PHONE:	606-441-0763
ADDRESS:	2055 Memorial Parkway Newport, KY 41075-1367	ALT. PHONE:	606-292-3618

COMMENTS: ---

TREATMENT

PROCESS	Y/A		
River		CHEMICALS:	ferric sulfate, lime, potassium permanganate, PAC, copper sulfate, sodium hydroxide, rapid chlorination (pre- and/or post), and fluoridation
Settling	Y		
Rapid Mix	Y		
Flocculation	Y		
Sedimentation	Y	COMMENTS:	Dual media filters.
Filters	Y		
Clearwell	Y		
Distribution			

UTILITY NAME: **B.E. Payne Water Treatment Plant**
OWNER: **Louisville Water Company**

MILE POINT:	594.5	STATE: KY COUNTY:	Jefferson
INTAKE DEPTH (ft):	-	POPULATION SERVED:	700,000***
PLANT CAPACITY (MGD):	60	AVG. PRODUCTION (MGD):	20.0
STORAGE CAPACITY:	-		
CONTACT:	John L. Huber	PLANT PHONE:	502-569-3600
ADDRESS:	435 S. 3rd St. Louisville, KY 40202	ALT. PHONE:	---

COMMENTS: ---

****With both plants.*

TREATMENT

PROCESS	Y/A		
River		CHEMICALS:	copper sulfate, potassium permanganate, PAC, alum, ferric chloride polymer, lime, soda ash, carbon dioxide, chlorination (with ammonia pre- and post-), and fluoridation
Settling	Y		
Rapid Mix	Y		
Flocculation	Y		
Sedimentation	Y	COMMENTS.	Dual media (anthracite/sand) filters.
Filters	Y		
Clearwell	Y		
Distribution			

UTILITY NAME: **Crescent Hill Purification Plant**
OWNER: **Louisville Water Company**

MILE POINT:	600.6	STATE: KY COUNTY:	Jefferson
INTAKE DEPTH (ft):	-	POPULATION SERVED:	700,000***
PLANT CAPACITY (MGD):	240.0	AVG. PRODUCTION (MGD):	125.0
STORAGE CAPACITY:	280 MG		
CONTACT:	John L. Huber	PLANT PHONE:	502-569-3600
ADDRESS:	435 S. 3rd St. Louisville, KY 40202	ALT. PHONE:	----

COMMENTS: ----

****With both plants.*

TREATMENT

PROCESS	Y/A		
River		CHEMICALS:	copper sulfate, potassium permanganate, PAC, alum, ferric chloride, polymer, lime, soda ash, carbon dioxide, chlorination (with ammonia: pre- and post-), and fluoridation
Settling	Y		
Rapid Mix	Y		
Flocculation	Y		
Sedimentation	Y	COMMENTS:	Dual media filters; optional lime soda, CO_2 softening step
Filters	Y		
Clearwell	Y		
Distribution			

UTILITY NAME: **Indiana Cities (New Albany)**
OWNER: **Indiana Cities Water Corporation**

MILE POINT:	609.0	STATE: IN COUNTY:	Floyd
INTAKE DEPTH (ft):	15	POPULATION SERVED:	40,000
PLANT CAPACITY (MGD):	7.0	AVG. PRODUCTION (MGD):	4.5
STORAGE CAPACITY:	1.25 MG		
CONTACT:	David Eblesisor	PLANT PHONE:	812-945-7492
ADDRESS:	1001 Penn Street Jeffersonville, IN 47130	ALT. PHONE:	812-282-8204

COMMENTS: Secondary source of 1.5 MGD from wells

TREATMENT

PROCESS	Y/A		
River		CHEMICALS:	alum, sodium aluminate, polymers, phosphate, chlorination (with ammonia pre- and post-), PAC, and fluoridation
Settling	Y		
Rapid Mix	Y		
Flocculation	Y	COMMENTS:	Rapid seed dual media filters
Sedimentation	Y		
Filters	Y		
Clearwell	Y		
Distribution			

UTILITY NAME: **Evansville Water Works**
OWNER: **Municipality**

MILE POINT:	791.5	STATE: IN COUNTY:	Vanderburgh
INTAKE DEPTH (ft):	10	POPULATION SERVED:	140,000
PLANT CAPACITY (MGD):	60	AVG. PRODUCTION (MGD):	30.0
STORAGE CAPACITY:	7.5 MG at plant		
CONTACT:	Mark Griese	PLANT PHONE:	812-428-0568
ADDRESS:	P.O. Box 19 Evansville, IN 47740	ALT. PHONE:	---

COMMENTS: ---

TREATMENT

PROCESS	Y/A		
River		CHEMICALS.	alum, lime, PAC, potassium permanganate, chlorination, and fluoridation
Settling	Y		
Rapid Mix	Y		
Flocculation	Y	COMMENTS.	Both primary and secondary settling is used. The filters are dual media, rapid sand
Sedimentation	Y		
Filters	Y		
Clearwell	Y		
Distribution			

UTILITY NAME: **Henderson Water Treatment Plant**
OWNER: **City of Henderson**

MILE POINT:	803.2	STATE: KY COUNTY:	Henderson
INTAKE DEPTH (ft):	30	POPULATION SERVED:	42,000
PLANT CAPACITY (MGD).	6 0	AVG. PRODUCTION (MGD):	5.0
STORAGE CAPACITY:	1.2 MG Clearwell 1 MG 2x.5 MG		
CONTACT:	Bobby Gish	PLANT PHONE:	502-826-2421
ADDRESS:	P O. Box 341 Henderson, KY 42420	ALT. PHONE:	----

COMMENTS: Plant will be doubled in 1989

TREATMENT

PROCESS	Y/A		
River		CHEMICALS:	alum, lime, potassium permanganate, sodium hydroxide, chlorination, fluoridation, aquaolene (see Appendix for proposed 1989)
Settling	Y		
Rapid Mix	Y		
Flocculation	Y		
Sedimentation	Y	COMMENTS:	Dual media filters are used. Plant is proposed to be doubled in 1989
Filters	Y		
Clearwell	Y		
Distribution			

UTILITY NAME: **Mt. Vernon Water Department**
OWNER: **Municipality**

MILE POINT:	829.2	STATE: IN COUNTY:	Posey
INTAKE DEPTH (ft):	45	POPULATION SERVED:	8,000
PLANT CAPACITY (MGD):	2.8	AVG. PRODUCTION (MGD):	2.0
STORAGE CAPACITY:	350,000		
CONTACT:	Harold Cox	PLANT PHONE:	812-838-3726
ADDRESS:	P.O. Box 19 Mt. Vernon, IN 47620	ALT. PHONE:	812-838-2136

COMMENTS: ---

TREATMENT

PROCESS	Y/A		
River		CHEMICALS:	alum, polymer, lime, chlorination (pre- and post-), and fluoridation
Settling	Y		
Rapid Mix	Y		
Flocculation	Y	COMMENTS:	Dual media filters.
Sedimentation	Y		
Filters	Y		
Clearwell	Y		
Distribution			

UTILITY NAME: **Morganfield Water Works**
OWNER: **City of Morganfield**

MILE POINT:	839.9	STATE: KY COUNTY:	Union
INTAKE DEPTH (ft):	18	POPULATION SERVED.	8,000
PLANT CAPACITY (MGD):	6.0	AVG. PRODUCTION (MGD):	1.8
STORAGE CAPACITY:	1.5 MG 2x500,000, 1 400,000		
CONTACT:	John Coffman	PLANT PHONE:	502-389-1695
ADDRESS:	P.O. Box 420 Morganfield, KY 42437	ALT. PHONE:	---

COMMENTS: ---

TREATMENT

PROCESS	Y/A		
River		CHEMICALS:	lime, alum, PAC, polymer, chlorination (pre- and post-), and fluoridation
Settling	Y		
Rapid Mix	Y		
Flocculation	Y	COMMENTS:	An aeration (tray type) process occurs before the rapid mix. Dual media filters are used.
Sedimentation	Y		
Filters	Y		
Clearwell	Y		
Distribution			

UTILITY NAME: **Uniontown Water Works**
OWNER: **City of Uniontown**

MILE POINT:	842.5	STATE: KY COUNTY:	Union
INTAKE DEPTH (ft):	5	POPULATION SERVED:	1,500
PLANT CAPACITY (MGD):	0.36	AVG. PRODUCTION (MGD):	0.1
STORAGE CAPACITY:	170,000 gal.		
CONTACT:	John Stevens	PLANT PHONE:	502-822-9118
ADDRESS:	Main Street, Box 548 Uniontown, KY 42461	ALT. PHONE:	502-822-4277

COMMENTS: ---

TREATMENT

PROCESS	Y/A		
River		CHEMICALS:	alum, lime, PAC, chlorination (pre- and post-), and fluoridation
Settling	N		
Rapid Mix	Y	COMMENTS:	Rapid sand filters.
Flocculation	Y		
Sedimentation	Y		
Filters	Y		
Clearwell	Y		
Distribution			

UTILITY NAME: **Sturgis Water Plant**
OWNER: **City of Sturgis**

MILE POINT:	871.3	STATE: KY COUNTY:	Union
INTAKE DEPTH (ft):	16	POPULATION SERVED:	3,000
PLANT CAPACITY (MGD).	1.2	AVG. PRODUCTION (MGD)	0.3
STORAGE CAPACITY:	1 MG		
CONTACT:	Fred Williamson	PLANT PHONE:	502-333-4453
ADDRESS:	602 W. 6th St. Sturgis, KY 42459	ALT. PHONE:	502-333-2166

COMMENTS: ---

TREATMENT

PROCESS	Y/A		
River		CHEMICALS:	alum, lime, potassium permanganate, PAC, phosphate (as needed), and chlorination (pre- and post-)
Settling	N		
Rapid Mix	Y		
Flocculation	Y	COMMENTS:	Rapid sand/anthracite sand filters
Sedimentation	Y		
Filters	Y		
Clearwell	Y		
Distribution			

UTILITY NAME: **Rosiclaire**
OWNER: **City of Rosiclaire**

MILE POINT:	891.3	STATE: IL COUNTY:	Hardin
INTAKE DEPTH (ft):	15	POPULATION SERVED:	1,800
PLANT CAPACITY (MGD):	0.403	AVG. PRODUCTION (MGD):	0.160
STORAGE CAPACITY:	0.150 MG		
CONTACT:	Norman Cubley	PLANT PHONE:	618-285-6201
ADDRESS:	P.O. Box 608 Rosiclaire, IL 62982	ALT. PHONE:	618-285-3445

COMMENTS: ---

TREATMENT

PROCESS	Y/A		
River		CHEMICALS:	lime, alum, PAC, chlorination, and fluoridation
Settling	N		
Rapid Mix	Y	COMMENTS.	Rapid sand filters.
Flocculation	Y		
Sedimentation	Y		
Filters	Y		
Clearwell	Y		
Distribution			

UTILITY NAME: **Golconda**
OWNER: **City of Golconda**

MILE POINT:	902.5	STATE: IL COUNTY:	Pope
INTAKE DEPTH (ft):	31	POPULATION SERVED:	1,000
PLANT CAPACITY (MGD):	0.369	AVG. PRODUCTION (MGD):	0.1
STORAGE CAPACITY:	0.351 MG		
CONTACT.	Roger Wallace	PLANT PHONE:	618-683-4331
ADDRESS.	Box 511 Golconda, IL 62938	ALT. PHONE:	618-683-3341

COMMENTS. ----

TREATMENT

PROCESS	Y/A		
River		CHEMICALS:	alum, lime, PAC, chlorination (pre- and post-), and fluoridation
Settling	N		
Rapid Mix	Y	COMMENTS:	Rapid sand filters
Flocculation	Y		
Sedimentation	Y		
Filters	Y		
Clearwell	Y		
Distribution			

UTILITY NAME: **Paducah Water Works**
OWNER: **City of Paducah**

MILE POINT:	935.9	STATE: KY COUNTY:	McCracken
INTAKE DEPTH (ft):	16.5	POPULATION SERVED:	55,000
PLANT CAPACITY (MGD):	12.0	AVG. PRODUCTION (MGD):	6.5
STORAGE CAPACITY:	11.3 MG		
CONTACT:	Marvin G. Devers	PLANT PHONE:	502-442-2746
ADDRESS:	P.O. Box 2377 Paducah, KY 42002-2377	ALT. PHONE:	502-442-4747

COMMENTS: ---

TREATMENT

PROCESS	Y/A	
River		CHEMICALS: alum, copper sulfate, PAC, sodium hydroxide, chlorination (pre- and post-), and fluoridation
Settling	N	
Rapid Mix	Y	
Flocculation	Y	COMMENTS:
Sedimentation	Y	
Filters	Y	
Clearwell	Y	
Distribution		

UTILITY NAME: **Cairo**
OWNER: **Illinois-American Water Co.-Southern Division**

MILE POINT:	977 5	STATE: IL COUNTY:	Alexander
INTAKE DEPTH (ft):	10	POPULATION SERVED:	6,000
PLANT CAPACITY (MGD):	4.06	AVG. PRODUCTION (MGD).	1.4
STORAGE CAPACITY:	0 325 MG		
CONTACT:	Herbert Hodges	PLANT PHONE:	618-734-4045
ADDRESS:	618 Commercial Avenue Cairo, IL 62914	ALT. PHONE:	618-734-1211

COMMENTS: ---

TREATMENT

PROCESS	Y/A	
River		CHEMICALS: alum, polymer, PAC, zinc polyphosphate, chlorination (pre- and post-), and fluoridation
Settling	N	
Rapid Mix	Y	
Flocculation	Y	COMMENTS:
Sedimentation	Y	
Filters	Y	
Clearwell	Y	
Distribution		

Ohio River Valley Water Sanitation Commission
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