CHEMICAL DATA FOR WATER SAMPLES COLLECTED DURING FOUR UPRIVER CRUISES ON THE MISSISSIPPI RIVER BETWEEN NEW ORLEANS, LOUISIANA, AND MINNEAPOLIS, MINNESOTA, MAY 1990-APRIL 1992

Edited by John A. Moody

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CONVERSION FACTORS AND ABBREVIATIONS

Multiply	*By*	*To obtain*
	Length	
micrometer (µm)	0.00003937	inch
millimeter (mm)	0.03937	inch
meter (m)	3.281	foot
kilometer (km)	0.6214	mile
	Area	
square meter (m^2)	10.76	square foot
square kilometer (km^2)	0.3861	square mile
	Volume	
microliter (µL)	0.00003382	ounces, fluid
milliliter (mL)	0.03382	ounces, fluid
liter (L)	0.2642	gallon
cubic meter (m^3)	35.31	cubic foot
	Flow	
centimeter per second (cm/s)	0.03281	foot per second
meter per second (m/s)	3.281	foot per second
cubic meter per second (m^3/s)	35.31	cubic foot per second
cubic meter per year (m^3/year)	35.31	cubic foot per year
kilometer per hour (km/h)	0.6214	mile per hour
	Mass	
milligram (mg)	0.00003527	ounce, avoirdupois
gram (g)	0.002205	pound, avoirdupois
metric ton	2,205	pound, avoirdupois
	Temperature	
degree Celsius (°C)	F = 1.8°C + 32	degree Fahrenheit

The following terms and abbreviations also were used in these chapters:

Concentration

gram per milliliter (g/mL)
milligram per liter (mg/L)
microgram per liter (µg/L)
nanogram per liter (ng/L)
parts per million (ppm)
parts per billion (ppb)

The following equations were used to compute loads of chemicals:

concentration (mg/L) × flow (m^3/s) × 8.64×10^{-2} = metric ton per day
concentration (ng/L) × flow (m^3/s) × 8.64×10^{-5} = kilogram per day

CHAPTER 1 - INTRODUCTION

by John A. Moody

ABSTRACT

Surface-water samples were collected approximately every 18 to 28 km relative to the water from a research vessel that was underway 24 hours a day up the Mississippi River from New Orleans, Louisiana, to Minneapolis, Minnesota, in order to study the longitudinal variability of chemicals, the cross-channel variability of chemicals, and the effects of sewage outfalls.

The methods and data for computing the water discharge associated with each sample and the distance between samples collected from a moving vessel on a flowing river are explained and listed in this chapter. The product of this water discharge and the concentration of chemical constituents listed in later chapters gives the approximate flux of these chemicals. The distance between samples in the moving water permits the calculation of chemical gradients and the determination of the spatial scales of the longitudinal chemical variability.

BACKGROUND

The Mississippi River drains about 40 percent of the conterminous United States. At Vicksburg, Miss., it has a mean annual water discharge of about 500 x 10^9 m^3/yr. At 193 river kilometers downstream from Vicksburg, approximately 25 percent of the water discharge is diverted from the Mississippi River into the Atchafalaya River and remaining water is discharged into the Gulf of Mexico.

The Mississippi River consists of the Lower Mississippi River, starting at the mouth of the river at Head of Passes, La. (Lower Mississippi River Mile 0.0), and extending 1,535 km upstream to the mouth of the Ohio River at Cairo, Ill. (Lower Mississippi River Mile 953.8), and the Upper Mississippi River, which begins at the mouth of the Ohio River (Upper Mississippi River Mile 0.0) and extends about 1,360 km upstream to Minneapolis, Minn. (Upper Mississippi River Mile 854). In the Upper Mississippi River, there is a series of 29 navigation locks and dams starting at Upper Mississippi River Mile 185 near St. Louis, Mo. These navigation dams create a series of navigation pools connected by short reaches of free flowing river. The Mississippi River downstream from St. Louis, Mo., is free flowing but has been channelized by the U.S. Army Corps of Engineers.

Between 1987 and 1992, the U.S. Geological Survey investigated the transport of chemical pollutants in the Mississippi River (Leenheer and others, 1989; Meade and Stevens, 1990; Pereira and others, 1990, 1992, 1994; Pereira and Rostad, 1990; Taylor and others, 1990; and Moody and Meade, 1993). The strategy for this investigation was to begin upstream, follow the same water mass downstream, and sample the water mass as it passed selected sites downstream. Logistic constraints (use of a single vessel to sample the tributaries and the Mississippi River and limited time to process samples) resulted in samples being collected ahead of, behind, and within the water mass (Moody, 1993). In order to interpret these samples, a knowledge of the spatial variability of chemicals in the Mississippi River was needed. There are at least 14 tributaries with water discharges greater than 3×10^9 m^3/yr (see table 1.1 and fig. 1.1), which contribute water and a variety of chemicals to the Mississippi River at different times and at different locations along the length of the Mississippi River from Minneapolis, Minn., to New Orleans, La., creating a possibly complicated spatial distribution. The need to understand the spatial variability was the motivation for collecting data at closely spaced intervals along the length of the Mississippi River.

OBJECTIVES OF STUDY

The main objective of this study was to determine the longitudinal spatial variability of selected chemicals in the Mississippi River in order to aid the interpretation of more detailed chemical data collected during 10 downriver sampling cruises between July 1987 and May 1992. Additional objectives were to determine the spatial variability of chemical constituents at different seasons of the year, at different discharges, and at or below sewage outfalls for large municipalities.

Table 1-1.--*Discharge characteristics of some tributaries to the Mississippi River*

[Discharges were taken from the U.S. Geological Survey's water-resources data reports for the appropriate States without adjustment for inflows between the last downstream gaging station and the mouth of the tributary; m^3/yr, cubic meter per year; and %, percent]

Tributary	Period of record	Location of mouth of tributary, in river miles: Upstream from mouth of Ohio River	Location of mouth of tributary, in river miles: Upstream from Head of Passes, La.[1]	Mean annual water discharge (10^9 m^3/yr)	Percent of discharge of Mississippi River downstream from the mouth of the tributary (%)
Minnesota	1934–88	844.0	1,798.0	3.4	34
St. Croix	1902–88	811.5	1,765.3	3.9	25
Chippewa	1928–89	763.4	1,717.2	6.8	28
Black	1931–89	698.2	1,652.0	1.6	6
Wisconsin	1914–89	630.6	1,584.4	7.8	18
Rock	1939–90	479.0	1,432.8	5.5	11
Iowa	1914–89	434.0	1,387.8	6.2	11
Skunk	1914–89	395.7	1,349.5	2.2	4
Des Moines	1912–89	361.4	1,315.2	5.2	8
Illinois	1938–89	218.0	1,171.8	19.6	24
Missouri	1897–89	195.3	1,149.1	72.0	43
Kaskaskia	1969–90	117.3	1,071.1	3.3	2
Ohio	1928–90	0.0	953.8	243.1	57
White	1949–70	--	598.8	23.3	5
Arkansas	1927–89	--	581.5	37.4	7
Yazoo[2]	1969–89	--	437.2	12.3	2
TOTAL				453.6	

[1]Head of Passes is where the mouth of the Mississippi River divides into three channels or passes.

[2]Data provided by Henry Noble, U.S. Army Corps of Engineers, Vicksburg District.

Figure 1.1.--Mississippi River and some of its tributaries.

PURPOSE AND SCOPE

The purpose of this report is to publish in one volume the sampling and analytical procedures as well as the large set of chemical data. The chemical data included in this report are specific conductance, triazine and acetanilide herbicides, nutrients (NO_3, PO_4, NH_4, and NO_2), mercury, major and trace elements, and organic compounds with special emphasis on sewage-derived contaminants.

The report contains data from four upriver cruises. The cruise dates and the reaches of the Mississippi River that were sampled are listed in table 1.2. During the first cruise (May-June 1990) sampling was done on the Lower Mississippi River and part of the Upper Mississippi River to the mouth of the Illinois River. The first cruise comprised three parts—May 26 to May 29, 1990, June 4 to June 6, 1990, and June 9 to June 10, 1990. During the other three upriver cruises (June-July 1991, September-October 1991, and March-April 1992) sampling was done on both the Lower and Upper Mississippi Rivers, which included about 2,900 river kilometers.

Table 1-2.--*Upriver cruise names, dates, and the reaches of the Mississippi River that were sampled*

Cruise name	Dates	River reach
May-June 1990	May 26–29, 1990	Baton Rouge, La., to Cairo, Ill.
	June 4–6, 1990	Cairo, Ill., to mouth of Illinois River
	June 9–10, 1990	Mouth of Missouri River to St. Charles, Mo.
June-July 1991	June 23-July 2, 1991	Baton Rouge, La., to Minneapolis, Minn.
September-October 1991	Sept. 25-Oct. 4, 1991	New Orleans, La., to Minneapolis, Minn.
March-April 1992	March 24-April 4, 1992	New Orleans, La., to Minneapolis, Minn.

SAMPLING LOCATIONS

The spatial variability of chemicals in the Mississippi River was determined by collecting water samples at about 16-km intervals (this corresponds to 10 river-mile intervals on the navigation charts). Water samples were collected as close as possible to the midpoint of the river from the 17-m research vessel *ACADIANA*, which is operated by the Louisiana Universities Marine Consortium. The vessel traveled upriver at 11-14 km/h and was underway 24 hours per day, stopping only for fuel and locking through navigation dams, so that a nearly equally spaced sampling interval was maintained relative to the water in the river channel. The midpoint of the river was determined by the ship's radar, but this point was not always at the centroid of flow because of the asymmetry of the channel, which changed between meander bends. During the first three upriver cruises, three to five additional water samples were collected across the river at about every 160 km, or downstream from major tributaries, to determine the cross-channel variability and hence the degree of lateral mixing. During the last cruise (March-April 1992), this strategy was changed to determine the degree of heterogeneity downstream from river confluences or to detect the influence of sewage outfalls at or downstream from large municipalities. Cross-channel variability was not assessed in well-mixed reaches of the river as it had been during the first three upriver cruises. Samples from tributaries were collected either by going up the tributary a short distance (if the tributary was navigable—Yazoo, White, Ohio, Missouri, Illinois, and St. Croix) or by positioning the vessel as close as possible to the riverbank just downstream from the mouth of the tributary.

Because the water samples were collected at about 16-km intervals while the river was flowing between 2 and 8 km/h, the water samples were actually spaced about 18 to 24 km apart relative to the moving water. The spacing between some samples may be greater than 24 km because the vessel was stopped for a few hours to refuel or lock through a navigation dam.

In this report, the samples are located by two distances: (1) The river navigation distance where the sample was collected (measured in miles upstream from the mouth of the Mississippi River at Head of Passes, La., upstream from the mouth of the Ohio River at Cairo, Ill., or upstream from the mouth of the Missouri River) and (2) the relative distance with respect to the moving water (measured in kilometers from a starting point which was arbitarily chosen as the location of the first sample). This relative distance would be the same as the distance between samples collected at a fixed location at regular time intervals. A good example of the difference in the two distances is in the listings for the cruise up the Missouri River on June 9–10, 1990 (see table 2.6, chapter 2). While going upstream, the research vessel encountered enormous amounts of debris that clogged the cooling-water intakes for the engines and forced the vessel to stop, go back downstream, and tie up to a dock for a day of repairs. If the data were plotted versus the river navigation distance, 11 samples would be plotted at Mile 28.0; however, if the samples are plotted versus the relative distance, the samples would span a distance of 138 kilometers.

The water velocities used to calculate the relative distance were based on either stage or discharge measurements made at established stream-gaging stations. The regression equations used to calculate the water velocity are in table 1.3. Velocities for the stream-gaging stations located within each reach were averaged to give the reach-averaged velocities listed in table 1.4. Because the stream-gaging stations are commonly in narrow, stable reaches of the river, these estimated velocities may have a bias error and be larger than the reach-averaged velocity. In the free-flowing lower Mississippi River, velocities (which range from about 2 to 8 km/h) may have a bias error as much as 20 percent larger than reach-averaged velocities, so the error in values of the relative distance between samples might be on the order of 2 km. In the reach of the Upper Mississippi River, the stream-gaging stations are usually just downstream from a navigation dam where the river has a small cross-sectional area, and the velocities may have a bias error as much as 50 percent larger than the reach-averaged velocity for the entire pool. Velocities in this reach of the Upper Mississippi River are less than one-half those in the Mississippi River downstream from St. Louis, Mo., so the bias error in the relative distance between samples would also be on the order of 2 km. The relative distance provides a more accurate measure of chemical gradients in the river and gives a pseudosynoptic picture of the longitudinal variability of chemicals in the Mississippi River. The upriver cruise data, however, have been plotted using the river navigation distance so the effects of tributary inflow can be compared when all cruises are plotted on the same graph—using relative distance places the mouth of a tributary in a different location on each cruise depending upon the starting point, water velocity, and velocity of the research vessel.

Table 1.3.--*Regression equations relating cross-sectional averaged velocity to discharge or stage for stream-gaging stations on the Mississippi River*

[N, number measurements in regression equation; R^2, coefficient of determination; V, velocity in kilometer per hour; S, stage in meters; and Q, discharge in cubic meters per second]

River mile	Site name	N	R^2	Equation
	Upstream from Head of Passes, La.			
230	Baton Rouge, La.	31	0.87	$V = 0.514S + 0.69$
306	Tarbert Landing, Miss.[1]	43	0.93	$V = 0.230S + 2.08$
363	Natchez, Miss.	45	0.96	$V = 0.367S + 1.32$
436	Vicksburg, Miss.	45	0.93	$V = 0.413S + 3.14$
566	Arkansas City, Ark.	35	0.96	$V = 0.476S + 2.35$
663	Helena, Ark.	41	0.92	$V = 0.384S + 3.41$
735	Memphis, Tenn.	36	0.93	$V = 0.512S + 4.19$
918	Hickman, Ky.	36	0.91	$V = 0.364S + 2.63$
	Upstream from the mouth of the Ohio River			
44	Thebes, Ill.	37	0.94	$V = 0.361S + 2.58$
110	Chester, Ill.	25	0.92	$V = 0.436S + 3.24$
179	St. Louis, Mo.	39	0.94	$V = 0.443S + 2.84$
217	Grafton, Ill.	32	0.99	$V = 0.00067Q + 0.04$
364	Keokuk, Iowa	18	0.90	$V = 0.069Q^{1/2} + 0.31$
512	Clinton, Iowa	36	0.94	$V = 0.061Q^{1/2} - 0.54$
633	McGregor, Iowa	34	0.93	$V = 0.043Q^{1/2} - 0.21$
811	Prescott, Wis.	18	0.88	$V = 0.00091Q + 0.90$
	Upstream from the mouth of the Missouri River			
98	Hermann, Mo.	25	0.90	$V = 0.436 S + 2.67$

[1]Stage is at Red River Landing, La. (Mile 302), and discharge and mean velocity are measured at Tarbert Landing, Miss. (Mile 306).

Table 1.4.--*Water velocities used to calculate distance between sampling points relative to the moving water*

[km/h, kilometer per hour; LMR, Lower Mississippi River mile measured upstream from the mouth of the Mississippi River at Head of Passes; UMR, Upper Mississippi River mile measured upstream from the mouth of the Ohio River; MO, Missouri River mile measured upstream from mouth of the Missouri River]

Cruise dates	Water velocity[1] (km/h)	River reach (river miles)
	May-June 1990 Cruise	
May 26–29, 1990	5.8	LMR Mile 230–315
	8.3	LMR Mile 315–581
	8.0	LMR Mile 581–954
June 4–6, 1990	6.2	UMR Mile 0–195
	3.8	UMR Mile 195–218
June 9–10, 1990	5.9	MO Mile 0–40
	June-July 1991 Cruise	
June 23–27, 1991	4.8	LMR Mile 230–566
	5.7	LMR Mile 566–735
	4.5	LMR Mile 735–954
June 27-July 2, 1991	5.5	UMR Mile 0–195
	3.6	UMR Mile 195–361
	2.9	UMR Mile 361–631
	2.1	UMR Mile 631–703
	1.9	UMR Mile 703–844
	September-October 1991 Cruise	
September 24–29, 1991	1.8	LMR Mile 89–315
	3.3	LMR Mile 315–954
September 30-October 4, 1991	3.9	UMR Mile 0–195
	2.0	UMR Mile 195–361
	2.1	UMR Mile 361–631
	1.4	UMR Mile 631–703
	1.2	UMR Mile 703–844
	March-April 1992 Cruise	
March 25–30, 1992	5.1	LMR Mile 89–315
	5.7	LMR Mile 315–400
	6.9	LMR Mile 400–700
	5.7	LMR Mile 700–954
March 31-April 5, 1992	5.5	UMR Mile 0–195
	4.1	UMR Mile 195–361
	3.7	UMR Mile 361–434
	2.6	UMR Mile 434–631
	1.8	UMR Mile 631–844

[1]Velocities are calculated from regression equations in table 1.3 and averaged for the stream-gaging stations located within the reach given in the last column.

WATER DISCHARGES

In order to calculate the flux of chemicals (in metric tons per day or kilograms per day), the water discharge is listed in table 1.5 at gaging stations on the Mississippi River for the day the research vessel passed the gaging station. Discharges at the mouths of the tributaries are the water discharges at the gaging stations closest to the mouths of the tributaries for the day the research vessel passed the mouth. Discharges for sampling locations between gaging stations have been computed by linear interpolation between stations or between a station and the mouth of a tributary (see fig. 1.2). Because discharge values are interpolated and because there were no measured discharges at the mouth of each tributary, the discharges listed in each table of chemical data in this report are accurate to about 200 m^3/s.

Table 1.5.--***Water discharge of the Mississippi River at gaging stations between New Orleans, La., and Minneapolis, Minn., May 1990-April 1992***

[Discharges are given for the day the research vessel passed the location; m^3/s, cubic meter per second; NA, not applicable; ~, approximate; negative discharge represents a diversion of water from the Mississippi River to the Atchafalaya River]

Location	River mile: Upstream from mouth of Ohio R.	River mile: Upstream from Head of Passes, La.	Water discharge (m^3/s): May-June 1990	Water discharge (m^3/s): June-July 1991	Water discharge (m^3/s): September-October 1991	Water discharge (m^3/s): March-April 1992
			Lower Mississippi River			
Baton Rouge, La.[1]	NA	230	26,000	16,000	4,500	22,300
Tarbert Landing, Miss.[2]	NA	306	27,800	16,500	6,200	21,400
Old River Outflow[2]	NA	315	-5,500	-2,300	-1,400	-4,700
Natchez, Miss.[3]	NA	363	33,000	17,600	7,200	25,200
Vicksburg, Miss.[3]	NA	436	33,700	16,900	7,100	26,100
Mouth of Yazoo R.[13]	NA	437	~480	~2,000	~440	~340
Arkansas City, Ark.[3]	NA	566	36,300	15,600	6,200	26,400
Mouth of Arkansas R.[14]	NA	581	4,600	480	0	1,100
Mouth of White R.[4]	NA	599	1,600	750	200	1,100
Helena, Ark.[4]	NA	663	29,900	13,700	5,600	23,000
Memphis, Tenn.[4]	NA	735	31,700	13,400	5,600	23,300
Hickman, Ky.[4]	NA	918	29,900	11,400	5,500	17,400
Mouth of Ohio R.[5]	0	954	16,600	4,000	1,800	8,900
			Upper Mississippi River			
Thebes, Ill.[6]	44	998	12,300	7,800	3,700	7,600
Mouth of Kaskaskia R.[7]	117	1,071	300	20	5	160
St. Louis, Mo.[6]	179	1,133	8,500	7,300	3,200	7,800
Mouth of Missouri R.[6]	195	1,149				
June 05			3,300	1,800	1,100	2,100
June 06			3,400	NA	NA	NA
June 09			6,500	NA	NA	NA
June 10			6,900	NA	NA	NA
Grafton, Ill.[6]	217	1,171	5,500	5,400	2,000	6,000
Mouth of Illinois R.[7]	218	1,172	1,300	370	140	680
Lock & Dam 24[8]	273	1,227	NA	4,600	2,000	4,100
Lock & Dam 22[9]	301	1,255	NA	4,400	2,100	4,000
Lock & Dam 21[9]	325	1,279	NA	3,900	2,000	3,600
Lock & Dam 20[9]	343	1,297	NA	4,000	1,800	3,500
Mouth of Des Moines R.[15]	361	1,315	NA	940	30	330
Lock & Dam 19[9]	364	1,318	NA	3,000	1,800	3,400
Lock & Dam 18[9]	411	1,365	NA	3,000	1,600	3,400

Table 1.5.--*Water discharge of the Mississippi River at gaging stations between New Orleans, La., and Minneapolis, Minn., May 1990-April 1992--Continued*

Location	River mile: Upstream from mouth of Ohio R.	River mile: Upstream from Head of Passes, La.	Water discharge (m^3/s): May-June 1990	June-July 1991	September-October 1991	March-April 1992
		Upper Mississippi River--Continued				
Mouth of Iowa R.[15]	434	1,388	NA	460	83	300
Lock & Dam 17[9]	437	1,391	NA	2,400	1,600	2,800
Lock & Dam 16[9]	457	1,411	NA	2,500	1,500	2,900
Mouth of Rock R.[7]	479	1,433	NA	130	80	240
Lock & Dam 14[9]	493	1,447	NA	2,600	1,400	2,600
Lock & Dam 13[9]	523	1,477	NA	2,300	1,300	2,700
Lock & Dam 12[9]	557	1,511	NA	2,300	1,300	2,700
Lock & Dam 11[9]	583	1,537	NA	2,300	1,300	2,700
Lock & Dam 10[10]	615	1,569	NA	2,300	1,200	2,600
Mouth of Wisconsin R.[11]	631	1,585	NA	180	140	380
Lock & Dam 9[10]	648	1,602	NA	1,800	1,000	2,200
Lock & Dam 8[10]	679	1,633	NA	1,800	1,000	2,000
Lock & Dam 7[10]	703	1,657	NA	1,600	940	1,900
Lock & Dam 6[10]	714	1,668	NA	1,600	930	1,700
Lock & Dam 5A[10]	729	1,683	NA	not available	940	1,700
Lock & Dam 5[10]	738	1,692	NA	1,600	940	1,800
Lock & Dam 4[10]	753	1,707	NA	1,600	900	1,700
Mouth of Chippewa R.[11]	763	1,717	NA	230	130	340
Lock & Dam 3[10]	797	1,751	NA	1,100	580	1,000
Mouth of St. Croix R.[11]	811	1,765	NA	~100	100	260
Lock & Dam 2[10]	815	1,769	NA	1,000	340	680
Mouth of Minnesota R.[12]	844	1,798	NA	~630	140	290
Lock & Dam 1[10]	848	1,802	NA	410	230	300

[1] Estimated from stage-discharge relation based on 47 measurements.
[2] U.S. Army Corps of Engineers, New Orleans District.
[3] U.S. Army Corps of Engineers, Vicksburg District.
[4] U.S. Army Corps of Engineers, Memphis District.
[5] U.S. Geological Survey, Ohio R. at Metropolis, Ill.
[6] U.S. Geological Survey, Missouri R. at Hermann, Mo.
[7] U.S. Geological Survey, Illinois R. at Valley City, Ill.; Rock R. near Joslin, Ill.; Kaskaskia R. near Venedy Station, Ill.
[8] U.S. Army Corps of Engineers, St. Louis District.
[9] U.S. Army Corps of Engineers Rock Island District, Lock and Dam 11 through 22.
[10] U.S. Army Corps of Engineers, St. Paul District, Lock and Dam 10 through 1.
[11] U.S. Geological Survey, St. Croix R. at St. Croix Falls, Wis.; Chippewa R. at Durand, Wis.; Wisconsin R. at Muscoda, Wis.
[12] U.S. Geological Survey, Minnesota R. at Jordan, Minn.
[13] Discharge measurement at Redwood, Miss., which is closest to the date the research vessel passed the mouth plus measured discharge of Steele Bayou (no measurements for May 1990 and September 1991).
[14] U.S. Army Corps of Engineers, Little Rock District, Arkansas R. at Dam 2, Ark.
[15] U.S. Geological Survey, Des Moines R. at Keosauqua, Iowa., Iowa R. at Wapello, Iowa.

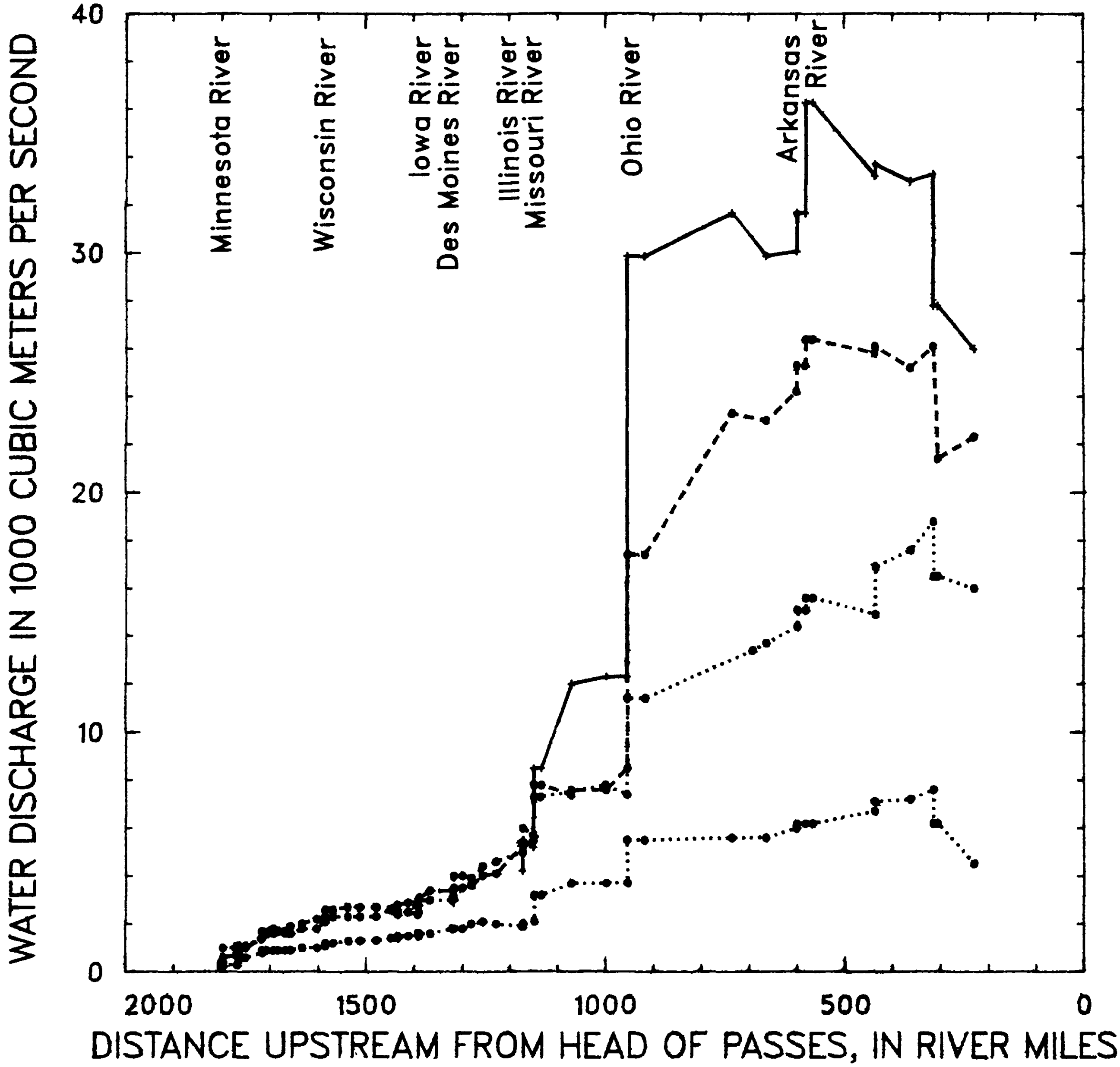

Figure 1.2.--Water discharge in the Mississippi River as a function of distance upstream from Head of Passes, La., for cruises in May-June 1990 (+'s connected by solid line), June-July 1991 (solid line), September-October 1991 (dotted line), and March-April 1992 (dashed line). The increase in discharge near river mile 300 is the result of passing the Old River Outflow Channel which diverts about 25 percent of the Mississippi River water into the Atchafalaya River and the decrease in discharge near river mile 1,000 is the result of passing the Ohio River. Other steplike decreases are the result of passing other tributaries.

SPECIFIC CONDUCTANCE AND TEMPERATURE

Specific conductance of the water samples on the first upriver sampling cruise in May-June 1990 was measured with an Amberscience conductivity meter (model 640) having a resolution of ±1 µS/cm. For the last three cruises, temperature and specific conductance of the water samples were measured with a LabComp model SCT-100 conductivity meter. Specific conductances measured by the meter were checked against a laboratory standard eight times between June 1991 and April 1992 and agreed within 5 µS/cm. The time between collecting the sample and measuring the temperature was sometimes as long as 20 minutes, so that temperatures are listed in the tables to the nearest degree and are included to indicate only general trends. Changes of 1 to 2 degrees Celsius between samples are not significant. Longitudinal variability of specific conductance and temperature are shown in figure 1.3 and 1.4 for all the upriver cruises. A more detailed description of the sampling and analytical procedures for each group of chemical compounds is in each of the following chapters.

ACKNOWLEDGMENTS

Collecting water samples 24 hours per day required a special alertness on the part of captains Wayne Simoneaux and Craig LeBoeuf, and crew, George Collier, Bob Cutting, Chuck Guidry, Jean Hough, and Suzanne Moody, of the research vessel ACADIANA to avoid numerous 30-barge tows headed downriver at night in clear and foggy weather. On some upriver cruises in the spring, they had to avoid tires, refrigerators, logs, and whole trees being carried downstream. A group of volunteers, Lesly Conaway, Dolly Dieter, Don Kelly, Ted Noyes, Dick Martin, John Sullivan, and Harold Wiegner, headed by Bob Meade, stood deck watches to assist the captains and crew in navigating upriver in all weather and river conditions. Ron Rathbun, Ted Noyes, and Wes Campbell stood scientific watches on some or all cruises to assist the authors of this report in collecting the water samples.

Water-discharge data at locations not measured by the U.S. Geological Survey were supplied by Whit Barton, Gordon Heitzman, Bill Koelner, Ray Kopsky, John Miller, Henry Noble, and Bob Walker from the U.S. Army Corps of Engineers. Verification of the calculated "relative distance from the first sample" and the interpolated discharges for all the tables in this report was a major task done thoroughly by William T. Moody, a volunteer.

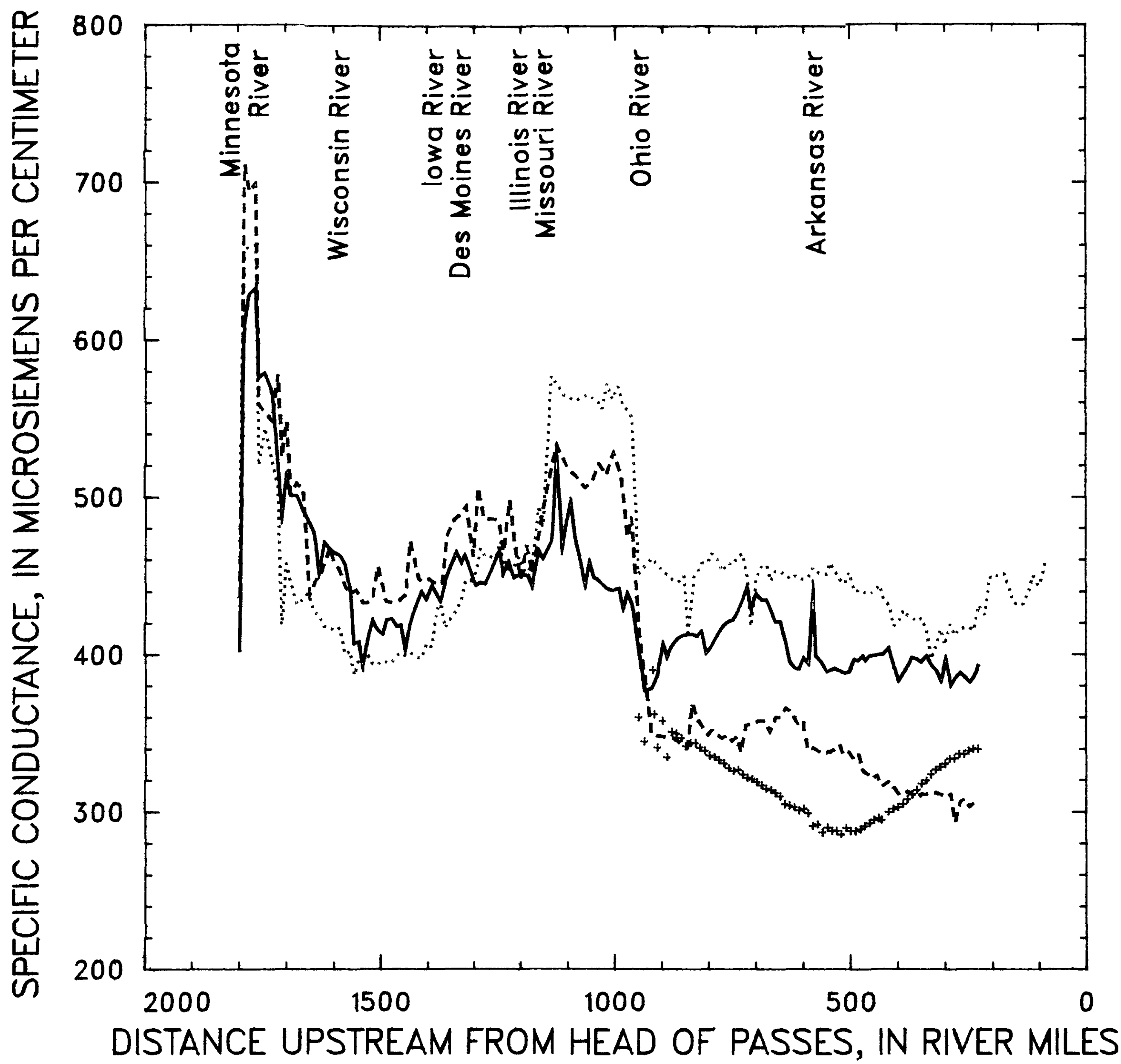

Figure 1.3.--Longitudinal variability of surface specific conductance in the Mississippi River as a function of distance upstream from Head of Passes, La., for cruises in May-June 1990 (+'s), June-July 1991 (solid line), September-October 1991 (dotted line), and March-April 1992 (dashed line). The increase near river mile 1,000 is a result of passing the Ohio River and the sudden decrease near river mile 1,800 is a result of passing the Minnesota River.

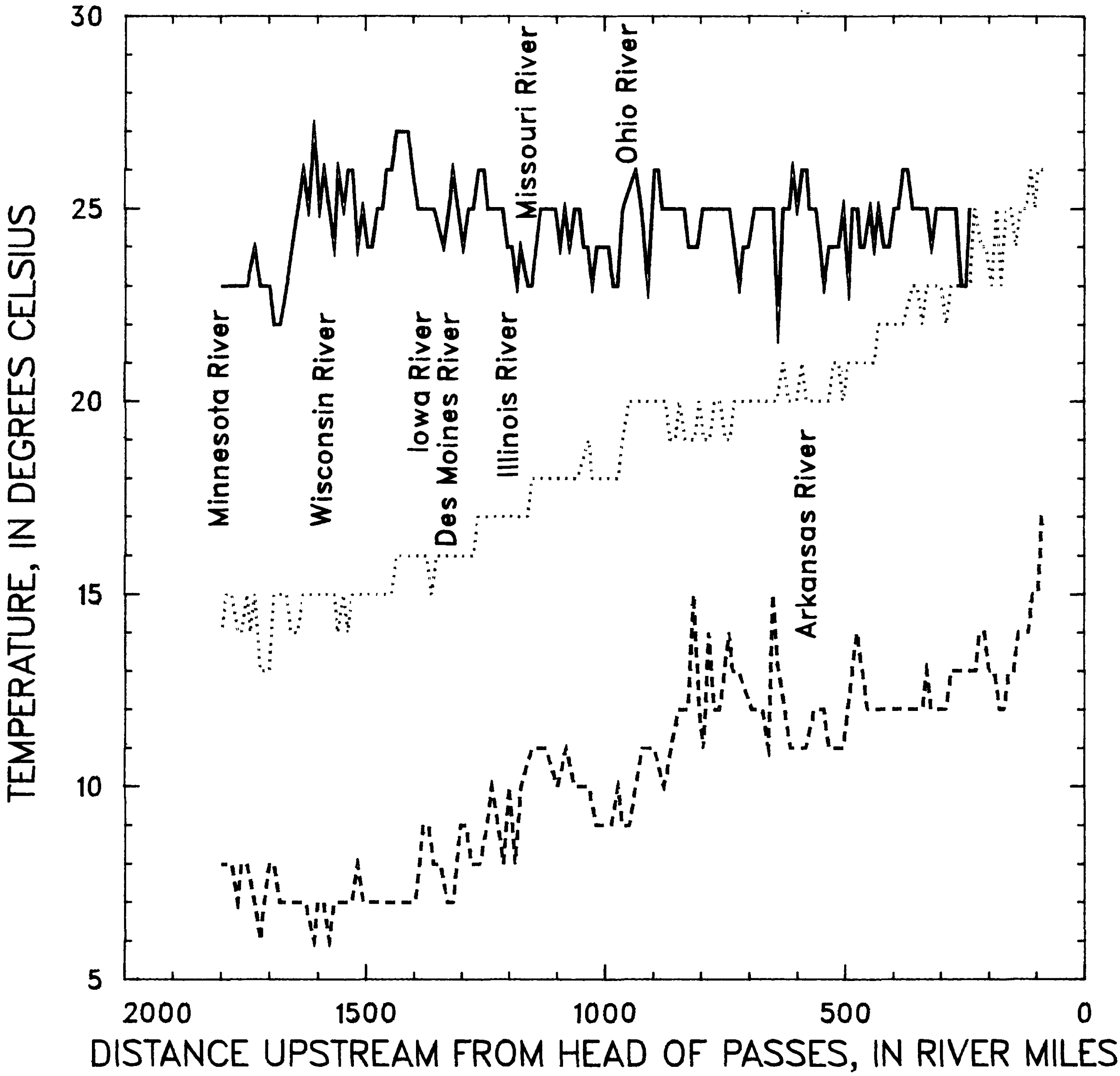

Figure 1.4.--Longitudinal variability of surface temperature in the Mississippi River as a function of distance upstream from Head of Passes, La., for cruises in June-July 1991 (solid line), September-October 1991 (dotted line), and March-April 1992 (dashed line).

REFERENCES

Leenheer, J.A., Meade, R.H., Taylor, H.E., and Pereira, W.E., 1989, Sampling, fractionation, and dewatering of suspended sediment from the Mississippi River for geochemical and trace-contaminant analysis, in Mallard, G.E., and Ragone, S.E., eds., U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings of the Technical Meeting, Phoenix, Arizona, September 26–30, 1988: U.S. Geological Survey Water-Resources Investigations Report 88-4420, p. 501–512.

Meade, R.H., and Stevens, H.H., Jr., 1990, Strategies and equipment for sampling suspended sediment and associated toxic chemicals in large rivers—with emphasis on the Mississippi River: Science of the Total Environment, v. 97/98, p. 125–135.

Moody, J.A., 1993, Evaluation of the Lagrangian scheme for collecting water samples from the Mississippi River during 1987–90: U.S. Geological Survey Water-Resources Investigations Report 93-4042, 31 p.

Moody, J.A., and Meade, R.H., 1992, Hydrologic and sedimentologic data collected during three cruises at low water on the Mississippi River and some of its tributaries, July 1987-June 1988: U.S. Geological Survey Open-File Report 91-485, 143 p.

Moody, J.A., and Meade, R.H., 1993, Hydrologic and sedimentologic data collected during four cruises at high water on the Mississippi River and some of its tributaries, March 1989-June 1990: U.S. Geological Survey Open-File Report 92-651, 227 p.

Pereira, W.E., and Rostad, C.E., 1990, Occurrence, distribution, and transport of herbicides and their degradation products in the Lower Mississippi River and its tributaries: Environmental Science and Technology, v. 24, no. 9, p. 1400–1406.

Pereira, W.E., Rostad, C.E., and Leiker, T.J., 1990, Distribution of agrochemicals in the Lower Mississippi River and its tributaries: Science of the Total Environment, v. 97/98, p. 41–53.

Pereira, W.E., Rostad, C.E., and Leiker, T.J., 1992, Synthetic organic agrochemicals in the lower Mississippi River and its major tributaries—Distribution, transport and fate: Journal of Contaminant Hydrology, v. 9, p. 175–188.

Pereira, W.E., Moody, J.A., Hostettler, F.D., Rostad, C.B., and Leiker, T.J., 1994, Concentrations and mass transport of pesticides and organic contaminants in the Mississippi River and some of its tributaries, 1987–89 and 1991–92: U.S. Geological Survey Open-File Report, 94-376, p. 149.

Stall, J.B., and Hiestand, D.W., 1969, Provisional time-of-travel for Illinois streams: Urbana, Illinois State Water Survey, Report of Investigation 63, 31 p.

Taylor, H.E., Garbarino, J.R., and Brinton, T.I., 1990, The occurrence and distribution of trace metals in the Mississippi River and its tributaries: The Science of the Total Environment, v. 97/98, p. 369–384.

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CHAPTER 2 - DISSOLVED HERBICIDES

by Donald A. Goolsby

ABSTRACT

The longitudinal variability of dissolved triazine herbicides in the Mississippi River was determined on four upriver cruises during May 1990 through April 1992. The first cruise was from Baton Rouge., La., to Grafton, Ill. The remaining three cruises were from near New Orleans, La., to Minneapolis, Minn., about 2,900 river kilometers above the mouth of the Mississippi River. The concentration and longitudinal variability of dissolved triazine herbicides in the Mississippi River were determined by a combination of immunoassay analysis by microtiter plate and magnetic particle methods and by gas chromatography and mass spectrometry.

INTRODUCTION

The majority of all herbicides used in the United States are applied to cropland in the Mississippi River basin to control weeds and grasses in the production of corn, sorghum, soybeans, and wheat. Based on data compiled by Gianessi and Puffer (1991), it is estimated that more than 100,000 metric tons (t) of herbicides are applied annually to cropland in the Mississippi River basin. A small fraction, generally less than 5 percent, of these herbicides is typically flushed into midwestern streams by runoff from storms in late spring and summer after herbicides are applied (Goolsby, Thurman, and Kolpin, 1991, Goolsby, Coupe, and Markovchick, 1991; Goolsby and Battaglin, 1993; Thurman and others, 1991, 1992). Herbicide concentrations in some midwestern streams exceed 50 micrograms per liter (μg/L) for short periods of time during storm runoff. These pulses of water that contain high concentrations and loads of herbicides are transported from small streams into large rivers and eventually into the Mississippi River. Moody and Goolsby (1993) hypothesized that the discharge of these pulses of water would result in a patchy longitudinal distribution of herbicides in the Mississippi River. To test this hypothesis, water samples were collected at frequent intervals along a 1,900 km reach of the Mississippi River from Baton Rouge, La., to Cairo, Ill. (fig 1.1), during May and June 1990. Results from these samples confirmed the hypothesis of a patchy longitudinal distribution (Moody and Goolsby, 1993). Three additional upriver cruises of the Mississippi River from the New Orleans, La., vicinity to Minneapolis, Minn., were undertaken during June 1991 through April 1992 to investigate the longitudinal variability of herbicides in other seasons of the year and at different flow conditions.

The purpose of this chapter is to present a description of the methods used to collect and analyze the water samples for dissolved herbicides, and to evaluate of the precision of the analytical results. This chapter also includes a tabulation of all data collected during the four cruises and presents the results from the four cruises in graphic form. Results from the May-June 1990 cruise have been discussed by Moody and Goolsby (1993). Some of the results from the three remaining cruises are discussed in Goolsby and Pereira (in press).

SAMPLE COLLECTION AND PROCESSING METHODS

The longitudinal variability of herbicides in the Mississippi River was investigated from water samples collected at intervals of about 16 km. Water samples were collected in non-contaminating glass or Teflon bottles from the upper two meters of the river at approximately midchannel. At intervals of about 160 km, water samples were collected at 3 or 5 locations across the river depending on proximity to tributaries, to examine cross-channel variability in herbicides. Cross-channel samples were collected at locations at about 10, 50, and 90 percent of the river's width, or at about 10, 30, 50, 70, and 90 percent of the river's width. Samples also were collected in or immediately downstream from the mouths of some tributaries (see table 1.1). Except for the first cruise (May-June 1990), all water samples were filtered immediately after collection through 142-mm diameter glass-fiber filters having a nominal pore size of about 0.7 µm. Filtration was accomplished with a 142-mm diameter aluminum-plate filter holder, a battery-powered ceramic-piston fluid-metering pump, and convoluted Teflon connecting tubing. Sample collection and filtration equipment was rinsed about once per day with methanol. Filters, precleaned by baking at several hundred degrees Celsius, were leached with 100–200 mL of sample, and the filtrate was collected in precleaned 125-mL amber baked-glass bottles. Samples were refrigerated until analyzed. Samples from the May-June 1990 upriver cruise were refrigerated and analyzed by immunoassay without filtration. Ten to twenty percent of the samples from each cruise were selected for analysis and confirmation of selected herbicides by gas chromatography and mass spectrometry (GC/MS). Samples from the May-June 1990 cruise were filtered through glass-fiber filters prior to GC/MS analysis.

ANALYTICAL METHODS

A combination of analytical methods was used to analyze water samples from the four Mississippi River upriver cruises. Relatively inexpensive enzyme-linked immunosorbent assay methods, referred to hereafter as immunoassay, were used to analyze all samples. These methods were used to obtain semiquantitative results for atrazine, the most heavily used and most persistent herbicide in the basin (Goolsby and Battaglin, 1993), and to provide highly detailed profiles of atrazine concentration and atrazine flux along the Mississippi River. Immunoassay methods also were used in an attempt to obtain semiquantitative results for alachlor, the second most heavily used herbicide in the Mississippi River basin. Although unsuccessful, the alachlor immunoassay did provide important information on the longitudinal variability of a major alachlor metabolite. Ten to twenty percent of the samples from each cruise were subsequently analyzed by GC/MS for eleven herbicides and two herbicide metabolites. The GC/MS results for atrazine were regressed against the triazine immunoassay results in order to obtain reliable estimates of the atrazine concentration in all samples.

Immunoassay Methods

Two immunoassay methods for atrazine were used and compared. These methods were based on coated microtiter plates and coated magnetic particles. Both immunoassay methods work on the same principle. The microtiter plate and the colloidal magnetic particles are coated with specific antibodies that bind to the herbicide of interest. For example, the atrazine antibody binds only to atrazine and other compounds that have a chemical structure very similar to atrazine. A small amount of water sample (200 μL or less) is added to a well on the antibody-coated microtiter plate or to a test tube containing a suspension of antibody-coated magnetic particles. Within about 3 minutes, a small amount of an enzyme conjugate reagent is mixed with the sample. This reagent is the herbicide of interest, for example, atrazine, to which an enzyme has been chemically bound. The herbicide-enzyme conjugate and the herbicide of interest compete for the limited number of antibody binding sites in the well or test tube. After a specified period of time, the water sample and unreacted herbicide-enzyme conjugate are removed from the well or the test tube, leaving behind the antibody-bound atrazine and antibody-bound herbicide-enzyme conjugate. A second reagent, consisting of an enzyme substrate and a chromogen, is then added which reacts with the enzyme attached to the herbicide-enzyme conjugate to produce a blue color that is inversely proportional to the amount of herbicide in the water sample. In the absence of the herbicide of interest, much of the enzyme conjugate binds to the antibody and reacts with the substrate and the chromogen to produce a deep blue color. The more atrazine, or other herbicide of interest, present in the water sample the less the herbicide-enzyme conjugate will bind and the lighter the color will be. After a specified period of time, a small amount of dilute sulfuric acid is added to stop the reaction. A relatively stable yellow color develops and the optical density of the color is measured with a colorimeter or spectrophotometer and results are quantified. The following sections briefly describe the two immunoassay methods used in this study.

Microtiter Plate Immunoassay Method

All water samples from the first three cruises were analyzed for triazine herbicides by a microtiter plate method onboard the research vessel, or in the U.S. Geological Survey Laboratory in Lawrence, Kansas. The term triazine, rather than atrazine, is used because several other triazine herbicides can react to a small degree in the test. In addition, water samples from September-October 1991 and March-April 1992 cruises were analyzed on the alachlor microtiter plates. Because of a high degree of cross reactivity with alachlor metabolites, the term acetanilides is used to classify the results from this test. Samples were analyzed in duplicate on antibody-coated microtiter plates according to the manufacturer's instructions which accompanied the plates and reagents (ImmunoSystems, Scarborough, Maine). A calibration curve was obtained from three standards containing known concentrations of atrazine or alachlor and a negative control or zero concentration solution. Each standard was measured in triplicate and the average optical density was used. A calibration curve was constructed by plotting the ratios of the optical densities of the standards to the optical density of the negative control (percent inhibition) verses concentration of the standards. Optical density measurements and quantification of results were obtained with either a microtiter plate strip reader (Bio-Tek model EL301; BioTek Instruments, Winooski, Vt.) onboard the vessel, or with a plate reader (Molecular Devices Inc., Menlo Park, California, model VMAX) in the Lawrence, Kansas, laboratory. The optimum range of the calibration curve was 0.1 to 3 μg/L. Samples having concentrations greater than 3 μg/L were diluted and reanalyzed.

The immunoassay method primarily measures atrazine, but the test also has a small degree of cross reactivity with several other triazine herbicides as shown in table 2.1. The concentration for 50 percent inhibition (IC_{50}) is a measure of the sensitivity of the immunoassay (table 2.1). Because concentration is inversely proportional to optical density, IC_{50} is the concentration that causes a 50 percent reduction in the optical density of the sample relative to a blank or negative control. The lower the IC_{50}, the more sensitive the immunoassay is to a particular herbicide. Similarly, the least detectable dose (LDD) is a measure of the lowest concentration that can be quantified. This is typically defined as an optical density that is 90 percent of that of the negative control. Fortunately for this study, triazine herbicides (other than atrazine) that have significant cross reactivity in the immunoassay method, occur in low concentrations in the Mississippi River basin relative to atrazine (Thurman and others, 1991, 1992); therefore, the response from the immunoassay method is caused primarily by atrazine. Humic and fulvic acids at concentrations of 5 to 100 mg/L have been shown to have no effect on atrazine response in the immunoassay method (Thurman and others, 1990).

The alachlor immunoassay responds not only to alachlor but also has a significant response to alachlor metabolites, particularly the ethane sulfonic acid (ESA) soil metabolite (Baker and others, 1993). This makes the immunoassay unsuitable for quantification of alachlor concentrations, but provides an indirect measure of ESA. A quantitative method for ESA has been developed based on this cross reactivity (Aga and others, 1994).

Table 2.1.--*Cross reactivity for triazine herbicides using the microtiter plate immunoassay method*

[%, percent; μg/L, microgram per liter; LDD, lowest detectable dose; Source 1, manufacturer's literature; Source 2, M.L. Pomes, U.S. Geological Survey, Lawrence, Kansas, written communication, June 1994; inhibition refers to a comparison of the optical density of the sample to the optical density of a negative control or blank; --, no data; and <, less than]

Compound	Concentration for 50% inhibition, IC_{50} (μg/L)		Concentration for LDD - 90% inhibition (μg/L)	
	Source 1	Source 2	Source 1	Source 2
Atrazine	0.25	0.42	0.02	0.02
Ametryn	3.0	--	0.04	--
Propazine	0.60	0.49	0.10	0.03
Prometryn	0.40	--	0.04	--
Prometon	1.00	1.46	0.01	0.06
Simazine	0.30	3.13	<0.01	0.23
Cyanazine	20.	31	1.0	1.0
Desethylatrazine	17.	8.7	1.5	0.12
Hydroxyatrazine	50.	--	4.0	--

Magnetic Particle Immunoassay Method

All water samples from June-July 1991, September-October 1991, and March-April 1992 cruises were analyzed for triazine herbicides by the magnetic particle immunoassay method onboard the vessel or at U.S. Geological Survey facilities in Lakewood, Colo. Many samples from September-October 1991 and March-April 1992 cruises also were analyzed for acetanilide herbicides with the alachlor immunoassay by this method. Samples were analyzed in accordance with the manufacturer's instructions (Ohmicron Inc., Newtown, Pa.). A calibration curve was developed from three standards containing known concentrations of atrazine or alachlor and a negative control or zero concentration solution. Each standard was prepared in duplicate, and the average optical density was used to construct the calibration curve. Samples were prepared in only one test tube, but the optical density of each tube was measured twice and averaged. Optical density measurements and quantification of results were obtained with a RPA-1 RaPID photometric analyzer (Ohmicron Inc., Newtown, Pa.), which contained a built-in microprocessor to compute percent inhibition and display final results. The optimum range of the calibration curve was 0.1 to 5 µg/L. Samples having concentrations greater than 5 µg/L were diluted and reanalyzed.

As with the microtiter plate, atrazine by the magnetic particle method also has a small degree of cross reactivity with several other triazine herbicides (table 2.2) and, thus, is not entirely specific to atrazine. The atrazine antibodies used in the two methods are from different sources and have slightly different cross reactivities with other herbicides. Most notable, the magnetic particle atrazine antibody has slightly more cross reactivity with desethylatrazine at low concentrations than does the microtiter plate antibody (see tables 2.1 and 2.2).

Table 2.2.--*Cross reactivity for triazine herbicides by the magnetic particle immunoassay method*

[%, percent; LLD, lowest detectable dose; inhibition, refers to a comparison of the optical density of the sample to the optical density of a negative control or blank; µg/L,micrograms per liter; Source 1, D.S. Aga, U.S. Geological Survey, Lawrence, Kansas, written communication, March 1992; Source 2, manufacturer's literature; --, no data].

Compound	Concentration for 50% inhibition (µg/L)	Concentration for LDD - 90% inhibition (µg/L)	
	Source 1	Source 1	Source 2
Atrazine	0.93	0.058	0.04
Ametryn	--	--	0.053
Propazine	0.83	0.032	0.033
Prometryn	--	--	0.054
Prometon	2.44	0.09	0.056
Simazine	7.52	0.42	0.34
Cyanazine	454	3.1	1.0
Desethylatrazine	10.5	0.064	0.062
Hydroxyatrazine	--	--	1.1

Gas Chromatography and Mass Spectrometry Method

Ten to twenty percent of the samples from the upriver cruises were selected for analysis by GC/MS at the U.S. Geological Survey Laboratory in Lawrence, Kansas. The samples selected represented both the range in herbicide concentrations measured during each cruise and various reaches of the river. A Waters Millilab workstation (Milford, Mass.) was used for solid phase extraction of the samples for herbicide analysis on C_{18} Sep-Pak cartridges. The cartridges were preconditioned as described by Thurman and others (1992), and Meyer and others (1993). Each 125-mL water sample was spiked with a surrogate standard, terbuthylazine, and pumped through the C_{18} Sep-Pak cartridge by a robotic probe. Herbicides were then eluted from the cartridge with ethyl acetate and spiked with an internal standard, phenanthrene-d_{10}. The extract was concentrated to 100 µL under a stream of warm nitrogen gas.

Automated GC/MS analyses of the concentrated extracts were performed on a Hewlett-Packard model 5890 gas chromatograph (Palo Alto, Calif.) and a model 5970 mass selective detector. Quantification of the base peak of each compound of interest was based on the response of the mass- to-charge ratio of the 188 ion of the internal standard, phenanthrene-d_{10}. Confirmation of each compound was based on the presence of the molecular ion and two confirming ions with a retention time match of plus or minus 0.2 percent relative to the internal standard (Thurman and others, 1990). The quantification limit for all herbicides was 0.05 µg/L.

QUALITY ASSURANCE AND PRECISION OF RESULTS

Extensive planning and effort was expended to insure the quality of the results from this study. This included the selection of non-contaminating materials for collection and processing of samples, periodic cleaning of equipment with methanol, immediate sample refrigeration and storage, rapid analysis by immunoassay within 1 to 10 days, and extraction of samples for GC/MS analysis within about 21 days. Analytical quality assurance for the immunoassay analyses consisted of the analysis of every tenth sample in duplicate (except for the May-June 1990 cruise) and the analysis of a control sample with every analytical run for June-July 1991 and September-October 1991 cruise. An estimate of the analytical precision of the results from each of the four cruises expressed as a standard deviation is given in table 2.3. The standard deviation was estimated by one of two methods. Method 1 was based on duplicate analyses of 10 to 24 samples in different analytical runs. The standard deviation was estimated from the square root of one-half the mean squared differences between duplicate measurements (Taylor, 1987, p. 22). Method 2 consisted of 5 to 18 analyses of the same sample within the same or in different analytical runs. The standard deviation was calculated from these measurements by standard statistical methods. As shown in table 2.3, the standard deviation increased with increasing herbicide concentrations. Also the standard deviation was lower for the magnetic particle method than for the microtiter plate method, indicating a higher degree of precision.

No quality assurance, external to the laboratory, was performed on the GC/MS samples from the upriver profiles. Normal laboratory quality assurance consists of the analysis of every tenth sample in duplicate. Because duplicates were not collected during these upriver cruises, this quality-assurance step was not done.

Table 2.3.--*Analytical precision data for triazine and acetanilide herbicides analyzed by immunoassay during four upriver cruises on the Mississippi River, May 1990 through April 1992*

[μg/L, micrograms per liter; NA, not applicable]

Cruise name	Herbicide	Immunoassay method	Replicates	Concentration Mean (μg/L)	Concentration Standard deviation (μg/L)	Concentration Range (μg/L)	[1]Statistical method
May-June 1990	Triazines	Microtiter plate	10	4.22	0.88	NA	1
June-July 1991	Triazines	Microtiter plate	12	4.67	0.59	2.3	2
	Triazines	Magnetic particle	18	3.51	0.16	0.6	2
September-October 1991	Triazines	Microtiter plate	18	0.46	0.126	0.60	2
	Triazines	Magnetic particle	14	0.45	0.088	0.31	2
	Acetanilides	Microtiter plate	18	0.29	0.070	0.26	2
	Acetanilides	Magnetic particle	5	0.24	0.031	0.08	2
March-April 1992	Triazines	Magnetic particle	24	0.19	0.034	NA	1
	Acetanilides	Magnetic particle	15	0.25	0.064	NA	1

[1]Standard deviation for statistical method 1 calculated from the results of 10 or more samples analyzed in duplicate (Taylor, 1987, p. 22). Standard deviation for statistical method 2 calculated from multiple analyses of the same sample by standard statistical methods.

RESULTS OF CHEMICAL ANALYSES

Analytical results for samples collected and analyzed from the four upriver cruises are given in tables 2.4 through 2.28. These data show herbicide concentrations at approximately midchannel, the cross-channel variability, and the herbicide concentrations in or just downstream from some tributaries. No interpretations of the immunoassay profiles are given in this data report. Some interpretations and discussion are given in Moody and Goolsby (1993) and Goolsby and Pereira (in press).

Longitudinal Variability

Immunoassay data for samples collected near mid-channel are listed in tables 2.4 through 2.12. The data are arranged by river mile upstream from Head of Passes, La. (fig. 1.1) and are separated into two tables for each cruise, one for the Lower Mississippi River and one for the Upper Mississippi River. Where samples were collected to determine cross-sectional variability, the mean value for the cross section is given in these tables.

Cross-Channel Variability

Immunoassay data for samples collected to determine cross-sectional variability are given in tables 2.13 through 2.20. There are two tables for each cruise, one for the Lower Mississippi River and one for the Upper Mississippi River. As shown in the tables, cross-channel variability was greatest below major tributaries.

Tributary Concentrations

Data collected in a tributary or just downstream from the mouth of a tributary and near the bank of the river are given in tables 2.21 through 2.24. There is one table for each cruise.

Gas Chromatography and Mass Spectrometry

Analytical results for samples analyzed by gas chromatography and mass spectrometry are given in table 2.25 through 2.28, one table for each cruise. These results include samples from the Lower Mississippi River, Upper Mississippi River, and some of its tributaries.

Graphical Display of Results

Graphs of immunoassay results showing the longitudinal variability of triazine herbicides in the Mississippi River for each of the four upriver cruises are shown in figures 2.1 through 2.4. The data are plotted from upstream (Minneapolis, Minn.) to downstream (Baton Rouge, La.) location in the direction the river flows. Triazine concentrations from both the microtiter plate and magnetic particle immunoassays are displayed on the same graph as a function of river miles upstream from Head of Passes, La. A line fitted to the data by a smoothing function (SAS Institute, 1990, p. 416) is also shown on the plots. The concentration of atrazine determined by GC/MS is shown on the plots by an open circle. Triazine herbicide concentrations were highest during May through July, shortly after application. This seasonal trend in herbicide concentration has been demonstrated in other studies (Goolsby, Thurman, and Kolpin, 1991; Goolsby and Battaglin, 1993; Thurman and others, 1991, 1992).

Acetanilide concentrations determined by immunoassay for the September-October 1991 and March-April 1992 cruises are shown in figures 2.5 and 2.6. Alachlor concentration determined by GC/MS is shown by open circles. The concentration of acetanilides decreased in a downstream direction on both profiles, but little or no alachlor was detected by GC/MS. The immunoassay response was caused largely by an alachlor soil metabolite, ethane sulfonic acid (Baker and others, 1993; Aga and others 1994).

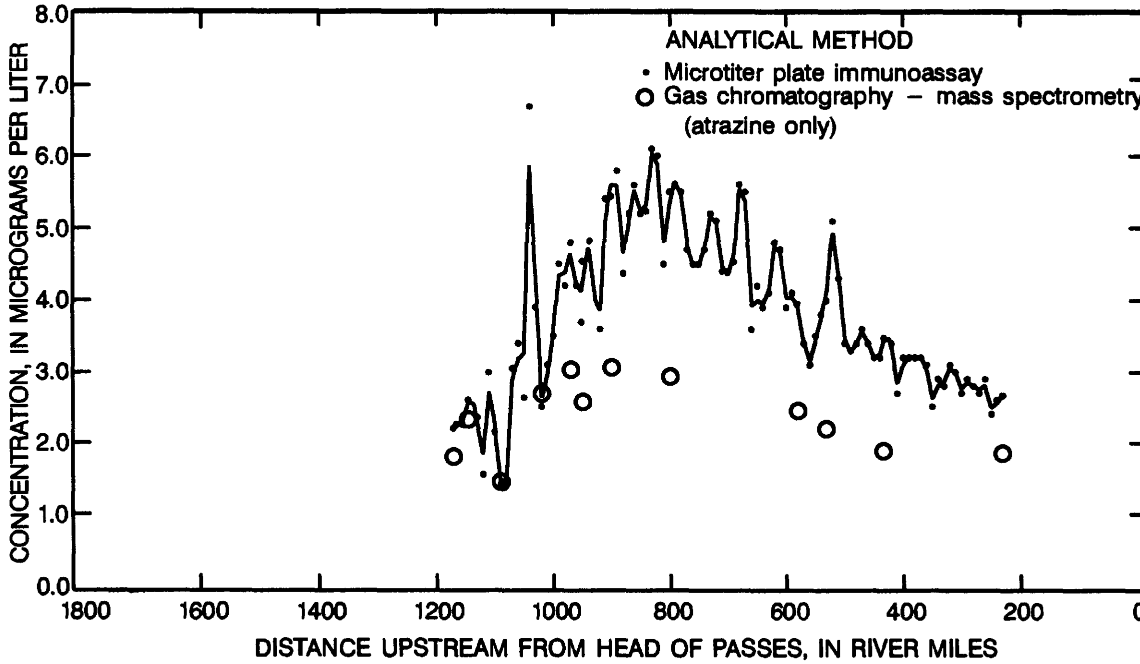

Figure 2.1.--Longitudinal variability of triazine herbicides in the Mississippi River between Baton Rouge, La., and Grafton, Ill., May-June 1990 cruise. The solid line is a smoothed profile of herbicide concentrations.

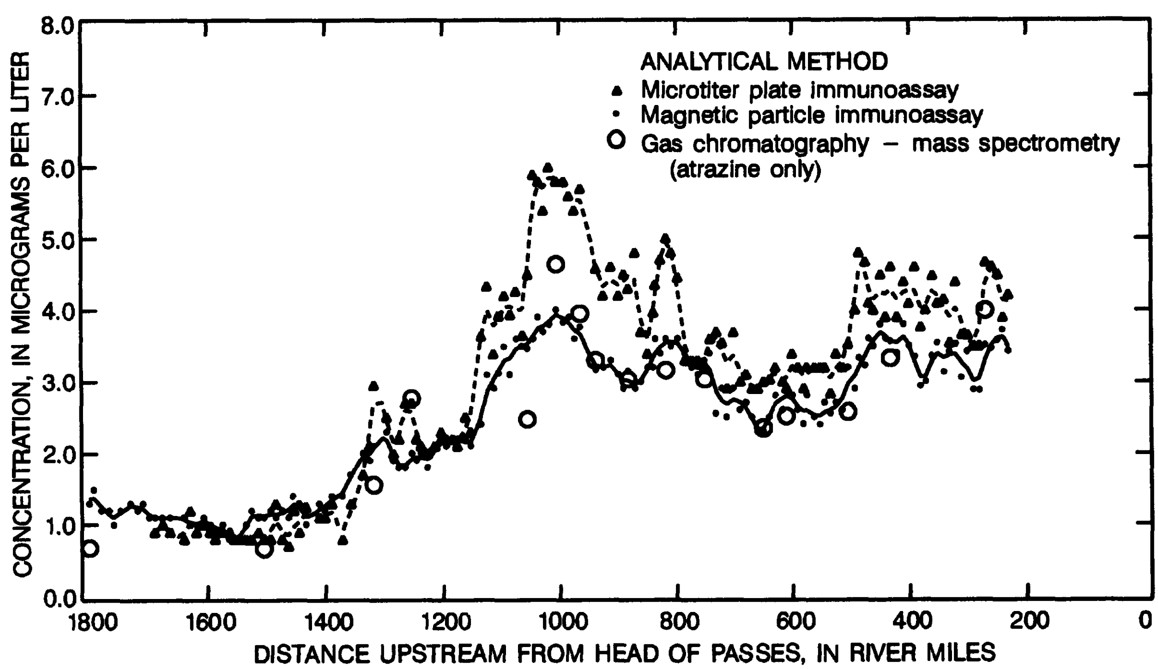

Figure 2.2.--Longitudinal variability of triazine herbicides in the Mississippi River between Baton Rouge, La., and Minneapolis, Minn., June-July 1991 cruise. The dashed and solid lines are smoothed profiles of herbicide concentrations.

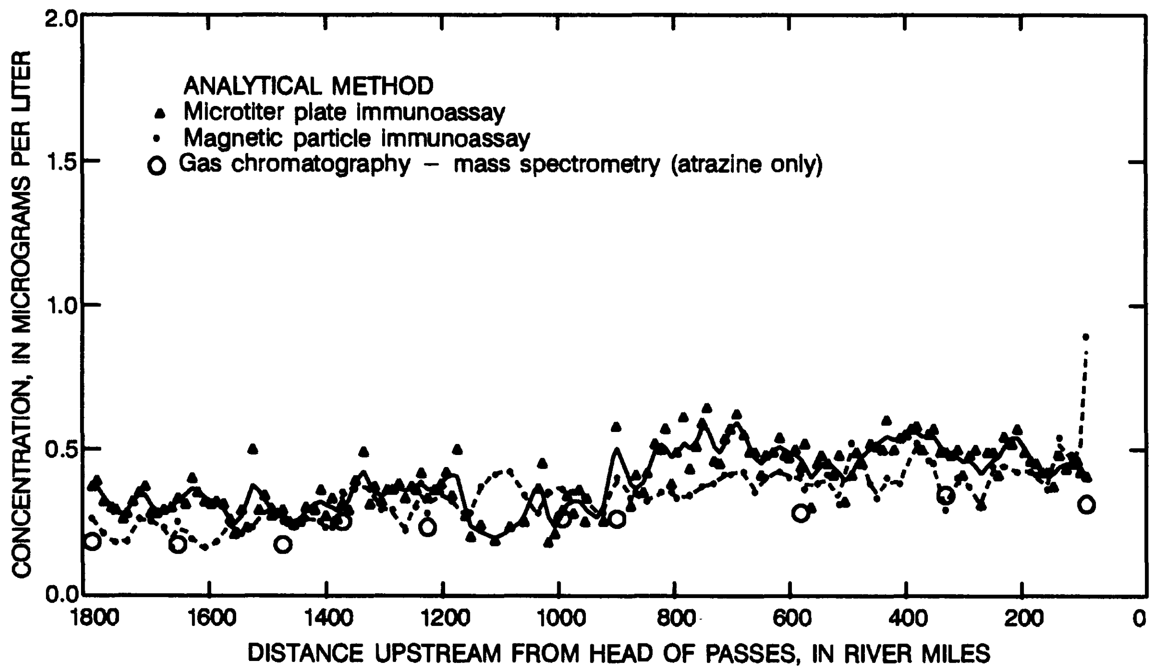

Figure 2.3.--Longitudinal variability of triazine herbicides in the Mississippi River between New Orleans, La., and Minneapolis, Minn., September-October 1991 cruise. The dashed and solid lines are smoothed profiles of herbicide concentrations.

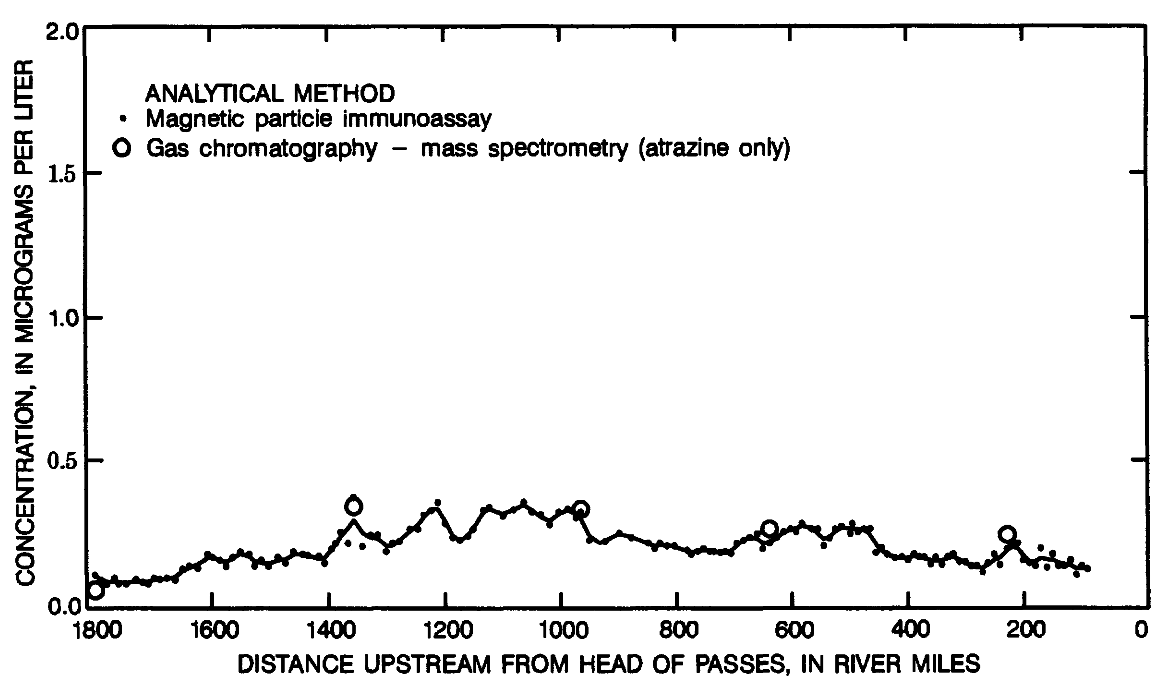

Figure 2.4.--Longitudinal variability of triazine herbicides in the Mississippi River between New Orleans, La., and Minneapolis, Minn., March-April 1992 cruise. The solid line is a smoothed profile of herbicide concentrations.

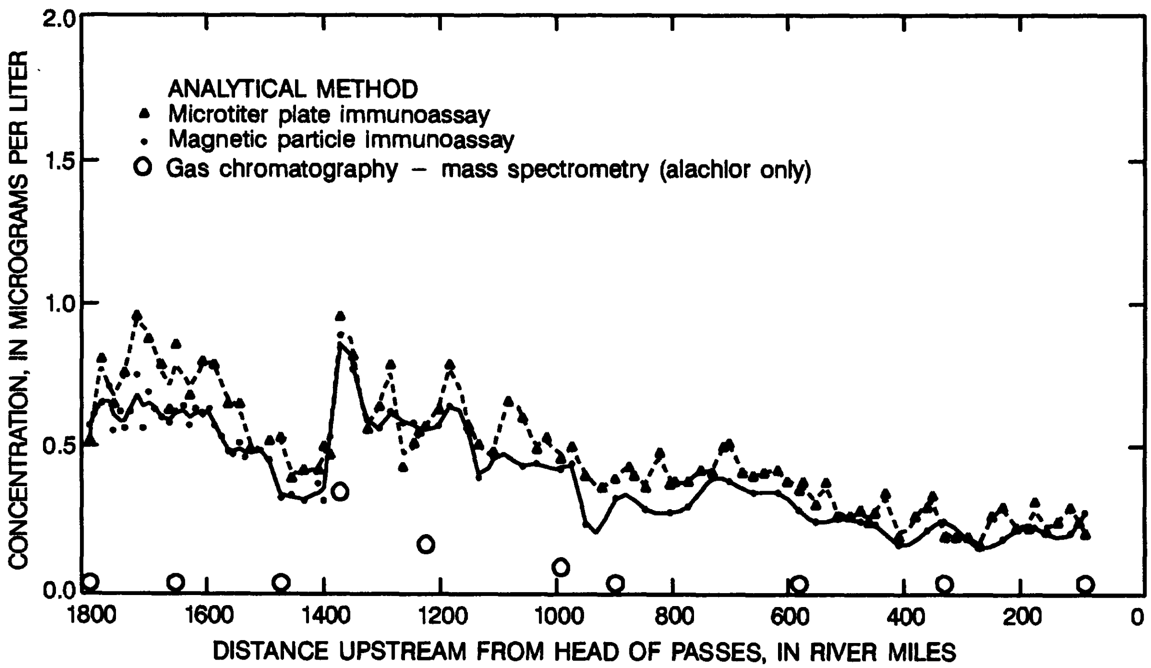

Figure 2.5.--Longitudinal variability of acetanilide herbicides in the Mississippi River between New Orleans, La., and Minneapolis, Minn., September-October 1991 cruise. The dashed and solid lines are smoothed profiles of herbicide concentrations.

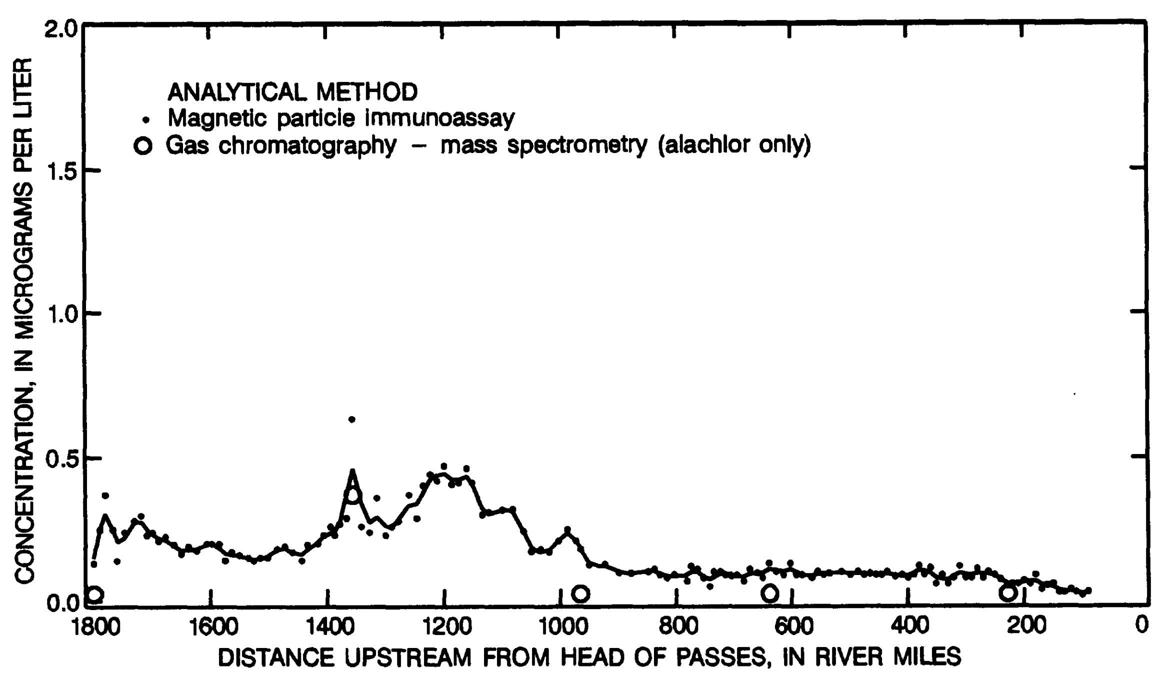

Figure 2.6.--Longitudinal variability of acetanilide herbicides in the Mississippi River between New Orleans, La., and Minneapolis, Minn., March-April 1992 cruise. The solid line is a smoothed profile of herbicide concentrations.

As shown in figures 2.1 through 2.4, the triazine immunoassay results tend to be slightly higher than results for atrazine determined by GC/MS. In order to obtain a more accurate estimate of atrazine in each sample based on the immunoassay results, a regression analysis was performed. The atrazine concentration obtained by GC/MS was regressed against triazine concentrations obtained by each of the two immunoassay methods. A zero intercept was specified to force the regression line through the origin. The data from all four cruises were pooled for each regression analysis. The regression results and a plot of the GC/MS results in relation to the immunoassay results are shown in figures 2.7 and 2.8. Smoothed profiles of the concentration of atrazine estimated from the regression analysis are shown in figure 2.9 for the microtiter plate method and in figure 2.10 for the magnetic particle method. Both the microtiter plate and the magnetic particle immunoassay method were used in the June-July 1991 and September-October 1991 cruises. For these two cruises, figure 2.11 shows a comparison of the atrazine concentration estimated from these two method using the regression analysis technique described above. Results from GC/MS analyses also are shown on figure 2.11 for reference.

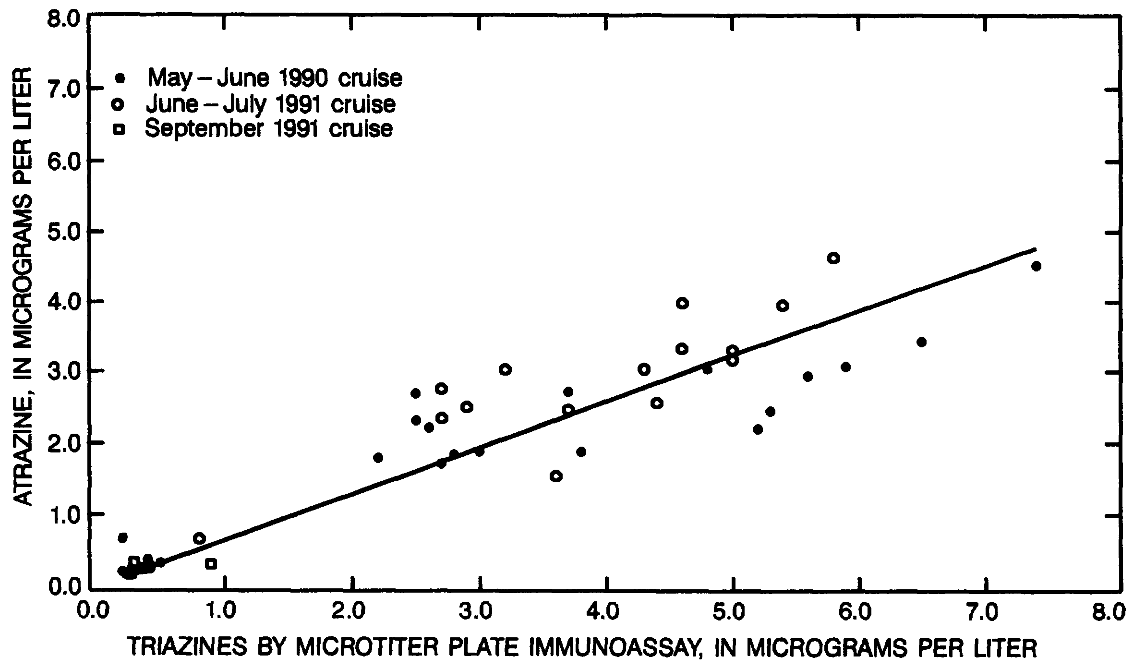

Figure 2.7.--Triazine herbicide concentration, analyzed by microtiter plate immunoassay, in relation to atrazine concentration, analyzed by gas chromatography-mass spectrometry. See tables 2.25–2.27. Regression equation is ATRAZINE = 0.73 TRIAZINES (by microtiter plate method, $R^2 = 0.77$).

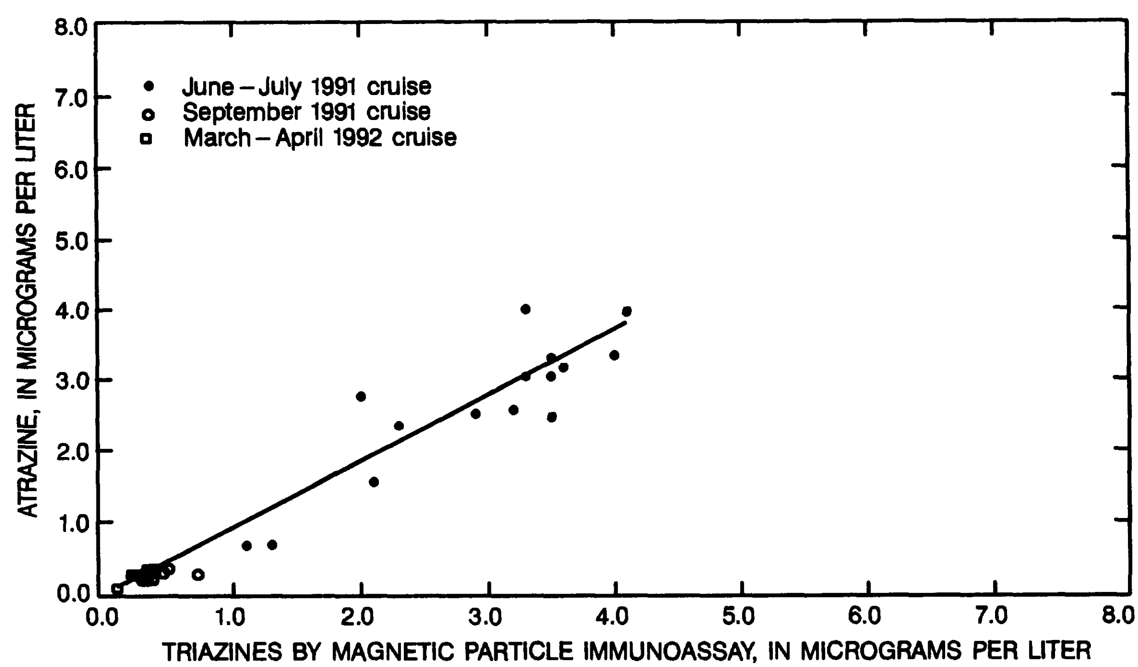

Figure 2.8.--Triazine herbicide concentration, analyzed by magnetic particle immunoassay, in relation to atrazine concentration, analyzed by gas chromatography-mass spectrometry. See tables 2.26–2.28. Regression equation is ATRAZINE = 0.93 TRIAZINES (magnetic particle method, $R^2 = 0.97$).

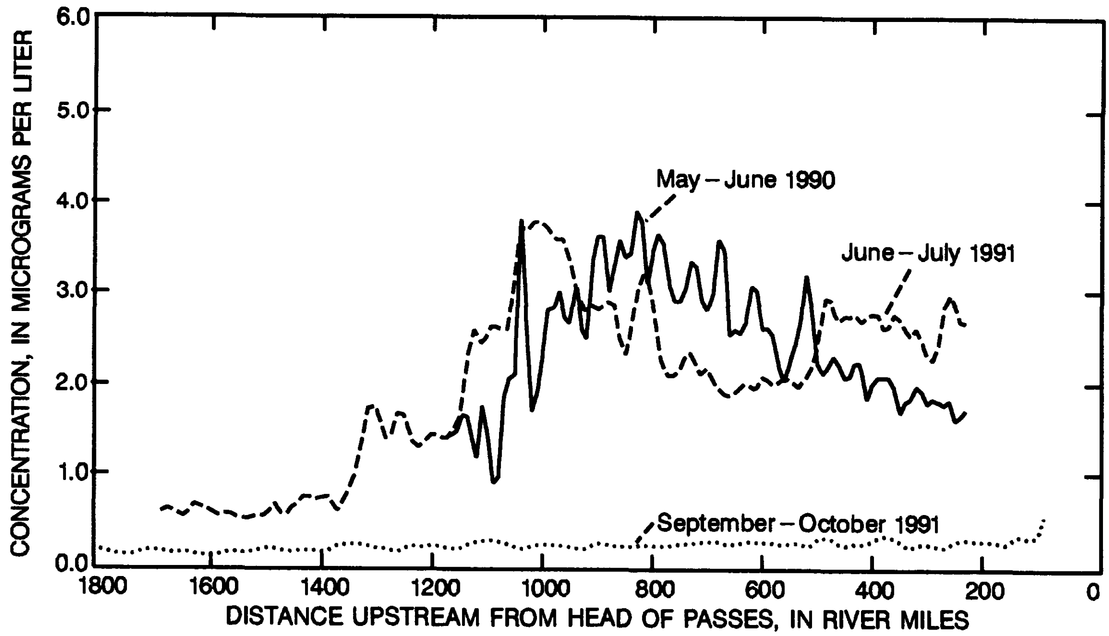

Figure 2.9.--Longitudinal variability of smoothed estimates of atrazine concentration in the Mississippi River between New Orleans, La., and Minneapolis, Minn. Atrazine concentrations estimated from microtiter plate immunoassay analyses and regression equations of immunoassay results versus gas chromatography-mass spectrometry (see figure 2.7).

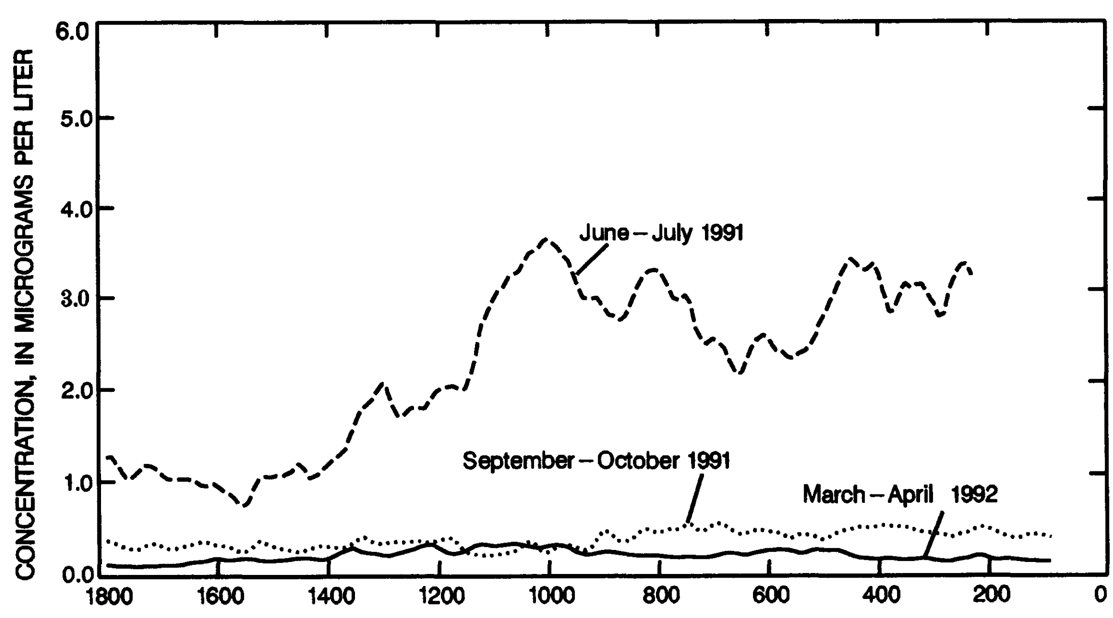

Figure 2.10.--Longitudinal variability of smoothed estimates of atrazine concentration in the Mississippi River between New Orleans, La., and Minneapolis, Minn. Atrazine concentrations estimated from magnetic particle immunoassay analyses and regression equations of immunoassay results versus gas chromatography-mass spectrometry (see figure 2.8).

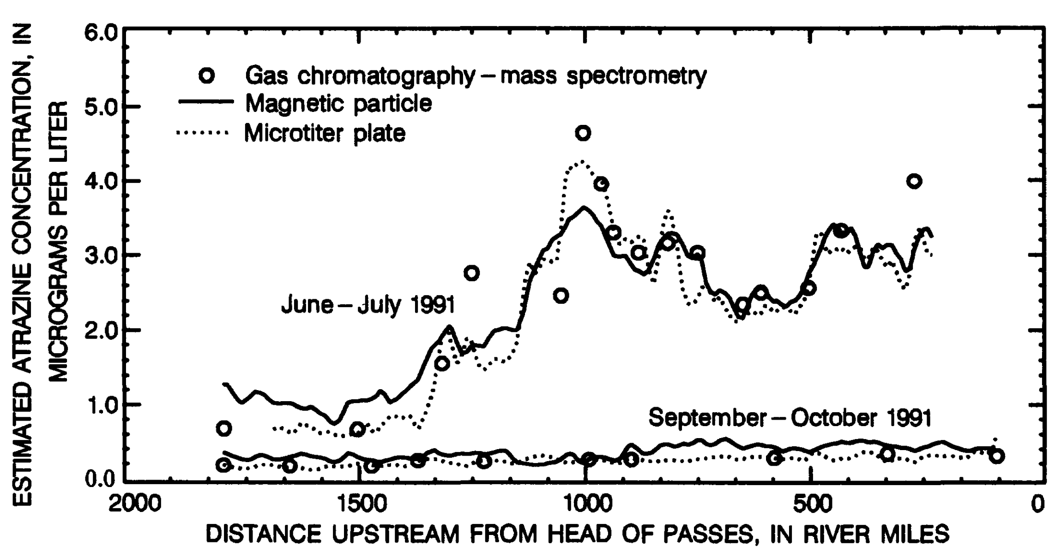

Figure 2.11.--Longitudinal variability of smooth estimates of atrazine concentration in the Mississippi River between New Orleans, La., and Minneapolis, Minn. Atrazine estimated from regression analysis (see figure 2.7–2.8). Estimates predicted from magnetic particle immunoassay analysis are shown as a solid line and those predicted by microtiter plate immunoassay are shown as a dotted line. Atrazine determined by gas chromatography-mass spectrometry are shown as open circles for comparison.

REFERENCES

Aga, D.S., Thurman, E.M., and Pomes, M.L., 1994, Determination of alachlor and its sulfonic acid metabolite by solid-phase extraction and enzyme-linked immunosorbent assay: Analytical Chemistry, v. 66, p. 1495–9.

Baker, D.B., Bushway, R.J., Adams, S.A., and Macomber, C., 1993, Immunoassay screens for alachlor in rural wells: false positives and an alachlor soil metabolite: Environmental Science and Technology, no. 3, p. 562–564.

Gianessi, L.P., and Puffer, C.M., 1991, Herbicide use in the United States: Washington, D.C., Resources for the Future, December 1990 (Revised April 1991), 128 p.

Goolsby, D.A., Thurman, E.M., and Kolpin, D.W., 1991, Herbicides in streams—Midwestern United States, in Proceedings 1991 ASCE Irrigation and Drainage Engineering Conference, Honolulu, Hawaii, July 23–27, 1991, p. 17–23.

Goolsby, D.A., Coupe, R.H., and Markovchick, D.J., 1991, Distribution of selected herbicides and nitrate in the Mississippi River and its major tributaries, April through June 1991: U.S. Geological Survey Water-Resources Investigations Report 91-4163, 35 p.

Goolsby, D.A., and Battaglin, W.A., 1993, Occurrence, distribution, and transport of agricultural chemicals in surface waters of the Midwestern United States, *in* Goolsby, D.A. and others, eds., Selected papers on agricultural chemicals in water resources of the Midcontinental United States: U.S. Geological Survey Open-File Report 93-418, p. 1–24.

Goolsby, D.A. and Pereira, W.E., in press, Pesticides in the Mississippi River, *in* Contaminants in the Mississippi River, 1987–92, Meade, R.H., ed., U.S. Geological Survey Water-Supply Paper 2440.

Meyer, M.T., Mills, M.S., and Thurman, E.M., 1993, Automated solid-phase extraction of herbicides from water for gas chromatographic-mass spectrometric analysis: Journal of Chromatography, v. 629, p. 55–59.

Moody, John A., and Goolsby, D.A., 1993, Spatial variability of triazine herbicides in the lower Mississippi River: Environmental Science and Technology, v. 27., no. 10, p. 2120–2126.

SAS Institute Inc., 1990, SAS/GRAPH Software: Reference, Version 6, First edition, volume 1, Cary, NC, SAS Institute, Inc., 794 p.

Stall, J.B., and Hiestand, D.W., 1969, Provisional time-of-travel for Illinois streams: Urbana, Illinois State Water Survey, Report of Investigation 63, 31 p.

Taylor, J.K., 1987, Quality-Assurance Measurements of Chemical Measurements: Lewis Publishers, Chelsea, Mi., 328 p.

Thurman, E.M., Meyer, M.T., Pomes, M.L., Perry, C.E., and Schwab, A.P., 1990, Enzyme-linked immunosorbent assay compared with gas chromatography/mass spectrometry for the determination of herbicides in water: Analytical Chemistry, v. 62, p. 2043–2048.

Thurman, E.M., Goolsby, D.A., Meyer, M.T., and Kolpin, D.W., 1991, Herbicides in surface waters of the Midwestern United States: The effect of spring flush: Environmental Science and Technology, v. 25, p. 1794–1796.

Thurman, E.M., Goolsby, D.A., Meyer, M.T., and Kolpin, D.W., 1992, A reconnaissance study of herbicides and their metabolites in surface water of the Midwestern United States using immunoassay and gas chromatography/mass spectrometry: Environmental Science and Technology, v. 26, no. 12, p. 2440–2447.

(page 37 follows)

Table 2.4.--*Concentration of triazine herbicides in approximately midchannel of the Lower Mississippi River between Baton Rouge, La., and Cairo, Ill., May-June 1990 cruise*

[km, kilometers; CDT, Central Daylight Time; m^3/s, cubic meters per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; µg/L, micrograms per liter; and --, no measurement]

Location			Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Concentration using microtiter plate method (µg/L)
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank				
			May 26, 1990			
230	0	[2]X	0006	26,000	340	2.7
240	24	0.5	0125	26,200	340	2.6
249.5	46	0.5	0240	26,400	339	2.4
260	72	0.3	0412	26,700	337	2.9
270	94	0.7	0516	26,900	337	2.7
280	117	0.2	0625	27,100	334	2.8
290	140	0.5	0735	27,400	334	2.9
300	163	[2]X	0848	27,600	331	2.7
310	185	0.5	0955	27,800	329	3.0
320	207	0.8	1055	33,300	327	3.1
330	232	0.5	1155	33,200	324	2.8
340	255	0.2	1252	33,100	320	2.9
350	279	0.5	1347	33,100	318	2.5
360	306	0.7	1503	33,000	314	3.1
370	338	0.5	1700	33,100	311	3.2
380	364	0.4	1818	33,200	308	3.2
390	389	0.4	1920	33,400	305	3.2
400	414	0.5	2028	33,500	303	3.2
410	440	0.5	2135	33,500	302	2.7
420	465	0.5	2240	33,500	300	3.4
			May 27, 1990			
433.5	499	[2]X	0015	33,700	295	3.5
440	517	0.5	0110	33,300	296	3.2
450	543	0.8	0218	33,500	295	3.2
460	569	0.5	0333	33,800	293	3.4
470	596	0.5	0450	34,000	291	3.6
480	621	0.7	0600	34,200	289	3.4
490	647	0.5	0707	34,500	288	3.3
500	672	0.5	0810	34,800	288	3.4
510	697	0.2	0918	34,900	290	4.3
520	722	0.5	1023	35,100	286	5.1
531	751	[2]X	1147	35,500	288	4.0

Table 2.4.--*Concentration of triazine herbicides in approximately midchannel of the Lower Mississippi River between Baton Rouge, La., and Cairo, Ill., May-June 1990 cruise--Continued*

Location			Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Concentration using microtiter plate method (µg/L)
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank				
			May 27, 1990--Continued			
540	782	0.5	1350	35,700	288	3.8
550	810	0.5	1510	35,900	290	3.5
560	836	0.5	1625	36,200	287	3.1
570	862	0.5	1735	36,300	292	3.4
581	890	[2]X	1855	36,300	291	4.0
590	913	0.6	2000	31,700	299	4.1
600	940	0.5	2120	30,000	302	3.9
610	967	0.5	2240	30,000	301	4.7
			May 28, 1990			
620	993	0.5	0003	30,000	303	4.8
630	1,020	0.5	0125	30,000	304	4.1
640	1,048	0.5	0250	29,900	305	3.9
650	1,075	0.5	0415	29,900	310	4.2
660	1,101	0.3	0530	29,900	312	3.6
670	1,126	0.4	0640	30,100	314	5.5
680	1,152	0.5	0755	30,300	315	5.6
690	1,178	[2]X	0909	30,600	317	4.5
700	1,204	0.3	1025	30,800	319	4.4
710	1,230	0.3	1145	31,100	321	4.4
720	1,255	0.3	1255	31,400	322	5.1
730	1,282	0.8	1418	31,700	324	5.2
740	1,329	0.4	1813	31,700	327	4.7
750	1,356	0.6	1930	31,600	326	4.5
760	1,382	0.3	2048	31,500	328	4.5
770	1,408	0.5	2205	31,400	331	4.7
780	1,434	0.6	2320	31,300	333	5.5
			May 29, 1990			
790	1,461	0.7	0040	31,200	335	5.6
800	1,488	[2]X	0202	31,100	336	5.5
810	1,516	0.9	0335	31,000	339	4.5
820	1,544	0.3	0453	30,900	341	6.0
830	1,568	0.5	0605	30,800	344	6.1
840	1,595	[2]X	0726	30,700	344	5.2
850	1,621	0.6	0845	30,600	342	5.2

Table 2.4.--*Concentration of triazine herbicides in approximately midchannel of the Lower Mississippi River between Baton Rouge, La., and Cairo, Ill., May-June 1990 cruise--Continued*

Location			Time (CDT)	Water discharge[3] (m³/s)	Specific conductance (μS/cm)	Concentration using microtiter plate method (μg/L)
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank				
May 29, 1990--Continued						
860	1,648	0.5	1007	30,500	347	5.6
870	1,674	0.3	1120	30,400	350	5.2
880	1,701	[2]X	1244	30,300	351	4.4
890	1,727	0.5	1400	30,200	335	5.8
900	1,754	[2]X	1520	30,100	358	5.4
910	1,780	[2]X	1642	30,000	341	5.4
917	1,800	[2]X	1742	29,900	362	--
920	1,807	0.5	1800	29,900	390	3.6
937.6	1,851	[2]X	2004	29,700	345	4.8
950	1,885	[2]X	2149	29,500	360	4.5

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 230.0 upriver from Head of Passes, La., on May 26, 1990, at 0006 hours.

[2] X indicates three to five samples were collected across the river at this location. These individual values appear in table 2.13; the values of specific conductance, and chemical concentrations in this table are the mean values.

[3] Water discharges are linearly interpolated values between discharges listed in table 1.5 in chapter 1.

Table 2.5.--*Concentration of triazine herbicides at approximately midchannel of the Upper Mississippi River between Cairo, Ill., and Grafton, Ill., May-June 1990 cruise*

[km, kilometers; CDT, Central Daylight Time; m^3/s, cubic meters per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; and µg/L, micrograms per liter]

Location						
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Concentration using microtiter plate method (µg/L))
			June 4, 1990			
0	0	0.5	1840	12,300	403	3.7
10	23	0.5	1945	12,300	408	4.2
20	47	0.5	2100	12,300	409	4.8
30	71	0.5	2215	12,300	414	4.2
40	94	0.5	2325	12,300	414	4.5
50	119	[2]X	0052	12,100	419	3.5
60	144	0.5	0220	11,900	425	3.1
70	168	0.5	0335	11,600	429	2.5
80	192	0.5	0451	11,400	424	3.9
90	216	0.5	0610	11,100	423	6.7
100.8	242	[2]X	0734	10,800	432	2.6
110	264	0.6	0846	10,600	437	3.4
119.5	289	[2]X	1020	10,000	440	3.0
130.7	316	[2]X	1151	9,800	450	1.4
140	339	[2]X	1307	9,500	454	1.4
150	363	[2]X	1423	9,300	458	2.2
160	390	[2]X	1611	9,000	456	3.0
170	415	[2]X	1740	8,900	473	1.6
179.3	438	[2]X	1859	8,500	473	2.4
196	476	[2]X	2053	5,200	501	2.2
196	520	[2]X	0811	[4]4,700	504	3.0
206	543	[2]X	0957	5,100	509	2.2
216	564	[2]X	1112	5,500	549	2.3
220.7	572	0.5	1130	4,200	407	2.2

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 0.0 upriver from mouth of Ohio River on June 4, 1990, at 1840 hours.

[2] X indicates three to five samples were collected across the river at this location. These individual values appear in table 2.14; the values for specific conductance and chemical concentrations in this table are the mean values.

[3] Water discharges are linearly interpolated values between discharges listed in table 1.5 in chapter 1.

[4]Discharge estimated as the discharge of the Mississippi at St. Louis, Mo., on June 6, 1990, of 8,100 m^3/s minus the discharge of the Missouri River on June 6, 1990, of 3,400 m^3/s.

Table 2.6.--*Concentration of triazine herbicides at approximately midchannel of the Missouri River between mouth of the Missouri River and St. Charles, Mo., May-June 1990 cruise*

[μS/cm, microsiemens per centimeter at 25 degrees Celsius; and μg/L, micrograms per liter]

Location						
River miles upriver from mouth of Missouri River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Concentration using microtiter plate method (μg/L)
			June 9, 1990			
0	0	0.5	0558	5,500	351	1.8
10	24	0.5	0722	5,600	346	2.2
20	49	0.5	0850	5,700	338	2.8
30	74	0.5	1022	5,800	329	3.3
38.8	106	0.5	1322	5,900	336	2.4
29.9	[3]96	0.5	1410	6,000	333	2.5
28.0	116	0.98	1812	6,100	340	2.5
28.0	131	0.98	2045	6,100	340	2.3
28.0	150	0.98	2400	6,200	357	2.5
			June 10, 1990			
28.0	167	0.98	0305	6,300	371	3.7
28.0	181	0.98	0525	6,300	379	2.7
28.0	196	0.98	0800	6,400	382	3.0
28.0	207	0.98	1000	6,500	380	2.4
28.0	219	0.98	1200	6,500	372	2.0
28.0	230	0.98	1356	6,500	364	2.4
28.0	242	0.98	1600	6,600	355	2.8
28.0	254	0.98	1800	6,700	346	2.7
27.9	264	0.5	1944	6,800	328	3.5

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 0.0 upriver from mouth of Missouri River on June 9, 1990, at 0558 hours.

[2]Discharge between Missouri River Mile 40 and Mile 0 is about equal to the discharge at Hermann, Mo. 1 day earlier, so that the interpolation in time was done between June 7 (4,400 m^3/s), June 8 (5,900 m^3/s), June 9 (6,500 m^3/s), and June 10 (6,900 m^3/s).

[3] Research vessel *ACADIANA* had to stop at Mile 38.8, go back downriver, and tie up to a dock at Mile 28.0 on the right bank, because of debris that was clogging the cooling-water intakes for the engines.

Table 2.7.--*Concentration of triazine herbicides in approximately midchannel of the Lower Mississippi River between Baton Rouge, La., and Cairo, Ill., June-July 1991 cruise*

[km, kilometers; CDT, Central Daylight Time; m^3/s, cubic meters per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; µg/L, micrograms per liter; and --, no measurement]

Location							Concentration	
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conduc-tance (µS/cm)	Temperature (°C)	Microtiter plate method (µg/L)	Magnetic particle method (µg/L)
				June 23, 1991				
230.0	0	[2]X	2240	16,000	393	---	4.2	3.4
240.3	22	0.5	2345	16,100	386	25	3.9	3.7
				June 24, 1991				
248.8	40	0.5	0045	16,100	382	23	4.5	3.6
258.6	60	0.5	0146	16,200	385	23	4.6	3.5
269.6	83	0.5	0300	16,300	388	25	4.7	3.5
279.7	107	0.5	0415	16,300	385	25	3.5	2.9
289.8	130	0.5	0525	16,400	380	25	3.5	2.9
300.0	152	0.5	0640	16,500	397	25	3.7	3.4
310.0	173	0.5	0745	16,500	383	25	3.7	3.1
320.0	193	0.5	0833	18,500	390	24	4.4	3.5
330.4	217	0.5	1010	18,300	393	25	3.6	3.4
340.0	237	0.5	1105	18,100	399	25	4.2	3.1
351.2	260	0.5	1215	17,800	395	25	4.1	3.6
360.0	279	[2]X	1320	17,700	397	25	4.4	3.3
371.2	310	0.5	1605	17,500	398	26	4.0	3.0
380.4	329	0.5	1704	17,400	392	26	3.8	2.9
389.8	349	0.5	1810	17,300	388	25	4.6	3.4
399.4	370	0.5	1915	17,300	383	25	4.1	3.5
409.5	392	0.5	2029	17,200	393	24	4.4	3.8
420.1	414	0.5	2135	17,100	404	24	3.9	3.4
432.0	440	0.5	2259	16,900	400	25	4.6	3.6
439.8	457	0.5	2352	14,900	400	24	3.9	3.6
				June 25, 1991				
449.1	476	0.5	0050	15,000	399	25	4.5	3.8
460.8	501	0.5	0215	15,000	399	24	4.0	3.5
469.0	519	0.5	0315	15,100	396	24	4.1	3.6
475.0	532	[2]X	0400	15,100	399	25	4.7	3.3
485.5	554	0.5	0512	15,200	396	25	4.8	3.3
493.0	571	0.5	0618	15,200	397	23	4.0	2.9
504.5	595	0.7	0725	15,300	389	25	3.5	3.2
514.1	616	0.5	0837	15,300	388	24	3.2	2.6
525.3	640	0.5	1000	15,400	390	24	3.4	2.7

Table 2.7.--*Concentration of triazine herbicides in approximately midchannel of the Lower Mississippi River between Baton Rouge, La., and Cairo, Ill., June-July 1991 cruise--Continued*

Location							Concentration	
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	Microtiter plate method (μg/L)	Magnetic particle method (μg/L)
				June 25, 1991--Continued				
534.5	660	0.5	1106	15,400	391	24	2.8	2.6
545.0	687	0.5	1310	15,500	390	23	3.2	2.7
552.5	705	0.5	1420	15,500	389	24	3.2	2.4
562.2	726	0.5	1528	15,600	395	25	3.2	2.5
575.0	753	0.5	1635	15,600	399	25	3.2	2.8
580.8	766	[2]X	1718	15,600	438	27	2.6	2.3
590.3	788	0.6	1834	15,100	394	26	3.2	2.6
600.2	808	0.5	1932	14,600	398	25	3.4	2.8
610.0	833	0.5	2109	14,400	391	26	2.9	2.9
616.5	850	0.5	2223	14,300	391	25	3.0	2.6
629.3	875	0.5	2314	14,200	395	25	3.2	2.8
				June 26, 1991				
639.7	903	0.5	0113	13,900	409	22	3.0	2.5
650.2	928	0.5	0241	13,800	421	25	3.0	2.3
660.2	951	0.5	0353	13,700	421	25	2.9	2.3
669.9	973	0.5	0505	13,700	428	25	2.9	2.5
680.0	996	0.5	0616	13,600	435	25	3.1	2.7
689.9	1,018	0.5	0725	13,600	435	25	3.0	2.6
702.0	1,047	0.5	0903	13,500	439	24	3.7	2.9
712.9	1,072	[2]X	1023	13,500	429	24	2.7	2.7
721.5	1,093	0.5	1135	13,500	443	23	3.6	2.9
731.5	1,116	0.5	1248	13,400	434	24	3.7	2.6
742.0	1,148	0.5	1525	13,300	427	25	3.6	3.4
751.1	1,168	0.5	1640	13,300	422	25	3.2	3.3
762.2	1,192	0.5	1802	13,200	421	25	3.3	3.1
773.0	1,215	0.5	1919	13,100	418	25	3.3	3.2
785.0	1,241	0.7	2042	12,900	412	25	3.3	3.4
797.4	1,269	0.6	2224	12,700	405	25	4.5	3.6
807.9	1,292	0.8	2345	12,600	401	24	4.8	3.5
				June 27, 1991				
817.5	1,312	0.7	0105	12,500	415	24	5.0	3.6
826.7	1,332	0.5	0221	12,400	412	24	4.7	3.4
835.5	1,351	0.5	0324	12,300	413	25	4.4	3.6
839.0	1,360	[2]X	0403	12,300	413	25	4.0	3.2
848.5	1,381	0.5	0525	12,200	413	25	3.4	3.2

Table 2.7.--*Concentration of triazine herbicides in approximately midchannel of the Lower Mississippi River between Baton Rouge, La., and Cairo, Ill., June-July 1991 cruise--Continued*

Location							Concentration	
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Temperature (°C)	Microtiter plate method (µg/L)	Magnetic particle method (µg/L)
June 27, 1991--Continued								
860.2	1,407	0.5	0653	12,000	412	25	3.7	3.0
870.0	1,427	0.5	0757	11,900	410	25	4.8	2.9
882.4	1,453	0.5	0919	11,800	405	25	4.3	3.2
890.5	1,471	0.5	1017	11,700	398	26	4.5	2.9
898.9	1,489	[2]X	1118	11,600	407	26	4.2	3.1
911.9	1,517	0.1	1255	11,500	386	23	4.6	3.3
924.5	1,544	0.5	1418	11,400	378	25	4.2	3.2
937.6	1,572	[2]X	1553	11,500	377	26	4.5	3.2

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 230.0 upriver from Head of Passes, La., on June 23, 1991, at 2240 hours.

[2]X indicates three to five samples were collected across the river at this location. These individual values appear in table 2.15; the values of specific conductance, temperature, and chemical concentrations in this table are the mean values.

[3] Water discharges are linearly interpolated values between discharges listed in table 1.5 in chapter 1.

Table 2.8.--*Concentration of triazine herbicides in approximately midchannel of the Upper Mississippi River between Cairo, Ill., and Minneapolis, Minn., June-July 1991 cruise*

[km, kilometers; CDT, Central Daylight Time; m^3/s, cubic meters per second; µS/cm, microsiemens per centimeter at °C, 25 degrees Celsius; µg/L, micrograms per liter; and --, no measurement]

Location							Concentration	
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conduc-tance (µS/cm)	Temper-ature (°C)	Microtiter plate method (µg/L)	Magnetic particle method (µg/L)
				June 27, 1991				
10.8	1,638	0.5	2034	7,800	432	25	5.7	3.8
20.9	1,661	0.5	2151	7,800	439	23	5.4	3.6
29.6	1,682	0.5	2304	7,800	429	23	5.6	3.9
				June 28, 1991				
39.0	1,704	0.5	0024	7,800	442	24	5.8	3.8
51.6	1,735	0.5	0214	7,800	441	24	5.8	4.0
63.3	1,761	0.5	0334	7,700	442	24	6.0	3.8
73.7	1,785	0.5	0452	7,700	445	23	5.4	3.7
82.8	1,806	0.5	0603	7,700	448	24	5.8	3.9
91.0	1,824	0.5	0702	7,500	449	24	5.9	3.6
100.7	1,846	[2]X	0814	7,500	458	24	4.6	3.4
110.0	1,868	0.1	0928	7,500	444	25	3.7	3.5
120.1	1,891	0.9	1045	7,400	461	24	4.3	3.6
130.6	1,916	0.1	1205	7,400	473	25	3.9	3.1
140.4	1,938	0.9	1321	7,400	497	24	4.2	3.5
150.0	1,961	[2]X	1437	7,400	484	26	4.0	3.1
158.2	1,980	0.1	1541	7,400	468	25	3.4	2.9
170.0	2,006	0.9	1706	7,300	526	25	4.3	3.1
180.3	2,031	0.1	1832	7,300	472	25	3.6	2.4
198.4	2,077	0.3	2245	5,500	461	23	--	--
				June 29, 1991				
207.2	2,097	0.3	0012	5,400	466	23	2.3	2.1
221.6	2,144	0.3	0709	5,000	443	24	2.5	2.2
229.2	2,160	0.5	0802	4,900	450	23	2.1	2.2
240.2	2,182	0.5	0915	4,800	451	24	2.2	2.2
249.2	2,200	0.5	1026	4,800	451	24	2.2	2.1
260.2	2,223	0.5	1145	4,700	449	25	2.3	2.2
272.0	2,246	0.5	1257	4,600	459	25	2.1	2.1
283.3	2,272	0.5	1514	4,500	451	25	2.0	1.8
291.0	2,288	0.5	1606	4,400	466	25	2.1	2.0
299.0	2,304	0.5	1701	4,400	460	26	2.2	1.9
310.0	2,327	0.5	1842	4,200	452	26	2.7	2.0

Table 2.8.--*Concentration of triazine herbicides in approximately midchannel of the Upper Mississippi River between Cairo, Ill., and Minneapolis, Minn., June-July 1991 cruise--Continued*

Location							Concentration	
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	Microtiter plate method (μg/L)	Magnetic particle method (μg/L)
				June 29, 1991--Continued				
321.0	2,350	0.5	1959	3,900	445	25	2.7	1.8
331.0	2,371	0.5	2120	3,900	446	25	2.2	1.8
341.5	2,394	0.5	2312	4,000	444	24	2.0	1.9
				June 30, 1991				
363.9	2,438	0.6	0123	3,000	463	26	2.5	2.3
370.9	2,454	0.5	0302	3,000	458	25	3.0	2.1
381.8	2,474	0.8	0405	3,000	465	24	2.1	1.9
402.8	2,515	0.5	0620	3,000	450	25	1.7	2.0
417.2	2,553	0.5	1139	3,000	434	25	1.3	1.7
435.2	2,588	0.5	1349	2,400	444	25	0.8	1.4
447.6	2,615	0.5	1613	2,400	435	26	1.3	1.4
457.1	2,638	0.5	1842	2,500	440	27	1.1	1.2
480.0	2,681	0.5	2046	2,500	423	27	1.1	1.3
491.1	2,703	0.5	2219	2,600	403	26	1.3	1.0
501.0	2,724	0.5	2355	2,500	419	26	0.9	1.3
				July 1, 1991				
509.3	2,740	0.5	0056	2,400	418	25	1.2	1.4
520.0	2,760	0.5	0204	2,300	423	25	0.7	1.1
531.0	2,783	0.5	0340	2,300	422	24	0.8	1.2
539.8	2,800	0.5	0440	2,300	413	24	1.3	1.1
551.0	2,821	0.5	0555	2,300	416	25	0.8	1.2
560.7	2,840	0.7	0700	2,300	422	24	0.8	1.1
572.0	2,862	0.5	0813	2,300	409	26	0.9	1.1
581.5	2,880	0.5	0914	2,300	392	26	0.8	1.2
590.5	2,898	0.7	1030	2,300	408	25	0.8	1.0
602.2	2,921	0.5	1145	2,300	407	26	0.8	0.8
610.0	2,938	0.5	1329	2,300	442	24	0.8	0.8
621.3	2,961	0.6	1509	2,300	458	25	0.9	0.8
633.0	2,984	0.5	1634	2,100	463	26	0.9	1.0
641.8	3,000	0.5	1735	1,900	464	25	0.8	0.9
653.0	3,021	0.5	1855	1,800	467	27	0.9	1.0
664.7	3,043	0.5	2014	1,800	471	25	1.0	1.1
675.5	3,063	0.5	2123	1,800	452	26	0.9	1.0
686.1	3,082	0.5	2238	1,700	478	25	1.2	1.0

Table 2.8.--*Concentration of triazine herbicides in approximately midchannel of the Upper Mississippi River between Cairo, Ill., and Minneapolis, Minn., June-July 1991 cruise--Continued*

Location							Concentration	
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Temperature (°C)	Microtiter plate method (µg/L)	Magnetic particle method (µg/L)
				July 2, 1991				
710.0	3,126	0.5	0133	1,600	491	23	0.8	1.1
723.2	3,152	0.5	0347	1,600	501	22	0.9	1.1
735.7	3,176	0.5	0535	1,600	501	22	1.0	1.1
745.5	3,196	0.5	0813	1,600	513	23	--	1.1
755.5	3,215	0.5	0939	1,600	488	23	--	1.3
764.9	3,233	0.8	1049	1,300	526	23	--	1.2
776.4	3,253	0.5	1154	1,200	567	24	--	1.3
793.2	3,284	0.5	1344	1,100	579	23	--	1.2
805.5	3,307	0.5	1519	1,100	576	23	--	1.0
812.4	3,320	0.5	1614	900	633	23	--	1.2
826.1	3,345	0.5	1757	1,000	629	23	--	1.2
838.0	3,368	0.5	2008	1,000	606	23	--	1.5
846.0	3,383	0.5	2115	400	402	23	--	1.3

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 230.0 upriver from Head of Passes, La., on June 23, 1991, at 2240 hours.

[2]X indicates two to five samples were collected across the river at this location. These individual values appear in table 2.16; the values of specific conductance, temperature, and chemical concentration in this table are the mean values.

[3]Water discharges are linearly interpolated values between discharges listed in table 1.5 in chapter 1.

Table 2.9.--*Concentration of triazine and acetanilide herbicides in approximately midchannel of the Lower Mississippi River between New Orleans, La., and Cairo, Ill., September-October 1991 cruise*

[km, kilometers; CDT, Central Daylight Time; m^3/s, cubic meters per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; µg/L, micrograms per liter; and --, no measurement]

Location							Concentration			
							Triazines		Acetanilides	
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Temperature (°C)	Microtiter plate method (µg/L)	Magnetic particle method (µg/L)	Microtiter plate method (µg/L)	Magnetic particle method (µg/L)
					September 25, 1991					
88.5	0	[2]X	0647	4,500	457	26	0.46	0.44	0.29	0.24
99.1	19	0.6	0757	4,500	444	26	0.43	0.42	0.24	--
105.1	30	0.6	0853	4,500	444	25	--	0.46	--	--
113.9	45	0.5	0922	4,500	450	26	0.48	0.45	0.29	0.20
123.1	61	0.5	1019	4,500	441	25	--	0.43	--	--
134.9	82	0.4	1126	4,500	432	25	0.54	0.48	0.24	--
146.0	100	0.5	1235	4,500	431	24	--	0.37	--	--
155.6	119	0.6	1325	4,500	433	25	0.36	0.42	0.21	0.20
164.7	136	0.5	1430	4,500	441	25	--	0.45	--	--
175.4	155	0.5	1532	4,500	451	23	0.41	0.45	0.31	0.22
184.8	172	[2]X	1635	4,500	451	26	0.42	0.46	0.22	--
195.1	191	0.4	1742	4,500	448	23	--	0.53	--	--
206.8	212	0.5	1850	4,500	449	24	0.42	0.57	0.22	--
216.2	229	0.5	1950	4,500	425	24	--	0.52	--	--
230.0	254	[2]X	2120	4,500	431	25	0.44	0.53	0.29	0.18
					September 26, 1991					
240.0	280	0.5	0241	4,700	415	23	--	0.41	--	--
249.0	296	0.3	0337	4,900	417	23	0.44	0.49	0.26	--
258.8	314	0.7	0435	5,100	417	23	--	0.49	--	--
269.9	334	0.5	0545	5,400	416	23	0.30	0.38	0.16	0.15
279.7	352	0.5	0655	5,600	412	23	--	0.50	--	--
289.6	370	0.5	0758	5,800	419	22	0.37	0.48	0.19	--
301.0	389	0.7	0924	6,100	406	23	--	0.41	--	--
310.0	405	0.5	1019	6,300	416	23	0.40	0.50	0.19	--
321.1	426	0.5	1128	7,500	404	23	--	0.48	--	--
330.4	444	0.5	1229	7,400	397	23	0.29	0.49	0.19	0.21
340.0	463	0.5	1334	7,400	415	22	--	0.49	--	--
351.3	485	0.8	1447	7,300	423	23	0.45	0.57	0.33	--
360.0	503	[2]X	1555	7,200	421	23	0.46	0.55	0.29	0.21
371.2	525	0.5	1704	7,200	----	---	--	0.50	--	--
380.5	546	0.4	1900	7,200	425	22	0.52	0.58	0.26	--
389.6	564	0.5	2007	7,200	428	22	--	0.57	--	--
398.8	582	0.8	2111	7,200	421	22	--	0.55	--	--

Table 2.9.--*Concentration of triazine and acetanilide herbicides in approximately midchannel of the Lower Mississippi River between New Orleans, La., and Cairo, Ill., September-October 1991 cruise--Continued*

[km, kilometers; CDT, Central Daylight Time; m^3/s, cubic meters per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; µg/L, micrograms per liter; and --, no measurement]

upriver from Head of Passes, La.	upriver from first sample[1] (km)	of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conduc-tance (µS/cm)	Temper-ature (°C)	Microtiter plate method (µg/L)	Magnetic particle method (µg/L)	Microtiter plate method (µg/L)	Magnetic particle method (µg/L)
				September 26, 1991--Continued						
409.5	604	0.4	2235	7,100	418	22	0.38	0.54	0.19	0.16
420.1	625	0.6	2345	7,100	431	22	--	0.50	--	--
				September 27, 1991						
432.0	649	0.4	0114	7,100	436	22	0.40	0.50	0.34	--
439.8	664	0.2	0208	6,600	444	21	--	0.50	--	--
449.2	683	0.6	0312	6,600	441	21	0.33	0.51	0.27	0.23
460.8	706	[2]X	0433	6,600	438	21	0.38	0.52	0.24	--
474.5	733	0.5	0615	6,500	440	21	0.45	0.45	0.28	0.24
485.2	754	0.5	0730	6,500	441	21	--	0.49	--	--
493.0	770	0.5	0825	6,500	440	21	0.52	0.46	0.26	--
504.5	793	0.8	0953	6,400	452	20	--	0.32	--	--
514.1	812	0.7	1059	6,400	445	21	0.31	0.48	0.26	0.25
524.9	834	0.5	1225	6,300	448	21	--	0.41	--	--
534.5	853	0.1	1335	6,300	453	20	0.41	0.45	0.38	--
545.0	877	0.3	1544	6,300	458	20	--	0.48	--	--
551.8	891	0.5	1630	6,300	451	20	0.38	0.45	0.30	0.24
562.8	913	0.3	1750	6,200	451	20	--	0.30	--	--
574.0	935	0.5	1903	6,200	453	20	0.36	0.52	0.38	--
580.8	948	[2]X	1957	6,100	455	20	0.41	0.44	0.35	0.26
590.3	968	0.5	2111	6,100	449	21	--	0.50	--	--
601.0	991	0.5	2309	6,000	448	20	0.40	0.47	0.38	--
				September 28, 1991						
608.8	1,009	0.5	0047	5,900	448	20	--	0.48	--	--
617.7	1,025	0.5	0122	5,900	450	20	0.42	0.54	0.42	0.34
629.3	1,049	0.2	0252	5,800	448	21	--	0.49	--	--
641.7	1,072	0.5	0427	5,700	451	20	0.40	0.48	0.41	--
650.2	1,089	0.5	0527	5,700	453	20	--	0.41	--	--
660.2	1,109	0.5	0640	5,600	453	20	0.35	0.49	0.40	0.34
669.9	1,128	0.5	0752	5,600	447	20	--	0.56	--	--
679.4	1,147	0.5	0858	5,600	457	20	0.42	0.55	0.41	--
689.9	1,169	0.5	1031	5,600	456	20	--	0.62	--	--
702.0	1,193	0.7	1200	5,600	448	20	0.41	0.57	0.51	0.38
712.9	1,215	[2]X	1327	5,600	418	20	0.41	0.57	0.50	--
721.5	1,235	0.5	1436	5,600	452	20	--	0.45	--	--
731.5	1,255	0.5	1546	5,600	464	20	0.38	0.46	0.41	0.39

Table 2.9.--*Concentration of triazine and acetanilide herbicides in approximately midchannel of the Lower Mississippi River between New Orleans, La., and Cairo, Ill., September-October 1991 cruise--Continued*

Location							Concentration			
							Triazines		Acetanilides	
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	Microtiter plate method (μg/L)	Magnetic particle method (μg/L)	Microtiter plate method (μg/L)	Magnetic particle method (μg/L)
				September 28, 1991--Continued						
742.0	1,277	0.5	1811	5,600	462	19	--	0.64	--	--
751.1	1,298	0.5	1920	5,600	457	19	0.37	0.63	0.42	--
762.2	1,319	0.5	2036	5,600	458	20	--	0.51	--	--
773.0	1,343	0.5	2240	5,600	453	20	0.34	0.60	0.38	0.29
783.0	1,362	0.7	2344	5,600	460	19	--	0.61	--	--
				September 29, 1991						
795.5	1,387	0.2	0124	5,600	464	19	0.33	0.49	0.38	--
804.5	1,405	0.3	0234	5,600	458	20	0.35	0.54	0.37	0.27
814.8	1,426	0.4	0350	5,600	458	19	--	0.57	--	--
822.2	1,441	0.5	0455	5,500	454	19	0.35	0.50	0.48	--
833.6	1,463	0.5	0610	5,500	449	19	--	0.52	--	--
846.5	1,489	[2]X	0752	5,500	414	20	0.32	0.41	0.36	0.28
855.0	1,506	0.5	0852	5,500	450	19	--	0.36	--	--
866.5	1,529	0.5	1010	5,500	446	19	0.35	0.37	0.40	--
875.4	1,549	[2]X	1121	5,500	447	20	0.33	0.33	0.43	--
898.9	1,596	[2]X	1419	5,500	453	20	0.40	0.46	0.39	0.32
922.6	1,644	[2]X	1715	5,500	461	20	0.28	0.31	0.36	--
950.5	1,699	[2]X	2029	5,500	484	19	0.34	0.32	0.40	0.23

[1] Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 88.5 upriver from Head of Passes, La., on September 25, 1991, at 0647 hours..

[2] X indicates three to five samples were collected across the river at this location. These individual values appear in table 2.17; the values of specific conductance, temperature, and chemical concentrations in this table are the mean values.

[3] Water discharges are linearly interpolated values between discharges listed in table 1.5 in chapter 1.

Table 2.10.--*Concentration of triazine and acetanilide herbicides at approximately midchannel of the Upper Mississippi River between Cairo, Ill. and Minneapolis, Minn., September-October 1991 cruise*

[km, kilometers; CDT, Central Daylight Time; m^3/s, cubic meters per second; μS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degree Celsius; μg/L, micrograms per liter; and --, no measurement]

Location							Concentration			
							Triazines		Acetanilide	
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	Microtiter plate method (μg/L)	Magnetic particle method (μg/L)	Microtiter plate method (μg/L)	Magnetic particle method (μg/L)
					September 30, 1991					
10.8	1,736	0.5	0039	3,700	550	19	--	0.34	--	--
19.8	1,755	0.5	0148	3,700	555	18	0.35	0.29	0.50	0.44
30.8	1,778	0.7	0315	3,700	559	18	--	0.33	--	--
39.0	1,795	0.5	0413	3,700	570	18	0.36	0.28	0.46	0.42
51.6	1,822	0.8	0550	3,700	562	18	--	0.22	--	--
63.6	1,846	0.5	0712	3,600	572	18	0.35	0.24	0.53	--
73.7	1,867	0.6	0823	3,600	556	18	--	0.35	--	--
80.8	1,882	^2X	0924	3,600	560	19	0.28	0.34	0.50	0.44
104.5	1,932	^2X	1222	3,500	565	18	0.34	0.29	0.60	0.43
128.9	1,983	^2X	1521	3,400	561	18	0.42	0.28	0.66	--
155.0	2,037	^2X	1835	3,300	565	18	0.41	0.24	0.48	0.46
180.3	2,090	^2X	2139	3,200	577	18	0.37	0.28	0.50	0.42
					October 1, 1991					
198.4	2,134	0.5	0127	2,000	481	18	0.28	0.24	0.57	0.55
207.2	2,151	0.3	0253	2,000	493	17	--	0.28	--	--
221.6	2,179	0.5	0507	2,000	457	17	--	0.50	--	--
230.5	2,195	0.5	0600	2,000	452	17	0.32	0.34	0.79	0.64
240.2	2,210	0.5	0700	2,000	454	17	--	0.42	--	--
249.2	2,230	0.5	1000	2,000	462	17	0.35	0.38	0.63	0.59
260.2	2,250	0.5	1109	2,000	456	17	--	0.36	--	--
272.0	2,272	0.5	1225	2,000	454	17	0.28	0.37	0.57	0.56
283.3	2,293	^2X	1407	2,000	461	17	0.38	0.42	0.55	0.54
292.0	2,309	0.5	1504	2,100	468	17	0.30	0.36	0.51	0.58
299.5	2,323	0.5	1553	2,100	461	17	--	0.37	--	--
310.0	2,343	0.5	1740	2,000	462	17	0.22	0.33	0.43	0.58
321.0	2,363	0.5	1852	2,000	462	16	--	0.38	--	--
331.0	2,384	0.5	2107	1,900	467	16	0.29	0.36	0.79	0.62
341.0	2,404	0.5	2212	1,800	452	16	--	0.36	--	--
					October 2, 1991					
351.0	2,421	0.5	0000	1,800	447	16	0.29	0.33	0.64	0.56
363.0	2,444	0.7	0136	1,800	447	16	--	0.37	--	--
371.0	2,459	0.5	0245	1,700	436	16	0.36	0.31	0.56	0.56

Table 2.10.--*Concentration of triazine and acetanilide herbicides at approximately midchannel of the Upper Mississippi River between Cairo, Ill. and Minneapolis, Minn., September-October 1991 cruise--Continued*

Location							Concentration			
							Triazines		Acetanilide	
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Temperature (°C)	Microtiter plate method (µg/L)	Magnetic particle method (µg/L)	Microtiter plate method (µg/L)	Magnetic particle method (µg/L)
				October 2, 1991--Continued						
382.0	2,479	0.5	0347	1,700	428	16		0.49		
397.0	2,507	0.5	0532	1,600	422	16	0.36	0.39	0.82	0.72
407.0	2,531	0.5	0928	1,600	417	15		0.29		
418.0	2,555	0.5	1218	1,600	435	16	0.35	0.31	0.96	0.89
427.0	2,572	0.5	1321	1,600	424	16		0.26		
435.0	2,586	0.5	1413	1,600	405	16	0.23	0.29	0.47	0.52
447.0	2,610	0.5	1626	1,500	407	16	0.23	0.27	0.50	0.31
455.5	2,626	0.5	1720	1,500	398	16	0.25	0.36	0.42	0.37
465.7	2,644	0.5	1837	1,500	398	16		0.29		
480.0	2,671	0.5	2013	1,400	401	16	0.26	0.30	0.42	0.31
491.0	2,692	0.5	2141	1,400	399	15		0.25		
502.0	2,713	0.5	2322	1,400	401	15	0.23	0.24	0.39	0.33
				October 3, 1991						
509.3	2,727	0.5	0016	1,300	399	15		0.25		
520.0	2,746	0.5	0129	1,300	395	15	0.25	0.29	0.53	0.32
531.0	2,767	0.5	0248	1,300	395	15		0.27		
539.2	2,782	0.5	0343	1,300	396	15	0.30	0.27	0.52	0.45
551.0	2,805	0.5	0537	1,300	393	15		0.34		
560.7	2,823	0.5	0656	1,300	394	15		0.29		
572.0	2,846	0.5	0805	1,300	400	14	0.24	0.50	0.52	0.49
581.5	2,863	0.5	0904	1,300	396	15		0.23		0.46
590.5	2,883	0.5	1131	1,300	396	14	0.21	0.29	0.65	0.51
602.2	2,904	0.5	1246	1,200	387	15		0.21		0.47
610.0	2,920	0.5	1412	1,200	402	15	0.24	0.26	0.65	0.48
621.3	2,939	0.5	1548	1,200	400	15		0.31		0.53
632.0	2,963	0.5	1703	1,100	417	15	0.18	0.32	0.79	0.57
641.8	2,976	0.5	1807	1,000	415	15		0.31		0.63
653.0	2,996	0.5	1932	1,000	417	15	0.16	0.32	0.80	0.61
665.5	3,018	0.5	2050	1,000	418	15		0.35		0.63
675.5	3,036	0.5	2158	1,000	425	15	0.19	0.40	0.68	0.57
686.1	3,055	0.5	2313	1,000	427	14		0.31		0.64

Table 2.10.--*Concentration of triazine and acetanilide herbicides at approximately midchannel of the Upper Mississippi River between Cairo, Ill. and Minneapolis, Minn., September-October 1991 cruise--Continued*

Location							Concentration			
							Triazines		Acetanilide	
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	Microtiter plate method (μg/L)	Magnetic particle method (μg/L)	Microtiter plate method (μg/L)	Magnetic particle method (μg/L)
						October 4, 1991				
700.0	3,080	0.5	0121	940	439	14	0.25	0.33	0.86	0.62
710.0	3,098	0.5	0232	930	435	15	\0.16	0.32	0.63	0.58
723.2	3,121	0.5	0410	940	432	15	0.23	0.29	0.79	0.60
735.7	3,146	0.5	0545	940	445	15		0.28		0.63
745.5	3,166	0.5	0902	920	458	13	0.25	0.28	0.88	0.69
755.5	3,182	0.5	1108	900	419	13		0.37		0.56
764.5	3,199	0.5	1215	720	507	13	0.26	0.35	0.96	0.75
776.4	3,219	0.5	1319	670	522	15		0.32		0.62
786.2	3,236	0.5	1431	630	535	14	0.18	0.28	0.76	0.56
793.1	3,248	0.5	1520	600	544	15		0.26		0.62
805.5	3,270	0.5	1642	510	520	14	0.18	0.30	0.65	0.55
812.5	3,282	0.5	1729	360	660	14		0.30		0.71
826.1	3,306	0.5	1900	350	659	15	0.21	0.32	0.81	0.65
838.0	3,327	0.5	2023	360	657	15		0.39		0.61
846.0	3,342	0.5	2213	230	472	14	0.26	0.37	0.52	0.55

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 88.5 upriver from Head of Passes, La., on September 25, 1991, at 0647 hours.

[2]X indicates three to five samples were collected across the river at this location. These individual values appear in table 2.18; the values of specific conductance, temperature, and chemical concentrations in this table are the mean values.

[3]Water discharges are linearly interpolated values between discharges listed in table 1.5 in chapter 1.

Table 2.11.--*Concentration of triazine and acetanilides herbicides in approximately midchannel of the Lower Mississippi River between New Orleans, La., and Cairo, Ill., March-April 1992 cruise*

[km, kilometers; CDT, Central Daylight Time; m^3/s, cubic meters per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; µg/L, micrograms per liter; --, no measurement; and <, less than]

Location							Concentration	
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Temperature (°C)	Triazines magnetic particle method (µg/L)	Acetanilides magnetic particle method (µg/L)
				March 25, 1992				
90.0	0	[2]X	0705	22,300	288	17	0.12	<0.10
100.0	23	0.5	0829	22,300	--	15	0.13	<0.10
110.0	45	0.5	0938	22,300	--	15	0.10	<0.10
119.0	65	0.5	1044	22,300	--	14	0.15	<0.10
130.0	90	0.5	1205	22,300	--	14	0.13	<0.10
139.8	112	0.5	1312	22,300	--	14	0.13	<0.10
149.7	134	0.6	1424	22,300	--	13	0.17	<0.10
160.1	157	0.5	1539	22,300	--	13	0.13	<0.10
170.0	179	0.5	1649	22,300	--	12	0.19	<0.10
179.5	200	0.5	1752	22,300	--	12	0.13	<0.10
190.0	223	0.5	1900	22,300	--	13	0.14	<0.10
200.0	245	0.5	2011	22,300	--	13	0.15	<0.10
210.0	267	0.5	2124	22,300	--	14	0.21	<0.10
220.0	290	0.5	2236	22,300	--	14	0.20	<0.10
228.0	309	[2]X	2348	22,300	306	13	0.20	<0.10
				March 26, 1992				
240.3	358	0.5	0532	22,200	305	13	0.14	<0.10
250.0	380	0.5	0647	22,100	303	13	0.17	<0.10
260.8	404	0.5	0804	21,900	308	13	0.14	0.10
270.0	424	0.5	0907	21,800	306	13	0.11	<0.10
280.0	446	0.5	1018	21,700	293	13	0.13	0.11
290.0	468	0.5	1131	21,600	311	12	0.13	<0.10
300.0	490	0.5	1243	21,500	309	12	0.14	<0.10
310.0	513	0.5	1354	21,400	311	12	0.15	0.12
321.1	538	0.5	1515	25,800	312	12	0.17	<0.10
330.4	559	0.6	1620	25,600	312	13	0.16	<0.10
340.0	581	0.5	1731	25,500	311	12	0.14	<0.10
351.3	607	0.8	1853	25,400	311	12	0.16	<0.10
360.0	628	[2]X	2011	25,200	308	12	0.14	0.14
371.2	661	0.5	2252	25,300	311	12	0.16	<0.10
				March 27, 1992				
380.8	684	0.3	0019	25,400	313	12	0.16	0.12
389.0	705	0.5	0117	25,500	311	12	0.17	<0.10

Table 2.11.--*Concentration of triazine and acetanilides herbicides in approximately midchannel of the Lower Mississippi River between New Orleans, La., and Cairo, Ill., March-April 1992 cruise--Continued*

Location							Concentration	
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	Triazines magnetic particle method (μg/L)	Acetanilides magnetic particle method (μg/L)
				March 27, 1992--Continued				
399.4	728	0.5	0234	25,600	311	12	0.15	<0.10
409.5	754	0.5	0402	25,800	316	12	0.16	<0.10
421.8	784	0.5	0531	25,900	319	12	0.16	<0.10
435.3	819	[2]X	0729	26,100	316	12	0.17	0.12
445.2	844	0.5	0847	25,800	323	12	0.20	<0.10
454.3	867	0.5	0957	25,800	321	12	0.18	<0.10
464.8	893	0.5	1121	25,900	324	13	0.26	<0.10
475.0	920	0.5	1246	26,000	326	14	0.26	<0.10
485.5	946	0.6	1410	26,000	337	13	0.25	0.10
495.1	971	0.5	1532	26,200	334	12	0.28	--
504.5	995	0.8	1651	26,300	338	11	0.24	<0.10
514.1	1,021	0.6	1823	26,300	336	11	0.27	0.10
525.0	1,049	0.5	1951	26,300	343	11	0.26	--
535.0	1,076	[2]X	2128	26,300	340	11	0.23	0.10
				March 28, 1992				
544.9	1,111	0.5	0009	26,400	338	12	0.20	<0.10
555.0	1,137	0.5	0139	26,400	339	12	0.26	0.10
565.1	1,165	0.5	0317	26,400	338	12	0.26	<0.10
582.0	1,213	0.5	0613	25,300	341	11	0.28	<0.10
592.1	1,238	0.5	0734	25,000	340	11	0.25	<0.10
602.0	1,264	0.5	0858	23,800	358	11	0.26	0.13
614.1	1,295	0.5	1040	23,600	356	11	0.25	<0.10
626.6	1,328	0.5	1229	23,500	363	12	0.23	0.10
638.7	1,358	0.5	1401	23,400	366	13	0.21	0.13
650.1	1,387	0.6	1540	23,200	360	15	0.19	<0.10
659.8	1,412	[2]X	1659	23,100	360	11	0.24	0.10
672.7	1,445	0.5	1843	23,100	351	12	0.23	0.11
683.4	1,472	0.5	2011	23,100	358	12	0.22	<0.10
695.0	1,501	0.6	2138	23,100	358	12	0.21	<0.10
705.0	1,527	0.5	2308	23,200	352	12	0.17	<0.10
				March 29, 1992				
714.3	1,549	0.8	0029	23,200	356	12	0.18	<0.10
723.3	1,571	[2]X	0143	23,300	355	14	0.18	0.12
735.0	1,613	0.5	0544	23,300	338	13	0.18	0.10
742.0	1,630	0.5	0640	23,100	348	14	0.18	<0.10

Table 2.11.--*Concentration of triazine and acetanilides herbicides in approximately midchannel of the Lower Mississippi River between New Orleans, La., and Cairo, Ill., March-April 1992 cruise--Continued*

Location							Concentration	
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	Triazines magnetic particle method (μg/L)	Acetanilides magnetic particle method (μg/L)
March 29, 1992--Continued								
752.9	1,657	0.5	0820	22,700	345	13	0.19	<0.10
763.0	1,681	0.5	0940	22,400	349	12	0.18	0.11
774.0	1,707	0.5	1103	22,000	347	12	0.17	0.12
784.6	1,732	0.8	1227	21,700	349	14	0.19	0.07
795.5	1,758	0.5	1356	21,300	352	11	--	--
804.7	1,780	0.3	1513	21,100	349	12	0.20	<0.10
815.8	1,807	0.5	1644	20,700	354	15	0.20	<0.10
828.0	1,835	0.5	1810	20,300	360	12	0.21	<0.10
837.4	1,857	0.6	1926	20,000	369	12	0.19	0.11
848.0	1,884	[2]X	2105	19,700	341	12	0.21	0.10
March 30, 1992								
878.1	1,956	[2]X	0107	18,700	347	10	0.22	0.11
898.9	2,006	[2]X	0400	18,000	389	11	0.25	0.10
923.0	2,063	[2]X	0713	17,300	349	11	0.22	0.22
950.5	2,128	[2]X	1047	17,000	417	10	0.26	0.20

[1]Distance are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 90.0 upriver from Head of Passes, La., on March 25, 1992, at 0705 hours.

[2]X indicates three to five saples were collected across the river at this location. These individual values appear in table 2.19; the values of specific conductance, temperature, and chemical concentration in this table. Values below the detection limit were not included in the mean values.

[3]Water discharges are linearly interpolated values between discharges listed in table 1.5 in chapter 1.

Table 2.12.--*Concentration of triazine and acetanilide herbicides at approximately midchannel of the Upper Mississippi River between Cairo, Ill. and Minneapolis, Minn., March-April 1992 cruise*

[km, kilometers; CDT, Central Daylight Time; m^3/s, cubic meters per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degree Celsius; µg/L, micrograms per liter; and --, no sample analyzed]

Location							Concentration	
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Temperature (°C)	Triazines Magnetic particle method (µg/L)	Acetanilides Magnetic particle method (µg/L)
				March 30, 1992				
11.6	2,173	0.6	1422	8,000	487	9	0.32	0.18
19.8	2,192	0.5	1528	7,900	474	10	0.30	0.21
34.3	2,226	0.5	1719	7,700	514	9	0.33	0.25
49.4	2,261	0.5	1920	7,600	528	9	0.32	0.21
65.4	2,299	0.5	2138	7,600	514	9	0.28	0.17
80.5	2,335	0.5	2346	7,500	521	10	0.31	0.18
				March 31, 1992				
96.2	2,371	0.5	0143	7,700	509	10	0.32	0.17
109.8	2,404	[2]X	0340	7,800	506	10	0.35	0.24
127.7	2,448	[2]X	0629	7,500	513	11	0.33	0.32
145.7	2,491	[2]X	0903	7,600	518	10	0.31	0.31
169.7	2,548	[2]X	1229	7,700	533	11	0.34	0.31
180.3	2,574	[2]X	1405	7,800	516	11	0.33	0.30
198.3	2,620	0.5	1717	5,900	492	11	0.26	0.41
207.1	2,640	0.2	1850	5,900	--	--	0.24	0.46
221.0	2,673	0.5	2125	5,300	451	10	0.22	0.41
233.5	2,699	0.4	2248	5,000	469	8	0.23	0.41
				April 1, 1992				
246.0	2,729	0.5	0123	4,700	448	10	0.28	0.47
258.5	2,759	0.5	0250	4,400	468	8	0.35	0.42
270.0	2,782	0.6	0454	4,200	498	9	0.32	0.44
282.6	2,809	0.5	0630	4,100	465	10	0.31	0.40
293.0	2,830	0.5	0745	4,000	485	9	0.26	0.29
307.0	2,861	0.7	0943	3,900	486	8	0.26	0.37
324.6	2,897	[2]X	1143	3,600	484	8	0.22	0.28
336.0	2,921	0.5	1311	3,500	506	9	0.21	0.26
347.0	2,945	0.5	1437	3,500	462	9	0.18	0.23
361.7	2,975	0.7	1620	3,300	494	7	0.24	0.36
374.0	3,003	0.5	1823	3,400	489	7	0.24	0.24
388.0	3,031	0.4	1948	3,400	485	8	0.20	0.26
403.0	3,060	0.7	2121	3,400	475	8	0.37	0.63

Table 2.12.--*Concentration of triazine and acetanilide herbicides at approximately midchannel of the Upper Mississippi River between Cairo, Ill. and Minneapolis, Minn., March-April 1992 cruise--Continued*

Location							Concentration	
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	Triazines Magnetic particle method (μg/L)	Acetanilides Magnetic particle method (μg/L)
				April 2, 1992				
413.0	3,088	0.5	0035	3,400	445	9	0.21	0.29
425.0	3,113	0.5	0156	3,200	445	9	0.25	0.27
441.2	3,147	0.6	0423	2,800	448	7	0.19	0.26
453.0	3,169	0.5	0539	2,900	446	7	0.14	0.23
462.8	3,188	0.7	0650	2,900	448	7	0.17	0.20
481.6	3,224	[2]X	0908	2,500	472	7	0.17	0.20
490.7	3,242	0.2	1031	2,600	438	7	0.17	0.14
506.4	3,272	0.5	1228	2,600	434	7	0.18	0.17
520.0	3,298	0.5	1403	2,700	433	7	0.14	0.19
533.0	3,323	0.5	1530	2,700	434	7	0.16	0.18
549.0	3,353	0.5	1716	2,700	456	7	0.13	0.15
561.3	3,377	0.5	1838	2,700	435	8	0.15	0.15
572.9	3,398	0.5	1951	2,700	433	7	0.13	0.14
581.5	3,415	0.5	2046	2,700	433	7	0.17	0.15
597.0	3,444	0.9	2237	2,700	441	7	0.18	0.16
				April 3, 1992				
610.0	3,472	0.5	0120	2,600	439	7	0.16	0.17
621.0	3,494	0.4	0245	2,600	443	6	0.13	0.14
631.9	3,514	0.5	0406	2,200	453	7	0.15	0.20
644.9	3,538	0.5	0532	2,200	459	7	0.16	0.20
653.0	3,553	0.5	0628	2,200	468	6	0.17	0.20
669.9	3,583	0.5	0813	2,100	453	7	0.12	0.18
684.3	3,609	0.5	0955	2,100	446	7	0.13	0.19
696.1	3,630	[2]X	1116	2,000	438	7	0.12	0.16
709.5	3,655	0.5	1307	1,800	505	7	0.08	0.20
723.6	3,681	[2]X	1449	1,700	508	8	<0.10	0.22
735.7	3,703	0.5	1614	1,800	502	8	0.09	0.21
745.5	3,721	0.5	1726	1,700	548	8	0.09	0.24
755.5	3,740	0.5	1859	1,600	525	7	0.07	0.23
764.5	3,756	0.7	2005	1,300	578	6	0.08	0.30
776.4	3,777	0.5	2107	1,200	548	7	0.09	0.28
793.1	3,806	0.5	2210	1,000	554	8	0.07	0.24

Table 2.12.--*Concentration of triazine and acetanilide herbicides at approximately midchannel of the Upper Mississippi River between Cairo, Ill. and Minneapolis, Minn., March-April 1992 cruise--Continued*

Location							Concentration	
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	Triazines Magnetic particle method (μg/L)	Acetanilides Magnetic particle method (μg/L)
				April 4, 1992				
805.5	3,829	0.5	0015	1,000	559	8	0.07	0.14
813.0	3,843	0.5	0117	690	699	7	0.09	0.25
826.1	3,868	0.8	0304	650	694	8	0.07	0.37
835.1	3,887	[2]X	0548	630	711	8	0.10	0.25
845.6	3,907	0.5	0733	310	437	8	0.10	0.13

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 90.0 upriver from Head of Passes, La., on March 25, 1992, at 0705 hours.

[2]X indicates two or three samples were collected across the river at this location. These individual values appear in table 2.20: the values of specific conductance, temperature, and chemical concentrations in this table are the mean values. Values below the detection limit were not included in the mean.

[3]Water discharges are linearly interpolated values between dishcharges listed in table 1.5 in chapter 1.

(page 61 follows)

Table 2.13.--*Cross-channel variability of triazine herbicides in the Lower Mississippi River between Baton Rouge, La., and Cairo, Ill., May-June 1990 cruise*

[km, kilometers; CDT, Central Daylight Time; μS/cm, microsiemens per centimeter at 25 degrees Celsius; μg/L, micrograms per liter; and --, no measurement]

Location			Time (CDT)	Specific conductance (μS/cm)	Concentration using microtiter plate method (μg/L)
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank			
		May 26, 1990			
230	0	0.3	0006	341	2.7
		0.5	0003	340	2.5
		0.7	0008	339	2.8
		May 27, 1990			
300	163	0.3	0845	331	2.7
		0.5	0848	330	2.4
		0.7	0851	331	3.0
433.5	499	0.1	0021	292	3.1
		0.3	0018	295	3.5
		0.5	0015	296	3.3
		0.7	0013	296	3.8
		0.9	0010	298	3.7
531	751	0.3	1149	290	2.1
		0.5	1147	289	4.7
		0.8	1144	286	5.2
581	890	0.1	1901	298	4.1
		0.3	1858	297	4.0
		0.5	1855	292	5.3
		0.7	1853	276	2.4
		May 28, 1990			
690	1,178	0.1	0912	316	4.3
		0.5	0909	317	4.5
		0.8	0906	317	4.8
		May 29, 1990			
800	1,488	0.3	0202	334	5.3
		0.5	0200	337	5.6
		0.7	0205	337	5.7
840	1,595	0.2	0723	340	6.0
		0.6	0726	346	5.0
		0.8	0729	347	4.7
880	1,701	0.1	1244	334	4.0

Table 2.13.--*Cross-channel variability of triazine herbicides in the Lower Mississippi River between Baton Rouge, La., and Cairo, Ill., May-June 1990 cruise--Continued*

Location			Time (CDT)	Specific conductance (μS/cm)	Concentration using microtiter plate method (μg/L)
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank			
		May 29, 1990--Continued			
		0.3	1243	346	--
		0.5	1242	353	4.5
		0.7	1241	359	--
		0.9	1240	362	4.6
900	1,754	0.1	1520	322	5.9
		0.3	1518	349	--
		0.5	1517	365	5.4
		0.7	1516	371	--
		0.9	1515	383	5.0
910	1,780	0.1	1645	319	--
		0.3	1644	324	--
		0.5	1643	325	5.4
		0.7	1642	340	--
		0.9	1641	399	--
917	1,800	0.1	1744	315	--
		0.3	1743	329	--
		0.5	1742	363	--
		0.7	1741	399	--
		0.9	1740	405	--
937.6	1,851	0.1	2006	294	--
		0.3	2005	297	6.2
		0.5	2004	325	5.5
		0.7	2003	400	4.1
		0.9	2002	410	3.5
950	1,885	0.1	2151	285	5.4
		0.3	2150	309	6.5
		0.5	2149	375	5.1
		0.7	2148	415	3.0
		0.9	2142	416	2.7

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 230.0 upriver from Head of Passes, La., on May 26, 1990, at 0006 hours.

Table 2.14.--*Cross-channel variability of triazine herbicides in the Upper Mississippi River between Cairo, Ill., and Grafton, Ill., May-June 1990 cruise*

[km, kilometers; CDT, Central Daylight Time; µS/cm, microsiemens per centimeter at 25 degrees Celsius; and µg/L, micrograms per liter]

Location					
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (µS/cm)	Concentration using microtiter plate method (µg/L)
		June 5, 1990			
50	119	0.1	0052	417	3.8
		0.5	0048	419	3.0
		0.9	0057	420	3.7
100.8	242	0.1	0730	437	3.3
		0.5	~0734	440	2.6
		0.9	0738	420	2.0
119.5	289	0.1	1018	466	2.8
		0.9	1022	425	3.3
130.7	316	0.1	1150	468	2.5
		0.4	1153	431	0.3
140	339	0.1	1309	486	2.6
		0.9	1305	423	0.2
150	363	0.1	1425	498	3.0
		0.9	1422	418	1.3
160	390	0.1	1610	505	2.2
		0.9	1613	406	3.8
170	415	0.1	1742	521	1.3
		0.9	1738	426	1.8
179.3	438	0.1	1858	518	3.3
		0.9	1900	428	1.4
		June 6, 1990			
196	476	0.1	2055	596	2.5
		0.9	2050	406	1.8

Table 2.14.--*Cross-channel variability of triazine herbicides in the Upper Mississippi River between Cairo, Ill., and Grafton, Ill., May-June 1990 cruise--Continued*

Location					
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (μS/cm)	Concentration using microtiter plate method (μg/L)
		June 6, 1990--Continued			
196	520	0.1	0810	604	3.3
		0.9	0812	405	2.8
206	543	0.1	0955	625	2.4
		0.4	1000	394	2.1
216	564	0.1	1110	705	2.6
		0.4	1114	393	1.9

[1]Because there was a 6-day break between the last Lower Mississippi River sample and the first Upper Mississippi River sample, the first sample was collected at Mile 0.0 upriver from mouth of Ohio River on June 4, 1990, at 1840 hours.

Table 2.15.--*Cross-channel variability of triazine herbicides in the Lower Mississippi River between Baton Rouge, La., and Cairo, Ill., June-July 1991*

[km, kilometers; CDT, Central Daylight Time; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; µg/L, micrograms per liter; and --, no measurement]

Location						Concentration	
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (µS/cm)	Temperature (° C)	Microtiter plate method (µg/L)	Magnetic particle method (µg/L)
			June 23, 1991				
230.0	0	0.2	1030	393	--	4.0	3.5
		0.5	1040	--	--	4.3	3.6
		0.8	1045	--	--	4.2	3.3
			June 24, 1991				
360.0	279	0.2	1326	396	24	4.6	3.1
		0.5	1320	395	26	4.6	3.4
		0.9	1315	399	25	4.0	3.5
			June 25, 1991				
475.0	532	0.2	0355	396	25	4.6	3.7
		0.5	0400	402	25	5.0	3.1
		0.9	0407	399	25	4.4	3.0
580.8	766	0.2	1712	391	26	2.9	2.4
		0.5	1718	388	27	2.9	2.4
		0.9	1724	536	27	2.1	2.0
			June 26, 1991				
712.9	1,072	0.1	1035	424	24	2.8	3.4
		0.5	1029	434	24	3.2	2.7
		0.9	1023	428	25	2.2	2.0
			June 27, 1991				
839.0	1,360	0.1	0410	414	26	4.0	3.1
		0.5	0403	413	25	4.2	3.1
		0.9	0355	411	25	3.7	3.4
898.9	1,489	0.1	1118	396	25	4.0	3.2
		0.5	1124	408	26	4.2	3.1
		0.9	1130	416	26	4.4	3.1
937.6	1,572	0.1	1559	362	26	3.7	2.8
		0.5	1553	368	26	4.8	3.2
		0.9	1543	402	25	4.9	3.5

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 230.0 upriver from Head of Passes, La., on June 23, 1991, at 2240 hours.

Table 2.16.--*Cross-channel variability of triazine herbicides in the Upper Mississippi River between Cairo, Ill., and Minneapolis, Minn., June-July 1991 cruise*

[km, kilometers; CDT, Central Daylight Time; µS/cm, microsiemens per centimeter at 25 degrees Celsius; and µg/L, micrograms per liter]

Location						Concentration	
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (µS/cm)	Temperature (°C)	Microtiter plate method (µg/L)	Magnetic particle method (µg/L)
			June 28, 1991				
100.7	1,846	0.4	0818	457	25	5.1	3.8
		0.9	0811	460	24	4.1	3.1
150.0	1,961	0.1	1439	470	26	4.2	3.4
		0.9	1434	498	25	3.7	2.8

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 230.0 upriver from Head of Passes, La., on June 23, 1991, at 2240 hours.

Table 2.17.--*Cross-channel variability of triazine and acetanilide herbicides in the Lower Mississippi River between New Orleans, La., and Cairo, Ill., September-October 1991 cruise*

[km, kilometers; CDT, Central Daylight Time; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; µg/L, micrograms per liter; and --, no measurement]

Location						Concentration			
						Triazines		Acetanalides	
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (µS/cm)	Temperature (° C)	Microtiter plate method (µg/L)	Magnetic particle method (µg/L)	Microtiter plate method (µg/L)	Magnetic particle method (µg/L)
September 25, 1991									
88.5	0	0.9	0655	465	27	--	0.42	--	--
		0.5	0647	463	25	--	0.45	--	--
		0.1	0640	443	27	0.46	0.45	0.29	0.24
184.8	172	0.1	1628	453	25	--	0.46		--
		0.5	1635	451	26	0.42	0.44	0.22	--
		0.9	1642	450	26	--	0.48	--	--
230.0	254	0.1	2114	439	25	--	0.57		--
		0.5	2122	426	25	0.44	0.49	0.29	0.18
		0.9	2130	429	25	--	0.53	--	--
September 26, 1991									
360.0	503	0.1	1550	420	22	--	0.52	--	--
		0.5	1555	420	23	0.46	0.52	0.29	0.21
		0.9	1600	422	24	--	0.62	--	--
September 27, 1991									
460.8	706	0.1	0428	440	20	--	0.54	--	--
		0.5	0433	437	21	0.38	0.48	0.24	--
		0.9	0437	438	21	--	0.54	--	--
580.8	948	0.1	1950	444	20	--	0.46	--	--
		0.5	1957	441	21	0.41	0.46	0.35	0.26
		0.9	2005	481	20	--	0.40	--	--
September 28, 1991									
712.9	1,215	0.3	1322	444	19	--	0.64	--	--
		0.5	1327	404	20	0.41	0.50	0.50	--
		0.8	1331	405	20	--	0.57	--	--
September 29, 1991									
846.5	1,489	0.1	0746	449	19	--	0.39	--	--
		0.5	0752	396	20	0.32	0.48	0.36	0.28
		0.9	0758	396	20	--	0.36	--	--

Table 2.17.--*Cross-channel variability of triazine and acetanilide herbicides in the Lower Mississippi River between New Orleans, La., and Cairo, Ill., September-October 1991 cruise--Continued*

Location						Concentration			
						Triazines		Acetanalides	
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (μS/cm)	Temperature (° C)	Microtiter plate method (μg/L)	Magnetic particle method (μg/L)	Microtiter plate method (μg/L)	Magnetic particle method (μg/L)
				September 29, 1991–Continued					
875.4	1,549	0.1	1115	444	20	--	0.35	--	--
		0.5	1121	447	20	0.33	0.30	0.43	--
		0.9	1128	449	20	--	0.34	--	--
898.9	1,596	0.1	1413	440	20	--	0.40	--	--
		0.5	1419	458	20	0.40	0.55	0.39	0.32
		0.9	1425	461	21	--	0.42	--	--
922.6	1,644	0.1	1710	444	20	--	0.33	--	--
		0.5	1715	461	20	0.28	0.32	0.36	--
		0.9	1719	478	20	--	0.28	--	--
950.5	1,699	0.1	2023	396	19	0.31	0.29	0.26	0.23
		0.5	2029	510	19	--	0.35	--	--
		0.8	2034	548	20	0.34	0.32	0.54	--

[1]Distances are computed using velocities in table 1.4 in chapter 1, and the first sample was collected at Mile 88.5 upriver from Head of Passes, La., on September 25, 1991, at 0647 hours.

Table 2.18.--*Cross-channel variability of triazine and acetanalide herbicides in the Upper Mississippi River between Cairo, Ill., and Minneapolis, Minn., September-October 1991 cruise*

[km, kilometers; CDT, Central Daylight Time; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; µg/L, micrograms per liter; and --, no measurement]

Location						Concentration			
						Triazines		Acetanilide	
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (µS/cm)	Temperature (°C)	Microtiter plate method (µg/L)	Magnetic particle method (µg/L)	Microtiter plate method (µg/L)	Magnetic particle method (µg/L)
				September 30, 1991					
80.8	1,882	0.1	0914	559	18	0.34	0.37	0.56	0.44
		0.5	0924	558	19	--	0.31	--	--
		0.9	0935	564	19	0.22	0.35	0.43	--
104.5	1,932	0.1	1217	549	18	--	0.29	--	--
		0.6	1222	568	19	0.34	0.27	0.60	0.43
		0.9	1226	578	18	--	0.32	--	--
128.9	1,983	0.2	1510	556	18	--	0.28	--	--
		0.5	1521	556	19	0.42	0.31	0.66	--
		0.9	1532	572	18	--	0.26	--	--
155.0	2,037	0.1	1830	527	18	--	0.27	--	--
		0.5	1835	542	18	0.41	0.26	0.48	0.46
		0.9	1840	627	19	--	0.19	--	--
180.3	2,090	0.1	2131	523	18	0.38	0.29	0.57	0.47
		0.5	2148	557	18	0.36	0.30	0.44	0.38
		0.9	2139	651	19	--	0.24	--	--
				October 1, 1991					
283.3	2,293	0.1	1400	463	17	--	0.40	--	--
		0.5	1407	460	17	0.38	0.46	0.55	0.54
		0.9	1412	461	17	--	0.39	--	--

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 88.5 upriver from Head of Passes, La., on September 25, 1991, at 0647 hours.

Table 2.19.--*Cross-channel variability of triazine and acetanilide herbicides in the Lower Mississippi River between New Orleans, La., and Cairo, Ill., March-April 1992 cruise*

[km, kilometers; CDT, Central Daylight Time; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius, µg/L, micrograms per liter; --, no measurement; and <, less than]

Location						Concentration	
						Triazines	Acetanilides
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (µS/cm)	Temperature (° C)	Magnetic particle method (µg/L)	Magnetic particle method (µg/L)
			March 25, 1992				
90.0	0	0.1	0705	337	16	0.14	<0.10
		0.5	0655	267	17	0.11	<0.10
		0.9	0713	261	16	0.12	<0.10
228.0	309	0.1	2344	305	13	0.21	<0.10
		0.5	2336	306	13	0.24	<0.10
		0.9	2352	306	13	0.16	<0.10
			March 26, 1992				
360.0	628	0.1	2000	308	12	0.17	0.16
		0.5	2022	309	12	0.11	0.11
		0.9	2011	--	--	0.13	<0.10
			March 27, 1992				
435.3	819	0.1	0737	298	12	0.16	<0.10
		0.5	0729	323	12	0.16	0.10
		0.9	0722	326	12	0.18	0.13
535.0	1,076	0.1	2117	340	11	0.26	0.10
		0.5	2128	340	11	0.24	0.11
		0.8	2139	341	11	0.20	<0.10
			March 28, 1992				
659.8	1,412	0.1	1653	358	11	0.23	0.10
		0.5	1659	358	11	0.24	<0.10
		1.0	1705	365	11	0.26	0.10
			March 29, 1992				
723.3	1,571	0.3	0143	354	12	0.19	0.11
		0.5	--	354	15	0.17	<0.10
		0.7	--	357	14	0.17	0.12
848.0	1,884	0.1	2100	329	13	0.23	0.10
		0.5	2105	348	11	0.20	<0.10
		0.9	2110	347	12	0.20	0.13

Table 2.19.--*Cross-channel variability of triazine and acetanilide herbicides in the Lower Mississippi River between New Orleans, La., and Cairo, Ill., March-April 1992 cruise--Continued*

Location						Concentration	
						Triazines	Acetanilides
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (μS/cm)	Temperature (° C)	Magnetic particle method (μg/L)	Magnetic particle method (μg/L)
				March 30, 1992			
878.1	1,956	0.2	0056	331	11	0.25	<0.10
		0.5	0106	344	10	0.20	<0.10
		0.9	0117	367	10	0.22	0.11
898.9	2,006	0.1	0406	378	12	0.27	<0.10
		0.5	0359	380	11	0.22	0.10
		0.9	0353	409	10	0.25	<0.10
923.0	2,063	0.1	0722	273	11	0.15	<0.10
		0.5	0713	331	11	0.19	<0.10
		0.9	0705	442	10	0.31	0.22
950.5	2,128	0.1	1040	288	11	0.12	<0.10
		0.5	1047	477	9	0.33	0.15
		0.9	1055	485	9	0.32	0.25

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 90.0 upriver from Head of Passes, La., on March 25, 1992, at 0705 hours.

Table 2.20.--*Cross-channel variability of triazine and acetanilide herbicides in the Upper Mississippi River between Cairo, Ill., and Minneapolis, Minn., March 31 to April 4, 1992*

[km, kilometers; CDT, Central Daylight Time; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; µg/L, micrograms per liter; and --, no sample analyzed]

Location						Concentration	
						Triazines	Acetanilides
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conduc-tance (µS/cm)	Temper-ature (° C)	Magnetic particle method (µg/L)	Magnetic particle method (µg/L)
			March 31, 1992				
109.8	2,404	0.1	0335	519	10	0.41	0.23
		0.5	0345	503	11	0.34	0.25
		0.9	0340	497	9	0.31	0.25
127.7	2,448	0.1	0636	521	11	0.35	0.34
		0.5	0629	511	11	0.32	0.33
		0.9	0622	506	10	0.31	0.29
145.7	2,491	0.1	0855	529	10	0.31	0.37
		0.5	0903	518	10	0.30	0.34
		0.9	0912	507	10	0.32	0.22
169.7	2,548	0.1	1237	544	11	0.30	0.39
		0.5	1229	518	10	0.31	0.40
		0.9	1221	536	12	0.40	0.14
180.3	2,574	0.1	1410	541	10	0.31	0.37
		0.5	1405	487	10	0.29	0.38
		0.9	1359	521	13	0.38	0.15
			April 1, 1992				
324.6	2,897	0.1	1147	458	8	0.19	0.26
		0.5	1142	459	8	0.22	0.29
		0.9	1138	535	9	0.24	0.29
			April 2, 1992				
481.6	3,224	0.1	0902	520	8	0.17	0.17
		0.5	0908	443	7	0.16	0.18
		0.9	0914	453	7	0.17	0.24
			April 3, 1992				
696.1	3,630	0.1	1122	389	7	0.12	0.14
		0.5	1116	425	7	0.12	0.16
		0.9	1110	499	7	0.13	0.19

Table 2.20.--*Cross-channel variability of triazine and acetanilide herbicides in the Upper Mississippi River between Cairo, Ill., and Minneapolis, Minn., March 31 to April 4, 1992--Continued*

Location						Concentration	
						Triazines	Acetanilides
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (μS/cm)	Temperature (° C)	Magnetic particle method (μg/L)	Magnetic particle method (μg/L)
			April 3, 1992--Continued				
723.6	3,681	0.5	1445	498	8	<0.10	0.28
		0.9	1452	519	7	<0.10	0.17
			April 4, 1992				
835.1	3,887	0.1	0540	743	8	<0.10	0.19
		0.5	0548	694	8	0.10	0.30
		0.8	0556	696	7	<0.10	0.26

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 90.0 upriver from Head of Passes, La., on March 25, 1992, at 0705 hours.

(page 75 follows)

Table 2.21.--*Concentration of triazine herbicides in some of the tributaries of the Mississippi River between Baton Rouge, La., and Grafton, Ill., May-June 1990 cruise*

[km, kilometers; CDT, Central Daylight Time; µS/cm, microsiemens per centimeter at 25 degrees Celsius; µg/L, micrograms per liter; BT, below the mouth of the tributary but near the bank; --, no measurement; and <, less than]

Name of tributary	Location			Date 1990	Time (CDT)	Specific conductance (µS/cm)	Concentration using microtiter plate method (µg/L)
	River miles	Distance upriver from first sample (km)	Fraction of distance from left to right bank				
Yazoo	433.5	[1]499	BT	5-27	0021	292	--
Arkansas	581.0	[1]890	BT	5-27	1850	247	0.4
Kaskaskia	117.5	[2]284	0.5	6-05	0952	326	2.7
Meramec[3]	160.9	[2]391	0.5	6-05	1622	318	<0.1
Missouri	195.3	[2]474	0.5	6-05	2045	426	1.3
Illinois	5.0	[4]0	0.5	6-06	1243	704	3.7
	15.0	19	0.5	6-06	1348	712	2.4
	25.0	39	0.5	6-06	1455	712	2.6
	35.0	58	0.5	6-06	1555	721	2.1
	45.0	77	0.5	6-06	1700	729	2.1
	55.0	96	0.5	6-06	1800	733	2.1
	61.3	108	0.9	6-06	1840	700	6.9

[1]Distances to the mouth of the tributary are computed using velocities in table 1.4 in chapter 1, and the first sample was collected at Mile 230.0 upriver from Head of Passes, La., on May 26, 1990, at 0006 hours.

[2]First sample was collected at mouth of the Ohio River on June 4, 1990 at 1840 hours.

[3]Sample collected from small boat.

[4]Distances from mouth of Illinois River calculated using a constant water speed of 3.2 km/h based on discharge of Illinois River in table 1.4 of this report and velocity in Table 2 published by Stall and Hiestand (1969).

Table 2.22.--*Concentration of triazine herbicides in some of the tributaries of the Mississippi River between Baton Rouge, La., and Minneapolis, Minn., June-July 1991 cruise*

[km, kilometers; CDT, Central Daylight Time; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; µg/L, micrograms per liter; BT, below the mouth of the tributary but near the bank; and --, no measurement]

Name of tributary	Location			Date 1991	Time (CDT)	Specific conductance (µS/cm)	Temp-erature (°C)	Concentration	
	River miles	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank					Microtiter plate method (µg/L)	Magnetic particle method (µg/L)
Upriver from Head of Passes									
Arkansas	580.0	766	BT	6-25	1724	536	27	2.1	2.0
Ohio	953.8	1,613	0.1	6-27	1909	231	26	1.6	1.0
			0.5		1903	243	25	1.2	1.3
			0.9		1858	323	26	2.0	1.5
Upriver from Mouth of Ohio River									
Missouri	195.3	2,062	0.5	6-28	1945	563	25	4.4	3.2
Illinois	217.9	2,132	0.5	6-29	0550	650	--	4.0	2.9
Des Moines	361.4	2,433	BT	6-30	0111	505	23	4.4	2.6
Skunk	395.8	2,501	BT	6-30	0533	622	27	1.6	1.8
Rock	479.0	2,679	BT	6-30	2035	481	27	1.3	1.1
Wisconsin	630.6	2,979	BT	7-01	1614	247	26	0.4	0.7
Black	698.2	3,104	BT	7-01	2359	418	25	0.9	1.2
Chippewa	763.4	3,230	BT	7-02	1035	439	22	--	1.1
St. Croix	811.5	3,318	0.5	7-02	1605	167	22	--	0.5
Minnesota	844.0	3,379	0.7	7-02	2058	745	24	--	1.4

[1]Distances to the mouth of the tributary are computed using velocities in table 1.4 in chapter 1, and the first sample was collected at Mile 230.0 upriver from Head of Passes, La., on June 23, 1991, at 2240 hours.

Table 2.23.--*Concentration of triazine and acetanilide herbicides in some of the tributaries of the Mississippi River between New Orleans, La., and Minneapolis, Minn., September-October 1991 cruise*

[km, kilometers; CDT, Central Daylight Time; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; µg/L, micrograms per liter; BT, below the mouth of the tributary but near the bank; --, no measurement; and <, less than]

Name of tributary	Location			Date 1991	Time (CDT)	Specific conductance (µS/cm)	Temperature (°C)	Concentration			
								Triazines		Acetanilides	
	River miles	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank					Microtiter plate method (µg/L)	Magnetic particle method (µg/L)	Microtiter plate method (µg/L)	Magnetic particle method (µg/L)
						Upriver from Head of Passes					
Arkansas	580.8	948	BT	9-27	2005	481	20	--	--	--	--
Ohio	953.8	1,712	0.1	9-29	2130	277	22	--	0.27	--	--
			0.5		2121	266	22	0.27	0.22	<0.10	0.10
			0.9		2115	275	20	--	0.20	--	--
						Upriver from Mouth of Ohio River					
Missouri	195.3	2,125	0.5	9-30	2333	707	18	0.25	0.20	0.15	0.16
Illinois	217.9	2,171	0.5	10-01	0415	671	19	0.26	0.24	0.23	0.23
Des Moines	361.4	2,441	BT	10-02	0118	447	16	0.30	0.44	0.70	0.63
Rock	479.0	2,669	BT	10-02	2005	665	17	0.44	0.50	0.48	0.45
Wisconsin	630.6	2,956	BT	10-03	1645	333	15	0.27	0.34	0.25	0.23
Black	698.2	3,076	0.5	10-04	0316	316	14	0.21	0.27	0.49	0.38
Chippewa	763.4	3,197	BT	10-04	1205	150	--	<0.10	0.14	<0.10	<0.10
St. Croix	811.5	3,280	0.5	10-04	1720	168	15	<0.10	0.13	0.11	0.10
Minnesota	844.0	3,338	0.5	10-04	2155	945	14	0.23	0.27	1.1	0.83

[1]Distances to the mouth of the tributary are computed using velocities in table 1.4 in chapter 1, and the first sample was collected at Mile 88.5 upriver from Head of Passes, La., on September 25, 1991, at 0647 hours.

Table 2.24.--*Concentration of triazine and acetanilide herbicides in some of the tributaries of the Mississippi River between New Orleans, La., and Minneapolis, Minn., March-April 1992 cruise*

[km, kilometers; CDT, Central Daylight Time; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; µg/L, micrograms per liter; BT, below the mouth of the tributary but near the bank; --, no measurement; and <, less than]

Name of tributary	Location: River miles	Location: Distance upriver from first sample[1] (km)	Location: Fraction of distance from left to right bank	Date 1992	Time (CDT)	Specific conductance (µS/cm)	Temperature (°C)	Concentration: Triazines, magnetic particle method (µg/L)	Concentration: Acetanilides, magnetic particle method (µg/L)
Upriver from Head of Passes									
Yazoo	435.3	819	BT	3-27	0737	298	12	--	--
Arkansas	582.0	1,213	1.0	3-28	0550	323	14	0.23	<0.10
Ohio	953.8	2,150	0.1	3-30	1258	237	11	0.10	<0.10
			0.5		1246	266	11	0.13	<0.10
			0.9		1252	328	10	0.16	<0.10
Upriver from Mouth of Ohio River									
Kaskaskia	117.5	2,423	0.5	3-31	0450	478	11	0.93	0.29
Missouri	195.3	2,612	0.4	3-31	1554	528	12	0.38	<0.10
Illinois	217.9	2,666	0.5	3-31	2035	778	12	0.73	0.32
Des Moines	361.4	2,880	0.5	4-01	1615	726	9	0.17	0.21
Iowa	433.9	3,132	BT	4-02	0307	448	7	0.21	0.23
Rock	479.0	3,219	BT	4-02	0838	535	7	0.20	0.19
Wisconsin	630.6	3,512	BT	4-03	0356	241	6	0.17	<0.10
Chippewa	763.4	3,754	BT	4-03	1953	243	7	<0.10	0.30
St. Croix	811.5	3,840	0.6	4-04	0103	162	5	<0.10	<0.10
Minnesota	844.0	3,904	0.5	4-04	0711	901	7	<0.10	0.39

[1]Distances to the mouth of the tributary are computed using velocities in table 1.4 in chapter 1, and the first sample was collected at Mile 90.0 upriver from Head of Passes, La., on March 25, 1992, at 0705 hours.

(Page 80 follows)

Table 2.25.--*Concentration of herbicides determined by gas between Baton Rouge, La., and*

[Herbicides analyzed but not detected: ametryn, pyometryn, terbutryn; km, kilometers;

--, no measurement;

Location								Concentration (µg/L)	
								Triazines	
Name of river	River miles	Distance upriver from first sample (km)	Fraction of distance from left to right bank	Date 1990	Time (CDT)	Specific conductance (µS/cm)	Temp-erature (°C)	Microtiter plate method	Magnetic particle method
Upriver from									
Lower Mississippi[1]	230	0	0.7	5-26	0008	339	--	2.8	--
	433.5	499	0.7	5-27	0013	296	--	3.8	--
	531	751	0.8	5-27	1144	286	--	5.2	--
	581	890	0.5	5-27	1855	292	--	5.3	--
	800	1,488	0.5	5-29	0200	337	--	5.6	--
	900	1,754	0.1	5-29	1520	322	--	5.9	--
	950	1,885	0.3	5-29	2150	309	--	6.5	--
	950	1,885	0.9	5-29	2142	416	--	2.7	--
Upriver from Mouth of Ohio River									
Upper Mississippi[2]	20	0	0.5	6-04	2100	409	--	4.8	--
	70	168	0.5	6-05	0335	429	--	2.5	--
	140	339	0.1	6-05	1309	486	--	2.6	--
	140	339	0.9	6-05	1305	423	--	0.2	--
	196	476	0.1	6-05	2055	596	--	2.5	--
	220.7	572	0.5	6-06	1130	407	--	2.2	--
Arkansas[1]	581.0	890	BT	5-27	1850	247	--	0.4	--
Ohio	953	(5)	--	5-29	--	--	--	3.0	--
Illinois[3]	5	0	0.5	6-06	1243	704	--	3.7	--
	55	96	0.5	6-06	1800	733	--	2.1	--
	61.3	108	0.9	6-06	1840	700	--	6.9	--
Missouri[4]	20	49	0.5	6-09	0850	338	--	2.8	--
	28	131	0.98	6-09	2045	340	--	2.3	--
	27.9	264	0.5	6-10	1944	328	--	3.5	--
Tennessee	--	(5)	--	5-29	--	--	--	0.2	--
Cumberland	--	(5)	--	5-29	--	--	--	0.5	--
Wabash	--	(5)	--	5-29	--	--	--	7.4	--

[1]Distances in the Lower Mississippi River and to the mouth of tributary, are computed using velocities in table 1.4 in chapter 1, and the first sample was

[2]Distance upriver from mouth of Ohio River are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 0.0

[3]Distance are calculated using a constant water speed of 3.2 km/h based on discharge of Illinois River in table 1-5 of this report and velocity in Table 2

[4]Distances are calculated using velocities in table 1.4 in chapter 1, and the first sample was collected a Mile 0.0 upriver from mouth of Missouri River on

[5]These samples were not collected from the vessel but from bridges.

chromatography and mass spectroscopy in the Mississippi River and some of the tributaries Grafton, Ill., May-June 1990 cruise

CDT, Central Daylight Time; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; µg/L, micrograms per liter; <, less than; and BT, below the mouth of the tributary but near the bank]

Concentration of herbicides by gas chromatography and mass spectroscopy (µg/L)									
Alachlor	**Atrazine**	**Cyanazine**	**Des-ethyl-atrazine**	**Des-isopropyl-atrazine**	**Metolachlor**	**Metribuzin**	**Prometon**	**Propazine**	**Simazine**
Head of Passes									
0.39	1.85	1.17	0.20	0.22	0.53	<0.05	<0.05	<0.05	0.23
0.31	1.89	1.03	0.23	0.20	0.53	<0.05	<0.05	<0.05	0.29
0.36	2.20	1.05	0.27	0.20	0.59	<0.05	<0.05	<0.05	0.36
0.39	2.45	1.00	0.29	0.21	0.68	<0.05	<0.05	<0.05	0.40
0.56	2.93	1.42	0.38	0.25	0.94	<0.05	<0.05	<0.05	0.61
0.48	3.07	0.84	0.32	0.22	0.90	<0.05	<0.05	<0.05	0.53
0.64	3.43	1.32	0.40	0.23	1.08	<0.05	<0.05	<0.05	0.62
0.44	1.72	0.97	0.22	0.16	0.67	<0.05	<0.05	<0.05	0.10
of Ohio River									
0.62	3.03	1.97	0.43	0.22	1.43	<0.05	<0.05	<0.05	0.10
0.49	2.69	1.74	0.38	0.16	1.61	<0.05	<0.05	<0.05	0.13
0.46	2.22	1.44	0.32	0.14	1.35	<0.05	<0.05	<0.05	0.08
0.61	0.67	<0.20	<0.05	<0.05	0.24	<0.05	<0.05	<0.05	0.17
0.49	2.32	1.45	0.33	0.13	1.41	<0.05	<0.05	<0.05	0.08
0.58	1.80	1.34	0.28	0.10	1.38	<0.05	<0.05	<0.05	<0.05
0.05	0.38	<0.20	0.08	<0.05	0.09	<0.05	<0.05	<0.05	<0.05
0.27	1.89	0.72	0.23	0.15	0.66	<0.05	<0.05	<0.05	0.58
0.51	2.72	1.39	0.36	0.15	1.27	<0.05	<0.05	<0.05	0.12
0.36	2.18	1.21	0.30	0.12	1.06	<0.05	<0.05	<0.05	0.12
0.51	5.71	4.98	0.57	0.35	1.13	0.08	<0.05	0.07	0.16
0.47	2.59	0.76	0.28	0.15	0.86	0.13	<0.05	<0.05	<0.05
0.46	2.45	0.72	0.28	0.17	0.74	0.11	<0.05	<0.05	<0.05
0.53	3.56	0.83	0.28	0.21	0.67	0.14	<0.05	<0.05	<0.05
<0.05	0.21	<0.20	0.05	<0.05	0.06	<0.05	<0.05	<0.05	<0.05
0.05	0.33	<0.20	0.07	<0.05	0.08	<0.05	<0.05	<0.05	<0.05
8.20	4.53	1.53	0.58	0.30	1.09	<0.05	<0.05	0.06	0.86

collected at Mile 230.0 upriver from Head of Passes, La., on May 26, 1990, at 0006 hours.

upriver from mouth of Ohio River on June 4, 1990, at 1840 hours.

published by Stall and Hiestand (1969).

June 9, 1990 at 0558 hours.

Table 2.26.--*Concentration of herbicides determined by gas* *between Baton Rouge, La., and*

[Herbicides analyzed but not detected: ametryn, pyometryn, terbutryn; km, kilometers; --, no measurement; µg/L, micrograms per liter; <, less than;

Name of river	Location: River miles	Location: Distance upriver from first sample[1] (km)	Location: Fraction of distance from left to right bank	Date 1991	Time (CDT)	Specific conductance (µS/cm)	Temp-erature (°C)	Concentration (µg/L) Triazines: Microtiter plate method	Concentration (µg/L) Triazines: Magnetic particle method
									Upriver from
Lower Mississippi	269.6	83	0.5	6-24	0300	388	25	4.7	3.5
	432.0	440	0.5	6-24	2259	400	25	4.6	3.6
	504.5	595	0.7	6-25	0725	389	25	3.5	3.2
	610.0	833	0.5	6-25	2109	391	26	2.9	2.9
	650.2	928	0.5	6-26	0241	421	25	3.0	2.3
	751.1	1,168	0.5	6-26	1640	422	25	3.2	3.3
	817.5	1,312	0.7	6-27	0105	415	24	5.0	3.6
	882.4	1,453	0.5	6-27	0919	405	25	4.3	3.2
	937.6	1,572	0.9	6-27	1548	402	25	4.9	3.5
								Upriver from Mouth	
Upper Mississippi	10.8	1,638	0.5	6-27	2034	432	25	5.7	3.8
	51.6	1,735	0.5	6-28	0214	441	24	5.8	4.0
	100.7	1,846	0.4	6-28	0818	457		4.1	3.1
	299.0	2,304	0.5	6-29	1701	460	26	2.2	1.9
	363.9	2,438	0.6	6-30	0123	463	26	3.0	2.1
	551.0	2,821	0.5	7-01	0555	416	25	0.8	1.2
	846.0	3,383	0.5	7-02	2115	402	23	--	1.3
Ohio	953.8	1,613	0.5	6-27	1903	243	25	1.2	1.3
Illinois	217.9	2,132	0.5	6-29	0550	650	--	4.0	2.9
Des Moines	361.4	2,433	BT	6-30	0111	505	23	4.4	2.6
St. Croix	811.5	3,318	0.5	7-02	1605	167	22	--	0.5
Minnesota	844.0	3,379	0.7	7-02	2058	745	24	--	1.4

[1]Distances, to the mouth of the tributary, are computed using velocities in table 1.4 in chapter 1, and the first sample was collected at Mile 230.0 upriver from Head of Passes, La., on June 23, 1991, at 2240 hours.

chromatography and mass spectroscopy in the Mississippi River and some of the tributaries Minneapolis, Minn., June-July 1991 cruise

CDT, Central Daylight Time; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; and BT, below the mouth of the tributary but near the bank]

Concentration of herbicides by gas chromatography and mass spectroscopy (µg/L)									
Alachlor	Atrazine	Cyanazine	Des-ethyl-atrazine	Des-isopropyl-atrazine	Metolachlor	Metribuzin	Prometon	Propazine	Simazine
Head of Passes									
0.61	3.99	2.60	0.40	0.23	1.70	<0.05	<0.05	<0.05	0.07
0.51	3.33	1.98	0.38	0.21	1.45	0.25	<0.05	<0.05	0.08
0.41	2.57	1.67	0.31	0.16	1.10	0.23	<0.05	<0.05	0.07
0.41	2.51	1.18	0.31	0.15	1.09	0.24	<0.05	<0.05	0.08
0.41	2.35	1.04	0.30	0.14	0.96	0.24	<0.05	<0.05	0.07
0.41	3.03	1.50	0.37	0.19	1.15	0.24	<0.05	<0.05	0.09
0.38	3.16	1.98	0.40	0.25	1.25	<0.05	<0.05	<0.05	0.08
0.42	3.03	1.73	0.38	0.22	1.26	<0.05	<0.05	<0.05	0.08
0.63	3.30	2.15	<0.05	<0.05	1.50	<0.05	<0.05	<0.05	0.06
of Ohio River									
0.87	3.95	2.22	0.50	0.28	1.81	0.24	<0.05	<0.05	0.05
1.22	4.64	2.14	0.54	0.26	2.21	<0.05	<0.05	<0.05	0.06
1.07	2.47	2.40	0.32	0.18	3.61	0.23	<0.05	<0.05	<0.05
0.26	2.76	1.32	0.42	0.21	0.69	0.22	0.06	<0.05	0.08
0.71	1.56	1.29	0.27	0.16	1.34	0.22	<0.05	<0.05	<0.05
0.38	0.67	1.06	0.11	0.09	0.72	0.24	<0.05	<0.05	<0.05
0.09	0.68	0.59	0.10	0.07	0.13	0.22	<0.05	<0.05	0.08
0.08	0.90	0.26	0.12	0.06	0.24	<0.05	<0.05	<0.05	0.06
0.34	3.21	1.56	0.39	0.23	1.02	0.24	<0.05	<0.05	<0.05
0.86	1.88	1.49	0.30	0.13	1.77	0.22	<0.05	<0.05	<0.05
0.06	0.41	0.14	0.05	<0.05	0.08	<0.05	<0.05	<0.05	<0.05
0.67	1.08	1.18	0.18	0.24	0.90	0.25	<0.05	<0.05	<0.05

Table 2.27.--*Concentration of herbicides determined by gas between New Orleans, La., and*

[Herbicides analyzed but not detected: ametryn, pyometryn, terbutryn; km, kilometers; --, no measurement; µg/L, micrograms per liter; <, less than;

Name of river	Location			Date 1991	Time (CDT)	Specific conductance (µS/cm)	Temp-erature (°C)	Concentration (µg/L)	
	River miles	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank					Triazines	
								Microtiter plate method	Magnetic particle method
								Upriver from	
Lower Mississippi	88.5	0	0.5	9-25	0647	463	25	0.46	0.45
	330.4	444	0.5	9-26	1229	397	23	0.29	0.49
	580.8	948	0.5	9-27	1957	441	21	0.41	0.45
	898.9	1,596	0.5	9-29	1419	458	20	0.40	0.46
								Upriver from Mouth	
Upper Mississippi	39.0	1,795	0.5	9-30	0413	570	18	0.36	0.28
	272.0	2,272	0.5	10-1	1225	454	17	0.28	0.37
	418.0	2,555	0.5	10-2	1218	435	16	0.35	0.31
	520.0	2,746	0.5	10-3	0129	395	15	0.25	0.29
	700.0		0.5	10-4	0121	439	--	0.25	0.33
	846.0	3,342	0.5	10-4	2213	472	14	0.26	0.37
Ohio	953.8	1,712	0.5	9-29	2121	266	22	0.27	0.22
Missouri	195.3	2,125	0.5	9-30	2333	707	18	0.25	0.20
Illinois	217.5	2,171	0.5	10-1	0415	671	19	0.26	0.24
Rock	479.0	2,669	BT	10-2	2005	665	17	0.44	0.50
Wisconsin	630.6	2,956	BT	10-3	1645	333	15	0.27	0.34
Black	698.2	3,076	0.5	10-4	0316	316	14	0.21	0.27
Chippewa	763.4	3,197	BT	10-4	1205	150	--	<0.10	0.14
St. Croix	811.5	3,280	0.5	10-4	1720	168	15	<0.10	0.13
Minnesota	844.0	3,338	0.5	10-4	2155	945	14	0.23	0.27

[1]Distances, to the mouth of the tributary, are computed using velocities in table 1.4 in chapter 1, and the first sample was collected at Mile 88.5 upriver from Head of Passes, La., on September 25, 1991, at 0647 hours.

chromatography and mass spectroscopy in the Mississippi River and some of the tributaries Minneapolis, Minn., September-October 1991 cruise

CDT, Central Daylight Time; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; and BT, below the mouth of the tributary but near the bank]

Concentration of herbicides by gas chromatography and mass spectroscopy (µg/L)									
Alachlor	Atrazine	Cyanazine	Des-ethyl-atrazine	Des-isopropyl-atrazine	Metolachlor	Metribuzin	Prometon	Propazine	Simazine
Head of Passes									
<0.05	0.31	0.11	0.08	0.11	0.07	<0.05	0.05	<0.05	<0.05
<0.05	0.34	0.09	0.09	0.15	0.08	<0.05	0.06	<0.05	<0.05
<0.05	0.28	0.05	0.09	<0.05	0.05	<0.05	0.05	<0.05	<0.05
<0.05	0.26	<0.05	0.08	0.06	0.05	<0.05	0.05	<0.05	<0.05
of Ohio River									
0.08	0.26	0.06	0.10	0.06	0.05	<0.05	<0.05	<0.05	<0.05
0.16	0.23	0.07	0.10	0.08	0.05	<0.05	<0.05	<0.05	<0.05
0.34	0.25	<0.05	0.10	0.06	<0.05	<0.05	<0.05	<0.05	<0.05
<0.05	0.17	<0.05	0.09	0.07	<0.05	<0.05	<0.05	<0.05	<0.05
<0.05	0.17	0.05	0.11	0.08	<0.08	<0.05	<0.05	<0.05	<0.05
<0.05	0.18	<0.12	0.11	0.07	0.08	<0.05	<0.05	<0.05	<0.05
<0.05	0.21	<0.05	0.07	0.09	<0.05	0.05	<0.05	<0.05	<0.05
<0.05	0.21	0.05	0.06	0.05	0.05	<0.05	<0.05	<0.05	<0.05
<0.05	0.19	0.07	0.07	0.07	<0.05	<0.05	0.11	<0.05	0.05
<0.05	0.23	0.13	0.17	0.07	<0.05	<0.05	<0.05	<0.05	<0.05
<0.05	0.24	<0.05	0.09	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
<0.05	0.15	0.05	0.10	0.06	<0.05	<0.05	<0.05	<0.05	<0.05
<0.05	0.05	<0.05	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
<0.05	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
<0.05	0.12	<0.05	0.07	0.10	0.07	<0.05	<0.05	<0.05	<0.05

Table 2.28.--*Concentration of herbicides determined by gas between New Orleans, La., and*

[Herbicides analyzed but not detected: ametryn, pyometryn, terbutryn; km, kilometers; --, no measurement;

Name of river	Location			Date 1992	Time (CDT)	Specific conductance (μS/cm)	Temp-erature (°C)	Concentration (μg/L)	
								Triazines	
	River miles	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank					Microtiter plate method	Magnetic particle method
									Upriver from
Lower Mississippi	228.0	309	0.5	3-25	2336	306	13	--	0.24
	638.7	1,358	0.5	3-28	1401	366	13	--	0.22
								Upriver from Mouth	
Upper Mississippi	11.6	2,173	0.6	3-30	1422	487	9	--	0.32
	403.0	3,060	0.7	4-1	2121	475	8	--	0.37
	845.6	3,907	0.5	4-4	0733	437	8	--	<0.10
Ohio	953.5	2,150	0.5	3-30	1246	266	11	--	0.13
Kaskaskia	117.5	2,423	0.5	3-31	0450	478	11	--	0.93
Missouri	195.3	2,612	0.4	3-31	1554	528	12	--	0.38
Illinois	217.9	2,666	0.5	3-31	2125	778	12	--	0.73
Minnesota	844	3,904	0.5	4-4	0711	901	7	--	<0.10

[1]Distances, to the mouth of the tributary, are computed using velocities in table 1.4 in chapter 1, and the first sample was collected at Mile 90.0 upriver from Head of Passes, La., on March 25, 1992, at 0705 hours.

chromatography and mass spectroscopy in the Mississippi River and some of the tributaries Minneapolis, Minn., March-April 1992 cruise

CDT, Central Daylight Time; μS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; μg/L, micrograms per liter; <, less than; and BT, below the mouth of the tributary but near the bank]

Concentration of herbicides by gas chromatography and mass spectroscopy (μg/L)									
Alachlor	Atrazine	Cyanazine	Des-ethyl-atrazine	Des-isopropyl-atrazine	Metolachlor	Metribuzin	Prometon	Propazine	Simazine
Head of Passes									
<0.05	0.24	<0.05	0.05	<0.05	0.10	<0.05	<0.05	<0.05	0.06
<0.05	0.26	<0.05	0.07	<0.05	0.08	<0.05	<0.05	<0.05	<0.05
of Ohio River									
<0.05	0.33	0.07	0.10	<0.05	0.09	<0.05	<0.05	<0.05	<0.05
0.37	0.34	<0.05	0.09	0.06	<0.05	<0.05	<0.05	<0.05	<0.05
<0.05	<0.05	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
<0.05	0.15	<0.05	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
0.05	0.85	0.39	0.20	0.12	0.13	<0.05	<0.05	<0.05	0.15
<0.05	0.35	0.09	0.09	0.06	0.10	<0.05	<0.05	<0.05	<0.05
0.05	0.69	0.75	0.12	0.08	0.16	<0.05	<0.05	<0.05	<0.05
<0.05	0.05	<0.05	<0.05	0.05	0.05	<0.05	<0.05	<0.05	<0.05

(page 89 follows)

CHAPTER 3 - NUTRIENTS

by Ronald C. Antweiler, Charles J. Patton, and Howard E. Taylor

ABSTRACT

Concentrations of the dissolved nutrients (nitrate, nitrite, ammonium and orthophosphate) were measured on surface-water grab samples collected at intervals along the entire length of the navigable portion of the Mississippi River during three cruises in June-July 1991, September-October 1991, and March-April 1992. Samples also were collected at the mouths of some of the tributaries, and, at selected points, three-sample cross sections were collected across the river to measure cross-channel variability. The samples were filtered immediately after collection. Samples were analyzed colorimetrically on an air-segmented continuous-flow system within 2 weeks of collection. The large number of samples collected (between 179 and 207 per cruise) in the short time periods (about 10 days per cruise) give a picture of the longitudinal variation of the Mississippi River at an "instant" of time.

INTRODUCTION

In this chapter, nutrients described are four ionic compounds of nitrogen and phosphorus: nitrate (NO_3^-), nitrite (NO_2^-), ammonium (NH_4^+) and orthophosphate (PO_4^{-3}). These compounds are vital for living organisms, and can be produced and utilized by animals and plants. Nutrients in surface waters originate from many different sources. They may come from agriculture, from the addition of fertilizers to crops, or they may originate from domestic sewage, lawn fertilizers, detergents or other household products. In addition, nutrients can originate from various industrial processes including the manufacture of fertilizers, from animal feedlots or slaughterhouses, or from natural sources. The goals of this research were to study how concentrations and transport of these nutrients varied in the Mississippi River longitudinally along the navigable course of the river between New Orleans, La., and Minneapolis, Minn., at three different times (June-July 1991, September-October 1991, and March-April 1992). These data could be used to evaluate the potential effects that nutrients have on the Mississippi River system and on the people who live along its banks.

METHODS

The first sampling cruise started in Baton Rouge, La., and ended in Minneapolis, Minn. The following two cruises started in New Orleans, La., and ended in Minneapolis. Surface-water grab samples were collected at intervals of approximately every 16 km near mid-channel. In addition, samples were taken from some of the tributaries and three samples were collected across the channel to measure the cross-channel variability in the river at selected locations.

Samples were collected from the river into a clean 2-L Teflon bottle placed in a weighted aluminum holder designed so that the nozzle of the bottle faced upstream with no metal or plastics other than the Teflon bottle neck in the path of the collected water. The sampler was lowered into the river from the side of the vessel opposite the sewage and exhaust outlets to a maximum depth of 0.5 m using a nylon rope. The bottle was rinsed a minimum of two times before the sample was collected. Special care was taken to exclude outwash from the vessel's hull.

Care was taken to minimize possible nutrient contamination of the samples by using Teflon, high- density polyethylene, Teflon-coated stainless steel or pure, non-corrosive steels. In addition, non-talc polyethylene, polyvinyl, or Teflon gloves were used during all sample handling and processing procedures. Samples were transferred into pre-cleaned 250 mL opaque polyethylene bottles. The bottles were new and were copiously rinsed with deionized water prior to sample collection.

The processing of the sample was changed slightly between the first cruise and the following two cruises. On the June-July 1991 cruise, after filling the sample bottle, the sample was briefly allowed to settle (less than 10 minutes) before pumping it through a pre-cleaned 50-mm diameter inline nylon filter with a nominal pore diameter of 0.45 µm. The filter and pump were pre-cleaned by pumping 40 mL of deionized water through the filter, followed by 20 mL of sample water, which was then discarded. An opaque polyethylene bottle was then placed at the outlet of the filter and the filtered sample was collected. These bottles were then refrigerated at 0–5 °C until on-board analyses could be performed. The September-October cruise used the same collection procedure modified for vacuum filtration to process the sample. While the same contamination precautions were implemented, the filtration devices were exchanged for high-density polyethylene filter funnels and 47-mm diameter Nuclepore polycarbonate membrane filters with a 0.4-µm nominal pore diameter. The protocol was as follows. The filter funnel was thoroughly cleaned and rinsed with deionized water, and a new membrane filter was placed on the filter support using Teflon-coated forceps and was rinsed with about 100 mL of deionized water, followed by 20–30 mL of sample water which was discarded. Then the river-water sample was filtered into pre-cleaned polyethylene bottles. The sample was chilled and shipped by overnight mail to Denver, where it was analyzed within a week of receipt. The March-April 1992 cruise used the same techniques as the September-October 1991 cruise, except that a Teflon filter funnel was used instead of a high-density polyethylene filter funnel. In addition, after the samples were collected, they were frozen and shipped to Denver for analysis, which was performed within a month of receipt. No preservatives of any kind were used, beyond chilling or freezing the samples. It was felt that the short time between collection and analysis would not result in appreciable degradation of the sample, and that preservatives can frequently add unwanted analytical artifacts. Analyses were performed on an Alpkem air-segmented continuous-flow system, model RFA-300, as described in greater detail by Antweiler and others (1993).

Analyses were always performed in duplicate. If the two analyses were not similar, the sample was run in duplicate again. Analyses were supplemented by determination of standard reference samples to insure accuracy and by frequent (every six samples) calibration standards to insure precision. Table 3.1 provides pertinent information on the accuracy, precision, and detection limits for each of the four analytes. For more information, the reader should consult Antweiler and others (1993).

Table 3.1.--***Calibration ranges, detection limits, precision, and accuracy for nutrient analyses***

[Data from Antweiler and others, 1993; n, the number of samples analyzed; na, not applicable; --, not determined]

Parameter	Nitrate plus nitrite		Nitrite		Ammonium		Orthophosphate	
	n	Value	n	Value	n	Value	n	Value
Calibration range in milligrams nitrogen or phosphorus per liter	na	0.02–8.00	na	0.002–1.00	na	0.006–2.00	na	0.002–1.00
Detection limit in milligrams nitrogen or phosphorus per liter	17	0.02	29	0.0016	37	0.006	45	0.0019
Percent precision at 10 times the detection limit[1]	30	17.9	25	14.1	61	11.8	74	11.3
Percent precision at middle of calibration range[1]	33	2.3	51	2.3	28	4.8	30	4.8
Percent precision at high end of calibration range[1]	36	2.2	25	2.2	39	3.1	72	4.3
Percent accuracy at low end of calibration range [2]	70	4.2	--	--	28	17.5	38	5.5
Percent accuracy at high end of calibration range[2]	16	0.2	--	--	28	5.2	46	7.7

[1]Percent precision is the absolute precision divided by the observed value times 100, reported at the 95 percent confidence level.

[2]Percent accuracy is the reported value minus the observed value divided by the reported value times 100.

RESULTS OF ANALYSES

The results of analyses for three upriver cruises of the Mississippi River are given in tables 3.2 to 3.16 as the mean of duplicate analyses performed for each sample. Results that were less than the detection limit are identified in the tables using the less than symbol (<) preceding the detection limit value. Parameters that were not determined for a particular sample or that were in error are identified by dashes (--) within the tables. The nutrient transport in the Mississippi River, in kilograms per day, may be calculated by multiplying the water discharges (in m^3/s) listed in the tables by the nutrient concentrations and a unit conversion factor (86.4). The concentration data is ordered by river mile upriver from Head of Passes, Louisiana. The quantitative results are listed in three types of tables.

Longitudinal Variability

Data collected in approximately mid-channel are listed in two tables for each cruise with one table for the Lower Mississippi River (tables 3.2, 3.4, and 3.6) and one table for the Upper Mississippi River (tables 3.3, 3.5, and 3.7). The longitudinal variabilities of nitrate and orthophosphate concentrations of these mid-channel samples are shown in figures 3.1 and 3.2.

Cross-Channel Variability

Data collected at two to three locations across the channel are listed in two tables for each cruise with one table for the Lower Mississippi River (tables 3.8, 3.10, and 3.12) and one table for the Upper Mississippi River (tables 3.9, 3.11, and 3.13). The average of these cross-channel values appears in the corresponding tables for longitudinal variability.

Tributary Concentrations

Data collected in a tributary or just downstream from the mouth of a tributary near the bank are listed in one table for each cruise (tables 3.14, 3.15, and 3.16).

SUMMARY

Nitrate concentrations in the Mississippi River ranged from 0.4 mg/L to about 6 mg/L as nitrogen (N), the lower values occurring during the September- October 1991 cruise. Orthophosphate concentrations ranged from near 0 to about 0.17 mg/L as phosphorus. Many nitrite and ammonium ion concentrations were below their respective detection limits, with concentrations as large as about 0.1 mg/L as N for nitrite and 0.15 mg/L as N for ammonium.

REFERENCES

Antweiler, R.C., Patton, C.J., and Taylor, H.E., 1993, Automated, colorimetric methods for determination of nitrate plus nitrite, nitrite, ammonium and orthophosphate ions in natural water samples: U.S. Geological Survey Open-File Report 93-638.

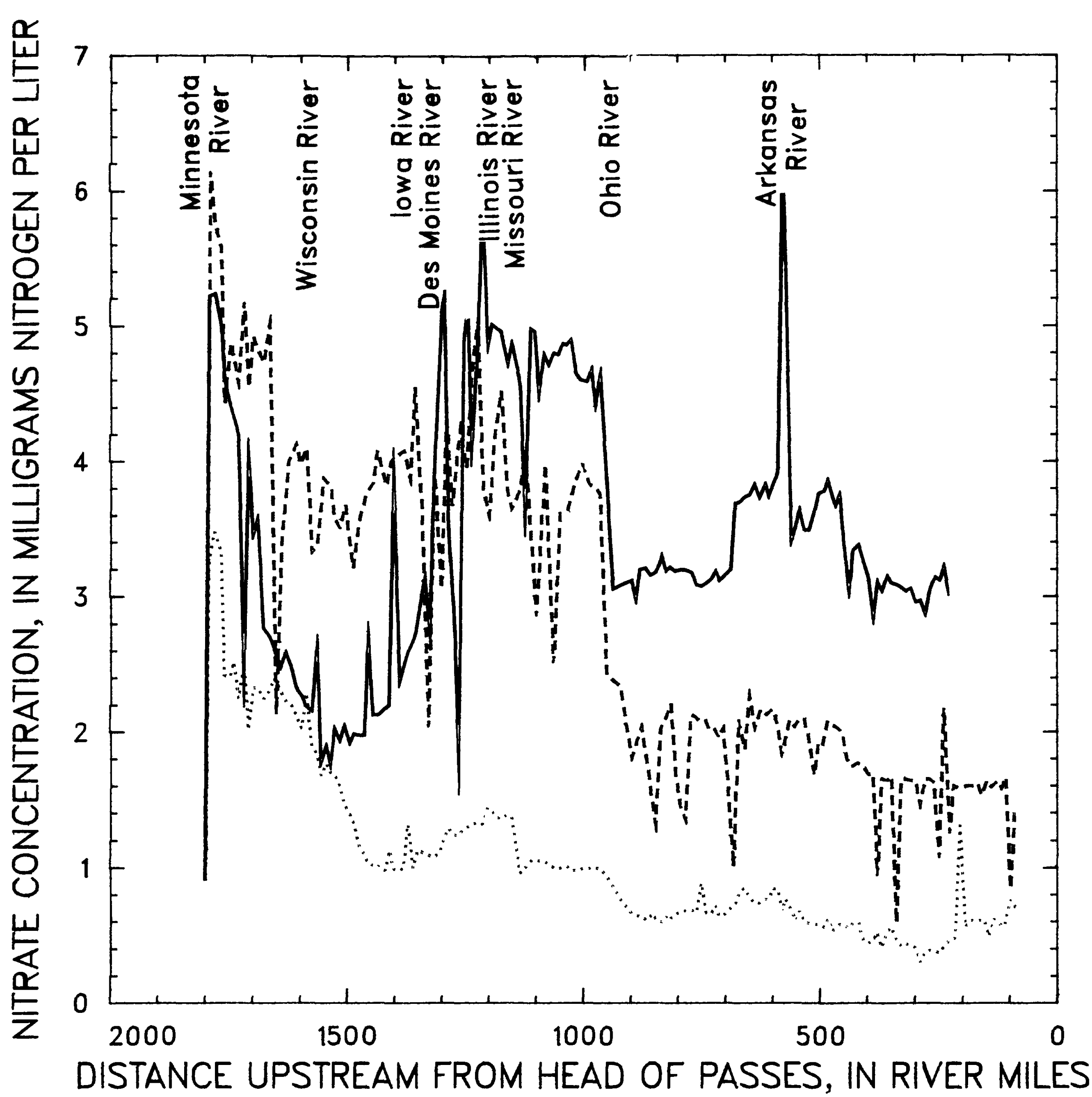

Figure 3.1.--Longitudinal variability of nitrate concentration in the Mississippi River upstream from Head of Passes, La., during June-July 1991 (solid line), September-October 1991 (dotted line), and March-April 1992 cruises (dashed line).

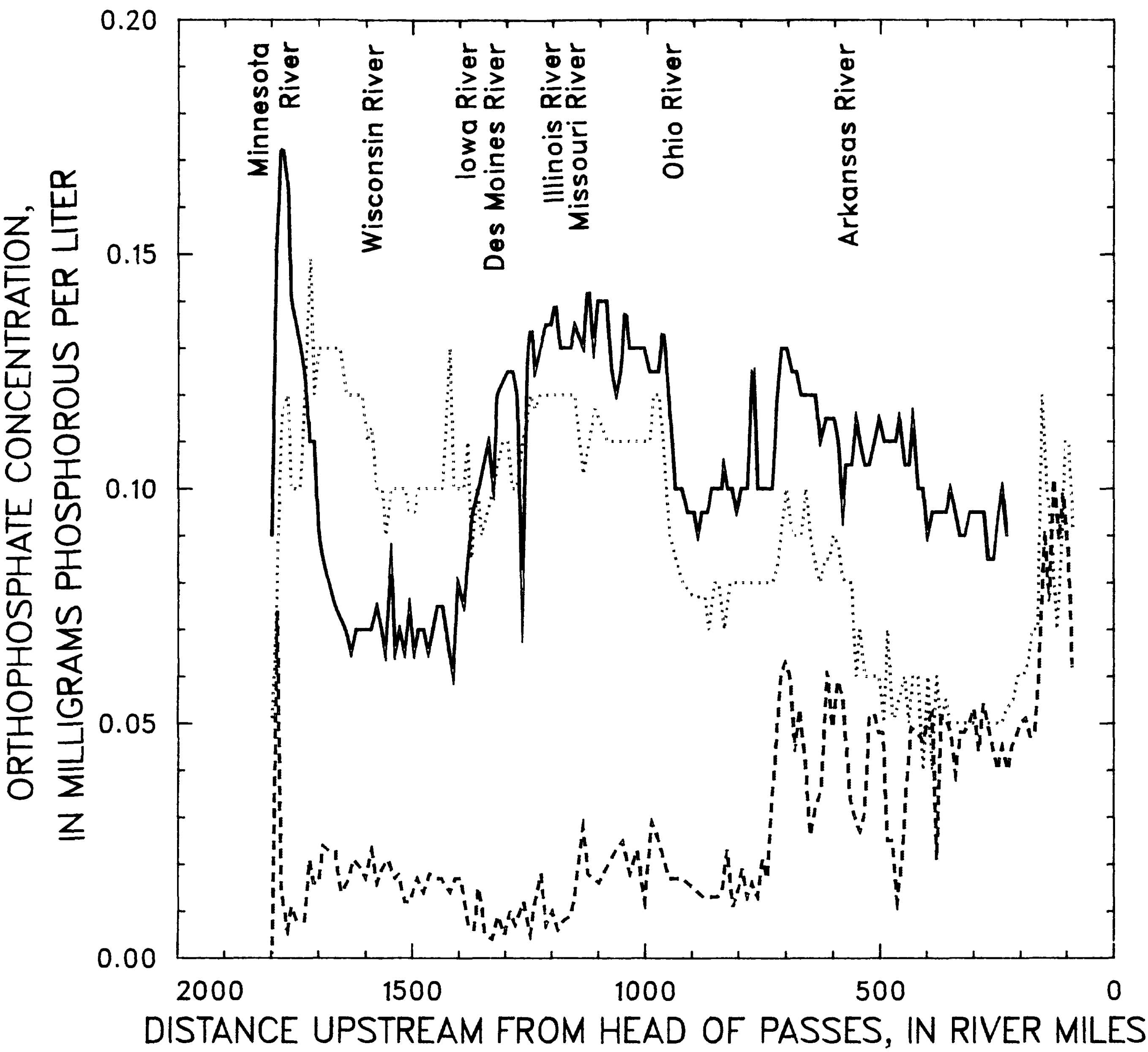

Figure 3.2.--Longitudinal variability of orthophosphate concentration in the Mississippi River upstream from Head of Passes, La., during cruises in June-July 1991 (solid line), September-October 1991 (dotted line), and March-April 1992 cruises (dashed line).

Table 3.2.--*Concentration of nutrients in approximately midchannel of the Lower Mississippi River between Baton Rouge, La., and Cairo, Ill., June-July 1991 cruise*

[km, kilometers; CDT, Central Daylight Time; m^3/s, cubic meters per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; N, nitrogen; P, phosphorus; mg/L, milligrams per liter; --, no measurement; and <, less than]

Location							Concentration			
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Temperature (°C)	Nitrate (NO_3) mg N/L	Nitrite (NO_2) mg N/L	Ammonia (NH_4) mg N/L	Ortho phosphate (PO_4) mg P/L
					June 23, 1991					
230.0	0	[2]X	2240	16,000	393	---	3.01	< 0.005	< 0.02	0.090
240.3	22	0.5	2345	16,100	386	25	3.22	< 0.005	< 0.02	0.100
					June 24, 1991					
248.8	40	0.5	0045	16,100	382	23	3.12	< 0.005	< 0.02	0.095
258.6	60	0.5	0146	16,200	385	23	3.14	< 0.005	< 0.02	0.085
269.6	83	0.5	0300	16,300	388	25	3.06	< 0.005	< 0.02	0.085
279.7	107	0.5	0415	16,300	385	25	2.87	< 0.005	< 0.02	0.095
289.8	130	0.5	0525	16,400	380	25	2.97	< 0.005	< 0.02	0.095
300.0	152	0.5	0640	16,500	397	25	2.96	< 0.005	< 0.02	0.095
310.0	173	0.5	0745	16,500	383	25	3.06	< 0.005	< 0.02	0.095
320.0	193	0.5	0833	18,500	390	24	3.04	0.006	< 0.02	0.090
330.4	217	0.5	1010	18,300	393	25	3.07	0.005	< 0.02	0.090
340.0	237	0.5	1105	18,100	399	25	3.09	< 0.005	--	--
351.2	260	0.5	1215	17,800	395	25	3.10	< 0.005	< 0.02	0.100
360.0	279	[2]X	1320	17,700	397	25	3.15	< 0.005	< 0.02	0.095
371.2	310	0.5	1605	17,500	398	26	3.04	< 0.005	< 0.02	0.095
380.4	329	0.5	1704	17,400	392	26	3.11	< 0.005	< 0.02	0.095
389.8	349	0.5	1810	17,300	388	25	2.84	< 0.005	0.04	0.095
399.4	370	0.5	1915	17,300	383	25	3.13	< 0.005	< 0.02	0.090
409.5	392	0.5	2029	17,200	393	24	3.25	< 0.005	< 0.02	0.100
420.1	414	0.5	2135	17,100	404	24	3.38	< 0.005	< 0.02	0.100
432.0	440	0.5	2259	16,900	400	25	3.34	< 0.005	< 0.02	0.115
439.8	457	0.5	2352	14,900	400	24	3.04	< 0.005	< 0.02	0.105
					June 25, 1991					
449.1	476	0.5	0050	15,000	399	25	3.31	< 0.005	< 0.02	0.105
460.8	501	0.5	0215	15,000	399	24	3.75	< 0.005	< 0.02	0.115
469.0	519	0.5	0315	15,100	396	24	3.67	0.007	< 0.02	0.110
475.0	532	[2]X	0400	15,100	399	25	3.73	< 0.005	< 0.02	0.110
485.5	554	0.5	0512	15,200	396	25	3.86	< 0.005	< 0.02	0.110
493.0	571	0.5	0618	15,200	397	23	3.78	< 0.005	< 0.02	0.110
504.5	595	0.7	0725	15,300	389	25	3.76	< 0.005	< 0.02	0.115
514.1	616	0.5	0837	15,300	388	24	3.62	< 0.005	< 0.02	0.110
525.3	640	0.5	1000	15,400	390	24	3.49	< 0.005	< 0.02	0.105

Table 3.2.--*Concentration of nutrients in approximately midchannel of the Lower Mississippi River between Baton Rouge, La., and Cairo, Ill., June-July 1991 cruise--Continued*

Location							Concentration			
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	Nitrate (NO_3) mg N/L	Nitrite (NO_2) mg N/L	Ammonia (NH_4) mg N/L	Ortho phosphate (PO_4) mg P/L
534.5	660	0.5	1106	15,400	391	24	3.49	0.006	< 0.02	0.105
545.0	687	0.5	1310	15,500	390	23	3.64	< 0.005	< 0.02	0.110
552.5	705	0.5	1420	15,500	389	24	3.53	< 0.005	< 0.02	0.115
562.2	726	0.5	1528	15,600	395	25	3.41	< 0.005	< 0.02	0.105
575.0	753	0.5	1635	15,600	399	25	5.54	< 0.005	< 0.02	0.105
580.8	766	[2]X	1718	15,600	438	27	6.27	< 0.005	< 0.02	0.093
590.3	788	0.6	1834	15,100	394	26	3.91	< 0.005	< 0.02	0.110
600.2	808	0.5	1932	14,600	398	25	3.83	< 0.005	< 0.02	0.115
610.0	833	0.5	2109	14,400	391	26	3.74	0.005	< 0.02	0.115
616.5	850	0.5	2223	14,300	391	25	3.83	0.006	0.03	0.115
629.3	875	0.5	2314	14,200	395	25	3.73	0.005	< 0.02	0.110
					June 26, 1991					
639.7	903	0.5	0113	13,900	409	22	3.83	0.005	< 0.02	0.120
650.2	928	0.5	0241	13,800	421	25	3.75	< 0.005	< 0.02	0.120
660.2	951	0.5	0353	13,700	421	25	3.74	< 0.005	< 0.02	0.120
669.9	973	0.5	0505	13,700	428	25	3.70	< 0.005	< 0.02	0.120
680.0	996	0.5	0616	13,600	435	25	3.69	< 0.005	0.03	0.125
689.9	1,018	0.5	0725	13,600	435	25	3.20	0.012	< 0.02	0.125
702.0	1,047	0.5	0903	13,500	439	24	3.16	0.022	< 0.02	0.130
712.9	1,072	[2]X	1023	13,500	429	24	3.12	0.023	< 0.02	0.130
721.5	1,093	0.5	1135	13,500	443	23	3.19	0.017	< 0.02	0.120
731.5	1,116	0.5	1248	13,400	434	24	3.13	0.015	< 0.02	0.100
742.0	1,148	0.5	1525	13,300	427	25	3.10	0.014	< 0.02	0.100
751.1	1,168	0.5	1640	13,300	422	25	3.08	0.014	< 0.02	0.100
762.2	1,192	0.5	1802	13,200	421	25	3.09	0.014	0.03	0.100
773.0	1,215	0.5	1919	13,100	418	25	3.18	0.014	< 0.02	0.130
785.0	1,241	0.7	2042	12,900	412	25	3.20	0.013	< 0.02	0.100
797.4	1,269	0.6	2224	12,700	405	25	3.20	0.012	< 0.02	0.100
807.9	1,292	0.8	2345	12,600	401	24	3.19	0.013	< 0.02	0.095
					June 27, 1991					
817.5	1,312	0.7	0105	12,500	415	24	3.22	0.013	< 0.02	0.100
826.7	1,332	0.5	0221	12,400	412	24	3.19	0.013	< 0.02	0.100
835.5	1,351	0.5	0324	12,300	413	25	3.30	0.013	< 0.02	0.105
839.0	1,360	[2]X	0403	12,300	413	25	3.25	0.015	< 0.02	0.100
848.5	1,381	0.5	0525	12,200	413	25	3.18	0.013	< 0.02	0.100

Table 3.2.--*Concentration of nutrients in approximately midchannel of the Lower Mississippi River between Baton Rouge, La., and Cairo, Ill., June-July 1991 cruise--Continued*

Location							Concentration			
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	Nitrate (NO_3) mg N/L	Nitrite (NO_2) mg N/L	Ammonia (NH_4) mg N/L	Ortho phosphate (PO_4) mg P/L
				June 27, 1991--Continued						
860.2	1,407	0.5	0653	12,000	412	25	3.16	0.012	< 0.02	0.100
870.0	1,427	0.5	0757	11,900	410	25	3.21	0.013	< 0.02	0.095
882.4	1,453	0.5	0919	11,800	405	25	3.20	0.012	< 0.02	0.095
890.5	1,471	0.5	1017	11,700	398	26	2.98	0.020	< 0.02	0.090
898.9	1,489	[2]X	1118	11,600	407	26	3.13	0.019	< 0.02	0.093
911.9	1,517	0.1	1255	11,500	386	23	--	< 0.005	< 0.02	0.095
924.5	1,544	0.5	1418	11,400	378	25	--	0.005	< 0.02	0.100
937.6	1,572	[2]X	1553	11,500	377	26	3.06	0.014	< 0.02	0.102

[1]Distances are computed using velocities listed in table 1.4 in chapter 1. and the first sample was collected at Mile 230.0 upriver from Head of Passes, La., on June 23, 1991, at 2240 hours.

[2]X indicates three to five samples were collected across the river at this location. These individual values appear in table 3.8; the values of specific conductance, temperature, and chemical concentrations in this table are the mean values. Values below the detection limit were NOT included in the mean.

[3] Water discharges are linearly interpolated values between discharges listed in table 1.5 in chapter 1.

Table 3.3.--*Concentration of nutrients in approximately midchannel of the Upper Mississippi River between Cairo, Ill., and Minneapolis, Minn., June-July 1991 cruise*

[km, kilometers; CDT, Central Daylight Time; m³/s, cubic meters per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; N, nitrogen; P, phosphorus; <, less than; and mg/L, milligrams per liter]

Location							Concentration			
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m³/s)	Specific conductance (µS/cm)	Temperature (°C)	Nitrate (NO_3) mg N/L	Nitrite (NO_2) mg N/L	Ammonia (NH_4) mg N/L	Ortho phosphate (PO_4) mg P/L
				June 27, 1991						
10.8	1,638	0.5	2034	7,800	432	25	4.64	0.011	< 0.02	0.135
20.9	1,661	0.5	2151	7,800	439	23	4.41	0.008	< 0.02	0.125
29.6	1,682	0.5	2304	7,800	429	23	4.68	0.010	< 0.02	0.125
				June 28, 1991						
39.0	1,704	0.5	0024	7,800	442	24	4.59	0.011	< 0.02	0.125
51.6	1,735	0.5	0214	7,800	441	24	4.60	0.010	< 0.02	0.130
63.3	1,761	0.5	0334	7,700	442	24	4.65	0.008	< 0.02	0.130
73.7	1,785	0.5	0452	7,700	445	23	4.90	0.011	< 0.02	0.130
82.8	1,806	0.5	0603	7,700	448	24	4.86	0.013	< 0.02	0.130
91.0	1,824	0.5	0702	7,500	449	24	4.87	0.015	< 0.02	0.140
100.7	1,846	[2]X	0814	7,500	458	24	4.80	0.010	< 0.02	0.125
110.0	1,868	0.1	0928	7,500	444	25	4.80	0.012	< 0.02	0.120
120.1	1,891	0.9	1045	7,400	461	24	4.71	0.022	< 0.02	0.125
130.6	1,916	0.1	1205	7,400	473	25	4.79	0.039	< 0.02	0.140
140.4	1,938	0.9	1321	7,400	497	24	4.50	0.016	< 0.02	0.140
150.0	1,961	[2]X	1437	7,400	484	26	4.98	0.024	0.03	0.142
158.2	1,980	0.1	1541	7,400	468	25	4.98	0.023	0.03	0.130
170.0	2,006	0.9	1706	7,300	526	25	3.62	0.012	0.05	0.145
180.3	2,031	0.1	1832	7,300	472	25	4.59	0.012	< 0.02	0.130
198.4	2,077	0.3	2245	5,500	461	23	4.87	0.015	< 0.02	0.135
				June 29, 1991						
207.2	2,097	0.3	0012	5,400	466	23	4.72	0.010	< 0.02	0.130
221.6	2,144	0.3	0709	5,000	443	24	4.96	0.006	< 0.02	0.130
229.2	2,160	0.5	0802	4,900	450	23	4.98	0.010	< 0.02	0.130
240.2	2,182	0.5	0915	4,800	451	24	5.01	0.016	< 0.02	0.140
249.2	2,200	0.5	1026	4,800	451	24	4.85	0.016	< 0.02	0.135
260.2	2,223	0.5	1145	4,700	449	25	5.91	0.017	0.03	0.135
272.0	2,246	0.5	1257	4,600	459	25	4.73	0.020	< 0.02	0.130
283.3	2,272	0.5	1514	4,500	451	25	4.10	0.024	0.03	0.125
291.0	2,288	0.5	1606	4,400	466	25	5.13	0.030	0.03	0.135
299.0	2,304	0.5	1701	4,400	460	26	4.92	0.030	0.03	0.130
310.0	2,327	0.5	1842	4,200	452	26	1.80	0.031	0.10	0.075

Table 3.3.--*Concentration of nutrients in approximately midchannel of the Upper Mississippi River between Cairo, Ill., and Minneapolis, Minn., June-July 1991 cruise--Continued*

Location							Concentration			
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	Nitrate (NO_3) mg N/L	Nitrite (NO_2) mg N/L	Ammonia (NH_4) mg N/L	Ortho phosphate (PO_4) mg P/L
321.0	2,350	0.5	1959	3,900	445	25	2.95	0.047	0.02	0.120
331.0	2,371	0.5	2120	3,900	446	25	3.43	0.058	< 0.02	0.125
341.5	2,394	0.5	2312	4,000	444	24	5.45	0.063	0.02	0.125
				June 30, 1991						
363.9	2,438	0.6	0123	3,000	463	26	3.72	0.061	< 0.02	0.120
370.9	2,454	0.5	0302	3,000	458	25	2.74	0.056	< 0.02	0.100
381.8	2,474	0.8	0405	3,000	465	24	3.14	0.070	< 0.02	0.110
402.8	2,515	0.5	0620	3,000	450	25	2.71	0.058	0.02	0.100
417.2	2,553	0.5	1139	3,000	434	25	2.60	0.061	< 0.02	0.095
435.2	2,588	0.5	1349	2,400	444	25	2.37	0.071	< 0.02	0.075
447.6	2,615	0.5	1613	2,400	435	26	3.86	0.048	< 0.02	0.080
457.1	2,638	0.5	1842	2,500	440	27	2.20	0.058	< 0.02	0.060
480.0	2,681	0.5	2046	2,500	423	27	2.13	0.042	< 0.02	0.075
491.1	2,703	0.5	2219	2,600	403	26	2.13	0.047	< 0.02	0.075
501.0	2,724	0.5	2355	2,500	419	26	2.70	0.045	< 0.02	0.070
				July 1, 1991						
509.3	2,740	0.5	0056	2,400	418	25	1.98	0.038	< 0.02	0.065
520.0	2,760	0.5	0204	2,300	423	25	1.98	0.045	< 0.02	0.070
531.0	2,783	0.5	0340	2,300	422	24	1.99	0.036	< 0.02	0.070
539.8	2,800	0.5	0440	2,300	413	24	1.92	0.034	< 0.02	0.065
551.0	2,821	0.5	0555	2,300	416	25	2.05	0.042	0.02	0.075
560.7	2,840	0.7	0700	2,300	422	24	1.94	0.034	< 0.02	0.065
572.0	2,862	0.5	0813	2,300	409	26	2.03	0.041	< 0.02	0.070
581.5	2,880	0.5	0914	2,300	392	26	1.76	0.034	< 0.02	0.065
590.5	2,898	0.7	1030	2,300	408	25	1.90	0.037	< 0.02	0.085
602.2	2,921	0.5	1145	2,300	407	26	1.78	0.039	< 0.02	0.065
610.0	2,938	0.5	1329	2,300	442	24	2.62	0.047	< 0.02	0.070
621.3	2,961	0.6	1509	2,300	458	25	2.16	0.048	< 0.02	0.075
633.0	2,984	0.5	1634	2,100	463	26	2.19	0.046	< 0.02	0.070
641.8	3,000	0.5	1735	1,900	464	25	2.27	0.048	< 0.02	0.070
653.0	3,021	0.5	1855	1,800	467	27	2.32	0.052	< 0.02	0.070
664.7	3,043	0.5	2014	1,800	471	25	2.49	0.065	< 0.02	0.070
675.5	3,063	0.5	2123	1,800	452	26	2.59	0.070	< 0.02	0.065
686.1	3,082	0.5	2238	1,700	478	25	2.48	0.072	< 0.02	0.070

Table 3.3.--*Concentration of nutrients in approximately midchannel of the Upper Mississippi River between Cairo, Ill., and Minneapolis, Minn., June-July 1991 cruise--Continued*

Location							Concentration			
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Temperature (°C)	Nitrate (NO_3) mg N/L	Nitrite (NO_2) mg N/L	Ammonia (NH_4) mg N/L	Orthophosphate (PO_4) mg P/L
					July 2, 1991					
710.0	3,126	0.5	0133	1,600	491	23	2.71	0.083	< 0.02	0.075
723.2	3,152	0.5	0347	1,600	501	22	2.77	0.102	< 0.02	0.080
735.7	3,176	0.5	0535	1,600	501	22	3.58	0.102	< 0.02	0.085
745.5	3,196	0.5	0813	1,600	513	23	3.46	0.106	< 0.02	0.090
755.5	3,215	0.5	0939	1,600	488	23	4.03	0.114	< 0.02	0.110
764.9	3,233	0.8	1049	1,300	526	23	2.46	--	< 0.02	0.110
776.4	3,253	0.5	1154	1,200	567	24	4.21	0.072	0.09	0.125
793.2	3,284	0.5	1344	1,100	579	23	4.41	0.059	0.05	0.135
805.5	3,307	0.5	1519	1,100	576	23	4.61	0.061	0.09	0.140
812.4	3,320	0.5	1614	900	633	23	5.03	0.054	0.04	0.165
826.1	3,345	0.5	1757	1,000	629	23	5.24	0.054	0.04	0.175
838.0	3,368	0.5	2008	1,000	606	23	5.22	0.053	0.04	0.150
846.0	3,383	0.5	2115	400	402	23	0.91	0.009	< 0.02	0.090

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 230.0 upriver from Head of Passes, La., on June 23, 1991, at 2240 hours.

[2]X indicates three to five samples were collected across the river at this location. These individual values appear in table 3.9; the values of specific conductance, temperature, and chemical concentration in this table are the mean values. Values below the detection limit were NOT included in the mean.

[3]Water discharges are linearly interpolated values between discharges listed in table 1.5 in chapter 1.

Table 3.4.--*Concentration of nutrients in approximately midchannel of the Lower Mississippi River between New Orleans, La., and Cairo, Ill., September-October 1991 cruise*

[km, kilometers; CDT, Central Daylight Time; m^3/s, cubic meters per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; N, nitrogen; P, phosphorus; mg/L, milligrams per liter; <, less than; and --, no measurement]

Location							Concentration			
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Temperature (°C)	Nitrate (NO_3) mg N/L	Nitrite (NO_2) mg N/L	Ammonia (NH_4) mg N/L	Ortho phosphate (PO_4) mg P/L
				September 25, 1991						
88.5	0	[2]X	0647	4,500	457	26	0.71	0.060	0.05	0.092
99.1	19	0.6	0757	4,500	444	26	0.76	0.070	0.10	0.110
105.1	30	0.6	0853	4,500	444	25	0.69	0.050	< 0.01	0.110
113.9	45	0.5	0922	4,500	450	26	0.56	0.050	< 0.01	0.085
123.1	61	0.5	1019	4,500	441	25	0.58	0.050	0.02	0.070
134.9	82	0.4	1126	4,500	432	25	0.62	0.030	< 0.01	0.090
146.0	100	0.5	1235	4,500	431	24	0.49	0.020	< 0.01	0.100
155.6	119	0.6	1325	4,500	433	25	0.61	0.020	0.03	0.120
164.7	136	0.5	1430	4,500	441	25	0.61	0.010	< 0.01	0.070
175.4	155	0.5	1532	4,500	451	23	0.60	0.010	< 0.01	0.070
184.8	172	[2]X	1635	4,500	451	26	0.61	0.010	0.02	0.063
195.1	191	0.4	1742	4,500	448	23	0.56	0.010	< 0.01	0.060
206.8	212	0.5	1850	4,500	449	24	1.31	0.010	0.04	0.060
216.2	229	0.5	1950	4,500	425	24	0.48	0.010	< 0.01	0.055
230.0	254	[2]X	2120	4,500	431	25	0.46	0.010	0.03	0.053
				September 26, 1991						
240.0	280	0.5	0241	4,700	415	23	0.42	0.005	< 0.01	0.050
249.0	296	0.3	0337	4,900	417	23	0.37	0.010	< 0.01	0.050
258.8	314	0.7	0435	5,100	417	23	0.38	0.005	< 0.01	0.050
269.9	334	0.5	0545	5,400	416	23	0.39	0.005	< 0.01	0.050
279.7	352	0.5	0655	5,600	412	23	0.37	0.005	< 0.01	0.050
289.6	370	0.5	0758	5,800	419	22	0.30	0.010	< 0.01	0.050
301.0	389	0.7	0924	6,100	406	23	0.41	0.010	< 0.01	0.050
310.0	405	0.5	1019	6,300	416	23	--	--	--	--
321.1	426	0.5	1128	7,500	404	23	0.44	0.010	< 0.01	0.050
330.4	444	0.5	1229	7,400	397	23	0.42	0.010	< 0.01	0.050
340.0	463	0.5	1334	7,400	415	22	0.47	0.010	< 0.01	0.050
351.3	485	0.8	1447	7,300	423	23	0.56	0.010	< 0.01	0.050
360.0	503	[2]X	1555	7,200	421	23	0.52	0.010	0.01	0.055
371.2	525	0.5	1704	7,200	----	---	0.41	0.010	< 0.01	0.050
380.5	546	0.4	1900	7,200	425	22	0.52	0.005	< 0.01	0.060
389.6	564	0.5	2007	7,200	428	22	0.46	0.010	< 0.01	0.040
398.8	582	0.8	2111	7,200	421	22	0.44	0.010	< 0.01	0.060

Table 3.4.--*Concentration of nutrients in approximately midchannel of the Lower Mississippi River between New Orleans, La., and Cairo, Ill., September-October 1991 cruise--Continued*

Location							Concentration			
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	Nitrate (NO_3) mg N/L	Nitrite (NO_2) mg N/L	Ammonia (NH_4) mg N/L	Ortho phosphate (PO_4) mg P/L
409.5	604	0.4	2235	7,100	418	22	0.46	0.010	< 0.01	0.040
420.1	625	0.6	2345	7,100	431	22	0.59	0.005	< 0.01	0.060
September 27, 1991										
432.0	649	0.4	0114	7,100	436	22	0.59	0.005	< 0.01	0.060
439.8	664	0.2	0208	6,600	444	21	0.55	0.005	< 0.01	0.050
449.2	683	0.6	0312	6,600	441	21	0.57	0.005	< 0.01	0.060
460.8	706	[2]X	0433	6,600	438	21	0.58	0.010	0.02	0.055
474.5	733	0.5	0615	6,500	440	21	0.53	0.005	< 0.01	0.050
485.2	754	0.5	0730	6,500	441	21	0.62	0.005	< 0.01	0.070
493.0	770	0.5	0825	6,500	440	21	0.56	0.005	< 0.01	0.050
504.5	793	0.8	0953	6,400	452	20	0.58	0.005	0.03	0.060
514.1	812	0.7	1059	6,400	445	21	0.58	0.005	< 0.01	0.060
524.9	834	0.5	1225	6,300	448	21	0.59	0.005	< 0.01	0.060
534.5	853	0.1	1335	6,300	453	20	0.60	0.010	< 0.01	0.060
545.0	877	0.3	1544	6,300	458	20	0.68	0.005	< 0.01	0.070
551.8	891	0.5	1630	6,300	451	20	0.61	0.005	< 0.01	0.060
562.8	913	0.3	1750	6,200	451	20	--	0.010	< 0.01	0.080
574.0	935	0.5	1903	6,200	453	20	0.77	0.005	< 0.01	0.080
580.8	948	[2]X	1957	6,100	455	20	0.68	0.005	0.03	0.081
590.3	968	0.5	2111	6,100	449	21	0.84	0.005	< 0.01	0.088
601.0	991	0.5	2309	6,000	448	20	0.85	0.005	< 0.01	0.090
September 28, 1991										
608.8	1,009	0.5	0047	5,900	448	20	0.77	0.005	< 0.01	0.085
617.7	1,025	0.5	0122	5,900	450	20	0.77	0.005	< 0.01	0.085
629.3	1,049	0.2	0252	5,800	448	21	0.74	0.005	< 0.01	0.080
641.7	1,072	0.5	0427	5,700	451	20	0.75	0.005	< 0.01	0.085
650.2	1,089	0.5	0527	5,700	453	20	0.79	0.005	< 0.01	0.090
660.2	1,109	0.5	0640	5,600	453	20	0.85	0.005	0.02	0.100
669.9	1,128	0.5	0752	5,600	447	20	0.83	0.005	< 0.01	0.090
679.4	1,147	0.5	0858	5,600	457	20	0.74	0.005	0.05	0.090
689.9	1,169	0.5	1031	5,600	456	20	0.70	0.005	< 0.01	0.090
702.0	1,193	0.7	1200	5,600	448	20	0.66	0.005	0.03	0.100
712.9	1,215	[2]X	1327	5,600	418	20	0.64	0.007	0.02	0.091
721.5	1,235	0.5	1436	5,600	452	20	0.72	0.005	< 0.01	0.083
731.5	1,255	0.5	1546	5,600	464	20	0.66	0.005	<0.01	0.080

Table 3.4.--*Concentration of nutrients in approximately midchannel of the Lower Mississippi River between New Orleans, La., and Cairo, Ill., September-October 1991 cruise--Continued*

Location							Concentration			
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	Nitrate (NO_3) mg N/L	Nitrite (NO_2) mg N/L	Ammonia (NH_4) mg N/L	Ortho phosphate (PO_4) mg P/L
742.0	1,277	0.5	1811	5,600	462	19	0.67	0.005	< 0.01	0.080
751.1	1,298	0.5	1920	5,600	457	19	0.89	0.005	< 0.01	0.080
762.2	1,319	0.5	2036	5,600	458	20	0.67	0.005	< 0.01	0.080
773.0	1,343	0.5	2240	5,600	453	20	0.69	0.005	< 0.01	0.080
783.0	1,362	0.7	2344	5,600	460	19	0.68	0.005	< 0.01	0.080
					September 29, 1991					
795.5	1,387	0.2	0124	5,600	464	19	0.68	0.005	< 0.01	0.080
804.5	1,405	0.3	0234	5,600	458	20	0.66	0.005	< 0.01	0.080
814.8	1,426	0.4	0350	5,600	458	19	0.63	0.010	< 0.01	0.080
822.2	1,441	0.5	0455	5,500	454	19	0.66	0.005	< 0.01	0.080
833.6	1,463	0.5	0610	5,500	449	19	0.60	0.005	< 0.01	0.070
846.5	1,489	[2]X	0752	5,500	414	20	0.61	0.010	0.01	0.080
855.0	1,506	0.5	0852	5,500	450	19	0.66	0.010	< 0.01	0.080
866.5	1,529	0.5	1010	5,500	446	19	0.61	0.010	< 0.01	0.070
875.4	1,549	[2]X	1121	5,500	447	20	0.63	0.010	0.01	0.077
898.9	1,596	[2]X	1419	5,500	453	20	0.66	0.012	0.01	0.077
922.6	1,644	[2]X	1715	5,500	461	20	0.77	0.023	0.01	0.080
950.5	1,699	[2]X	2029	5,500	484	19	0.94	0.028	0.03	0.090

[1] Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 88.5 upriver from Head of Passes, La., on September 25, 1991, at 0647 hours..

[2] X indicates three to five samples were collected across the river at this location. These individual values appear in table 3.10; the values of specific conductance, temperature, and chemical concentrations in this table are the mean values. Values below the detection limit were NOT included in the mean.

[3] Water discharges are linearly interpolated values between discharges listed in table 1.5 in chapter 1.

Table 3.5.--*Concentration of nutrients at approximately midchannel of the Upper Mississippi River between Cairo, Ill. and Minneapolis, Minn., September-October 1991 cruise*

[km, kilometers; CDT, Central Daylight Time; m^3/s, cubic meters per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; N, nitrogen; P, phosphorus; <, less than; and mg/L, milligrams per liter]

Location							Concentration			
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Temperature (°C)	Nitrate (NO_3) mg N/L	Nitrite (NO_2) mg N/L	Ammonia (NH_4) mg N/L	Ortho phosphate (PO_4) mg P/L
				September 30, 1991						
10.8	1,736	0.5	0039	3,700	550	19	0.99	0.020	0.02	0.110
19.8	1,755	0.5	0148	3,700	555	18	1.00	0.020	0.02	0.120
30.8	1,778	0.7	0315	3,700	559	18	0.99	0.020	0.03	0.120
39.0	1,795	0.5	0413	3,700	570	18	1.00	0.020	0.05	0.110
51.6	1,822	0.8	0550	3,700	562	18	0.99	0.020	0.03	0.110
63.6	1,846	0.5	0712	3,600	572	18	0.98	0.020	0.03	0.110
73.7	1,867	0.6	0823	3,600	556	18	0.98	0.020	0.03	0.110
80.8	1,882	[2]X	0924	3,600	560	19	1.01	0.020	0.04	0.110
104.5	1,932	[2]X	1222	3,500	565	18	0.99	0.020	0.04	0.110
128.9	1,983	[2]X	1521	3,400	561	18	1.05	0.020	0.05	0.110
155.0	2,037	[2]X	1835	3,300	565	18	1.06	0.027	0.09	0.117
180.3	2,090	[2]X	2139	3,200	577	18	0.97	0.015	0.02	0.103
				October 1, 1991						
198.4	2,134	0.5	0127	2,000	481	18	1.37	0.030	0.02	0.120
207.2	2,151	0.3	0253	2,000	493	17	1.39	0.020	< 0.01	0.120
221.6	2,179	0.5	0507	2,000	457	17	1.36	0.020	< 0.01	0.120
230.5	2,195	0.5	0600	2,000	452	17	1.37	0.030	< 0.01	0.120
240.2	2,210	0.5	0700	2,000	454	17	1.42	0.035	< 0.01	0.120
249.2	2,230	0.5	1000	2,000	462	17	1.44	0.030	< 0.01	0.120
260.2	2,250	0.5	1109	2,000	456	17	1.32	0.030	0.03	0.120
272.0	2,272	0.5	1225	2,000	454	17	1.33	0.030	< 0.01	0.120
283.3	2,293	[2]X	1407	2,000	461	17	1.32	0.030	0.02	0.117
292.0	2,309	0.5	1504	2,100	468	17	1.30	0.020	< 0.01	0.120
299.5	2,323	0.5	1553	2,100	461	17	1.29	0.015	< 0.01	0.115
310.0	2,343	0.5	1740	2,000	462	17	1.24	0.010	< 0.01	0.110
321.0	2,363	0.5	1852	2,000	462	16	1.24	0.010	< 0.01	0.100
331.0	2,384	0.5	2107	1,900	467	16	1.29	0.010	0.02	0.100
341.0	2,404	0.5	2212	1,800	452	16	1.22	0.010	0.03	0.110
				October 2, 1991						
351.0	2,421	0.5	0000	1,800	447	16	1.11	0.010	< 0.01	0.110
363.0	2,444	0.7	0136	1,800	447	16	1.08	0.015	0.02	0.105
371.0	2,459	0.5	0245	1,700	436	16	1.09	0.010	< 0.01	0.100

Table 3.5.--*Concentration of nutrients at approximately midchannel of the Upper Mississippi River between Cairo, Ill. and Minneapolis, Minn., September-October 1991 cruise--Continued*

Location							Concentration			
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	Nitrate (NO_3) mg N/L	Nitrite (NO_2) mg N/L	Ammonia (NH_4) mg N/L	Ortho phosphate (PO_4) mg P/L
				October 2, 1991--Continued						
382.0	2,479	0.5	0347	1,700	428	16	--	--	--	--
397.0	2,507	0.5	0532	1,600	422	16	1.13	0.010	< 0.01	0.090
407.0	2,531	0.5	0928	1,600	417	15	1.00	0.010	< 0.01	0.100
418.0	2,555	0.5	1218	1,600	435	16	1.32	0.020	< 0.01	0.085
427.0	2,572	0.5	1321	1,600	424	16	1.00	0.010	< 0.01	0.110
435.0	2,586	0.5	1413	1,600	405	16	0.98	0.025	< 0.01	0.100
447.0	2,610	0.5	1626	1,500	407	16	0.99	0.010	< 0.01	0.100
455.5	2,626	0.5	1720	1,500	398	16	1.13	0.030	0.04	0.100
465.7	2,644	0.5	1837	1,500	398	16	0.98	0.010	0.04	0.130
480.0	2,671	0.5	2013	1,400	401	16	1.03	0.020	0.04	0.100
491.0	2,692	0.5	2141	1,400	399	15	1.02	0.010	0.03	0.100
502.0	2,713	0.5	2322	1,400	401	15	1.04	0.010	0.04	0.100
				October 3, 1991						
509.3	2,727	0.5	0016	1,300	399	15	1.10	0.030	< 0.01	0.100
520.0	2,746	0.5	0129	1,300	395	15	1.16	0.020	< 0.01	0.100
531.0	2,767	0.5	0248	1,300	395	15	1.32	0.020	0.02	0.100
539.2	2,782	0.5	0343	1,300	396	15	1.39	0.005	< 0.01	0.095
551.0	2,805	0.5	0537	1,300	393	15	1.47	0.020	< 0.01	0.095
560.7	2,823	0.5	0656	1,300	394	15	1.60	0.020	0.02	0.100
572.0	2,846	0.5	0805	1,300	400	14	1.68	0.025	< 0.01	0.100
581.5	2,863	0.5	0904	1,300	396	15	1.70	0.030	0.02	0.100
590.5	2,883	0.5	1131	1,300	396	14	1.77	0.030	< 0.01	0.100
602.2	2,904	0.5	1246	1,200	387	15	1.68	0.040	< 0.01	0.090
610.0	2,920	0.5	1412	1,200	402	15	1.84	0.040	< 0.01	0.100
621.3	2,939	0.5	1548	1,200	400	15	1.90	0.040	< 0.01	0.100
632.0	2,963	0.5	1703	1,100	417	15	2.29	0.040	< 0.01	0.113
641.8	2,976	0.5	1807	1,000	415	15	2.03	0.055	< 0.01	0.110
653.0	2,996	0.5	1932	1,000	417	15	2.12	0.040	< 0.01	0.120
665.5	3,018	0.5	2050	1,000	418	15	2.21	0.030	0.03	0.120
675.5	3,036	0.5	2158	1,000	425	15	2.23	0.050	0.02	0.120
686.1	3,055	0.5	2313	1,000	427	14	2.30	0.050	< 0.01	0.120

Table 3.5.--*Concentration of nutrients at approximately midchannel of the Upper Mississippi River between Cairo, Ill. and Minneapolis, Minn., September-October 1991 cruise--Continued*

Location							Concentration			
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	Nitrate (NO_3) mg N/L	Nitrite (NO_2) mg N/L	Ammonia (NH_4) mg N/L	Ortho phosphate (PO_4) mg P/L
					October 4, 1991					
700.0	3,080	0.5	0121	940	439	14	2.40	0.060	< 0.01	0.130
710.0	3,098	0.5	0232	930	435	15	2.31	0.060	< 0.01	0.130
723.2	3,121	0.5	0410	940	432	15	2.25	0.050	0.02	0.130
735.7	3,146	0.5	0545	940	445	15	2.33	0.050	< 0.01	0.130
745.5	3,166	0.5	0902	920	458	13	2.33	0.065	0.02	0.130
755.5	3,182	0.5	1108	900	419	13	2.02	0.050	0.02	0.120
764.5	3,199	0.5	1215	720	507	13	2.50	0.060	0.03	0.150
776.4	3,219	0.5	1319	670	522	15	2.25	0.040	0.03	0.120
786.2	3,236	0.5	1431	630	535	14	2.52	0.030	< 0.01	0.100
793.1	3,248	0.5	1520	600	544	15	2.41	0.040	< 0.01	0.100
805.5	3,270	0.5	1642	510	520	14	2.42	0.030	0.03	0.100
812.5	3,282	0.5	1729	360	660	14	3.33	0.030	0.04	0.120
826.1	3,306	0.5	1900	350	659	15	3.48	0.020	< 0.01	0.115
838.0	3,327	0.5	2023	360	657	15	3.27	0.030	< 0.01	0.070
846.0	3,342	0.5	2213	230	472	14	0.91	0.010	0.02	0.050

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 88.5 upriver from Head of Passes, La., on September 25, 1991, at 0647 hours.

[2]X indicates three to five samples were collected across the river at this location. These individual values appear in table 3.11; the values of specific conductance, temperature, and chemical concentrations in this table are the mean values.

[3]Water discharges are linearly interpolated values between discharges listed in table 1.5 in chapter 1.

Table 3.6.--*Concentration of nutrients in approximately midchannel of the Lower Mississippi River between New Orleans, La., and Cairo, Ill., March-April 1992 cruise*

[km, kilometers; CDT, Central Daylight Time; m^3/s, cubic meters per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; N, nitrogen; P, phosphorus; mg/L, milligrams per liter; <, less than; and --, no measurement]

Location							Concentration			
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Temperature (°C)	Nitrate (NO_3) mg N/L	Nitrite (NO_2) mg N/L	Ammonia (NH_4) mg N/L	Ortho phosphate (PO_4) mg P/L
March 25, 1992										
90.0	0	[2]X	0705	22,300	288	16	1.40	0.010	< 0.006	0.062
100.0	23	0.5	0829	22,300	--	15	0.84	0.006	< 0.006	0.087
110.0	45	0.5	0938	22,300	--	15	1.66	0.014	< 0.006	0.099
119.0	65	0.5	1044	22,300	--	14	1.58	0.012	< 0.006	0.089
130.0	90	0.5	1205	22,300	--	14	1.63	0.012	< 0.006	0.102
139.8	112	0.5	1312	22,300	--	14	1.59	0.010	< 0.006	0.076
149.7	134	0.6	1424	22,300	--	13	1.64	0.010	< 0.006	0.091
160.1	157	0.5	1539	22,300	--	13	1.53	0.010	< 0.006	0.067
170.0	179	0.5	1649	22,300	--	12	1.62	0.009	< 0.006	0.048
179.5	200	0.5	1752	22,300	--	12	1.60	0.009	< 0.006	0.047
190.0	223	0.5	1900	22,300	--	13	1.60	0.010	0.006	0.051
200.0	245	0.5	2011	22,300	--	13	1.59	0.009	< 0.006	0.050
210.0	267	0.5	2124	22,300	--	14	1.58	0.011	0.007	0.047
220.0	290	0.5	2236	22,300	--	14	1.60	0.010	0.014	0.045
228.0	309	[2]X	2348	22,300	306	13	1.24	0.008	< 0.006	0.040
March 26, 1992										
240.3	358	0.5	0532	22,200	305	13	2.17	0.011	< 0.006	0.045
250.0	380	0.5	0647	22,100	303	13	1.07	0.007	< 0.006	0.040
260.8	404	0.5	0804	21,900	308	13	1.62	0.011	< 0.006	0.045
270.0	424	0.5	0907	21,800	306	13	1.65	0.013	< 0.006	0.050
280.0	446	0.5	1018	21,700	293	13	1.65	0.013	< 0.006	0.054
290.0	468	0.5	1131	21,600	311	12	1.46	0.012	< 0.006	0.044
300.0	490	0.5	1243	21,500	309	12	1.64	0.013	< 0.006	0.053
310.0	513	0.5	1354	21,400	311	12	1.64	0.015	< 0.006	0.050
321.1	538	0.5	1515	25,800	312	12	1.65	0.014	< 0.006	0.048
330.4	559	0.6	1620	25,600	312	13	1.65	0.017	< 0.006	0.048
340.0	581	0.5	1731	25,500	311	12	0.59	0.007	< 0.006	0.039
351.3	607	0.8	1853	25,400	311	12	1.67	0.018	< 0.006	0.048
360.0	628	[2]X	2011	25,200	308	12	1.64	0.017	0.008	0.051
371.2	661	0.5	2252	25,300	311	12	1.65	0.022	< 0.006	0.051
March 27, 1992										
380.8	684	0.3	0019	25,400	313	12	0.94	0.042	< 0.006	0.021
389.0	705	0.5	0117	25,500	311	12	1.69	0.024	< 0.006	0.052

Table 3.6.--*Concentration of nutrients in approximately midchannel of the Lower Mississippi River between New Orleans, La., and Cairo, Ill., March-April 1992 cruise--Continued*

Location							Concentration			
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	Nitrate (NO_3) mg N/L	Nitrite (NO_2) mg N/L	Ammonia (NH_4) mg N/L	Ortho phosphate (PO_4) mg P/L
399.4	728	0.5	0234	25,600	311	12	1.68	0.024	0.007	0.050
409.5	754	0.5	0402	25,800	316	12	1.74	0.024	0.012	0.046
421.8	784	0.5	0531	25,900	319	12	1.77	0.026	0.007	0.048
435.3	819	[2]X	0729	26,100	316	12	1.74	0.024	0.008	0.049
445.2	844	0.5	0847	25,800	323	12	1.80	0.026	0.009	0.037
454.3	867	0.5	0957	25,800	321	12	1.99	0.027	<0.006	0.021
464.8	893	0.5	1121	25,900	324	13	2.03	0.028	<0.006	0.012
475.0	920	0.5	1246	26,000	326	14	2.05	0.027	<0.006	0.025
485.5	946	0.6	1410	26,000	337	13	2.08	0.027	0.010	0.025
495.1	971	0.5	1532	26,200	334	12	1.91	0.022	<0.006	0.048
504.5	995	0.8	1651	26,300	338	11	1.93	0.005	<0.006	0.048
514.1	1,021	0.6	1823	26,300	336	11	1.68	0.007	<0.006	0.052
525.0	1,049	0.5	1951	26,300	343	11	1.95	0.021	<0.006	0.051
535.0	1,076	[2]X	2128	26,300	340	11	2.10	0.027	0.014	0.031
					March 28, 1992					
544.9	1,111	0.5	0009	26,400	338	12	2.10	0.027	0.013	0.027
555.0	1,137	0.5	0139	26,400	339	12	2.04	0.025	0.010	0.030
565.1	1,165	0.5	0317	26,400	338	12	2.09	0.027	0.010	0.034
582.0	1,213	0.5	0613	25,300	341	11	1.84	0.012	<0.006	0.056
592.1	1,238	0.5	0734	25,000	340	11	2.07	0.014	<0.006	0.059
602.0	1,264	0.5	0858	23,800	358	11	2.17	0.025	<0.006	0.049
614.1	1,295	0.5	1040	23,600	356	11	2.13	0.017	0.008	0.061
626.6	1,328	0.5	1229	23,500	363	12	2.17	0.029	0.013	0.036
638.7	1,358	0.5	1401	23,400	366	13	2.03	0.029	0.015	0.032
650.1	1,387	0.6	1540	23,200	360	15	2.27	0.034	0.019	0.026
659.8	1,412	[2]X	1659	23,100	360	11	1.86	0.030	0.022	0.040
672.7	1,445	0.5	1843	23,100	351	12	2.09	0.011	0.010	0.053
683.4	1,472	0.5	2011	23,100	358	12	1.01	0.018	0.008	0.044
695.0	1,501	0.6	2138	23,100	358	12	1.58	0.023	0.010	0.060
705.0	1,527	0.5	2308	23,200	352	12	2.03	0.020	0.015	0.063
					March 29, 1992					
714.3	1,549	0.8	0029	23,200	356	12	1.96	0.032	0.015	0.060
723.3	1,571	[2]X	0143	23,300	355	14	2.02	0.032	0.017	0.047
735.0	1,613	0.5	0544	23,300	338	13	2.01	0.030	0.016	0.030
742.0	1,630	0.5	0640	23,100	348	14	2.08	0.032	0.015	0.017

Table 3.6.--*Concentration of nutrients in approximately midchannel of the Lower Mississippi River between New Orleans, La., and Cairo, Ill., March-April 1992 cruise--Continued*

Location							Concentration			
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Temperature (°C)	Nitrate (NO_3) mg N/L	Nitrite (NO_2) mg N/L	Ammonia (NH_4) mg N/L	Ortho phosphate (PO_4) mg P/L
752.9	1,657	0.5	0820	22,700	345	13	2.07	0.030	0.013	0.021
763.0	1,681	0.5	0940	22,400	349	12	2.11	0.031	0.015	0.013
774.0	1,707	0.5	1103	22,000	347	12	2.13	0.031	0.016	0.016
784.6	1,732	0.8	1227	21,700	349	14	1.35	0.022	0.010	0.013
795.5	1,758	0.5	1356	21,300	352	11	1.45	0.023	0.013	0.019
804.7	1,780	0.3	1513	21,100	349	12	1.66	0.024	0.013	0.014
815.8	1,807	0.5	1644	20,700	354	15	2.21	0.032	0.015	0.011
828.0	1,835	0.5	1810	20,300	360	12	2.10	0.031	0.017	0.023
837.4	1,857	0.6	1926	20,000	369	12	2.03	0.027	0.016	0.015
848.0	1,884	[2]X	2105	19,700	341	12	1.32	0.018	0.017	0.013
					March 30, 1992					
878.1	1,956	[2]X	0107	18,700	347	10	2.04	0.027	0.023	0.013
898.9	2,006	[2]X	0400	18,000	389	11	1.81	0.024	0.024	0.014
923.0	2,063	[2]X	0713	17,300	349	11	2.34	0.027	0.033	0.018
950.5	2,128	[2]X	1047	17,000	417	10	2.42	0.023	0.036	0.016

[1]Distance are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 90.0 upriver from Head of Passes, La., on March 25, 1992, at 0705 hours.

[2]X indicates three to five samples were collected across the river at this location. These individual values appear in table 3.12; the values of specific conductance, temperature, and chemical concentration in this table are the mean values. Values below the detection limit were NOT included in the mean.

[3]Water discharges are linearly interpolated values between discharges listed in table 1.5 in chapter 1.

Table 3.7.--*Concentration of major ions at approximately midchannel of the Upper Mississippi River between Cairo, Ill. and Minneapolis, Minn., March-April 1992 cruise*

[km, kilometers; CDT, Central Daylight Time; m^3/s, cubic meters per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; N, nitrogen; P, phosphorus; <, less than; mg/L, milligrams per liter; and --, no sample analyzed]

Location							Concentration			
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Temperature (°C)	Nitrate (NO_3) mg N/L	Nitrite (NO_2) mg N/L	Ammonia (NH_4) mg N/L	Ortho phosphate (PO_4) mg P/L
					March 30, 1992					
11.6	2,173	0.6	1422	8,000	487	9	3.76	0.030	0.056	0.022
19.8	2,192	0.5	1528	7,900	474	10	3.80	0.029	0.057	0.025
34.3	2,226	0.5	1719	7,700	514	9	3.83	0.030	0.075	0.029
49.4	2,261	0.5	1920	7,600	528	9	3.98	0.029	0.062	0.012
65.4	2,299	0.5	2138	7,600	514	9	3.84	0.028	0.062	0.023
80.5	2,335	0.5	2346	7,500	521	10	3.64	0.028	0.057	0.018
					March 31, 1992					
96.2	2,371	0.5	0143	7,700	509	10	3.62	0.028	0.079	0.025
109.8	2,404	[2]X	0340	7,800	506	10	2.52	0.022	0.065	0.023
127.7	2,448	[2]X	0629	7,500	513	11	3.98	0.027	0.063	0.020
145.7	2,491	[2]X	0903	7,600	518	10	2.86	0.021	0.072	0.016
169.7	2,548	[2]X	1229	7,700	533	11	4.07	0.026	0.094	0.018
180.3	2,574	[2]X	1405	7,800	516	11	3.79	0.024	0.066	0.028
198.3	2,620	0.5	1717	5,900	492	11	3.65	0.018	0.034	0.013
207.1	2,640	0.2	1850	5,900	--	--	3.78	0.019	0.011	0.009
221.0	2,673	0.5	2125	5,300	451	10	4.52	0.024	<0.006	0.008
233.5	2,699	0.4	2248	5,000	469	8	4.21	0.022	<0.006	0.006
					April 1, 1992					
246.0	2,729	0.5	0123	4,700	448	10	3.60	0.018	<0.006	0.010
258.5	2,759	0.5	0250	4,400	468	8	3.79	0.019	<0.006	0.007
270.0	2,782	0.6	0454	4,200	498	9	5.03	0.025	0.010	0.018
282.6	2,809	0.5	0630	4,100	465	10	4.67	0.023	<0.006	0.012
293.0	2,830	0.5	0745	4,000	485	9	3.95	0.021	<0.006	0.005
307.0	2,861	0.7	0943	3,900	486	8	4.25	0.021	<0.006	0.012
324.6	2,897	[2]X	1143	3,600	484	8	3.67	0.018	0.008	0.006
336.0	2,921	0.5	1311	3,500	506	9	4.35	0.020	<0.006	0.010
347.0	2,945	0.5	1437	3,500	462	9	3.06	0.020	<0.006	0.005
361.7	2,975	0.7	1620	3,300	494	7	3.95	0.021	<0.006	0.009
374.0	3,003	0.5	1823	3,400	489	7	2.04	0.014	<0.006	0.004
388.0	3,031	0.4	1948	3,400	485	8	3.62	0.021	<0.006	0.005
403.0	3,060	0.7	2121	3,400	475	8	4.55	0.024	<0.006	0.015

Table 3.7.--*Concentration of major ions at approximately midchannel of the Upper Mississippi River between Cairo, Ill. and Minneapolis, Minn., March-April 1992 cruise--Continued*

Location							Concentration			
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Temperature (°C)	Nitrate (NO_3) mg N/L	Nitrite (NO_2) mg N/L	Ammonia (NH_4) mg N/L	Ortho phosphate (PO_4) mg P/L
					April 2, 1992					
413.0	3,088	0.5	0035	3,400	445	9	3.87	0.023	<0.006	0.006
425.0	3,113	0.5	0156	3,200	445	9	4.08	0.026	<0.006	0.007
441.2	3,147	0.6	0423	2,800	448	7	4.04	0.025	0.009	0.017
453.0	3,169	0.5	0539	2,900	446	7	4.00	0.025	0.006	0.017
462.8	3,188	0.7	0650	2,900	448	7	3.82	0.024	<0.006	0.014
481.6	3,224	[2]X	0908	2,500	472	7	4.08	0.027	0.009	0.018
490.7	3,242	0.2	1031	2,600	438	7	3.84	0.027	<0.006	0.017
506.4	3,272	0.5	1228	2,600	434	7	3.76	0.028	<0.006	0.018
520.0	3,298	0.5	1403	2,700	433	7	3.55	0.028	<0.006	0.014
533.0	3,323	0.5	1530	2,700	434	7	3.21	0.029	0.018	0.017
549.0	3,353	0.5	1716	2,700	456	7	3.68	0.029	<0.006	0.012
561.3	3,377	0.5	1838	2,700	435	8	3.51	0.027	<0.006	0.012
572.9	3,398	0.5	1951	2,700	433	7	3.58	0.029	<0.006	0.018
581.5	3,415	0.5	2046	2,700	433	7	3.82	0.028	<0.006	0.017
597.0	3,444	0.9	2237	2,700	441	7	3.88	0.029	<0.006	0.021
					April 3, 1992					
610.0	3,472	0.5	0120	2,600	439	7	3.38	0.030	<0.006	0.019
621.0	3,494	0.4	0245	2,600	443	6	3.33	0.026	<0.006	0.016
631.9	3,514	0.5	0406	2,200	453	7	4.10	0.031	<0.006	0.023
644.9	3,538	0.5	0532	2,200	459	7	3.98	0.032	<0.006	0.017
653.0	3,553	0.5	0628	2,200	468	6	4.13	0.029	<0.006	0.019
669.9	3,583	0.5	0813	2,100	453	7	4.00	0.026	<0.006	0.021
684.3	3,609	0.5	0955	2,100	446	7	3.39	0.023	0.010	0.016
696.1	3,630	[2]X	1116	2,000	438	7	2.14	0.015	0.016	0.014
709.5	3,655	0.5	1307	1,800	505	7	5.02	0.009	0.009	0.023
723.6	3,681	[2]X	1449	1,700	508	8	4.73	0.030	0.013	0.023
735.7	3,703	0.5	1614	1,800	502	8	4.83	0.018	0.012	0.024
745.5	3,721	0.5	1726	1,700	548	8	4.93	0.031	0.014	0.016
755.5	3,740	0.5	1859	1,600	525	7	4.55	0.030	0.022	0.016
764.5	3,756	0.7	2005	1,300	578	6	5.18	0.035	0.031	0.021
776.4	3,777	0.5	2107	1,200	548	7	4.58	0.025	0.009	0.008
793.1	3,806	0.5	2210	1,000	554	8	4.88	0.024	0.014	0.008

Table 3.7.--*Concentration of major ions at approximately midchannel of the Upper Mississippi River between Cairo, Ill. and Minneapolis, Minn., March-April 1992 cruise--Continued*

Location							Concentration			
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Temperature (°C)	Nitrate (NO_3) mg N/L	Nitrite (NO_2) mg N/L	Ammonia (NH_4) mg N/L	Ortho phosphate (PO_4) mg P/L
					April 4, 1992					
805.5	3,829	0.5	0015	1,000	559	8	4.43	0.020	0.018	0.011
813.0	3,843	0.5	0117	690	699	7	5.59	0.024	<0.006	0.006
826.1	3,868	0.8	0304	650	694	8	5.75	0.023	0.025	0.014
835.1	3,887	[2]X	0548	630	711	8	6.15	0.043	0.154	0.074
845.6	3,907	0.5	0733	310	437	8	0.95	0.010	<0.006	0.001

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 90.0 upriver from Head of Passes, La., on March 25, 1992, at 0705 hours.

[2]X indicates two to three samples were collected across the river at this location. These individual values appear in table 3.13; the values of specific conductance, temperature, and chemical concentrations in this table are the mean values. Values below the detection limit were NOT included in the mean.

[3]Water discharges are linearly interpolated values between dishcharges listed in table 1.5 in chapter 1.

Table 3.8.--*Cross-channel variability of nutrients in the Lower Mississippi River between Baton Rouge, La., and Cairo, Ill., June-July 1991 cruise*

[km, kilometers; CDT, Central Daylight Time; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; N, nitrogen; P, phosphorus; <, less than; mg/L, milligrams per liter; and --, no measurement]

Location						Concentration			
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (µS/cm)	Temperature (°C)	Nitrate (NO_3) mg N/L	Nitrite (NO_2) mg N/L	Ammonia (NH_4) mg N/L	Ortho phosphate (PO_4) mg P/L
				June 23, 1991					
230.0	0	0.2	1030	393	--	--	--	--	--
		0.5	1040	--	--	--	--	--	--
		0.8	1045	--	--	3.01	<0.005	< 0.02	0.090
				June 24, 1991		--			
360.0	279	0.2	1326	396	24	--	--	--	--
		0.5	1320	395	26	3.15	<0.005	< 0.02	0.095
		0.9	1315	399	25	--	--	--	--
				June 25, 1991					
475.0	532	0.2	0355	396	25	--	--	--	--
		0.5	0400	402	25	3.73	<0.005	< 0.02	0.110
		0.9	0407	399	25	--	--	--	--
580.8	766	0.2	1712	391	26	13.92	<0.005	< 0.02	0.110
		0.5	1718	388	27	3.43	<0.005	< 0.02	0.110
		0.9	1724	536	27	1.45	<0.005	< 0.02	0.060
				June 26, 1991					
712.9	1,072	0.1	1035	424	24	3.11	0.018	< 0.02	0.115
		0.5	1029	434	24	3.12	0.024	< 0.02	0.130
		0.9	1023	428	25	3.13	0.027	< 0.02	0.145
				June 27, 1991					
839.0	1,360	0.1	0410	414	26	--	--	--	--
		0.5	0403	413	25	3.25	0.015	< 0.02	0.100
		0.9	0355	411	25	--	--	--	--
898.9	1,489	0.1	1118	396	25	2.88	0.019	< 0.02	0.085
		0.5	1124	408	26	3.19	0.019	< 0.02	0.095
		0.9	1130	416	26	3.31	0.019	< 0.02	0.100
937.6	1,572	0.1	1559	362	26	3.98	<0.005	0.02	0.120
		0.5	1553	368	26	3.18	0.011	< 0.02	0.100
		0.9	1543	402	25	2.03	0.016	< 0.02	0.085

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 230.0 upriver from Head of Passes, La., on June 23, 1991, at 2240 hours.

Table 3.9.--*Cross-channel variability of nutrients in the Upper Mississippi River between Cairo, Ill., and Minneapolis, Minn., June-July 1991 cruise*

[km, kilometers; CDT, Central Daylight Time; µS/cm, microsiemens per centimeter at 25 degrees Celsius; N, nitrogen; P, phosphorus; <, less than; and mg/L, milligrams per liter]

Location						Concentration			
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specificc onduc-tance (µS/cm)	Temp-erature (°C)	Nitrate (NO_3) mg N/L	Nitrite (NO_2) mg N/L	Ammonia (NH_4) mg N/L	Ortho phos-phate (PO_4) mg P/L
				June 28, 1991					
100.7	1,846	0.4	0818	457	25	4.78	0.011	< 0.02	0.125
		0.9	0811	460	24	4.81	0.009	< 0.02	0.125
150.0	1,961	0.1	1439	470	26	5.58	0.032	0.04	0.130
		0.9	1434	498	25	4.38	0.016	0.02	0.155

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 230.0 upriver from Head of Passes, La., on June 23, 1991, at 2240 hours.

Table 3.10.--*Cross-channel variability of nutrients in the Lower Mississippi River between New Orleans, La., and Cairo, Ill., Ill., September-October 1991 cruise*

[km, kilometers; CDT, Central Daylight Time; µS/cm, microsiemens per centimeter at 25 degrees Celsius; N, nitrogen; P, phosphorus; mg/L, milligrams per liter; and <, less than]

Location						Concentration			
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (µS/cm)	Temperature (° C)	Nitrate (NO_3) mg N/L	Nitrite (NO_2) mg N/L	Ammonia (NH_4) mg N/L	Ortho phosphate (PO_4) mg P/L
				September 25, 1991					
88.5	0	0.9	0655	465	27	0.74	0.060	0.02	0.090
		0.5	0647	463	25	0.63	0.060	0.03	0.075
		0.1	0640	443	27	0.75	0.060	0.09	0.110
184.8	172	0.1	1628	453	25	0.60	0.010	0.03	0.090
		0.5	1635	451	26	0.66	0.010	0.01	0.040
		0.9	1642	450	26	0.58	0.010	<0.01	0.060
230.0	254	0.1	2114	439	25	0.50	0.010	0.03	0.060
		0.5	2122	426	25	0.43	0.010	<0.01	0.050
		0.9	2130	429	25	0.46	0.010	<0.01	0.050
				September 26, 1991					
360.0	503	0.1	1550	420	22	0.51	0.010	0.01	0.060
		0.5	1555	420	23	0.61	0.010	<0.01	0.055
		0.9	1600	422	24	0.45	0.010	<0.01	0.050
				September 27, 1991					
460.8	706	0.1	0428	440	20	0.53	0.010	0.01	0.045
		0.5	0433	437	21	0.62	<0.005	0.02	0.060
		0.9	0437	438	21	0.59	<0.005	<0.01	0.060
580.8	948	0.1	1950	444	20	0.77	<0.005	<0.01	0.085
		0.5	1957	441	21	0.73	0.005	0.03	0.095
		0.9	2005	481	20	0.55	<0.005	<0.01	0.063
				September 28, 1991					
712.9	1,215	0.3	1322	444	19	0.64	0.010	0.03	0.102
		0.5	1327	404	20	0.63	0.005	0.02	0.085
		0.8	1331	405	20	0.64	0.005	<0.01	0.085
				September 29, 1991					
846.5	1,489	0.1	0746	449	19	0.61	0.010	0.01	0.080
		0.5	0752	396	20	0.62	<0.005	<0.01	0.080
		0.9	0758	396	20	0.59	<0.005	<0.01	0.080

Table 3.10.--*Cross-channel variability of nutrients in the Lower Mississippi River between New Orleans, La., and Cairo, Ill., Ill., September-October 1991 cruise--Continued*

Location						Concentration			
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (µS/cm)	Temperature (° C)	Nitrate (NO_3) mg N/L	Nitrite (NO_2) mg N/L	Ammonia (NH_4) mg N/L	Orthophosphate (PO_4) mg P/L
			September 29, 1991--Continued						
875.4	1,549	0.1	1115	444	20	0.64	0.010	0.01	0.070
		0.5	1121	447	20	0.65	0.010	<0.01	0.080
		0.9	1128	449	20	0.60	0.010	<0.01	0.080
898.9	1,596	0.1	1413	440	20	0.63	0.015	0.01	0.070
		0.5	1419	458	20	0.68	0.010	<0.01	0.080
		0.9	1425	461	21	0.68	0.010	<0.01	0.080
922.6	1,644	0.1	1710	444	20	0.67	0.020	<0.01	0.070
		0.5	1715	461	20	0.74	0.030	0.01	0.080
		0.9	1719	478	20	0.90	0.020	<0.01	0.090
950.5	1,699	0.1	2023	396	19	0.72	0.025	0.01	0.060
		0.5	2029	510	19	0.90	0.030	0.03	0.100
		0.8	2034	548	20	1.21	0.030	0.04	0.110

[1]Distances are computed using velocities in table 1.4 in chapter 1, and the first sample was collected at Mile 88.5 upriver from Head of Passes, La., on September 25, 1991, at 0647 hours.

Table 3.11.--*Cross-channel variability of nutrients in the Upper Mississippi River between Cairo, Ill., and Minneapolis, Minn., September-October 1991 cruise*

[km, kilometers; CDT, Central Daylight Time; µS/cm, microsiemens per centimeter at 25 degrees Celsius; N, nitrogen; P, phosphorus; and mg/L, milligrams per liter]

Location						Concentration			
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (µS/cm)	Temperature (°C)	Nitrate (NO_3) mg N/L	Nitrite (NO_2) mg N/L	Ammonia (NH_4) mg N/L	Ortho phosphate (PO_4) mg P/L
				September 30, 1991					
80.8	1,882	0.1	0914	559	18	1.04	0.020	0.03	0.110
		0.5	0924	558	19	1.00	0.020	0.04	0.110
		0.9	0935	564	19	0.98	0.020	0.05	0.110
104.5	1,932	0.1	1217	549	18	1.07	0.020	0.03	0.110
		0.6	1222	568	19	0.98	0.020	0.05	0.110
		0.9	1226	578	18	0.93	0.020	0.05	0.110
128.9	1,983	0.2	1510	556	18	1.10	0.020	0.04	0.110
		0.5	1521	556	19	1.10	0.020	0.04	0.110
		0.9	1532	572	18	0.94	0.020	0.06	0.110
155.0	2,037	0.1	1830	527	18	1.34	0.040	0.06	0.110
		0.5	1835	542	18	1.14	0.020	0.02	0.110
		0.9	1840	627	19	0.69	0.020	0.18	0.130
180.3	2,090	0.1	2131	523	18	1.30	0.020	0.02	0.110
		0.5	2148	557	18	0.56	0.010	0.03	0.090
		0.9	2139	651	19	1.04	0.015	0.02	0.110
				October 1, 1991					
283.3	2,293	0.1	1400	463	17	1.32	0.050	0.02	0.120
		0.5	1407	460	17	1.32	0.020	0.02	0.120
		0.9	1412	461	17	1.33	0.020	0.01	0.110

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 88.5 upriver from Head of Passes, La., on September 25, 1991, at 0647 hours.

Table 3.12.--*Cross-channel variability of nutrients in the Lower Mississippi River between New Orleans, La., and Cairo, Ill., March-April 1992 cruise*

[km, kilometers; CDT, Central Daylight Time; µS/cm, microsiemens per centimeter at 25 degrees Celsius; N, nitrogen; P, phosphorus; µg/L, micrograms per liter; <, less than; and --, no measurement]

Location						Concentration			
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (µS/cm)	Temperature (° C)	Nitrate (NO_3) mg N/L	Nitrite (NO_2) mg N/L	Ammonia (NH_4) mg N/L	Orthophosphate (PO_4) mg P/L
				March 25, 1992					
90.0	0	0.1	0705	337	16	1.60	0.009	< 0.006	0.060
		0.5	0655	267	17	1.04	0.008	< 0.006	0.059
		0.9	0713	261	16	1.56	0.012	< 0.006	0.066
228.0	309	0.1	2344	305	13	1.55	0.009	< 0.006	0.046
		0.5	2336	306	13	1.55	0.010	< 0.006	0.038
		0.9	2352	306	13	0.63	0.004	< 0.006	0.035
				March 26, 1992					
360.0	628	0.1	2000	308	12	1.63	0.021	< 0.006	0.049
		0.5	2022	309	12	1.68	0.014	0.008	0.056
		0.9	2011	--	--	1.61	0.016	< 0.006	0.047
				March 27, 1992					
435.3	819	0.1	0737	298	12	1.80	0.026	< 0.006	0.047
		0.5	0729	323	12	1.77	0.026	0.008	0.046
		0.9	0722	326	12	1.64	0.019	< 0.006	0.054
535.0	1,076	0.1	2117	340	11	2.14	0.027	0.010	0.038
		0.5	2128	340	11	2.11	0.027	0.010	0.041
		0.8	2139	341	11	2.05	0.026	0.022	0.014
				March 28, 1992					
659.8	1,412	0.1	1653	358	11	1.59	0.035	0.016	0.027
		0.5	1659	358	11	1.99	0.035	0.014	0.031
		1.0	1705	365	11	2.01	0.019	0.035	0.063
				March 29, 1992					
723.3	1,571	0.3	0143	354	12	1.97	0.031	0.018	0.057
		0.5	--	354	15	2.11	0.032	0.020	0.035
		0.7	--	357	14	1.98	0.033	0.014	0.048
848.0	1,884	0.1	2100	329	13	2.26	0.030	0.020	0.012
		0.5	2105	348	11	0.53	0.008	0.011	0.015
		0.9	2110	347	12	1.17	0.016	0.019	0.013

Table 3.12.--*Cross-channel variability of nutrients in the Lower Mississippi River between New Orleans, La., and Cairo, Ill., March-April 1992 cruise--Continued*

Location						Concentration			
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (μS/cm)	Temperature (° C)	Nitrate (NO_3) mg N/L	Nitrite (NO_2) mg N/L	Ammonia (NH_4) mg N/L	Orthophosphate (PO_4) mg P/L
March 30, 1992									
878.1	1,956	0.2	0056	331	11	1.36	0.019	0.019	0.011
		0.5	0106	344	10	2.23	0.029	0.022	0.014
		0.9	0117	367	10	2.54	0.033	0.028	0.014
898.9	2,006	0.1	0406	378	12	3.02	0.037	0.034	0.016
		0.5	0359	380	11	1.10	0.015	0.022	0.016
		0.9	0353	409	10	1.31	0.020	0.015	0.011
923.0	2,063	0.1	0722	273	11	3.53	0.036	0.059	0.032
		0.5	0713	331	11	2.15	0.026	0.023	0.009
		0.9	0705	442	10	1.33	0.020	0.018	0.012
950.5	2,128	0.1	1040	288	11	1.35	0.019	0.017	0.010
		0.5	1047	477	9	2.16	0.018	0.040	0.021
		0.9	1055	485	9	3.74	0.033	0.052	0.018

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 90.0 upriver from Head of Passes, La., on March 25, 1992, at 0705 hours.

Table 3.13.--*Cross-channel variability of nutrients in the Upper Mississippi River between Cairo, Ill., and Minneapolis, Minn., March-April 1992 cruise*

[km, kilometers; CDT, Central Daylight Time; µS/cm, microsiemens per centimeter at 25 degrees Celsius; N, nitrogen; P, phosphorus; <, less than; mg/L, milligrams per liter; and --, no sample analyzed]

Location						Concentration			
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (µS/cm)	Temperature (° C)	Nitrate (NO_3) mg N/L	Nitrite (NO_2) mg N/L	Ammonia (NH_4) mg N/L	Orthophosphate (PO_4) mg P/L
				March 31, 1992					
109.8	2,404	0.1	0335	519	10	2.06	0.017	0.053	0.025
		0.5	0345	503	11	3.04	0.029	0.078	0.025
		0.9	0340	497	9	2.45	0.019	0.065	0.019
127.7	2,448	0.1	0636	521	11	3.51	0.027	0.080	0.019
		0.5	0629	511	11	4.17	0.027	0.054	0.018
		0.9	0622	506	10	4.25	0.027	0.055	0.023
145.7	2,491	0.1	0855	529	10	2.88	0.018	0.034	0.011
		0.5	0903	518	10	--	--	--	--
		0.9	0912	507	10	2.84	0.024	0.111	0.022
169.7	2,548	0.1	1237	544	11	2.81	0.028	0.184	0.031
		0.5	1229	518	10	4.65	0.024	0.026	0.012
		0.9	1221	536	12	4.75	0.026	0.071	0.012
180.3	2,574	0.1	1410	541	10	2.00	0.020	0.142	0.055
		0.5	1405	487	10	4.69	0.026	0.024	0.009
		0.9	1359	521	13	4.68	0.025	0.032	0.019
				April 1, 1992					
324.6	2,897	0.1	1147	458	8	4.69	0.017	0.008	0.007
		0.5	1142	459	8	2.72	0.016	< 0.006	0.007
		0.9	1138	535	9	3.61	0.021	< 0.006	0.005
				April 2, 1992					
481.6	3,224	0.1	0902	520	8	3.95	0.027	0.009	0.014
		0.5	0908	443	7	3.94	0.026	< 0.006	0.016
		0.9	0914	453	7	4.35	0.027	< 0.006	0.023
				April 3, 1992					
696.1	3,630	0.1	1122	389	7	3.72	0.023	0.016	0.015
		0.5	1116	425	7	1.20	0.009	< 0.006	0.012
		0.9	1110	499	7	1.49	0.013	0.017	0.016

Table 3.13.--*Cross-channel variability of nutrients in the Upper Mississippi River between Cairo, Ill., and Minneapolis, Minn., March-April 1992 cruise--Continued*

Location			Time (CDT)	Specific conductance (μS/cm)	Temperature (° C)	Concentration			
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank				Nitrate (NO_3) mg N/L	Nitrite (NO_2) mg N/L	Ammonia (NH_4) mg N/L	Ortho phosphate (PO_4) mg P/L
				April 3, 1992--Continued					
723.6	3,681	0.5	1445	498	8	--	--	--	--
		0.9	1452	519	7	4.73	0.030	0.013	0.023
				April 4, 1992					
835.1	3,887	0.1	0540	743	8	6.09	0.086	0.437	0.208
		0.5	0548	694	8	6.16	0.021	0.009	0.007
		0.8	0556	696	7	6.21	0.021	0.015	0.008

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 90.0 upriver from Head of Passes, La., on March 25, 1992, at 0705 hours.

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Table 3.14.--*Concentration of nutrients in some of the tributaries of the Mississippi River between Baton Rouge, La. and Minneapolis, Minn., June-July 1991 cruise*

[km, kilometers; CDT, Central Daylight Time; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; N, nitrogen; P, phosphorus; mg/L, milligrams per liter; BT, below the mouth of the tributary but near the bank; <, less than; and --, no measurement]

Name of tributary	Location			Date 1991	Time (CDT)	Specific conductance (µS/cm)	Temperature (°C)	Concentration			
	River miles	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank					Nitrate (NO_3) mg N/L	Nitrite (NO_2) mg N/L	Ammonia (NH_4) mg N/L	Ortho phosphate (PO_4) mg P/L
Upriver from Head of Passes											
Arkansas	580.0	766	BT	6-25	1724	536	27	--	--	--	--
Ohio	953.8	1,613	0.1	6-27	1909	231	26	0.45	0.012	0.02	0.020
			0.5		1903	243	25	0.42	0.033	0.02	0.010
			0.9		1858	323	26	0.81	0.041	< 0.02	0.010
Upriver from Mouth of Ohio River											
Missouri	195.3	2,062	0.5	6-28	1945	563	25	3.15	< 0.005	0.02	0.160
Illinois	217.9	2,132	0.5	6-29	0550	650	--	3.25	0.149	0.03	0.125
Des Moines	361.4	2,433	BT	6-30	0111	505	23	9.12	0.072	0.02	0.145
Skunk	395.8	2,501	BT	6-30	0533	622	27	9.78	0.035	0.02	0.185
Rock	479.0	2,679	BT	6-30	2035	481	27	2.25	0.049	< 0.02	0.055
Wisconsin	630.6	2,979	BT	7-01	1614	247	26	0.14	< 0.005	< 0.02	< 0.005
Black	698.2	3,104	BT	7-01	2359	418	25	2.66	0.058	< 0.02	0.040
Chippewa	763.4	3,230	BT	7-02	1035	439	22	4.07	0.080	0.07	0.085
St. Croix	811.5	3,318	0.5	7-02	1605	167	22	0.36	0.016	0.05	0.035
Minnesota	844.0	3,379	0.7	7-02	2058	745	24	7.41	0.054	0.07	0.185

[1]Distances to the mouth of the tributary are computed using velocities in table 1.4 in chapter 1, and the first sample was collected at Mile 230.0 upriver from Head of Passes, La., on June 23, 1991, at 2240 hours.

Table 3.15.--*Concentration of nutrients in some of the tributaries of the Mississippi River between New Orleans, La. and Minneapolis, Minn., September-October 1991 cruise*

[km, kilometers; CDT, Central Daylight Time; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; N, nitrogen, P, phosphorus; mg/L, milligrams per liter; BT, below the mouth of the tributary but near the bank; <, less than; and --, no measurement]

	Location							Concentration			
Name of tributary	River miles	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Date 1991	Time (CDT)	Specific conductance (µS/cm)	Temperature (°C)	Nitrate (NO_3) mg N/L	Nitrite (NO_2) mg N/L	Ammonia (NH_4) mg N/L	Ortho phosphate (PO_4) mg P/L
				Upriver from Head of Passes							
Arkansas	580.8	948	BT	9-27	2005	481	20	--	--	--	--
Ohio	953.8	1,712	0.1	9-29	2130	277	22	0.42	0.030	0.01	0.025
			0.5		2121	266	22	0.29	0.020	< 0.01	0.020
			0.9		2115	275	20	0.27	0.030	0.01	0.015
				Upriver from Mouth of Ohio River							
Missouri	195.3	2,125	0.5	9-30	2333	707	18	0.24	0.005	0.03	0.100
Illinois	217.9	2,171	0.5	10-01	0415	671	19	1.86	0.040	0.01	0.130
Des Moines	361.4	2,441	BT	10-02	0118	447	16	1.15	0.010	0.03	0.110
Rock	479.0	2,669	BT	10-02	2005	665	17	1.55	0.025	0.01	0.230
Wisconsin	630.6	2,956	BT	10-03	1645	333	15	0.84	0.020	0.03	0.040
Black	698.2	3,076	0.5	10-04	0316	316	14	1.41	0.035	0.02	0.060
Chippewa	763.4	3,197	BT	10-04	1205	150	--	0.54	0.020	0.02	0.040
St. Croix	811.5	3,280	0.5	10-04	1720	168	15	0.32	0.030	0.07	0.030
Minnesota	844.0	3,338	0.5	10-04	2155	945	14	7.34	0.020	0.01	0.110

[1]Distances to the mouth of the tributary, are computed using velocities in table 1.4 in chapter 1, and the first sample was collected at Mile 88.5 upriver from Head of Passes, La., on September 25, 1991, at 0647 hours.

Table 3.16.--*Concentration of nutrients in some of the tributaries of the Mississippi River between New Orleans, La. and Minneapolis, Minn., March-April 1992 cruise*

[km, kilometers; CDT, Central Daylight Time; µS/cm, microsiemens per centimeter at 25 degrees Celsius; °C, degrees Celsius; N, nitrogen; P, phosphorus; mg/L, milligrams per liter; BT, below the mouth of the tributary but near the bank; <, less than; and --, no measurement]

Name of tributary	Location: River miles	Location: Distance upriver from first sample[1] (km)	Location: Fraction of distance from left to right bank	Date 1992	Time (CDT)	Specific conductance (µS/cm)	Temperature (°C)	Concentration: Nitrate (NO_3) mg N/L	Concentration: Nitrite (NO_2) mg N/L	Concentration: Ammonia (NH_4) mg N/L	Concentration: Orthophosphate (PO_4) mg P/L
Upriver from Head of Passes											
Yazoo	435.3	819	BT	3-27	0737	298	12	--	--	--	--
Arkansas	582.0	1,213	1.0	3-28	0550	323	14	0.25	0.003	< 0.006	0.021
Ohio	953.8	2,150	0.1	3-30	1258	237	11	1.29	0.020	0.017	0.010
			0.5		1246	266	11	0.58	0.007	0.012	0.010
			0.9		1252	328	10	0.97	0.019	0.018	0.008
Upriver from Mouth of Ohio River											
Kaskaskia	117.5	2,423	0.5	3-31	0450	478	11	1.48	0.036	0.210	0.075
Missouri	195.3	2,612	0.4	3-31	1554	528	12	2.03	0.020	0.034	0.047
Illinois	217.9	2,666	0.5	3-31	2035	778	12	4.24	0.024	0.044	0.019
Des Moines	361.4	2,880	0.5	4-01	1615	726	9	5.48	0.018	< 0.006	0.020
Iowa	433.9	3,132	BT	4-02	0307	448	7	3.78	0.025	0.007	0.008
Rock	479.0	3,219	BT	4-02	0838	535	7	4.15	0.023	0.016	0.002
Wisconsin	630.6	3,512	BT	4-03	0356	241	6	0.90	0.018	< 0.006	0.014
Chippewa	763.4	3,754	BT	4-03	1953	243	7	1.31	0.014	0.029	0.018
St. Croix	811.5	3,840	0.6	4-04	0103	162	5	0.42	0.007	0.064	0.010
Minnesota	844.0	3,904	0.5	4-04	0711	901	7	10.45	0.030	0.025	0.015

[1]Distances, to the mouth of the tributary, are computed using velocities in table 1.4 in chapter 1, and the first sample was collected at Mile 90.0 upriver from Head of Passes, La., on March 25, 1992, at 0705 hours.

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CHAPTER 4 - MAJOR AND TRACE ELEMENTS

by David A. Roth, John R. Garbarino, and Howard E. Taylor

ABSTRACT

Concentrations of dissolved metals were measured in water samples collected from the Mississippi River and some of its tributaries. All water samples were filtered and preserved immediately after collection. Following several days of collection, a group of preserved samples was shipped overnight to the laboratory where analysis proceeded soon after arrival. Quantitative elemental data were collected for boron, barium, beryllium, calcium, cadmium, cobalt, chromium, copper, iron, lead, lithium, magnesium, manganese, mercury, molybdenum, nickel, silicon (as silica), strontium, vanadium, and zinc. Methods of analysis included inductively coupled plasma-optical emission spectroscopy, and cold vapor atomic fluorescence spectroscopy.

INTRODUCTION

Dissolved major elements such as calcium, magnesium, and sodium are usually present at relatively high concentrations in surface water, are essential to human health, and are generally considered nontoxic. Dissolved trace elements, some of which are essential to humans in very minute quantities, are generally very toxic at elevated concentrations. Natural sources account for much of these major and trace metals, but substantial anthropogenic inputs come from mining, industry, household wastes, and agricultural runoff. The goals of this research were to study how concentrations of selected major and trace elements varied longitudinally in the Mississippi River under different hydrologic conditions. From this data it will be possible to evaluate the effects of longitudinal differences in major and trace element concentrations.

Water samples were collected for elemental analysis on four upriver cruises on the Mississippi River between New Orleans, Louisiana, and Minneapolis, Minnesota, during May-June 1990, June-July 1991, September-October 1991, and March-April 1992. The location of the sampling sites is described in the "Introduction" (chapter 1) of this report. Boron, barium, beryllium, calcium, cadmium, cobalt, chromium, copper, iron, lead, lithium, magnesium, manganese, molybdenum, nickel, silicon (as silica), strontium, vanadium, and zinc were determined quantitatively for all water samples collected during each upriver cruise by inductively coupled plasma-optical emission spectroscopy. Mercury was quantitatively determined by cold vapor atomic fluorescence spectroscopy.

ANALYTICAL METHODS

During sample collection and processing, metal contamination was minimized by using Teflon, high-density polyethylene, and Teflon-coated stainless-steel apparatus and non-talc polyethylene, polyvinyl chloride, or Teflon gloves. All apparatus coming in contact with the water sample were thoroughly cleaned and rinsed with deionized water prior to each sampling.

Samples were collected using a 2-L Teflon bottle placed inside a weighted aluminum holder. The holder was designed so that the nozzle of the bottle faced upstream with no metal or plastic other than the Teflon bottle neck in the path of the water filling the bottle. The sampler was lowered into the water to a maximum depth of 0.5 meter using a nylon rope from the side of the vessel opposite the diesel exhaust outlet. The bottle was rinsed at least twice with river water at each site before the actual sample was collected. In addition, special care was taken to exclude any wash from the vessel's outer hull.

Sample processing was varied slightly between the May-June 1990 and June-July 1991 cruises and the September-October 1991 and March-April 1992 cruises. On the May-June 1990 and June-July 1991 cruises, after filling the collection bottle, the sand and heavy silt were briefly allowed to settle. The settled sample was then pumped through a pre-cleaned 50-mm diameter in-line nylon membrane filter with a nominal pore diameter of 0.45 μm using a Teflon coated piston pump equipped with Teflon hoses. The filter and pump were pre-cleaned by pumping 40 mL of deionized water through the filter followed by 20 mL of sample water, which was discarded. An acid-rinsed 250-mL polyethylene sample bottle was then placed at the outlet of the filter to collect the sample. The filtered water sample was preserved by adding 0.5 mL of concentrated ultrapure nitric acid (resulting in a pH of less than 2) from a Teflon dispensing bottle.

Subsequent cruises employed the same collection scheme but used a vacuum filtration apparatus made of polysufone or Teflon to process the sample. The filtration apparatus used a 47-mm diameter Nuclepore polycarbonate membrane filter with a nominal pore diameter of 0.40 μm. The processing protocol for this method was as follows: (1) The filter apparatus was thoroughly cleaned and rinsed with deionized water; (2) a new membrane filter was placed on the filter support using Teflon coated forceps and pre-cleaned by drawing 50 mL of 0.1 percent (volume/volume) ultrapure nitric acid rinse solution through into a waste bottle; (3) the filter was then rinsed and pre-loaded with particulates by drawing 100 mL of deionized water followed by 10 to 30 mL of sample water; (5) about 100-mL of sample was filtered into an pre-cleaned 125-mL polyethylene bottle; (6) the filtered water sample was preserved with 0.5 mL of concentrated ultrapure nitric acid; (7) the sample was labeled; and (8) the filter apparatus was cleaned with deionized water in preparation for the next sample.

Elements other than mercury were analyzed quantitatively using a Jarrell-Ash Atomcomp 975 inductively coupled plasma-optical emission spectrometer following the method described by Garbarino and Taylor (1979, 1980, 1994). Mercury was determined using a PS Analytical cold vapour atomic fluorescence spectrometer following the method described by Roth (1994).

All of the samples were analyzed in random fashion, reagent blank subtracted, and background corrected. The detection limits for all metals using each of the analytical techniques are listed in table 4.1. Expected analytical errors listed in table 4.1 are based on the standard deviation of two or more analyses of the individual samples or standards. Additional information on the instrumental setup, accuracy, and precision can be found in the references.

Quality assurance was monitored by analyzing one or more certified standard reference material during the course of the analysis for every 5 to 10 filtered water samples. Results obtained from these standard reference materials and the certified values are provided in tables 4.2 and 4.3.

Table 4.1.-- ***Analytical detection limits and expected percent relative standard deviation at two concentrations for analytes measured quantitatively***

[mg/L, milligram per liter; and µg/L, microgram per liter]

Element	Detection limit (mg/L)	Percent relative standard deviation at one sigma for stated concentration	
		0.10 mg/L	0.50 mg/L
	Inductively Coupled Plasma-Optical Emission Spectroscopy		
Boron	0.002	3.0	0.7
Barium	0.001	0.2	0.7
Beryllium	0.001	0.6	1.9
Calcium	0.001	3.2	0.5
Cadmium	0.01	1.3	0.8
Cobalt	0.01	2.6	0.5
Chromium	0.01	1.5	0.8
Copper	0.005	0.6	5.7
Iron	0.005	16	5.2
Lead	0.04	16	2.9
Lithium	0.005	2.5	2.6
Magnesium	0.001	0.4	0.12
Manganese	0.002	0.8	0.4
Molybdenum	0.05	8.4	5.4
Nickel	0.03	2.2	1.0
Silica	0.04	24	1.2
Sodium	0.05	1.8	0.2
Strontium	0.001	1.2	0.3
Vanadium	0.005	3.2	0.6
Zinc	0.01	0.9	5.4
	Cold Vapor Atomic Fluorescence Spectroscopy		
	(µg/L)	**0.001µg/L**	**0.100 µg/L**
Mercury	0.001	100	4.0

Table 4.2.--*Accuracy and precision data for elements determined quantitatively by inductively coupled plasma-optical emission spectrometry based on the standard reference water samples used in the analysis of the upriver water samples*

[NBS1643b, National Bureau of Standards Trace Elements in Water Sample No. 1643b; T101, T103, and T107; U.S. Geological Survey Standard Reference Water Sample No. T101, T103, and T107; LD, less than the detection limit; values in parentheses have not been certified; µg/L; micrograms per liter; mg/L, milligrams per liter; --, not determined]

Analyte	Reference standard	Unit	Published values		Analytical results		Number of replicates
			Mean	Standard deviation	Mean	Standard deviation	
			May-June 1990				
Boron	T101	µg/L	370	50	351	20	17
Boron	T107	µg/L	130	21	135	11	17
Barium	T101	µg/L	59.7	16	59.1	3.9	17
Barium	T107	µg/L	192	11	192	13	17
Beryllium	T101	µg/L	14.4	2.2	14.4	1.3	17
Beryllium	T107	µg/L	11.0	1.1	11.1	1.3	17
Calcium	T101	mg/L	72.5	2.4	68.8	3.5	17
Calcium	T107	mg/L	11.7	0.7	11.2	0.6	17
Cadmium	T101	µg/L	9.9	1.5	11.4	3.0	17
Cadmium	T107	µg/L	14.3	2.1	17.4	3.2	17
Cobalt	T101	µg/L	11.9	3.5	10.9	3.3	17
Cobalt	T107	µg/L	11.0	1.4	13.0	2.8	17
Chromium	T101	µg/L	18	3.2	17.1	6.9	17
Chromium	T107	µg/L	13.0	2.1	13.8	6.6	17
Copper	T101	µg/L	50	6.6	48.8	4.7	17
Copper	T107	µg/L	30.0	2.3	30.3	3.7	17
Iron	T101	µg/L	191	18	205	11	17
Iron	T107	µg/L	52	7	51.0	5.0	17
Lithium	T101	µg/L	68	5.7	72.6	12	17
Lithium	T107	µg/L	193	14	199	17	17
Magnesium	T101	mg/L	52.6	2.2	52.1	3.2	17
Magnesium	T107	mg/L	2.10	0.13	2.02	0.13	17
Manganese	T101	µg/L	50.4	4.1	47.0	3.7	17
Manganese	T107	µg/L	45	6	43.7	3.8	17
Molybdenum	T101	µg/L	50	3.3	45.4	17	17
Molybdenum	T107	µg/L	15.0	1.9	12.0	11	17
Sodium	T101	mg/L	96.8	4.1	93.6	5.1	17
Sodium	T107	mg/L	20.7	1.1	20.5	1.1	17
Nickel	T101	µg/L	32	5.8	21.7	12	17
Nickel	T107	µg/L	28.1	3.9	21.7	9.2	17
Lead	T101	µg/L	17.9	6.1	19.5	17	17

Table 4.2.--*Accuracy and precision data for elements determined quantitatively by inductively coupled plasma-optical emission spectrometry based on the standard reference water samples used in the analysis of the upriver water samples--Continued*

Analyte	Reference standard	Unit	Published values		Analytical results		Number of replicates
			Mean	Standard deviation	Mean	Standard deviation	
			May-June 1990--Continued				
Lead	T107	µg/L	26	4	25.6	19	17
Silica	T101	mg/L	6.97	0.47	7.02	0.33	17
Silica	T107	mg/L	7.7	0.5	7.86	0.40	17
Strontium	T101	µg/L	1,200	88	1,130	60	17
Strontium	T107	µg/L	61	4	58.1	3.6	17
Vanadium	T101	µg/L	16.9	4.7	16.3	2.7	17
Vanadium	T107	µg/L	14.0	2.8	15.2	2.1	17
Zinc	T101	µg/L	86	7.6	62.9	7.1	17
Zinc	T107	µg/L	75.8	9.9	87.2	9.4	17
			June-July 1991				
Boron	NBS1643b	µg/L	(95)	--	92.9	2.8	7
Barium	NBS1643b	µg/L	45	2	42.0	0.97	7
Beryllium	NBS1643b	µg/L	19	2	18.2	0.61	7
Calcium	T103	mg/L	54.7	2.0	53.9	0.84	20
Cadmium	NBS1643b	µg/L	20	1	19.5	2.0	7
Cobalt	NBS1643b	µg/L	26	1	25.7	4.0	7
Chromium	NBS1643b	µg/L	18.6	0.4	18.3	9.8	7
Copper	T103	µg/L	83.3	5.7	76.6	3.5	20
Iron	NBS1643b	µg/L	100	8	98.7	2.2	7
Lithium	T103	µg/L	32.5	3.1	32.5	1.0	20
Magnesium	T103	mg/L	30.5	1.2	31.9	0.58	20
Manganese	NBS1643b	µg/L	28	2	3.5	1.5	7
Molybdenum	NBS1643b	µg/L	86	3	9.1	18	7
Sodium	T103	mg/L	107	5.0	103.8	2.8	20
Nickel	NBS1643b	µg/L	50	3	42.5	18	7
Lead	NBS1643b	µg/L	24	0.7	LD	--	--
Silica	T103	mg/L	7.5	0.2	7.8	0.11	20
Strontium	NBS1643b	µg/L	231	6	222	5.3	7
Vanadium	NBS1643b	µg/L	46	0.4	44.3	3.4	7
Zinc	NBS1643b	µg/L	67	2.0	65.1	12	7
			September-October 1991				
Boron	NBS1643b	µg/L	(95)	--	91.7	3.3	9
Barium	NBS1643b	µg/L	45	2	42.4	0.43	9
Beryllium	NBS1643b	µg/L	19	2	18.6	0.78	9
Calcium	T103	mg/L	54.7	2.0	54.3	3.5	26
Cadmium	NBS1643b	µg/L	20	1	19.2	2.8	9

Table 4.2.--*Accuracy and precision data for elements determined quantitatively by inductively coupled plasma-optical emission spectrometry based on the standard reference water samples used in the analysis of the upriver water samples--Continued*

Analyte	Reference standard	Unit	Published values		Analytical results		Number of replicates
			Mean	Standard deviation	Mean	Standard deviation	
			September-October 1991--Continued				
Cobalt	NBS1643b	μg/L	26	1	27.6	3.6	9
Chromium	NBS1643b	μg/L	18.6	0.4	19.7	6.8	9
Copper	T103	μg/L	83.3	5.7	78.4	6.4	26
Iron	NBS1643b	μg/L	100	8	99.6	4.2	9
Lithium	T103	μg/L	32.5	3.1	3.6	2.0	26
Magnesium	T103	mg/L	30.5	1.2	32.6	2.2	26
Manganese	NBS1643b	μg/L	28	2	3.0	0.69	9
Molybdenum	NBS1643b	μg/L	86	3	103.6	17	9
Sodium	T103	mg/L	107	5.0	101.7	11	26
Nickel	NBS1643b	μg/L	50	3	54.9	10	9
Lead	NBS1643b	μg/L	24	0.7	LD	--	--
Silica	T103	mg/L	7.5	0.2	7.9	0.54	26
Strontium	NBS1643b	μg/L	231	6	227	4.0	9
Vanadium	NBS1643b	μg/L	46	0.4	43.6	3.4	9
Zinc	NBS1643b	μg/L	67	2.0	65.0	8.6	9
			March-April 1992				
Boron	NBS1643b	μg/L	(95)	--	92.6	4.2	
Barium	NBS1643b	μg/L	45	2	42.4	0.94	6
Beryllium	NBS1643b	μg/L	19	2	18.5	0.47	6
Calcium	T103	mg/L	54.7	2.0	55.1	3.1	18
Cadmium	NBS1643b	μg/L	20	1	2.2	2.4	6
Cobalt	NBS1643b	μg/L	26	1	27.0	2.9	6
Chromium	NBS1643b	μg/L	18.6	0.4	12.7	12	6
Copper	T103	μg/L	83.3	5.7	8.6	5.2	18
Iron	NBS1643b	mg/L	100	8	10.0	4.4	6
Lithium	T103	μg/L	32.5	3.1	32.1	2.7	18
Magnesium	T103	mg/L	30.5	1.2	32.3	1.8	18
Manganese	NBS1643b	μg/L	28	2	29.8	0.94	6
Molybdenum	NBS1643b	μg/L	86	3	104.1	17	6
Sodium	T103	μg/L	107	5.0	105.2	10	18
Nickel	NBS1643b	μg/L	50	3	43.6	5.5	6
Lead	NBS1643b	μg/L	24	0.7	LD	--	--
Silica	T103	mg/L	7.5	0.2	7.9	0.41	18
Strontium	NBS1643b	μg/L	231	6	227	7.0	6
Vanadium	NBS1643b	μg/L	46	0.4	43.8	2.6	6
Zinc	NBS1643b	μg/L	67	2.0	67.8	6.4	6

Table 4.3.--*Accuracy and precision data for mercury determined by quantitative cold vapor atomic fluorescence spectrometry based on the standard reference water samples used in the analysis of the upriver water samples*

[USGS-SRWS, U.S. Geological Survey Standard Reference Water Samples; published mean and published standard deviation based on a 1:10 dilution and assumes no change in the relative standard deviation due to dilution; all concentrations are in micrograms per liter; no measurements were made in May-June 1990]

Cruise	USGS-SRWS Hg 7					USGS-SRWS Hg 10				
	Published values		Analytical results			Published values		Analytical results		
	Mean	Standard deviation	Mean	Standard deviation	Number of replicates	Mean	Standard deviation	Mean	Standard deviaton	Number of replicates
June-July 1991	0.022	0.006	0.021	0.002	20	0.140	0.008	0.152	0.010	20
September-October 1991	0.022	0.006	0.023	0.003	88	0.140	0.008	0.148	0.013	83
March-April 1992	0.022	0.006	0.021	0.002	78	0.140	0.008	0.150	0.012	78

ANALYTICAL RESULTS

The analytical results are listed in table 4.4 to 4.22 for four upriver transects of the Mississippi River and represent a mean of two or more replicate analyses. When sample concentrations are less than or equal to the detection limit, the results are identified as less than values with a "<" preceding the detection limit value. Parameters that were not determined for a particular sample or that were in obvious error are identified by "--" . The concentration data is ordered by river mile upriver from Head of Passes, Louisiana. The quantitative results are listed in three types of tables. The elemental transport in the Mississippi River, in kilograms per day, may be calculated by multiplying the water discharges (in m^3/s) listed in the tables by the elemental concentrations and a conversion factor—86.4 when the concentration is in milligrams per liter (mg/L) and 0.0864 when the concentration is in micrograms per liter (μg/L).

The highest dissolved mercury concentrations of the last three cruises (mercury was not measured for samples collected on the May-June 1990 cruise) were found during the June-July 1991 cruise and the explanation is unknown. The dissolved mercury concentrations during the June-July 1991 cruise were roughly an order of magnitude greater than the concentrations from the September-October 1991 cruise, and 40 times greater than the concentrations from the March-April 1992 cruise. The mercury concentrations for these samples (June-July 1991 cruise) were checked using standard reference water samples (USGS Hg7 and USGS Hg10), for which the analytical results were very similar to the published values. The field blanks, which were processed identically to the samples, all had mercury concentrations below detectable levels (<0.001 μg/L).

Longitudinal Variability

Data collected in approximately mid-channel are listed in two tables for each cruise, with one table for the Lower Mississippi River (tables 4.4, 4.6, 4.8, and 4.10) and one table for the Upper Mississippi River (tables 4.7, 4.9, and 4.11). There is one table for mid-channel data collected in the Missouri River (table 4.5). The longitudinal variabilities of these mid-channel samples for calcium, silica, and mercury are shown in figures 4.1, 4.2, and 4.3.

Cross-Channel Variability

Data collected at two to three locations across the channel are listed in two tables for each cruise with one table for the Lower Mississippi River (tables 4.13, 4.15, and 4.17) and one table for the Upper Mississippi River (tables 4.12, 4.14, 4.16, and 4.18). The mean of these cross-channel values appears in the corresponding tables for longitudinal variability.

Tributary Concentrations

Data collected in a tributary or just downstream from the mouth of a tributary near the bank are listed in one table for each cruise (tables 4.19, 4.20, 4.21, and 4.22).

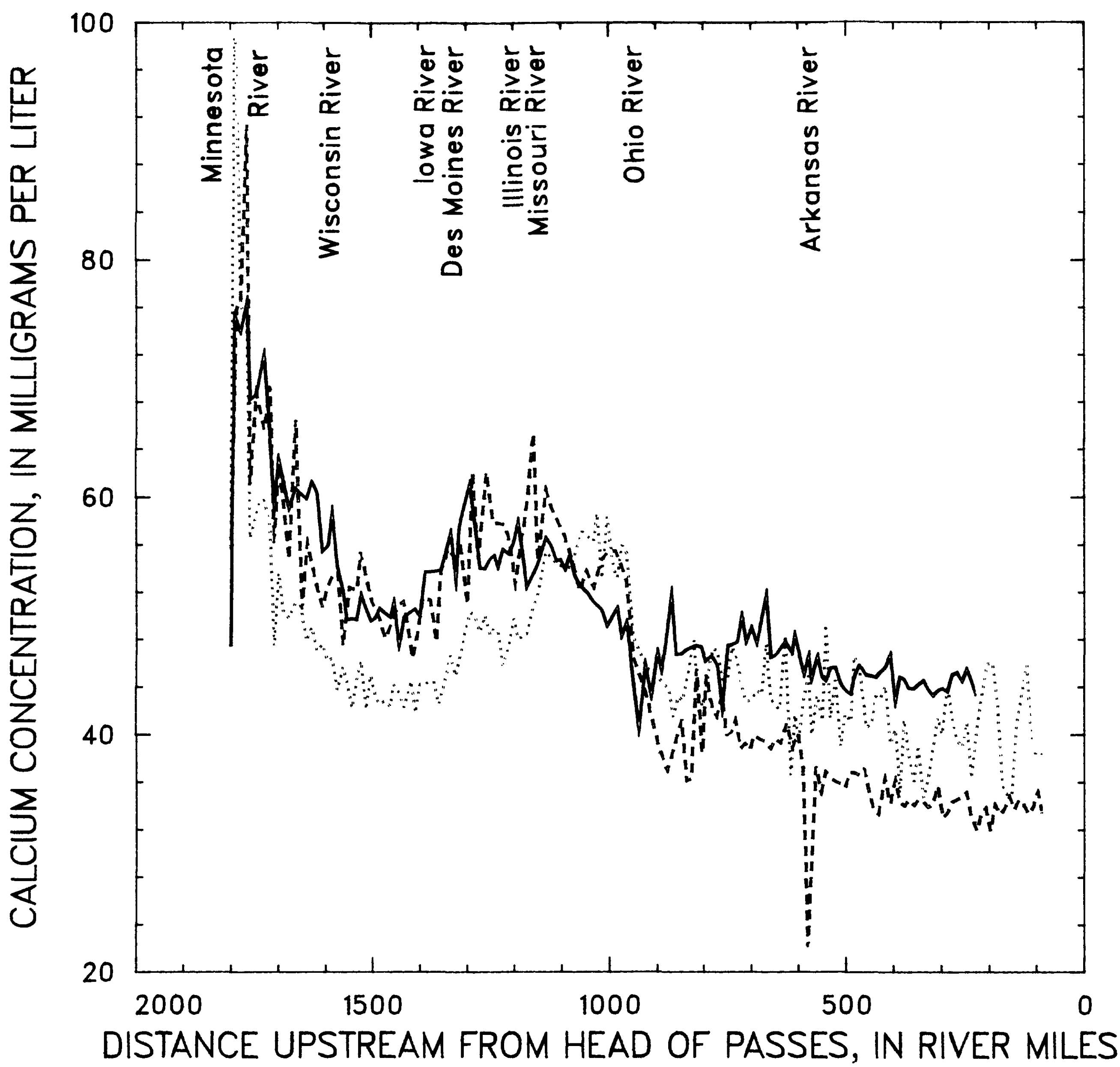

Figure 4.1.--Longitudinal variability of calcium in the Mississippi River upstream from Head of Passes, La., during cruises in June-July 1991 (solid line), September-October 1991 (dotted line), and March-April 1992 (dashed line).

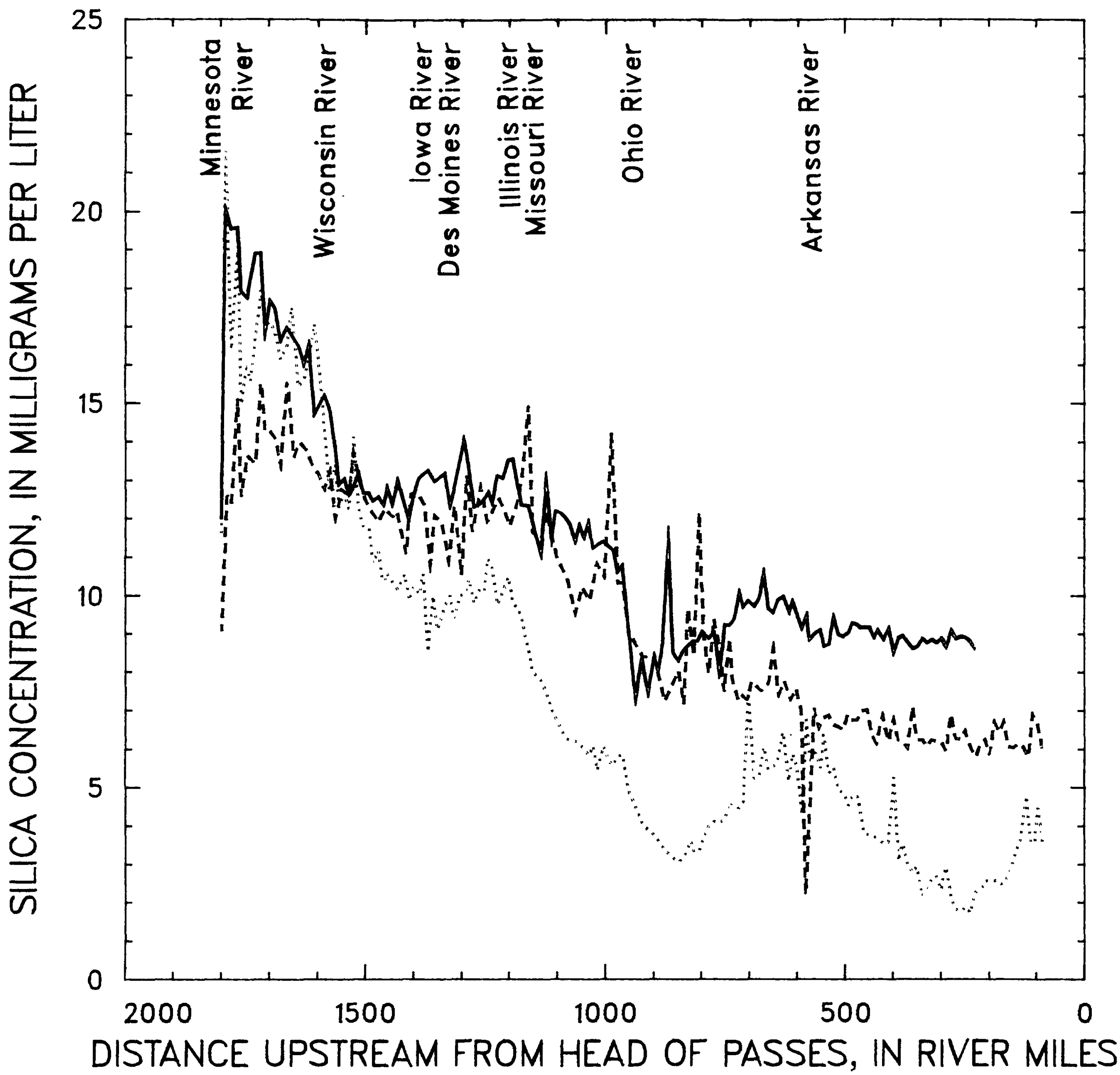

Figure 4.2.--Longitudinal variability of silica in the Mississippi River upstream from Head of Passes, La., during cruises in June-July 1991 (solid line), September-October 1991 (dotted line), and March-April 1992 (dashed line).

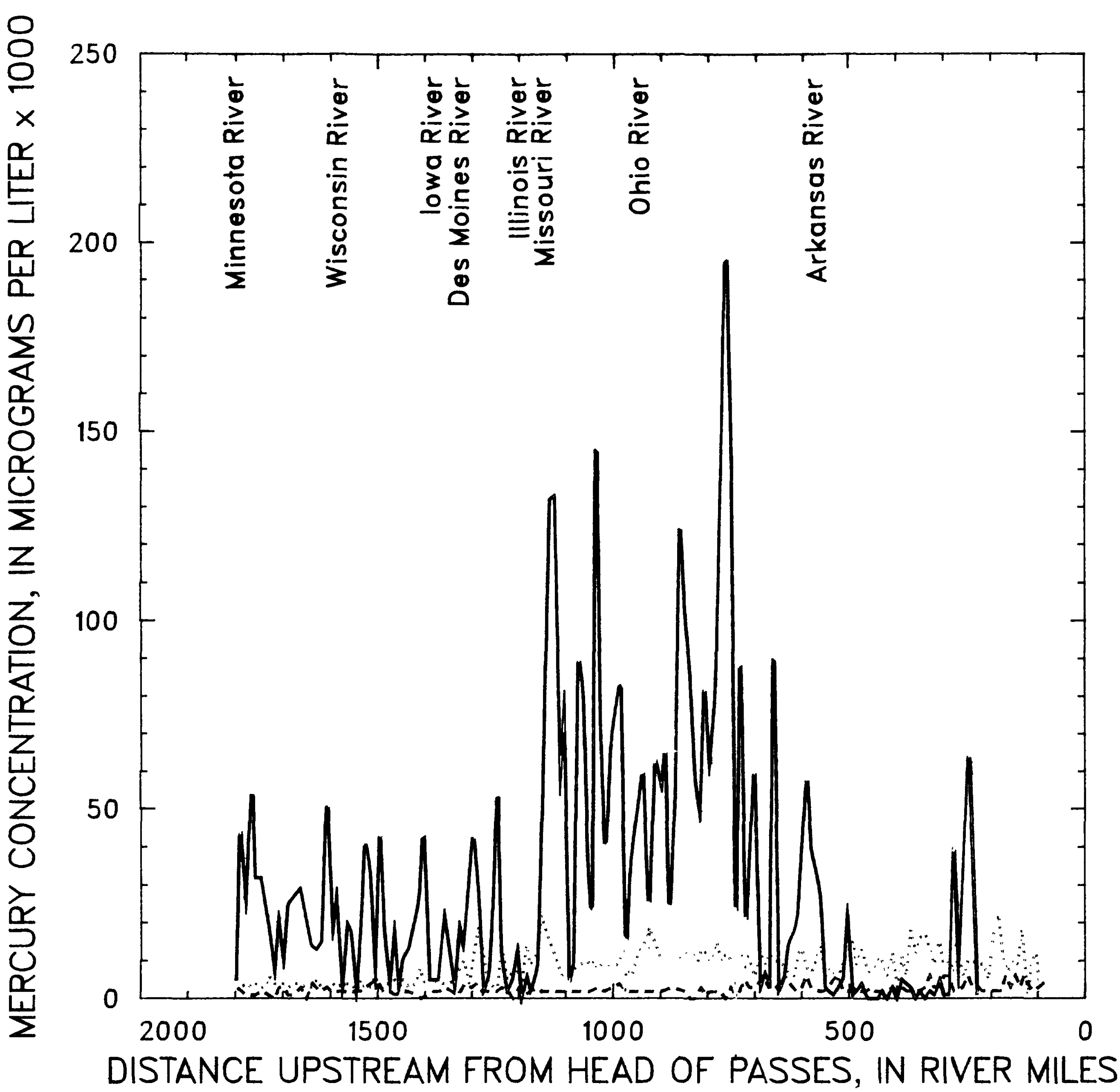

Figure 4.3.--Longitudinal variability of mercury in the Mississippi River upstream from Head of Passes, La., during cruises in June-July 1991 (solid line), September-October 1991 (dotted line), and March-April 1992 (dashed line).

SUMMARY

The trace elements, except mercury, were generally at or below the detection limit for the analysis method used. However, the major elements, calcium, magnesium, sodium, and silica comprised more than 95 percent of the dissolved inorganic cations found in the water of the Mississippi River. For the three upriver cruises between June 1991 and April 1992, the order of concentration of the major elements in the Upper Mississippi River was:

$$Ca>Mg>SiO_2>Na$$

The order of concentration in the Lower Mississippi River during the same time was:

$$Ca>Na>Mg>SiO_2$$

The order of major element concentrations measured between Cairo, Ill., and Grafton, Ill., during the May-June 1990 upriver cruise was the same as the order in the Lower Mississipppi River during the cruises between June 1991 and April 1992.

The changes in the chemistry of the water coincided with the inputs from the Ohio River, Illinois River and the Missouri River. The concentration of the major and trace elements generally decreased with increasing water discharge.

REFERENCES

Garbarino, J.R., and Taylor, H.E., 1979, Inductively coupled plasma-emission spectrometric method for routine water quality testing: Applied Spectroscopy, v. 33, p. 220–226.

Garbarino, J.R., and Taylor, H.E., 1980, A Babington-type nebulizer for use in the analysis of natural water samples by inductively coupled plasma spectrometry: Applied Spectroscopy, v. 34, p. 584–590.

Garbarino, J.R., and Taylor, H.E., 1994, Inductively coupled plasma-mass spectrometrics method for the determination of dissolved trace elements in natural water: U.S. Geological Survey Open-File Report 94-358, 28 p.

Roth, D.A., 1994, Ultratrace analysis of mercury and its distribution in some natural waters in the United States, Colorado State University, Fort Collins, Doctor of Philosophy Thesis, 309 p.

(page 140 follows)

Table 4.4.--*Concentration of major and trace elements*
Mississippi River between Cairo, Ill., and

[km, kilometers; CDT, Central Daylight Time;

μS/cm, microsiemens per centimeter at 25 degrees

Location											
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
											June 4, 1990
0.0	0	0.5	1840	12,300	403	0.046	0.095	<0.001	45.0	<0.01	<0.01
10.0	23	0.5	1945	12,300	408	0.043	0.094	<0.001	44.1	<0.01	<0.01
20.0	47	0.5	2100	12,300	409	0.044	0.092	<0.001	43.8	<0.01	<0.01
30.0	71	0.5	2215	12,300	414	0.044	0.093	<0.001	44.3	<0.01	<0.01
40.0	94	0.5	2325	12,300	414	0.043	0.096	<0.001	46.1	0.01	<0.01
											June 5, 1990
50.0	119	[2]X	0052	12,100	419	0.044	0.095	<0.001	46.3	<0.01	<0.01
60.0	144	0.5	0220	11,900	425	0.041	0.098	<0.001	47.3	<0.01	<0.01
70.0	168	0.5	0335	11,600	429	0.044	0.097	<0.001	47.6	<0.01	<0.01
80.0	192	0.5	0451	11,400	424	0.046	0.096	<0.001	47.5	<0.01	<0.01
90.0	216	0.5	0610	11,100	423	0.043	0.097	<0.001	48.1	<0.01	<0.01
100.8	242	[2]X	0734	10,800	432	0.043	0.090	<0.001	47.0	<0.01	<0.01
110.0	264	0.6	0846	10,600	437	0.041	0.093	<0.001	45.9	<0.01	<0.01
119.5	289	[2]X	1020	10,000	440	0.040	0.088	<0.001	45.8	<0.01	<0.01
130.7	316	[2]X	1151	9,800	450	0.036	0.086	<0.001	45.1	<0.01	<0.01
140.0	339	[2]X	1307	9,500	454	0.036	0.084	<0.001	44.2	<0.01	<0.01
150.0	363	[2]X	1423	9,300	458	0.042	0.088	0.001	48.6	<0.01	<0.01
160.0	390	[2]X	1611	9,000	456	0.054	0.098	0.002	49.0	<0.01	<0.01
170.0	415	[2]X	1740	8,900	473	0.054	0.094	0.001	49.6	<0.01	<0.01
179.3	438	[2]X	1859	8,500	473	0.058	0.098	<0.001	52.2	<0.01	<0.01
196.0	476	[2]X	2053	5,200	501	0.054	0.079	<0.001	58.0	<0.01	<0.01
											June 6, 1990
196.0	520	[2]X	0811	[4]4,700	504	0.048	0.074	<0.001	53.0	<0.01	<0.01
206.0	543	[2]X	0957	5,100	509	0.048	0.073	<0.001	54.3	<0.01	<0.01
216.0	564	[2]X	1112	5,500	549	0.054	0.071	<0.001	57.0	<0.01	<0.01
220.7	572	0.5	1130	4,200	407	0.025	0.074	<0.001	44.2	<0.01	<0.01

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 0.0 upriver from mouth of Ohio River, on June 4, 1990, at 1840 hours.

[2]X indicates two to three samples were collected across the river at this location. These individual values appear in table 4.12; the values for specific conductance and chemical concentrations in this table are the mean values. Values below the detection limit were NOT included in the mean.

[3] Water discharges are linearly interpolated values between discharges listed in table 1.5 in chapter 1.

[4]Discharge estimated as the discharge of the Mississippi at St. Louis, Mo., on June 6, 1990, 8,100 m^3/s minus the discharge of the Missouri River on June 6, 1990, of 3,400 m^3/s.

in approximately midchannel of the Upper Grafton, Ill., May-June 1990 cruise

m^3/s, cubic meters per second;

Celsius; and mg/L, milligrams per liter]

Concentration													
Cr (mg/L)	**Cu (mg/L)**	**Fe (mg/L)**	**Li (mg/L)**	**Mg (mg/L)**	**Mn (mg/L)**	**Mo (mg/L)**	**Na (mg/L)**	**Ni (mg/L)**	**Pb (mg/L)**	**SiO_2 (mg/L)**	**Sr (mg/L)**	**V (mg/L)**	**Zn (mg/L)**
<0.01	<0.005	<0.005	<0.005	14.1	<0.002	<0.05	13.2	<0.03	<0.04	8.2	0.152	<0.005	<0.01
<0.01	<0.005	<0.005	<0.005	14.0	<0.002	<0.05	13.2	<0.03	<0.04	7.8	0.150	0.001	<0.01
<0.01	<0.005	<0.005	<0.005	14.0	<0.002	<0.05	13.3	<0.03	<0.04	7.6	0.148	<0.005	<0.01
<0.01	<0.005	<0.005	<0.005	14.2	<0.002	<0.05	13.3	<0.03	<0.04	7.8	0.149	<0.005	<0.01
<0.01	<0.005	<0.005	0.015	15.1	<0.002	<0.05	13.5	<0.03	<0.04	8.3	0.156	<0.005	0.02
<0.01	<0.005	<0.005	<0.005	14.5	<0.002	<0.05	13.4	0.03	<0.04	8.0	0.153	<0.005	<0.01
<0.01	<0.005	<0.005	<0.005	14.8	<0.002	<0.05	13.5	<0.03	<0.04	7.8	0.157	<0.005	<0.01
<0.01	<0.005	<0.005	<0.005	15.1	<0.002	<0.05	13.5	0.03	<0.04	8.0	0.154	<0.005	<0.01
<0.01	<0.005	<0.005	<0.005	15.3	<0.002	<0.05	13.4	<0.03	<0.04	7.9	0.149	<0.005	<0.01
<0.01	<0.005	<0.005	<0.005	15.0	<0.002	<0.05	13.6	0.03	<0.04	8.2	0.159	<0.005	<0.01
<0.01	<0.005	<0.005	0.021	15.6	<0.002	<0.05	13.7	<0.03	<0.04	7.9	0.152	<0.005	0.02
<0.01	<0.005	<0.005	<0.005	14.3	<0.002	<0.05	13.4	<0.03	<0.04	7.8	0.155	<0.005	<0.01
<0.01	<0.005	<0.005	<0.005	14.5	<0.002	<0.05	13.2	0.04	<0.04	7.4	0.149	<0.005	<0.01
<0.01	<0.005	<0.005	<0.005	14.2	<0.002	<0.05	13.3	0.03	<0.04	7.4	0.148	<0.005	<0.01
<0.01	<0.005	<0.005	0.006	14.0	<0.002	<0.05	13.0	0.03	<0.04	7.2	0.143	<0.005	<0.01
<0.01	<0.005	<0.005	0.016	16.4	<0.002	<0.05	14.5	0.03	<0.04	8.4	0.156	<0.005	<0.01
<0.01	0.014	0.318	<0.005	16.9	0.003	0.06	14.9	0.04	<0.04	8.0	0.162	0.006	<0.01
<0.01	0.005	<0.005	0.006	16.7	<0.002	0.05	16.5	0.04	0.05	7.8	0.172	0.006	<0.01
<0.01	0.006	<0.005	<0.005	17.2	<0.002	<0.05	17.8	0.05	<0.04	8.4	0.186	<0.005	<0.01
<0.01	0.006	<0.005	0.019	22.0	<0.002	<0.05	14.0	0.06	0.07	8.9	0.137	0.006	0.01
<0.01	<0.005	<0.005	<0.005	19.6	<0.002	<0.05	13.1	0.04	<0.04	8.0	0.126	<0.005	<0.01
<0.01	<0.005	<0.005	<0.005	20.2	<0.002	<0.05	13.4	0.04	<0.04	7.8	0.130	<0.005	0.01
<0.01	<0.005	<0.005	<0.005	21.7	<0.002	<0.05	14.9	0.04	<0.04	7.8	0.138	<0.005	<0.01
<0.01	<0.005	<0.005	<0.005	14.8	<0.002	<0.05	8.4	<0.03	<0.04	8.4	0.098	<0.005	<0.01

Table 4.5.--*Concentration of major and trace elements*
Missouri River between mouth of the Missouri

[µS/cm, microsiemens per centimeter at

Location: River miles upriver from mouth of Missouri River	Location: Distance upriver from first sample[1] (km)	Location: Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
											June 9, 1990
0.0	0	0.50	0558	5,500	351	0.044	0.098	<0.001	37.7	<0.01	<0.01
10.0	24	0.50	0722	5,600	346	0.046	0.098	<0.001	36.5	<0.01	<0.01
20.0	49	0.50	0850	5,700	338	0.044	0.096	<0.001	35.3	<0.01	<0.01
30.0	74	0.50	1022	5,800	329	0.044	0.096	<0.001	34.5	<0.01	<0.01
38.8	106	0.50	1322	5,900	336	0.043	0.103	<0.001	36.8	<0.01	<0.01
29.9	[3]96	0.50	1410	6,000	333	0.042	0.099	<0.001	35.5	<0.01	<0.01
28.0	116	0.98	1812	6,100	340	0.045	0.103	<0.001	36.6	<0.01	<0.01
28.0	131	0.98	2045	6,100	340	0.044	0.103	<0.001	37.4	<0.01	<0.01
28.0	150	0.98	2400	6,200	357	0.045	0.101	<0.001	36.4	<0.01	<0.01
											June 10, 1990
28.0	167	0.98	0305	6,300	371	0.050	0.104	<0.001	38.4	<0.01	<0.01
28.0	181	0.98	0525	6,300	379	0.046	0.106	<0.001	39.0	<0.01	<0.01
28.0	196	0.98	0800	6,400	382	0.049	0.104	<0.001	39.5	<0.01	<0.01
28.0	207	0.98	1000	6,500	380	0.048	0.103	<0.001	38.7	<0.01	<0.01
28.0	219	0.98	1200	6,500	372	0.047	0.100	<0.001	38.0	<0.01	<0.01
28.0	230	0.98	1356	6,500	364	0.046	0.103	<0.001	37.8	<0.01	<0.01
28.0	242	0.98	1600	6,600	355	0.047	0.111	<0.001	40.7	<0.01	<0.01
28.0	254	0.98	1800	6,700	346	0.046	0.105	<0.001	38.3	<0.01	<0.01
27.9	264	0.50	1944	6,800	328	0.044	0.105	<0.001	37.9	<0.01	<0.01

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 0.0 upriver from mouth of Missouri River on June 9, 1990, at 0558 hours.

[2]Discharge between Missouri River Mile 40 and Mile 0 is about equal to the discharge at Hermann, Mo. 1 day earlier, so that the interpolation in time was done between June 7 (4,400 m^3/s), June 8 (5,900 m^3/s) June 9 (6,500 m^3/s) and June 10 (6,900 m^3/s).

[3] Research vessel ACADIANA had to stop at Mile 38.8, go back downriver, and tie up to a dock at Mile 28.0 on the right bank, because of debris that was clogging the cooling-water intakes for the engines.

in approximately midchannel of the
River and St. Charles, Mo., May-June 1990 cruise

25 degrees Celsius; mg/L, milligrams per liter]

Concentration													
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
<0.01	<0.005	<0.005	0.017	9.9	<0.002	<0.05	17.0	0.03	<0.04	7.5	0.181	0.005	<0.01
<0.01	<0.005	<0.005	0.017	9.6	<0.002	<0.05	16.3	0.04	<0.04	7.1	0.176	<0.005	<0.01
<0.01	<0.005	0.008	0.016	9.4	<0.002	<0.05	15.6	<0.03	<0.04	7.4	0.171	<0.005	<0.01
<0.01	<0.005	<0.005	0.014	9.2	<0.002	<0.05	14.8	0.03	<0.04	7.0	0.165	<0.005	<0.01
<0.01	<0.005	0.006	0.015	9.9	<0.002	<0.05	15.7	<0.03	<0.04	7.9	0.176	<0.005	<0.01
<0.01	<0.005	<0.005	0.022	9.6	<0.002	<0.05	15.2	0.03	<0.04	7.8	0.171	<0.005	<0.01
<0.01	<0.005	<0.005	0.022	9.8	<0.002	<0.05	15.7	<0.03	<0.04	7.7	0.176	<0.005	<0.01
<0.01	<0.005	<0.005	0.030	10.0	<0.002	<0.05	16.4	0.04	<0.04	8.0	0.181	<0.005	<0.01
<0.01	<0.005	<0.005	0.034	9.9	<0.002	<0.05	16.9	<0.03	<0.04	6.7	0.181	<0.005	<0.01
<0.01	<0.005	<0.005	0.033	10.2	<0.002	<0.05	17.9	0.03	<0.04	7.0	0.191	<0.005	<0.01
<0.01	<0.005	0.006	0.034	10.3	<0.002	<0.05	18.3	<0.03	<0.04	8.0	0.195	<0.005	<0.01
<0.01	<0.005	<0.005	0.034	10.4	<0.002	<0.05	18.4	<0.03	<0.04	8.1	0.198	<0.005	<0.01
<0.01	<0.005	<0.005	0.032	10.2	<0.002	<0.05	18.1	0.03	<0.04	7.9	0.195	<0.005	<0.01
<0.01	<0.005	<0.005	0.034	10.0	<0.002	<0.05	17.6	<0.03	<0.04	7.9	0.192	<0.005	<0.01
<0.01	<0.005	<0.005	0.032	10.0	<0.002	<0.05	16.9	<0.03	<0.04	7.9	0.190	<0.005	<0.01
<0.01	<0.005	<0.005	0.030	10.5	<0.002	<0.05	17.4	<0.03	<0.04	8.7	0.203	<0.005	<0.01
<0.01	<0.005	<0.005	0.024	9.8	<0.002	<0.05	16.2	<0.03	<0.04	7.9	0.190	<0.005	<0.01
<0.01	<0.005	0.011	0.025	9.8	<0.002	<0.05	14.9	0.05	<0.04	8.5	0.186	<0.005	<0.01

Table 4.6.--*Concentration of major and trace elements Mississippi River between Baton Rouge,*

[km, kilometers; CDT, Central Daylight Time; m^3/s, cubic meters per second; μS/cm, microsiements per centimeter

Location												
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
												June 23, 1991
230.0	0	[2]X	2240	16,000	393	---	0.036	0.073	<0.001	43.3	<0.01	<0.01
240.3	22	0.5	2345	16,100	386	25	0.037	0.074	<0.001	44.6	<0.01	<0.01
												June 24, 1991
248.8	40	0.5	0045	16,100	382	23	0.036	0.073	<0.001	45.5	<0.01	<0.01
258.6	60	0.5	0146	16,200	385	23	0.037	0.075	<0.001	44.5	<0.01	<0.01
269.6	83	0.5	0300	16,300	388	25	0.034	0.072	<0.001	45.2	<0.01	<0.01
279.7	107	0.5	0415	16,300	385	25	0.039	0.075	<0.001	45.1	<0.01	<0.01
289.8	130	0.5	0525	16,400	380	25	0.041	0.073	<0.001	43.6	<0.01	<0.01
300.0	152	0.5	0640	16,500	397	25	0.036	0.075	<0.001	43.9	<0.01	<0.01
310.0	173	0.5	0745	16,500	383	25	0.040	0.073	<0.001	43.7	<0.01	<0.01
320.0	193	0.5	0833	18,500	390	24	0.039	0.074	<0.001	43.3	<0.01	<0.01
330.4	217	0.5	1010	18,300	393	25	0.039	0.074	<0.001	43.8	<0.01	<0.01
340.0	237	0.5	1105	18,100	399	25	0.039	0.076	<0.001	44.5	<0.01	<0.01
351.2	260	0.5	1215	17,800	395	25	0.042	0.087	<0.001	44.2	<0.01	<0.01
360.0	279	[2]X	1320	17,700	397	25	0.043	0.093	<0.001	43.9	<0.01	<0.01
371.2	310	0.5	1605	17,500	398	26	0.039	0.111	<0.001	43.9	<0.01	<0.01
380.4	329	0.5	1704	17,400	392	26	0.056	0.118	<0.001	44.7	<0.01	<0.01
389.8	349	0.5	1810	17,300	388	25	0.043	0.117	<0.001	44.8	<0.01	<0.01
399.4	370	0.5	1915	17,300	383	25	0.043	0.099	<0.001	42.8	<0.01	<0.01
409.5	392	0.5	2029	17,200	393	24	0.044	0.146	<0.001	46.7	<0.01	<0.01
420.1	414	0.5	2135	17,100	404	24	0.041	0.139	<0.001	45.7	<0.01	<0.01
432.0	440	0.5	2259	16,900	400	25	0.041	0.154	<0.001	45.3	<0.01	<0.01
439.8	457	0.5	2352	14,900	400	24	0.054	0.167	<0.001	44.8	<0.01	<0.01
												June 25, 1991
449.1	476	0.5	0050	15,000	399	25	0.037	0.101	<0.001	45.0	<0.01	<0.01
460.8	501	0.5	0215	15,000	399	24	0.047	0.149	<0.001	45.0	<0.01	<0.01
469.0	519	0.5	0315	15,100	396	24	0.043	0.156	<0.001	45.6	<0.01	<0.01
475.0	532	[2]X	0400	15,100	399	25	0.042	0.119	<0.001	45.8	<0.01	<0.01
485.5	554	0.5	0512	15,200	396	25	0.040	0.111	<0.001	44.9	<0.01	<0.01
493.0	571	0.5	0618	15,200	397	23	0.037	0.119	<0.001	43.4	<0.01	<0.01
504.5	595	0.7	0725	15,300	389	25	0.041	0.117	<0.001	43.7	<0.01	<0.01
514.1	616	0.5	0837	15,300	388	24	0.043	0.112	<0.001	44.4	<0.01	<0.01
525.3	640	0.5	1000	15,400	390	24	0.104	0.185	<0.001	45.7	<0.01	<0.01

in approximately midchannel of the Lower La., and Cairo, Ill., June-July 1991 cruise

at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; and --, no measurement]

Concentration														
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (μg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
<0.01	<0.005	<0.005	<0.001	<0.005	14.1	<0.002	<0.05	14.4	<0.03	<0.04	8.6	0.164	<0.005	<0.01
<0.01	<0.005	0.017	0.042	<0.005	14.3	<0.002	<0.05	15.8	<0.03	<0.04	8.8	0.167	<0.005	<0.01
<0.01	<0.005	0.019	0.069	<0.005	14.8	<0.002	<0.05	15.6	<0.03	<0.04	8.9	0.169	<0.005	<0.01
0.02	<0.005	0.021	0.038	0.006	14.3	0.003	<0.05	15.9	<0.03	<0.04	8.9	0.166	<0.005	<0.01
<0.01	<0.005	<0.005	0.008	<0.005	14.7	<0.002	<0.05	16.1	<0.03	<0.04	8.9	0.168	<0.005	0.02
<0.01	<0.005	0.018	0.045	<0.005	14.5	0.002	<0.05	17.1	<0.03	<0.04	9.1	0.171	<0.005	0.01
<0.01	<0.005	<0.005	0.001	0.012	14.3	<0.002	<0.05	16.0	<0.03	<0.04	8.7	0.165	<0.005	<0.01
<0.01	<0.005	<0.005	0.001	<0.005	14.3	<0.002	<0.05	16.2	<0.03	<0.04	8.9	0.168	<0.005	0.03
<0.01	<0.005	<0.005	0.005	<0.005	14.2	<0.002	<0.05	16.4	<0.03	<0.04	8.8	0.168	<0.005	<0.01
<0.01	<0.005	<0.005	0.001	<0.005	14.1	0.002	<0.05	16.1	<0.03	<0.04	8.9	0.166	<0.005	0.01
0.01	<0.005	<0.005	0.002	<0.005	14.4	<0.002	<0.05	15.8	<0.03	<0.04	8.8	0.166	0.007	<0.01
<0.01	<0.005	0.006	<0.001	0.006	14.6	<0.002	<0.05	15.4	<0.03	<0.04	8.9	0.169	<0.005	<0.01
<0.01	<0.005	<0.005	0.002	<0.005	14.4	<0.002	<0.05	15.5	<0.03	<0.04	8.7	0.169	<0.005	0.01
<0.01	<0.005	<0.005	<0.001	0.012	14.4	<0.002	<0.05	14.8	<0.03	<0.04	8.6	0.166	<0.005	<0.01
<0.01	<0.005	<0.005	0.003	<0.005	14.3	<0.002	<0.05	14.3	<0.03	<0.04	8.8	0.168	<0.005	0.02
<0.01	<0.005	<0.005	0.004	<0.005	14.4	<0.002	<0.05	15.7	<0.03	<0.04	9.0	0.170	<0.005	0.02
<0.01	<0.005	<0.005	0.005	<0.005	14.4	<0.002	<0.05	15.7	<0.03	<0.04	8.9	0.171	<0.005	0.02
<0.01	<0.005	<0.005	<0.001	<0.005	14.1	<0.002	<0.05	13.6	<0.03	<0.04	8.5	0.161	<0.005	0.01
<0.01	<0.005	<0.005	0.003	<0.005	15.2	<0.002	<0.05	15.2	<0.03	<0.04	9.1	0.175	<0.005	0.02
0.02	<0.005	<0.005	<0.001	<0.005	15.1	<0.002	<0.05	14.0	<0.03	<0.04	8.9	0.170	<0.005	0.02
<0.01	<0.005	<0.005	0.002	0.008	14.8	<0.002	<0.05	13.8	<0.03	<0.04	9.1	0.168	<0.005	0.02
<0.01	<0.005	<0.005	<0.001	0.006	14.8	<0.002	<0.05	14.3	<0.03	<0.04	8.9	0.166	<0.005	0.02
<0.01	<0.005	<0.005	<0.001	<0.005	14.6	<0.002	<0.05	13.9	<0.03	<0.04	9.2	0.166	<0.005	<0.01
<0.01	<0.005	<0.005	<0.001	<0.005	14.7	<0.002	<0.05	13.4	<0.03	<0.04	9.2	0.166	<0.005	0.03
<0.01	<0.005	<0.005	0.002	<0.005	14.9	<0.002	<0.05	14.0	<0.03	<0.04	9.2	0.165	<0.005	<0.01
<0.01	<0.005	<0.005	0.004	<0.005	14.8	<0.002	<0.05	14.6	<0.03	<0.04	9.2	0.168	<0.005	0.02
<0.01	<0.005	<0.005	0.002	0.006	14.5	<0.002	<0.05	14.2	<0.03	<0.04	9.3	0.164	<0.005	0.02
<0.01	<0.005	<0.005	0.001	<0.005	14.1	<0.002	<0.05	13.0	<0.03	<0.04	9.0	0.158	<0.005	0.04
<0.01	<0.005	<0.005	0.022	<0.005	14.1	<0.002	<0.05	13.4	<0.03	0.05	8.9	0.158	<0.005	0.01
<0.01	<0.005	<0.005	0.005	<0.005	14.3	<0.002	<0.05	13.6	<0.03	<0.04	9.0	0.161	<0.005	0.01
<0.01	<0.005	0.016	--	0.008	14.5	<0.002	<0.05	16.5	<0.03	0.04	9.4	0.170	<0.005	0.10

Table 4.6.--*Concentration of major and trace elements*
Mississippi River between Baton Rouge,

Location												
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
534.5	660	0.5	1106	15,400	391	24	0.037	0.105	<0.001	45.6	<0.01	<0.01
545.0	687	0.5	1310	15,500	390	23	0.041	0.106	<0.001	44.6	<0.01	<0.01
552.5	705	0.5	1420	15,500	389	24	0.038	0.115	<0.001	44.8	<0.01	<0.01
562.2	726	0.5	1528	15,600	395	25	0.041	0.112	<0.001	46.6	<0.01	<0.01
575.0	753	0.5	1635	15,600	399	25	0.040	0.108	<0.001	44.7	<0.01	<0.01
580.8	766	[2]X	1718	15,600	438	27	0.044	0.113	<0.001	46.7	<0.01	<0.01
590.3	788	0.6	1834	15,100	394	26	0.045	0.109	<0.001	45.1	<0.01	<0.01
600.2	808	0.5	1932	14,600	398	25	--	--	--	--	--	--
610.0	833	0.5	2109	14,400	391	26	0.051	0.159	<0.001	48.5	<0.01	<0.01
616.5	850	0.5	2223	14,300	391	25	0.049	0.167	<0.001	46.9	<0.01	<0.01
629.3	875	0.5	2314	14,200	395	25	0.053	0.172	<0.001	47.9	<0.01	<0.01
												June 26, 1991
639.7	903	0.5	0113	13,900	409	22	0.041	0.141	<0.001	47.4	<0.01	<0.01
650.2	928	0.5	0241	13,800	421	25	0.046	0.152	<0.001	46.7	<0.01	<0.01
660.2	951	0.5	0353	13,700	421	25	0.055	0.128	<0.001	46.5	<0.01	<0.01
669.9	973	0.5	0505	13,700	428	25	0.053	0.167	<0.001	51.8	<0.01	<0.01
680.0	996	0.5	0616	13,600	435	25	0.050	0.136	<0.001	49.8	<0.01	<0.01
689.9	1,018	0.5	0725	13,600	435	25	0.058	0.128	<0.001	47.7	<0.01	<0.01
702.0	1,047	0.5	0903	13,500	439	24	0.050	0.118	<0.001	49.1	<0.01	<0.01
712.9	1,072	[2]X	1023	13,500	429	24	0.070	0.188	<0.001	47.8	<0.01	<0.01
721.5	1,093	0.5	1135	13,500	443	23	0.050	0.131	<0.001	50.0	<0.01	<0.01
731.5	1,116	0.5	1248	13,400	434	24	0.046	0.120	<0.001	47.8	<0.01	<0.01
742.0	1,148	0.5	1525	13,300	427	25	0.054	0.169	<0.001	47.6	<0.01	<0.01
751.1	1,168	0.5	1640	13,300	422	25	0.053	0.169	<0.001	47.6	<0.01	<0.01
762.2	1,192	0.5	1802	13,200	421	25	0.049	0.164	<0.001	42.2	<0.01	<0.01
773.0	1,215	0.5	1919	13,100	418	25	0.052	0.184	<0.001	45.9	<0.01	<0.01
785.0	1,241	0.7	2042	12,900	412	25	0.065	0.207	<0.001	46.7	<0.01	<0.01
797.4	1,269	0.6	2224	12,700	405	25	0.052	0.184	<0.001	46.2	<0.01	<0.01
807.9	1,292	0.8	2345	12,600	401	24	0.053	0.193	<0.001	47.4	<0.01	<0.01
												June 27, 1991
817.5	1,312	0.7	0105	12,500	415	24	0.051	0.164	<0.001	47.5	<0.01	<0.01
826.7	1,332	0.5	0221	12,400	412	24	--	--	--	--	--	--
835.5	1,351	0.5	0324	12,300	413	25	--	--	--	--	--	--
839.0	1,360	[2]X	0403	12,300	413	25	0.055	0.177	<0.001	47.2	<0.01	<0.01
848.5	1,381	0.5	0525	12,200	413	25	0.051	0.192	<0.001	46.8	<0.01	<0.01

in approximately midchannel of the Lower La., and Cairo, Ill., June-July 1991 cruise--Continued

Concentration														
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (μg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
<0.01	<0.005	<0.005	0.001	0.006	14.6	<0.002	<0.05	15.8	<0.03	<0.04	8.7	0.167	<0.005	0.04
<0.01	<0.005	<0.005	0.002	0.006	14.4	<0.002	<0.05	13.7	<0.03	<0.04	8.7	0.161	<0.005	0.03
<0.01	<0.005	<0.005	0.003	<0.005	14.4	<0.002	<0.05	12.9	<0.03	<0.04	9.1	0.160	<0.005	<0.01
<0.01	<0.005	<0.005	0.028	<0.005	14.9	<0.002	<0.05	14.1	<0.03	0.04	9.0	0.165	<0.005	0.01
<0.01	<0.005	<0.005	0.036	<0.005	14.3	<0.002	<0.05	14.5	<0.03	<0.04	8.8	0.162	<0.005	0.02
<0.01	<0.005	<0.005	0.039	0.006	14.9	<0.002	<0.05	13.4	<0.03	<0.04	9.5	0.163	<0.005	0.02
0.01	<0.005	<0.005	0.061	<0.005	14.4	<0.002	<0.05	12.6	<0.03	<0.04	9.1	0.158	<0.005	0.01
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<0.01	<0.005	<0.005	0.022	<0.005	15.7	<0.002	<0.05	14.4	<0.03	<0.04	9.9	0.169	<0.005	<0.01
0.01	<0.005	<0.005	0.018	<0.005	14.9	<0.002	<0.05	14.1	<0.03	<0.04	9.6	0.167	<0.005	0.03
<0.01	<0.005	<0.005	0.015	<0.005	15.2	<0.002	<0.05	15.1	<0.03	0.08	10.0	0.171	<0.005	0.03
<0.01	<0.005	<0.005	0.005	<0.005	15.2	<0.002	<0.05	13.8	<0.03	<0.04	9.9	0.169	<0.005	0.02
<0.01	<0.005	<0.005	0.002	0.006	15.0	<0.002	<0.05	14.4	<0.03	<0.04	9.6	0.170	<0.005	0.02
<0.01	<0.005	0.006	0.109	0.006	15.4	<0.002	<0.05	14.4	<0.03	<0.04	9.6	0.168	<0.005	0.03
<0.01	<0.005	<0.005	0.004	0.010	16.8	<0.002	<0.05	17.8	<0.03	<0.04	10.6	0.191	<0.005	<0.01
<0.01	<0.005	0.019	0.007	<0.005	16.0	<0.002	<0.05	16.9	<0.03	0.05	9.9	0.186	<0.005	0.03
<0.01	<0.005	0.009	0.003	0.010	15.5	<0.002	<0.05	16.3	<0.03	<0.04	9.7	0.179	<0.005	<0.01
<0.01	<0.005	0.006	0.065	0.017	15.7	<0.002	<0.05	17.2	<0.03	<0.04	9.9	0.190	<0.005	<0.01
<0.01	<0.005	0.009	0.061	<0.005	15.5	<0.002	<0.05	16.8	<0.03	0.04	9.7	0.188	<0.005	0.05
<0.01	<0.005	<0.005	0.015	0.012	16.3	<0.002	<0.05	17.9	<0.03	<0.04	10.1	0.197	0.005	<0.01
<0.01	<0.005	<0.005	0.104	0.015	15.4	<0.002	<0.05	16.2	<0.03	0.06	9.4	0.189	<0.005	<0.01
<0.01	<0.005	<0.005	0.004	0.014	15.5	<0.002	<0.05	15.9	<0.03	<0.04	9.2	0.188	<0.005	0.01
<0.01	<0.005	0.007	0.143	0.010	15.3	<0.002	<0.05	15.9	<0.03	<0.04	9.2	0.189	<0.005	<0.01
<0.01	<0.005	0.015	0.212	0.008	13.8	<0.002	<0.05	13.6	<0.03	<0.04	8.0	0.164	<0.005	0.05
<0.01	<0.005	<0.005	0.141	<0.005	15.4	<0.002	<0.05	14.1	<0.03	<0.04	9.0	0.179	0.010	0.03
<0.01	<0.005	<0.005	0.080	0.012	15.4	<0.002	<0.05	14.2	<0.03	<0.04	8.9	0.184	<0.005	0.04
<0.01	<0.005	<0.005	0.062	<0.005	15.5	<0.002	<0.05	13.4	<0.03	0.05	9.1	0.178	0.009	0.03
<0.01	<0.005	<0.005	0.086	0.008	15.6	<0.002	<0.05	14.1	<0.03	<0.04	8.8	0.183	<0.005	0.03
<0.01	<0.005	0.011	0.049	<0.005	15.5	<0.002	<0.05	14.0	<0.03	<0.04	8.8	0.183	<0.005	<0.01
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<0.01	<0.005	<0.005	0.088	<0.005	15.4	<0.002	<0.05	13.6	<0.03	<0.04	8.6	0.181	<0.005	<0.01
<0.01	<0.005	<0.005	0.100	<0.005	15.4	<0.002	<0.05	13.3	<0.03	<0.04	8.3	0.181	<0.005	0.03

Table 4.6.--*Concentration of major and trace elements Mississippi River between Baton Rouge,*

Location												
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Temperature (°C)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
												June 27, 1991
860.2	1,407	0.5	0653	12,000	412	25	0.056	0.200	<0.001	46.8	<0.01	<0.01
870.0	1,427	0.5	0757	11,900	410	25	0.055	0.186	<0.001	51.8	<0.01	<0.01
882.4	1,453	0.5	0919	11,800	405	25	0.055	0.183	<0.001	47.7	<0.01	<0.01
890.5	1,471	0.5	1017	11,700	398	26	0.052	0.180	<0.001	45.4	<0.01	<0.01
898.9	1,489	[2]X	1118	11,600	407	26	0.053	0.187	<0.001	46.9	<0.01	<0.01
911.9	1,517	0.1	1255	11,500	386	23	0.061	0.184	<0.001	43.2	<0.01	<0.01
924.5	1,544	0.5	1418	11,400	378	25	0.064	0.208	<0.001	45.9	<0.01	<0.01
937.6	1,572	[2]X	1553	11,500	377	26	0.046	0.168	<0.001	40.4	<0.01	<0.01

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 230.0 upriver from Head of Passes, La., on June 23, 1991, at 2240 hours.

[2]X indicates a single sample was collected across the river at this location; usually mid-channel. These individual values appear in table 4.13; the values of specific conductance, temperature, and chemical concentrations in this table are the mean values. Values below the detection limit were NOT included in the mean.

[3] Water discharges are linearly interpolated values between discharges listed in table 1.5 in chapter 1.

in approximately midchannel of the Lower
La., and Cairo, Ill., June-July 1991 cruise--Continued

Concentration														
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (μg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
<0.01	<0.005	<0.005	0.131	<0.005	15.7	<0.002	<0.05	13.2	<0.03	<0.04	8.5	0.179	0.007	0.04
<0.01	<0.005	<0.005	0.053	0.006	17.5	<0.002	<0.05	14.3	<0.03	<0.04	11.4	0.170	<0.005	0.01
<0.01	<0.005	0.022	0.018	<0.005	15.5	<0.002	<0.05	13.7	<0.03	<0.04	8.6	0.181	<0.005	0.03
<0.01	<0.005	<0.005	0.069	<0.005	15.1	<0.002	<0.05	12.6	<0.03	<0.04	8.0	0.174	0.007	0.02
<0.01	<0.005	<0.005	0.056	<0.005	15.3	<0.002	<0.05	13.7	<0.03	<0.04	8.4	0.177	<0.005	0.01
<0.01	<0.005	0.005	0.064	<0.005	14.0	<0.002	<0.05	12.2	<0.03	<0.04	7.5	0.163	0.007	<0.01
<0.01	<0.005	<0.005	0.019	<0.005	14.7	<0.002	<0.05	13.9	<0.03	<0.04	8.4	0.174	<0.005	0.04
<0.01	<0.005	<0.005	0.062	<0.005	13.2	<0.002	<0.05	10.7	<0.03	0.05	7.3	0.147	0.007	0.03

Table 4.7.--*Concentration of major and trace elements*
Mississippi River between Cairo, Ill.,

[km, kilometers; CDT, Central Daylight Time; m^3/s,

Location												
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
												June 27, 1991
10.8	1,638	0.5	2034	7,800	432	25	0.052	0.182	<0.001	49.5	<0.01	<0.01
20.9	1,661	0.5	2151	7,800	439	23	0.048	0.181	<0.001	48.3	<0.01	<0.01
29.6	1,682	0.5	2304	7,800	429	23	0.058	0.199	<0.001	50.7	<0.01	<0.01
												June 28, 1991
39.0	1,704	0.5	0024	7,800	442	24	--	--	--	--	--	--
51.6	1,735	0.5	0214	7,800	441	24	0.061	0.199	<0.001	49.2	<0.01	<0.01
63.3	1,761	0.5	0334	7,700	442	24	0.069	0.202	<0.001	50.5	<0.01	<0.01
73.7	1,785	0.5	0452	7,700	445	23	--	--	--	--	--	--
82.8	1,806	0.5	0603	7,700	448	24	0.060	0.211	<0.001	51.2	<0.01	<0.01
91.0	1,824	0.5	0702	7,500	449	24	0.045	0.193	<0.001	51.8	<0.01	<0.01
100.7	1,846	[2]X	0814	7,500	458	24	0.054	0.188	<0.001	52.2	<0.01	<0.01
110.0	1,868	0.1	0928	7,500	444	25	0.049	0.169	<0.001	52.6	<0.01	<0.01
120.1	1,891	0.9	1045	7,400	461	24	0.066	0.198	<0.001	53.3	<0.01	<0.01
130.6	1,916	0.1	1205	7,400	473	25	0.061	0.194	<0.001	55.1	<0.01	<0.01
140.4	1,938	0.9	1321	7,400	497	24	0.068	0.208	<0.001	53.9	<0.01	<0.01
150.0	1,961	[2]X	1437	7,400	484	26	0.072	0.194	<0.001	54.7	<0.01	<0.01
158.2	1,980	0.1	1541	7,400	468	25	0.050	0.108	<0.001	54.6	<0.01	<0.01
170.0	2,006	0.9	1706	7,300	526	25	0.088	0.201	<0.001	56.0	<0.01	<0.01
180.3	2,031	0.1	1832	7,300	472	25	0.049	0.110	<0.001	56.6	<0.01	<0.01
198.4	2,077	0.3	2245	5,500	461	23	0.048	0.151	<0.001	54.4	<0.01	<0.01
												June 29, 1991
207.2	2,097	0.3	0012	5,400	466	23	0.048	0.151	<0.001	53.5	<0.01	<0.01
221.6	2,144	0.3	0709	5,000	443	24	0.030	0.097	<0.001	52.4	<0.01	<0.01
229.2	2,160	0.5	0802	4,900	450	23	0.035	0.143	<0.001	54.9	<0.01	<0.01
240.2	2,182	0.5	0915	4,800	451	24	0.030	0.122	<0.001	57.9	<0.01	<0.01
249.2	2,200	0.5	1026	4,800	451	24	0.031	0.096	<0.001	56.2	<0.01	<0.01
260.2	2,223	0.5	1145	4,700	449	25	0.029	0.096	<0.001	55.2	<0.01	<0.01
272.0	2,246	0.5	1257	4,600	459	25	0.035	0.101	<0.001	55.6	<0.01	<0.01
283.3	2,272	0.5	1514	4,500	451	25	0.034	0.090	<0.001	54.1	<0.01	<0.01
291.0	2,288	0.5	1606	4,400	466	25	0.035	0.101	<0.001	55.1	<0.01	<0.01
299.0	2,304	0.5	1701	4,400	460	26	0.029	0.092	<0.001	54.8	<0.01	<0.01
310.0	2,327	0.5	1842	4,200	452	26	0.031	0.103	<0.001	54.0	<0.01	<0.01

in approximately midchannel of the Upper
and Minneapolis, Minn., June-July 1991

cubic meters per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter; and --, no measurement]

Concentration														
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (µg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
<0.01	<0.005	<0.005	0.035	0.014	17.0	<0.002	<0.05	13.3	<0.03	<0.04	10.8	0.166	<0.005	0.02
<0.01	<0.005	0.015	0.009	0.012	16.6	<0.002	<0.05	12.6	<0.03	<0.04	10.6	0.162	0.006	0.03
<0.01	<0.005	0.027	0.086	0.010	17.4	<0.002	<0.05	13.6	<0.03	<0.04	11.2	0.168	<0.005	0.02
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<0.01	<0.005	<0.005	0.069	0.010	17.3	<0.002	<0.05	12.9	<0.03	<0.04	11.4	0.161	0.006	0.04
<0.01	<0.005	0.006	0.034	0.014	17.1	<0.002	<0.05	14.3	<0.03	<0.04	11.2	0.168	<0.005	0.03
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<0.01	<0.005	0.007	0.169	0.008	17.4	<0.002	<0.05	14.5	<0.03	<0.04	11.9	0.179	0.005	0.04
<0.01	<0.005	<0.005	0.016	0.015	17.5	<0.002	<0.05	14.3	<0.03	<0.04	11.5	0.179	0.005	<0.01
<0.01	<0.005	<0.005	0.036	0.017	18.0	<0.002	<0.05	14.7	<0.03	<0.04	11.8	0.174	0.008	0.02
<0.01	<0.005	<0.005	0.082	0.006	18.1	<0.002	<0.05	13.5	<0.03	<0.04	11.4	0.161	<0.005	<0.01
<0.01	<0.005	<0.005	0.092	0.017	17.7	<0.002	<0.05	17.6	<0.03	<0.04	11.8	0.195	<0.005	0.02
<0.01	<0.005	0.010	0.009	0.015	18.5	<0.002	<0.05	16.8	<0.03	<0.04	12.0	0.187	<0.005	0.02
<0.01	<0.005	<0.005	0.004	0.017	17.0	<0.002	<0.05	21.6	<0.03	<0.04	12.2	0.224	<0.005	0.02
<0.01	<0.005	<0.005	0.076	0.016	18.8	<0.002	<0.05	17.6	<0.03	<0.04	12.2	0.188	<0.005	0.03
<0.01	<0.005	<0.005	0.059	<0.005	19.9	<0.002	<0.05	11.5	<0.03	<0.04	11.4	0.133	<0.005	<0.01
<0.01	<0.005	0.025	0.133	0.017	17.3	0.002	<0.05	25.8	<0.03	<0.04	13.0	0.262	0.007	<0.01
<0.01	<0.005	0.007	0.132	<0.005	21.4	<0.002	<0.05	11.8	<0.03	<0.04	11.1	0.137	<0.005	0.03
<0.01	<0.005	<0.005	0.040	<0.005	20.6	<0.002	<0.05	10.1	<0.03	0.06	11.9	0.128	0.009	0.01
<0.01	<0.005	<0.005	0.008	<0.005	20.1	<0.002	<0.05	9.2	<0.03	<0.04	12.3	0.126	0.006	0.03
<0.01	<0.005	<0.005	0.002	0.006	19.0	<0.002	<0.05	8.3	<0.03	<0.04	12.4	0.121	<0.005	0.02
0.02	<0.005	<0.005	0.006	<0.005	19.3	<0.002	<0.05	8.6	<0.03	<0.04	12.8	0.130	<0.005	0.03
<0.01	<0.005	<0.005	<0.001	<0.005	20.0	<0.002	<0.05	8.2	<0.03	<0.04	13.5	0.137	<0.005	<0.01
<0.01	<0.005	0.167	0.013	<0.005	19.4	0.014	<0.05	7.8	<0.03	<0.04	13.5	0.132	<0.005	<0.01
<0.01	<0.005	<0.005	0.005	0.006	19.4	<0.002	<0.05	7.9	<0.03	<0.04	13.0	0.129	<0.005	0.01
<0.01	<0.005	<0.005	0.002	<0.005	19.7	<0.002	<0.05	8.5	<0.03	<0.04	13.1	0.129	<0.005	0.02
<0.01	<0.005	<0.005	0.011	<0.005	19.7	<0.002	<0.05	8.5	<0.03	<0.04	12.4	0.121	0.006	<0.01
<0.01	<0.005	0.010	0.062	<0.005	18.8	<0.002	<0.05	7.7	<0.03	<0.04	12.7	0.131	<0.005	0.01
<0.01	<0.005	<0.005	0.029	0.006	19.5	<0.002	<0.05	7.8	<0.03	0.05	12.5	0.125	<0.005	0.01
<0.01	<0.005	<0.005	0.006	<0.005	19.9	0.002	<0.05	8.4	<0.03	<0.04	12.4	0.120	<0.005	0.01

Table 4.7.--*Concentration of major and trace elements*
Mississippi River between Cairo, Ill.,

Location												
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Temperature (°C)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
321.0	2,350	0.5	1959	3,900	445	25	0.032	0.095	<0.001	54.0	<0.01	<0.01
331.0	2,371	0.5	2120	3,900	446	25	0.036	0.098	<0.001	57.7	<0.01	<0.01
341.5	2,394	0.5	2312	4,000	444	24	0.036	0.106	<0.001	61.1	<0.01	<0.01
												June 30, 1991
363.9	2,438	0.6	0123	3,000	463	26	0.034	0.095	<0.001	57.7	<0.01	<0.01
370.9	2,454	0.5	0302	3,000	458	25	0.038	0.087	<0.001	52.9	<0.01	<0.01
381.8	2,474	0.8	0405	3,000	465	24	0.030	0.094	<0.001	57.0	<0.01	<0.01
402.8	2,515	0.5	0620	3,000	450	25	0.040	0.079	<0.001	53.8	<0.01	<0.01
417.2	2,553	0.5	1139	3,000	434	25	0.041	0.075	<0.001	53.7	<0.01	<0.01
435.2	2,588	0.5	1349	2,400	444	25	0.036	0.082	<0.001	53.7	<0.01	<0.01
447.6	2,615	0.5	1613	2,400	435	26	0.034	0.071	<0.001	50.0	<0.01	<0.01
457.1	2,638	0.5	1842	2,500	440	27	0.043	0.076	<0.001	50.6	<0.01	<0.01
480.0	2,681	0.5	2046	2,500	423	27	0.037	0.071	<0.001	49.9	<0.01	<0.01
491.1	2,703	0.5	2219	2,600	403	26	0.032	0.066	<0.001	47.5	<0.01	<0.01
501.0	2,724	0.5	2355	2,500	419	26	0.034	0.076	<0.001	51.2	<0.01	<0.01
												July 1, 1991
509.3	2,740	0.5	0056	2,400	418	25	0.037	0.077	<0.001	49.9	<0.01	<0.01
520.0	2,760	0.5	0204	2,300	423	25	0.029	0.072	<0.001	50.2	<0.01	<0.01
531.0	2,783	0.5	0340	2,300	422	24	0.032	0.074	<0.001	50.6	<0.01	<0.01
539.8	2,800	0.5	0440	2,300	413	24	0.039	0.068	<0.001	49.9	<0.01	<0.01
551.0	2,821	0.5	0555	2,300	416	25	0.030	0.066	<0.001	49.6	<0.01	<0.01
560.7	2,840	0.7	0700	2,300	422	24	0.036	0.067	<0.001	50.6	<0.01	<0.01
572.0	2,862	0.5	0813	2,300	409	26	0.031	0.068	<0.001	51.8	<0.01	<0.01
581.5	2,880	0.5	0914	2,300	392	26	0.033	0.072	<0.001	49.7	<0.01	<0.01
590.5	2,898	0.7	1030	2,300	408	25	0.031	0.061	<0.001	49.8	<0.01	<0.01
602.2	2,921	0.5	1145	2,300	407	26	0.033	0.065	<0.001	49.7	<0.01	<0.01
610.0	2,938	0.5	1329	2,300	442	24	0.036	0.080	<0.001	52.2	<0.01	<0.01
621.3	2,961	0.6	1509	2,300	458	25	0.041	0.076	<0.001	54.0	<0.01	<0.01
633.0	2,984	0.5	1634	2,100	463	26	0.045	0.075	<0.001	58.7	<0.01	<0.01
641.8	3,000	0.5	1735	1,900	464	25	0.046	0.088	<0.001	55.9	<0.01	<0.01
653.0	3,021	0.5	1855	1,800	467	27	0.043	0.076	<0.001	55.4	<0.01	<0.01
664.7	3,043	0.5	2014	1,800	471	25	0.043	0.073	<0.001	60.5	<0.01	<0.01
675.5	3,063	0.5	2123	1,800	452	26	0.037	0.080	<0.001	61.3	<0.01	<0.01
686.1	3,082	0.5	2238	1,700	478	25	0.037	0.067	<0.001	59.9	<0.01	<0.01

in approximately midchannel of the Upper
and Minneapolis, Minn., June-July 1991--Continued

Concentration														
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (µg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
<0.01	<0.005	<0.005	0.002	<0.005	19.7	<0.002	<0.05	8.0	<0.03	<0.04	12.3	0.121	0.006	0.01
<0.01	<0.005	<0.005	0.029	<0.005	20.2	<0.002	<0.05	8.3	<0.03	<0.04	13.3	0.131	0.006	<0.01
<0.01	<0.005	<0.005	0.045	<0.005	20.9	<0.002	0.06	8.9	<0.03	<0.04	14.0	0.141	<0.005	<0.01
<0.01	<0.005	<0.005	0.014	0.006	20.6	<0.002	<0.05	8.7	<0.03	<0.04	12.7	0.128	<0.005	<0.01
<0.01	<0.005	<0.005	0.019	<0.005	21.2	<0.002	<0.05	8.6	<0.03	<0.04	12.3	0.115	0.006	0.03
<0.01	<0.005	<0.005	0.003	<0.005	20.4	<0.002	<0.05	8.4	<0.03	<0.04	13.2	0.128	<0.005	<0.01
<0.01	<0.005	<0.005	0.022	<0.005	21.2	<0.002	<0.05	9.4	<0.03	<0.04	13.0	0.124	<0.005	<0.01
<0.01	<0.005	<0.005	0.005	<0.005	20.5	<0.002	<0.05	9.4	<0.03	<0.04	13.2	0.126	<0.005	0.01
<0.01	<0.005	0.006	0.005	<0.005	21.5	<0.002	<0.05	9.6	<0.03	<0.04	13.0	0.126	<0.005	0.02
<0.01	<0.005	0.006	0.049	<0.005	19.3	<0.002	<0.05	8.1	<0.03	<0.04	12.6	0.116	<0.005	0.03
<0.01	<0.005	<0.005	0.026	<0.005	21.8	<0.002	<0.05	9.4	<0.03	<0.04	12.0	0.119	<0.005	<0.01
<0.01	<0.005	<0.005	0.013	<0.005	19.5	<0.002	<0.05	7.8	<0.03	<0.04	13.0	0.116	0.006	0.01
0.01	<0.005	0.009	0.011	0.008	18.5	<0.002	<0.05	7.6	<0.03	<0.04	12.4	0.111	0.009	0.04
<0.01	<0.005	<0.005	0.003	0.012	19.6	<0.002	<0.05	8.4	<0.03	<0.04	12.8	0.121	<0.005	<0.01
0.02	<0.005	0.012	0.018	<0.005	18.9	<0.002	<0.05	8.2	<0.03	<0.04	12.3	0.119	<0.005	<0.01
<0.01	<0.005	0.006	0.004	0.008	19.1	<0.002	<0.05	8.2	<0.03	<0.04	12.6	0.121	<0.005	<0.01
<0.01	<0.005	<0.005	0.018	<0.005	19.3	<0.002	<0.05	8.2	<0.03	<0.04	12.5	0.123	<0.005	0.02
<0.01	<0.005	<0.005	0.049	0.008	19.3	<0.002	<0.05	8.4	<0.03	0.04	12.7	0.121	0.009	0.02
<0.01	<0.005	<0.005	0.008	0.006	18.7	<0.002	<0.05	8.2	<0.03	<0.04	12.7	0.123	<0.005	<0.01
0.02	<0.005	0.009	0.035	0.010	19.6	<0.002	<0.05	8.1	<0.03	<0.04	13.2	0.124	<0.005	<0.01
<0.01	<0.005	<0.005	0.043	<0.005	19.8	<0.002	<0.05	8.4	<0.03	<0.04	12.8	0.130	<0.005	0.01
<0.01	<0.005	0.007	0.018	<0.005	18.9	<0.002	<0.05	8.3	<0.03	<0.04	12.6	0.125	<0.005	0.03
0.01	<0.005	0.010	0.002	0.017	18.8	<0.002	<0.05	8.0	<0.03	<0.04	13.0	0.128	<0.005	<0.01
<0.01	<0.005	0.011	0.018	0.017	18.8	<0.002	<0.05	8.2	<0.03	<0.04	12.9	0.127	<0.005	<0.01
<0.01	<0.005	0.012	0.020	0.017	19.7	<0.002	<0.05	8.2	<0.03	<0.04	13.8	0.137	<0.005	<0.01
<0.01	<0.005	<0.005	0.003	0.017	20.9	<0.002	<0.05	8.5	<0.03	<0.04	14.8	0.141	0.006	0.02
<0.01	<0.005	<0.005	0.027	0.017	22.1	<0.002	<0.05	10.1	<0.03	<0.04	15.2	0.155	<0.005	<0.01
<0.01	<0.005	0.007	0.018	0.017	21.0	0.003	<0.05	9.3	<0.03	<0.04	15.0	0.152	<0.005	0.01
<0.01	<0.005	0.006	0.057	0.017	20.9	0.015	<0.05	9.3	<0.03	<0.04	14.7	0.150	0.005	<0.01
<0.01	<0.005	<0.005	0.015	0.017	22.8	<0.002	<0.05	10.2	<0.03	<0.04	16.5	0.165	0.008	<0.01
<0.01	<0.005	<0.005	0.013	0.016	23.0	<0.002	<0.05	10.3	<0.03	0.08	16.0	0.168	<0.005	0.03
<0.01	<0.005	0.007	0.014	0.016	22.7	0.003	<0.05	10.1	<0.03	<0.04	16.5	0.167	<0.005	0.02

Location: River miles upriver from mouth of Ohio River	Location: Distance upriver from first sample[1] (km)	Location: Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Temperature (°C)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
											July 2, 1991	
710.0	3,126	0.5	0133	1,600	491	23	0.050	0.076	<0.001	60.8	<0.01	<0.01
723.2	3,152	0.5	0347	1,600	501	22	0.044	0.076	<0.001	59.0	<0.01	<0.01
735.7	3,176	0.5	0535	1,600	501	22	0.044	0.072	<0.001	61.3	<0.01	<0.01
745.5	3,196	0.5	0813	1,600	513	23	0.041	0.065	<0.001	63.2	<0.01	<0.01
755.5	3,215	0.5	0939	1,600	488	23	0.039	0.063	<0.001	59.0	<0.01	<0.01
764.9	3,233	0.8	1049	1,300	526	23	0.050	0.075	<0.001	65.4	<0.01	<0.01
776.4	3,253	0.5	1154	1,200	567	24	0.056	0.079	<0.001	72.0	<0.01	<0.01
793.2	3,284	0.5	1344	1,100	579	23	0.065	0.084	<0.001	68.6	<0.01	<0.01
805.5	3,307	0.5	1519	1,100	576	23	0.052	0.079	<0.001	68.2	<0.01	<0.01
812.4	3,320	0.5	1614	900	633	23	0.062	0.091	<0.001	76.5	<0.01	<0.01
826.1	3,345	0.5	1757	1,000	629	23	0.064	0.089	<0.001	74.0	<0.01	<0.01
838.0	3,368	0.5	2008	1,000	606	23	0.064	0.094	<0.001	75.3	<0.01	<0.01
846.0	3,383	0.5	2115	400	402	23	0.034	0.060	<0.001	47.5	<0.01	<0.01

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 230.0 upriver from Head of Passes, La., on June 23, 1991, at 2240 hours.

[2]X indicates two samples were collected across the river at this location. These individual values appear in table 4.14; the values of specific conductance, temperature, and chemical concentration in this table are the mean values. Values below the detection limit were NOT included in the mean.

[3]Water discharges are linearly interpolated values between discharges listed in table 1.4 in chapter 1.

Concentration														
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (μg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
<0.01	<0.005	0.011	0.029	0.017	23.1	<0.002	<0.05	10.5	<0.03	0.06	17.0	0.171	<0.005	0.01
0.02	<0.005	0.013	0.027	0.017	22.4	<0.002	<0.05	9.7	<0.03	<0.04	16.6	0.168	<0.005	<0.01
<0.01	<0.005	0.021	0.025	0.017	23.4	<0.002	<0.05	10.5	<0.03	<0.04	17.5	0.174	<0.005	<0.01
<0.01	<0.005	0.020	0.010	0.017	24.1	<0.002	<0.05	10.4	<0.03	<0.04	17.7	0.182	<0.005	<0.01
0.01	<0.005	0.025	0.021	0.017	22.5	<0.002	<0.05	9.8	<0.03	<0.04	16.8	0.172	<0.005	<0.01
<0.01	<0.005	<0.005	0.007	0.017	25.6	<0.002	<0.05	10.9	<0.03	<0.04	18.9	0.190	0.007	0.02
<0.01	<0.005	0.012	0.019	0.019	28.2	0.008	<0.05	12.1	<0.03	<0.04	18.9	0.216	<0.005	<0.01
<0.01	<0.005	0.042	0.032	0.019	27.2	0.005	<0.05	11.8	<0.03	<0.04	17.7	0.210	<0.005	<0.01
<0.01	<0.005	0.071	0.032	0.016	27.0	0.004	<0.05	12.1	<0.03	<0.04	17.9	0.212	<0.005	0.02
<0.01	<0.005	0.009	0.060	0.023	30.6	0.009	<0.05	13.7	<0.03	<0.04	19.6	0.240	<0.005	<0.01
<0.01	<0.005	0.009	0.026	0.023	30.4	0.003	<0.05	12.7	<0.03	<0.04	19.5	0.231	0.006	0.01
<0.01	<0.005	<0.005	0.048	0.025	31.0	0.002	<0.05	12.0	<0.03	<0.04	20.0	0.239	0.009	0.01
<0.01	<0.005	0.022	0.005	<0.005	18.3	<0.002	<0.05	7.3	<0.03	<0.04	12.0	0.109	0.007	0.02

Table 4.8.--*Concentration of major and trace elements Mississippi River between New Orleans,*

[km, kilometers; CDT, Central Daylight Time; m^3/s, cubic meters per second; µS/cm, microsiemens per centimeter

Location													
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Temperature (°C)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
												September 25, 1991
88.5	0	[2]X	0647	4,500	457	26	0.056	0.069	<0.001	38.4	<0.01	<0.01
99.1	19	0.6	0757	4,500	444	26	0.055	0.071	<0.001	38.6	<0.01	<0.01
105.1	30	0.6	0853	4,500	444	25	0.056	0.070	<0.001	38.4	<0.01	<0.01
113.9	45	0.5	0922	4,500	450	26	0.057	0.069	<0.001	38.8	<0.01	<0.01
123.1	61	0.5	1019	4,500	441	25	0.059	0.084	<0.001	45.8	<0.01	<0.01
134.9	82	0.4	1126	4,500	432	25	0.060	0.076	<0.001	43.1	<0.01	<0.01
146.0	100	0.5	1235	4,500	431	24	0.059	0.072	<0.001	40.9	<0.01	<0.01
155.6	119	0.6	1325	4,500	433	25	0.050	0.062	<0.001	34.9	<0.01	<0.01
164.7	136	0.5	1430	4,500	441	25	0.054	0.061	<0.001	35.0	<0.01	<0.01
175.4	155	0.5	1532	4,500	451	23	0.049	0.061	<0.001	35.8	<0.01	<0.01
184.8	172	[2]X	1635	4,500	451	26	0.062	0.072	<0.001	42.4	<0.01	<0.01
195.1	191	0.4	1742	4,500	448	23	0.065	0.077	<0.001	46.0	<0.01	<0.01
206.8	212	0.5	1850	4,500	449	24	0.065	0.078	<0.001	46.0	<0.01	<0.01
216.2	229	0.5	1950	4,500	425	24	0.065	0.076	<0.001	43.7	<0.01	<0.01
230.0	254	[2]X	2120	4,500	431	25	0.061	0.069	<0.001	40.0	<0.01	<0.01
												September 26, 1991
240.0	280	0.5	0241	4,700	415	23	0.055	0.062	<0.001	36.4	<0.01	<0.01
249.0	296	0.3	0337	4,900	417	23	0.063	0.069	<0.001	41.0	<0.01	<0.01
258.8	314	0.7	0435	5,100	417	23	0.058	0.065	<0.001	39.0	<0.01	<0.01
269.9	334	0.5	0545	5,400	416	23	0.064	0.066	<0.001	39.5	<0.01	<0.01
279.7	352	0.5	0655	5,600	412	23	0.060	0.070	<0.001	41.1	<0.01	<0.01
289.6	370	0.5	0758	5,800	419	22	0.070	0.079	<0.001	44.2	<0.01	<0.01
301.0	389	0.7	0924	6,100	406	23	0.064	0.074	<0.001	40.0	<0.01	<0.01
310.0	405	0.5	1019	6,300	416	23	0.069	0.079	<0.001	41.4	<0.01	<0.01
321.1	426	0.5	1128	7,500	404	23	0.061	0.076	<0.001	38.6	<0.01	<0.01
330.4	444	0.5	1229	7,400	397	23	0.059	0.070	<0.001	36.5	<0.01	<0.01
340.0	463	0.5	1334	7,400	415	22	0.054	0.061	<0.001	34.7	<0.01	<0.01
351.3	485	0.8	1447	7,300	423	23	0.065	0.066	<0.001	38.8	<0.01	<0.01
360.0	503	[2]X	1555	7,200	421	23	0.058	0.061	<0.001	36.1	<0.01	<0.01
371.2	525	0.5	1704	7,200	--	--	0.057	0.065	<0.001	38.2	<0.01	<0.01
380.5	546	0.4	1900	7,200	425	22	0.066	0.068	<0.001	41.3	<0.01	<0.01
389.6	564	0.5	2007	7,200	428	22	0.051	0.058	<0.001	35.1	<0.01	<0.01
398.8	582	0.8	2111	7,200	421	22	0.061	0.075	<0.001	40.5	<0.01	<0.01

in approximately midchannel of the Lower
La., and Cairo, Ill., September-October 1991 cruise

at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; and --, no measurement]

Concentration														
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (µg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
<0.01	<0.005	0.132	0.005	0.013	14.4	0.018	<0.05	30.0	<0.03	<0.04	3.6	0.184	<0.005	0.02
<0.01	<0.005	0.316	0.004	0.015	15.0	0.034	<0.05	28.6	<0.03	<0.04	4.5	0.185	<0.005	0.04
<0.01	<0.005	<0.005	0.012	0.014	14.4	<0.002	<0.05	25.0	<0.03	<0.04	3.6	0.185	<0.005	0.02
<0.01	<0.005	<0.005	0.010	0.014	14.3	<0.002	<0.05	26.7	<0.03	<0.04	3.6	0.185	<0.005	<0.01
<0.01	<0.005	0.231	0.001	0.015	16.3	0.028	<0.05	36.4	<0.03	<0.04	4.8	0.220	0.006	0.02
0.02	<0.005	<0.005	0.018	0.016	16.0	<0.002	<0.05	30.4	<0.03	0.08	3.7	0.205	<0.005	<0.01
0.02	<0.005	<0.005	0.009	0.012	15.1	<0.002	<0.05	25.4	<0.03	0.05	3.3	0.195	<0.005	<0.01
<0.01	<0.005	<0.005	0.010	0.014	13.1	<0.002	<0.05	19.6	<0.03	<0.04	2.9	0.166	<0.005	<0.01
<0.01	<0.005	<0.005	0.007	0.014	13.3	<0.002	<0.05	18.5	<0.03	<0.04	2.6	0.166	<0.005	<0.01
<0.01	<0.005	<0.005	0.010	0.015	13.8	<0.002	<0.05	19.2	<0.03	<0.04	2.5	0.170	<0.005	0.02
<0.01	<0.005	0.020	0.022	0.015	15.5	<0.002	<0.05	26.7	<0.03	<0.04	2.6	0.201	<0.005	0.02
<0.01	<0.005	<0.005	0.017	0.015	16.5	<0.002	<0.05	29.7	<0.03	<0.04	2.6	0.219	0.006	<0.01
<0.01	<0.005	<0.005	0.005	0.015	16.5	<0.002	<0.05	30.6	<0.03	<0.04	2.6	0.219	<0.005	<0.01
<0.01	<0.005	<0.005	0.009	0.014	15.5	<0.002	<0.05	26.1	<0.03	<0.04	2.4	0.210	<0.005	<0.01
<0.01	<0.005	<0.005	0.007	0.014	14.6	0.009	<0.05	24.8	<0.03	<0.04	2.3	0.195	<0.005	<0.01
<0.01	<0.005	<0.005	0.010	0.014	13.6	<0.002	<0.05	20.0	<0.03	<0.04	1.7	0.179	<0.005	0.01
<0.01	<0.005	<0.005	0.010	0.015	15.1	<0.002	<0.05	25.0	<0.03	<0.04	1.9	0.201	<0.005	0.02
<0.01	<0.005	<0.005	0.006	0.014	14.1	<0.002	<0.05	27.2	<0.03	<0.04	1.8	0.191	<0.005	0.02
0.01	<0.005	<0.005	0.011	0.016	14.5	<0.002	<0.05	24.4	<0.03	<0.04	1.8	0.194	<0.005	0.01
<0.01	<0.005	<0.005	0.007	0.015	14.8	<0.002	<0.05	26.2	<0.03	<0.04	2.1	0.204	<0.005	0.01
0.01	<0.005	0.139	0.010	0.015	15.8	0.013	<0.05	29.8	<0.03	<0.04	2.9	0.220	0.006	0.01
<0.01	<0.005	0.013	0.009	0.015	14.6	<0.002	<0.05	25.0	<0.03	<0.04	2.3	0.199	0.006	<0.01
<0.01	<0.005	0.101	0.015	0.016	15.4	0.005	<0.05	26.5	<0.03	<0.04	2.7	0.206	<0.005	<0.01
0.01	<0.005	<0.005	0.009	0.014	15.0	0.002	<0.05	23.3	<0.03	0.05	2.6	0.190	<0.005	0.02
<0.01	<0.005	<0.005	0.013	0.014	13.6	0.019	<0.05	23.5	<0.03	0.06	2.4	0.180	<0.005	0.02
<0.01	<0.005	<0.005	0.017	0.014	13.4	<0.002	<0.05	17.6	<0.03	<0.04	2.2	0.172	<0.005	<0.01
<0.01	<0.005	0.009	0.016	0.014	15.2	<0.002	<0.05	22.2	0.03	0.05	2.9	0.192	<0.005	0.02
0.01	<0.005	0.013	0.012	0.014	13.7	0.005	<0.05	19.7	<0.03	<0.04	2.8	0.179	<0.005	0.02
<0.01	<0.005	<0.005	0.018	0.014	14.2	<0.002	<0.05	23.4	<0.03	<0.04	3.0	0.190	<0.005	0.01
<0.01	<0.005	0.012	0.006	0.016	15.6	<0.002	<0.05	24.4	<0.03	<0.04	3.5	0.204	<0.005	<0.01
<0.01	<0.005	<0.005	0.011	0.015	14.0	<0.002	<0.05	17.9	<0.03	<0.04	3.1	0.175	<0.005	<0.01
<0.01	<0.005	0.536	0.002	0.014	16.1	0.066	<0.05	23.3	<0.03	<0.04	5.3	0.201	<0.005	0.02

Table 4.8.--*Concentration of major and trace elements*
Mississippi River between New Orleans,

Location												
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
409.5	604	0.4	2235	7,100	418	22	0.066	0.065	<0.001	39.2	<0.01	<0.01
420.1	625	0.6	2345	7,100	431	22	0.070	0.070	<0.001	44.1	<0.01	<0.01
												September 27, 1991
432.0	649	0.4	0114	7,100	436	22	0.068	0.069	<0.001	43.0	<0.01	<0.01
439.8	664	0.2	0208	6,600	444	21	0.068	0.069	<0.001	43.2	<0.01	<0.01
449.2	683	0.6	0312	6,600	441	21	0.063	0.066	<0.001	40.9	<0.01	<0.01
460.8	706	[2]X	0433	6,600	438	21	0.065	0.066	<0.001	40.6	<0.01	<0.01
474.5	733	0.5	0615	6,500	440	21	0.074	0.074	0.001	45.9	<0.01	<0.01
485.2	754	0.5	0730	6,500	441	21	0.072	0.075	<0.001	46.6	<0.01	<0.01
493.0	770	0.5	0825	6,500	440	21	0.065	0.067	<0.001	41.1	<0.01	<0.01
504.5	793	0.8	0953	6,400	452	20	0.065	0.069	<0.001	41.8	<0.01	<0.01
514.1	812	0.7	1059	6,400	445	21	0.061	0.064	<0.001	39.0	<0.01	<0.01
524.9	834	0.5	1225	6,300	448	21	0.071	0.073	<0.001	44.6	<0.01	<0.01
534.5	853	0.1	1335	6,300	453	20	0.062	0.069	<0.001	41.4	<0.01	<0.01
545.0	877	0.3	1544	6,300	458	20	0.074	0.082	<0.001	49.3	<0.01	<0.01
551.8	891	0.5	1630	6,300	451	20	0.064	0.068	<0.001	41.2	<0.01	<0.01
562.8	913	0.3	1750	6,200	451	20	0.068	0.072	<0.001	43.3	<0.01	<0.01
574.0	935	0.5	1903	6,200	453	20	0.064	0.067	<0.001	40.0	<0.01	<0.01
580.8	948	[2]X	1957	6,100	455	20	0.070	0.078	<0.001	45.0	<0.01	<0.01
590.3	968	0.5	2111	6,100	449	21	0.061	0.077	<0.001	43.2	<0.01	<0.01
601.0	991	0.5	2309	6,000	448	20	0.064	0.067	<0.001	39.4	<0.01	<0.01
												September 28, 1991
608.8	1,009	0.5	0047	5,900	448	20	0.064	0.069	<0.001	41.7	<0.01	<0.01
617.7	1,025	0.5	0122	5,900	450	20	0.056	0.061	<0.001	36.6	<0.01	<0.01
629.3	1,049	0.2	0252	5,800	448	21	0.071	0.081	<0.001	48.4	<0.01	<0.01
641.7	1,072	0.5	0427	5,700	451	20	0.063	0.071	<0.001	42.2	<0.01	<0.01
650.2	1,089	0.5	0527	5,700	453	20	0.067	0.071	<0.001	42.4	<0.01	<0.01
660.2	1,109	0.5	0640	5,600	453	20	0.063	0.072	<0.001	43.1	<0.01	<0.01
669.9	1,128	0.5	0752	5,600	447	20	0.075	0.079	0.001	47.6	<0.01	<0.01
679.4	1,147	0.5	0858	5,600	457	20	0.067	0.073	<0.001	43.4	<0.01	<0.01
689.9	1,169	0.5	1031	5,600	456	20	0.066	0.074	<0.001	43.7	<0.01	<0.01
702.0	1,193	0.7	1200	5,600	448	20	0.066	0.081	<0.001	42.9	<0.01	<0.01
712.9	1,215	[2]X	1327	5,600	418	20	0.067	0.071	<0.001	42.8	<0.01	<0.01
721.5	1,235	0.5	1436	5,600	452	20	0.065	0.073	<0.001	44.1	<0.01	<0.01
731.5	1,255	0.5	1546	5,600	464	20	0.070	0.077	<0.001	46.3	<0.01	<0.01

Concentration														
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (µg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
0.01	<0.005	0.010	0.012	0.014	15.7	0.002	<0.05	23.2	<0.03	<0.04	3.6	0.194	<0.005	<0.01
<0.01	<0.005	0.019	0.006	0.015	16.4	0.003	<0.05	28.3	<0.03	<0.04	3.6	0.219	<0.005	0.01
<0.01	<0.005	<0.005	0.010	0.015	16.7	<0.002	<0.05	25.3	<0.03	<0.04	3.6	0.213	<0.005	<0.01
<0.01	<0.005	<0.005	0.011	0.015	16.8	<0.002	<0.05	25.9	<0.03	<0.04	3.7	0.213	0.006	0.01
<0.01	<0.005	<0.005	0.008	0.014	16.3	<0.002	<0.05	24.6	<0.03	<0.04	3.8	0.199	<0.005	<0.01
<0.01	<0.005	<0.005	0.007	0.014	15.5	<0.002	<0.05	23.9	<0.03	<0.04	3.8	0.199	0.007	0.02
0.01	<0.005	<0.005	0.013	0.016	17.7	<0.002	<0.05	28.5	<0.03	0.06	4.8	0.224	<0.005	<0.01
<0.01	<0.005	0.017	0.009	0.015	17.3	0.003	<0.05	29.8	<0.03	<0.04	4.8	0.228	<0.005	<0.01
<0.01	<0.005	0.007	0.015	0.014	16.0	<0.002	<0.05	24.0	<0.03	<0.04	4.5	0.199	<0.005	<0.01
<0.01	<0.005	<0.005	0.012	0.014	15.8	<0.002	<0.05	26.6	<0.03	<0.04	4.9	0.204	<0.005	0.02
<0.01	<0.005	<0.005	0.010	0.014	15.4	<0.002	<0.05	23.8	<0.03	<0.04	4.9	0.189	<0.005	<0.01
<0.01	<0.005	0.007	0.005	0.015	17.0	<0.002	<0.05	27.3	<0.03	<0.04	5.5	0.220	0.005	<0.01
<0.01	<0.005	<0.005	0.007	0.014	15.5	<0.002	<0.05	26.9	<0.03	<0.04	5.4	0.207	<0.005	0.02
<0.01	<0.005	0.007	0.008	0.015	18.3	<0.002	<0.05	33.8	<0.03	<0.04	6.4	0.248	<0.005	0.01
<0.01	<0.005	0.006	0.006	0.015	16.3	0.002	<0.05	22.7	<0.03	<0.04	5.5	0.205	0.006	<0.01
0.02	<0.005	0.009	0.014	0.016	16.8	<0.002	<0.05	26.3	<0.03	<0.04	5.9	0.215	<0.005	<0.01
<0.01	<0.005	<0.005	0.009	0.014	15.7	<0.002	<0.05	26.2	<0.03	<0.04	5.6	0.200	<0.005	<0.01
0.01	<0.005	0.216	0.008	0.015	17.8	0.026	<0.05	29.0	<0.03	0.06	6.8	0.227	<0.005	<0.01
<0.01	<0.005	0.167	0.008	0.015	15.7	0.021	<0.05	37.7	<0.03	<0.04	4.3	0.209	<0.005	0.02
<0.01	<0.005	<0.005	0.013	0.014	15.7	<0.002	<0.05	19.9	<0.03	<0.04	5.6	0.195	<0.005	<0.01
<0.01	<0.005	<0.005	0.012	0.014	16.6	<0.002	<0.05	23.2	<0.03	0.04	5.9	0.204	<0.005	<0.01
<0.01	<0.005	<0.005	0.006	0.015	15.2	<0.002	<0.05	17.2	<0.03	<0.04	5.2	0.178	0.006	<0.01
<0.01	<0.005	<0.005	0.007	0.015	18.9	<0.002	<0.05	28.8	<0.03	<0.04	6.4	0.237	<0.005	<0.01
<0.01	<0.005	<0.005	0.009	0.014	16.8	<0.002	<0.05	24.9	<0.03	<0.04	5.7	0.205	<0.005	0.01
0.01	<0.005	0.010	0.010	0.016	16.5	<0.002	<0.05	25.0	<0.03	<0.04	5.5	0.206	<0.005	<0.01
<0.01	<0.005	0.011	0.010	0.017	16.5	<0.002	<0.05	25.5	<0.03	0.05	5.5	0.208	0.007	0.01
<0.01	<0.005	0.013	0.012	0.017	18.7	<0.002	<0.05	29.4	<0.03	0.07	6.0	0.229	<0.005	<0.01
<0.01	<0.005	0.024	0.009	0.017	16.8	0.006	0.06	25.3	<0.03	<0.04	5.3	0.208	0.006	0.01
<0.01	<0.005	0.055	0.012	0.017	16.9	0.013	0.05	26.0	<0.03	0.04	5.2	0.210	0.011	0.01
0.01	<0.005	0.761	0.006	0.016	16.8	0.096	<0.05	26.4	<0.03	0.05	7.5	0.207	<0.005	0.02
<0.01	<0.005	0.015	0.010	0.017	16.8	<0.002	<0.05	26.0	<0.03	0.06	4.6	0.205	<0.005	<0.01
<0.01	<0.005	<0.005	0.012	0.017	17.4	<0.002	<0.05	27.0	<0.03	0.06	4.5	0.211	<0.005	<0.01
0.02	<0.005	0.008	0.011	0.016	18.6	<0.002	<0.05	27.2	<0.03	<0.04	4.6	0.223	<0.005	<0.01

Table 4.8.--*Concentration of major and trace elements*
Mississippi River between New Orleans,

Location												
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
742.0	1,277	0.5	1811	5,600	462	19	0.071	0.079	<0.001	47.4	<0.01	<0.01
751.1	1,298	0.5	1920	5,600	457	19	0.071	0.075	<0.001	44.7	<0.01	<0.01
762.2	1,319	0.5	2036	5,600	458	20	0.069	0.075	<0.001	44.6	<0.01	<0.01
773.0	1,343	0.5	2240	5,600	453	20	0.076	0.078	<0.001	47.1	<0.01	<0.01
783.0	1,362	0.7	2344	5,600	460	19	0.075	0.078	<0.001	47.2	<0.01	<0.01
											September	**29, 1991**
795.5	1,387	0.2	0124	5,600	464	19	0.068	0.073	<0.001	44.2	<0.01	<0.01
804.5	1,405	0.3	0234	5,600	458	20	0.064	0.069	<0.001	42.4	<0.01	<0.01
814.8	1,426	0.4	0350	5,600	458	19	0.068	0.071	<0.001	43.8	<0.01	<0.01
822.2	1,441	0.5	0455	5,500	454	19	0.075	0.078	<0.001	47.9	<0.01	<0.01
833.6	1,463	0.5	0610	5,500	449	19	0.070	0.073	<0.001	45.4	<0.01	<0.01
846.5	1,489	[2]X	0752	5,500	414	20	0.065	0.069	<0.001	42.8	<0.01	<0.01
855.0	1,506	0.5	0852	5,500	450	19	0.064	0.069	<0.001	43.2	<0.01	<0.01
866.5	1,529	0.5	1010	5,500	446	19	0.066	0.066	<0.001	41.5	<0.01	<0.01
875.4	1,549	[2]X	1121	5,500	447	20	0.066	0.069	<0.001	43.8	<0.01	<0.01
898.9	1,596	[2]X	1419	5,500	453	20	0.068	0.071	<0.001	44.7	<0.01	<0.01
922.6	1,644	[2]X	1715	5,500	461	20	0.068	0.073	<0.001	45.7	<0.01	<0.01
950.5	1,699	[2]X	2029	5,500	484	19	0.066	0.076	<0.001	48.2	<0.01	<0.01

[1] Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 88.5 upriver from Head of Passes, La., on September 25, 1991, at 0647 hours..

[2] X indicates three samples were collected across the river at this location. These individual values appear in table 4.15; the values of specific conductance, temperature, and chemical concentrations in this table are the mean values. Values below the detection limit were NOT included in the mean.

[3] Water discharges are linearly interpolated values between discharges listed in table 1.5 in chapter 1.

Concentration														
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (μg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
0.01	<0.005	0.040	0.011	0.016	19.0	0.006	<0.05	28.1	<0.03	0.06	4.6	0.227	<0.005	<0.01
<0.01	<0.005	0.008	0.010	0.017	17.9	<0.002	<0.05	25.2	<0.03	0.08	4.2	0.212	0.006	<0.01
<0.01	<0.005	0.016	0.012	0.017	17.6	<0.002	<0.05	26.9	<0.03	<0.04	4.1	0.213	0.008	0.01
0.01	<0.005	0.029	0.010	0.016	19.0	0.002	<0.05	29.0	<0.03	<0.04	4.1	0.225	<0.005	<0.01
<0.01	<0.005	<0.005	0.015	0.017	19.0	<0.002	<0.05	28.4	<0.03	<0.04	4.0	0.225	<0.005	<0.01
<0.01	<0.005	0.007	0.010	0.017	17.5	<0.002	<0.05	26.6	<0.03	<0.04	3.6	0.210	<0.005	0.01
0.02	<0.005	<0.005	0.012	0.016	17.1	<0.002	<0.05	25.1	0.03	<0.04	3.4	0.203	<0.005	<0.01
0.02	<0.005	<0.005	0.013	0.016	17.9	<0.002	<0.05	25.7	<0.03	<0.04	3.3	0.209	<0.005	<0.01
<0.01	<0.005	0.007	0.010	0.017	19.1	<0.002	<0.05	30.2	<0.03	<0.04	3.6	0.228	<0.005	<0.01
0.01	<0.005	0.010	0.012	0.016	18.6	<0.002	<0.05	26.0	<0.03	<0.04	3.2	0.217	<0.005	<0.01
<0.01	<0.005	0.014	0.012	0.017	16.7	<0.002	<0.05	25.8	<0.03	0.05	3.0	0.203	0.007	<0.01
<0.01	<0.005	0.010	0.011	0.017	16.8	<0.002	<0.05	25.7	<0.03	0.04	3.1	0.205	0.007	<0.01
<0.01	<0.005	0.007	0.010	0.017	16.3	<0.002	<0.05	25.0	<0.03	0.07	3.2	0.198	<0.005	<0.01
<0.01	<0.005	0.007	0.012	0.017	17.2	<0.002	<0.05	26.3	<0.03	<0.04	3.3	0.208	0.007	0.02
0.02	<0.005	0.006	0.010	0.017	18.0	<0.002	<0.05	25.9	<0.03	<0.04	3.7	0.213	0.007	0.02
0.01	<0.005	0.008	0.018	0.017	18.2	0.007	<0.05	26.3	<0.03	0.07	4.1	0.216	0.006	0.01
<0.01	<0.005	0.009	0.011	0.018	19.4	0.007	<0.05	27.6	<0.03	<0.04	4.9	0.224	0.006	<0.01

Table 4.9.--*Concentration of major and trace elements Mississippi River between Cairo, Ill. and*

[km, kilometers; CDT, Central Daylight Time;

µS/cm, microsiemens per centimeter at 25 degrees

Location: River miles upriver from mouth of Ohio River	Location: Distance upriver from first sample[1] (km)	Location: Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Temperature (°C)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
September 30, 1991												
10.8	1,736	0.5	0039	3,700	550	19	0.079	0.091	<0.001	55.2	<0.01	<0.01
19.8	1,755	0.5	0148	3,700	555	18	0.075	0.091	<0.001	56.0	<0.01	<0.01
30.8	1,778	0.7	0315	3,700	559	18	0.071	0.087	<0.001	53.2	<0.01	<0.01
39.0	1,795	0.5	0413	3,700	570	18	0.075	0.087	<0.001	54.0	<0.01	<0.01
51.6	1,822	0.8	0550	3,700	562	18	0.082	0.093	<0.001	58.3	<0.01	<0.01
63.6	1,846	0.5	0712	3,600	572	18	0.072	0.084	<0.001	53.1	<0.01	<0.01
73.7	1,867	0.6	0823	3,600	556	18	0.079	0.092	<0.001	58.6	<0.01	<0.01
80.8	1,882	[2]X	0924	3,600	560	19	0.078	0.088	<0.001	56.2	<0.01	<0.01
104.5	1,932	[2]X	1222	3,500	565	18	0.076	0.089	<0.001	57.1	<0.01	<0.01
128.9	1,983	[2]X	1521	3,400	561	18	0.071	0.083	<0.001	54.0	<0.01	<0.01
155.0	2,037	[2]X	1835	3,300	565	18	0.072	0.082	<0.001	54.2	<0.01	<0.01
180.3	2,090	[2]X	2139	3,200	577	18	0.078	0.086	<0.001	55.4	<0.01	<0.01
October 1, 1991												
198.4	2,134	0.5	0127	2,000	481	18	0.040	0.064	<0.001	51.8	<0.01	<0.01
207.2	2,151	0.3	0253	2,000	493	17	0.038	0.061	<0.001	50.7	<0.01	<0.01
221.6	2,179	0.5	0507	2,000	457	17	0.038	0.058	<0.001	48.5	<0.01	<0.01
230.5	2,195	0.5	0600	2,000	452	17	0.034	0.058	<0.001	48.2	<0.01	<0.01
240.2	2,210	0.5	0700	2,000	454	17	0.033	0.057	<0.001	48.0	<0.01	<0.01
249.2	2,230	0.5	1000	2,000	462	17	0.034	0.059	<0.001	49.7	<0.01	<0.01
260.2	2,250	0.5	1109	2,000	456	17	0.036	0.056	<0.001	47.5	<0.01	<0.01
272.0	2,272	0.5	1225	2,000	454	17	0.032	0.053	<0.001	45.8	<0.01	<0.01
283.3	2,293	[2]X	1407	2,000	461	17	0.037	0.059	<0.001	48.6	<0.01	<0.01
292.0	2,309	0.5	1504	2,100	468	17	0.038	0.058	<0.001	48.9	<0.01	<0.01
299.5	2,323	0.5	1553	2,100	461	17	0.037	0.055	<0.001	48.4	<0.01	<0.01
310.0	2,343	0.5	1740	2,000	462	17	0.037	0.055	<0.001	50.0	<0.01	<0.01
321.0	2,363	0.5	1852	2,000	462	16	0.038	0.055	<0.001	48.6	<0.01	<0.01
331.0	2,384	0.5	2107	1,900	467	16	0.042	0.060	<0.001	49.9	<0.01	<0.01
341.0	2,404	0.5	2212	1,800	452	16	0.031	0.056	<0.001	50.3	<0.01	<0.01
October 2, 1991												
351.0	2,421	0.5	0000	1,800	447	16	0.034	0.054	<0.001	48.9	<0.01	<0.01
363.0	2,444	0.7	0136	1,800	447	16	0.035	0.053	<0.001	46.5	<0.01	<0.01
371.0	2,459	0.5	0245	1,700	436	16	0.036	0.052	<0.001	44.9	<0.01	<0.01

in approximately midchannel of the Upper Minneapolis, Minn., September-October 1991 cruise

m^3/s, cubic meters per second;

Celsius; °C, degree Celsius and mg/L, milligrams per liter]

Concentration														
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (µg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
<0.01	<0.005	0.014	0.005	0.019	23.2	0.005	<0.05	31.3	<0.03	0.12	5.8	0.253	<0.005	<0.01
<0.01	<0.005	<0.005	0.013	0.017	23.2	<0.002	<0.05	33.2	<0.03	<0.04	5.8	0.256	<0.005	<0.01
0.01	<0.005	0.006	0.011	0.021	22.1	<0.002	<0.05	30.2	<0.03	<0.04	5.6	0.246	0.010	<0.01
<0.01	<0.005	0.008	0.009	0.019	22.2	<0.002	<0.05	32.5	<0.03	0.04	5.7	0.251	0.007	<0.01
<0.01	<0.005	0.009	0.009	0.023	24.8	<0.002	<0.05	34.3	<0.03	0.05	6.1	0.270	<0.005	<0.01
<0.01	<0.005	0.007	0.009	0.023	22.0	<0.002	<0.05	30.5	<0.03	0.05	5.4	0.245	<0.005	0.01
<0.01	<0.005	<0.005	0.009	0.025	24.8	<0.002	<0.05	33.9	<0.03	0.08	6.1	0.269	0.005	<0.01
0.01	<0.005	0.009	0.008	0.020	23.6	<0.002	<0.05	31.7	<0.03	0.08	5.8	0.257	0.007	<0.01
0.01	<0.005	0.007	0.011	0.022	23.4	<0.002	<0.05	33.5	<0.03	0.10	6.2	0.264	<0.005	<0.01
0.01	<0.005	0.009	0.008	0.019	22.4	<0.002	<0.05	29.7	0.04	0.07	6.3	0.241	0.011	0.01
0.02	<0.005	0.013	0.007	0.023	22.4	<0.002	<0.05	30.7	<0.03	0.09	6.9	0.243	0.007	0.01
0.02	<0.005	0.013	0.015	0.024	23.4	0.016	<0.05	33.7	<0.03	0.06	7.8	0.275	<0.005	<0.01
<0.01	<0.005	<0.005	0.022	0.008	22.3	0.003	<0.05	14.6	<0.03	<0.04	8.0	0.140	<0.005	<0.01
<0.01	<0.005	<0.005	0.012	0.012	22.0	<0.002	<0.05	14.3	<0.03	<0.04	8.6	0.136	<0.005	<0.01
0.01	<0.005	<0.005	0.009	0.009	21.4	<0.002	<0.05	11.6	<0.03	<0.04	9.4	0.125	<0.005	<0.01
<0.01	<0.005	<0.005	0.014	0.015	21.2	<0.002	<0.05	11.7	<0.03	<0.04	9.7	0.124	0.007	<0.01
<0.01	<0.005	<0.005	0.004	0.013	21.2	0.003	<0.05	11.6	<0.03	<0.04	9.8	0.124	<0.005	0.01
<0.01	<0.005	<0.005	0.007	0.006	21.5	<0.002	<0.05	12.6	<0.03	<0.04	10.5	0.128	<0.005	<0.01
<0.01	<0.005	0.005	0.007	0.007	21.0	<0.002	<0.05	11.2	<0.03	<0.04	10.1	0.122	<0.005	<0.01
<0.01	<0.005	0.007	0.005	0.013	20.4	0.003	<0.05	10.5	<0.03	0.05	9.8	0.116	0.006	<0.01
<0.01	<0.005	<0.005	0.014	0.009	21.4	0.003	<0.05	12.1	<0.03	<0.04	10.7	0.123	<0.005	0.01
<0.01	<0.005	<0.005	0.003	<0.005	22.0	<0.002	<0.05	12.2	<0.03	<0.04	11.0	0.124	<0.005	<0.01
<0.01	<0.005	<0.005	0.003	0.015	21.4	<0.003	<0.05	11.8	<0.03	<0.04	10.7	0.122	<0.005	<0.01
<0.01	<0.005	<0.005	0.004	0.011	22.1	<0.002	<0.05	12.5	<0.03	<0.04	10.2	0.126	<0.005	<0.01
<0.01	<0.005	<0.005	0.011	0.015	21.4	<0.002	<0.05	12.5	<0.03	<0.04	9.8	0.125	<0.005	<0.01
<0.01	<0.005	0.005	0.019	0.007	22.3	<0.002	<0.05	13.7	<0.03	<0.04	10.4	0.129	<0.005	<0.01
<0.01	<0.005	<0.005	0.012	0.014	21.6	<0.002	<0.05	13.6	<0.03	<0.04	10.0	0.128	<0.005	<0.01
<0.01	<0.005	<0.005	0.004	0.012	21.0	<0.002	<0.05	13.3	<0.03	<0.04	1.0	0.123	<0.005	<0.01
0.02	<0.005	<0.005	0.010	0.011	20.1	<0.002	<0.05	11.9	<0.03	<0.04	9.4	0.118	0.005	<0.01
<0.01	<0.005	0.007	0.008	<0.005	20.1	<0.002	<0.05	11.7	<0.03	<0.04	10.0	0.110	<0.005	<0.01

Table 4.9.--*Concentration of major and trace elements*
Mississippi River between Cairo, Ill. and

Location												
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
											October 2, 1991	
382.0	2,479	0.5	0347	1,700	428	16	0.032	0.049	<0.001	46.6	<0.01	<0.01
397.0	2,507	0.5	0532	1,600	422	16	0.037	0.048	<0.001	44.0	<0.01	<0.01
407.0	2,531	0.5	0928	1,600	417	15	0.037	0.047	<0.001	42.5	<0.01	<0.01
418.0	2,555	0.5	1218	1,600	435	16	0.035	0.052	<0.001	44.4	<0.01	<0.01
427.0	2,572	0.5	1321	1,600	424	16	0.038	0.048	<0.001	44.4	<0.01	<0.01
435.0	2,586	0.5	1413	1,600	405	16	0.032	0.045	<0.001	44.2	<0.01	<0.01
447.0	2,610	0.5	1626	1,500	407	16	0.028	0.045	<0.001	44.2	<0.01	<0.01
455.5	2,626	0.5	1720	1,500	398	16	0.028	0.044	<0.001	41.8	<0.01	<0.01
465.7	2,644	0.5	1837	1,500	398	16	0.032	0.046	<0.001	44.5	<0.01	<0.01
480.0	2,671	0.5	2013	1,400	401	16	0.032	0.042	<0.001	42.2	<0.01	<0.01
491.0	2,692	0.5	2141	1,400	399	15	0.028	0.043	<0.001	43.6	<0.01	<0.01
502.0	2,713	0.5	2322	1,400	401	15	0.029	0.043	<0.001	44.2	<0.01	<0.01
											October 3, 1991	
509.3	2,727	0.5	0016	1,300	399	15	0.032	0.041	<0.001	42.3	<0.01	<0.01
520.0	2,746	0.5	0129	1,300	395	15	0.037	0.045	<0.001	42.8	<0.01	<0.01
531.0	2,767	0.5	0248	1,300	395	15	0.031	0.041	<0.001	42.5	<0.01	<0.01
539.2	2,782	0.5	0343	1,300	396	15	0.038	0.044	<0.001	43.0	<0.01	<0.01
551.0	2,805	0.5	0537	1,300	393	15	0.024	0.043	<0.001	45.0	<0.01	<0.01
560.7	2,823	0.5	0656	1,300	394	15	0.034	0.043	<0.001	42.1	<0.01	<0.01
572.0	2,846	0.5	0805	1,300	400	14	0.027	0.051	<0.001	46.2	<0.01	<0.01
581.5	2,863	0.5	0904	1,300	396	15	0.028	0.042	<0.001	44.4	<0.01	<0.01
590.5	2,883	0.5	1131	1,300	396	14	0.036	0.042	<0.001	42.2	<0.01	<0.01
602.2	2,904	0.5	1246	1,200	387	15	0.030	0.042	<0.001	44.4	<0.01	<0.01
610.0	2,920	0.5	1412	1,200	402	15	0.027	0.043	<0.001	45.7	<0.01	<0.01
621.3	2,939	0.5	1548	1,200	400	15	0.031	0.040	<0.001	43.7	<0.01	<0.01
632.0	2,963	0.5	1703	1,100	417	15	0.032	0.043	<0.001	46.4	<0.01	<0.01
641.8	2,976	0.5	1807	1,000	415	15	0.036	0.045	<0.001	46.2	<0.01	<0.01
653.0	2,996	0.5	1932	1,000	417	15	0.041	0.050	<0.001	47.6	<0.01	<0.01
665.5	3,018	0.5	2050	1,000	418	15	0.034	0.048	<0.001	47.1	<0.01	<0.01
675.5	3,036	0.5	2158	1,000	425	15	0.033	0.044	<0.001	49.0	<0.01	<0.01
686.1	3,055	0.5	2313	1,000	427	14	0.036	0.042	<0.001	47.9	<0.01	<0.01

in approximately midchannel of the Upper
Minneapolis, Minn., September-October 1991 cruise--Continued

Concentration														
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (µg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
<0.01	<0.005	<0.005	0.005	<0.005	20.3	<0.002	<0.05	12.6	<0.03	<0.04	9.7	0.115	<0.005	<0.01
<0.01	<0.005	<0.005	0.004	0.009	19.0	<0.002	<0.05	11.8	<0.03	<0.04	9.1	0.112	<0.005	<0.01
<0.01	<0.005	0.006	0.004	<0.005	19.3	<0.002	<0.05	11.2	<0.03	<0.04	10.0	0.103	<0.005	0.01
<0.01	<0.005	<0.005	0.006	<0.005	19.4	<0.002	<0.05	12.8	<0.03	<0.04	8.5	0.117	<0.005	<0.01
<0.01	<0.005	0.009	0.004	<0.005	20.6	<0.002	<0.05	11.9	<0.03	<0.04	10.6	0.104	<0.005	<0.01
<0.01	<0.005	<0.005	0.005	<0.005	19.0	<0.002	<0.05	11.7	<0.03	<0.04	10.0	0.108	<0.005	<0.01
<0.01	<0.005	0.018	0.004	<0.005	19.0	0.002	<0.05	11.5	<0.03	<0.04	10.2	0.108	<0.005	<0.01
<0.01	<0.005	<0.005	0.008	<0.005	17.6	<0.002	<0.05	10.9	<0.03	<0.04	9.9	0.106	<0.005	<0.01
<0.01	<0.005	<0.005	0.004	<0.005	18.6	<0.002	<0.05	11.3	<0.03	<0.04	10.5	0.111	<0.005	<0.01
<0.01	<0.005	0.018	0.003	0.006	18.1	0.002	<0.05	10.3	<0.03	<0.04	10.2	0.105	<0.005	<0.01
<0.01	<0.005	0.009	0.005	0.006	18.3	<0.002	<0.05	10.8	<0.03	<0.04	10.4	0.109	<0.005	<0.01
<0.01	<0.005	0.007	0.005	<0.005	18.4	<0.002	<0.05	10.6	<0.03	<0.04	10.6	0.110	<0.005	<0.01
<0.01	<0.005	<0.005	0.005	0.007	18.0	<0.002	<0.05	9.8	<0.03	<0.04	10.2	0.104	<0.005	<0.01
<0.01	<0.005	<0.005	0.004	<0.005	18.6	<0.002	<0.05	9.7	<0.03	<0.04	11.2	0.104	<0.005	<0.01
<0.01	<0.005	0.006	0.004	<0.005	17.9	<0.002	<0.05	9.5	<0.03	<0.04	10.8	0.105	<0.005	<0.01
0.02	<0.005	0.009	0.002	<0.005	18.3	<0.002	<0.05	9.7	<0.03	<0.04	11.8	0.105	<0.005	<0.01
<0.01	<0.005	0.009	0.006	<0.005	18.2	<0.002	<0.05	10.1	<0.03	<0.04	11.8	0.110	<0.005	<0.01
<0.01	<0.005	0.009	0.003	<0.005	17.6	<0.002	<0.05	9.3	<0.03	<0.04	12.2	0.103	<0.005	<0.01
<0.01	<0.005	0.699	0.003	0.006	18.5	0.095	<0.05	9.6	<0.03	<0.04	14.1	0.114	<0.005	<0.01
<0.01	<0.005	0.005	0.005	<0.005	17.9	0.002	<0.05	9.7	<0.03	<0.04	12.2	0.110	<0.005	<0.01
<0.01	<0.005	0.015	0.002	<0.005	17.7	<0.002	<0.05	9.0	<0.03	<0.04	12.7	0.102	<0.005	<0.01
<0.01	<0.005	0.009	0.004	0.006	17.9	0.002	<0.05	9.7	<0.03	<0.04	12.3	0.109	<0.005	<0.01
<0.01	<0.005	<0.005	0.004	<0.005	18.1	<0.002	<0.05	9.5	<0.03	<0.04	13.4	0.114	<0.005	<0.01
<0.01	<0.005	0.010	0.004	0.011	17.9	0.005	<0.05	8.4	<0.03	<0.04	12.7	0.107	0.005	<0.01
<0.01	<0.005	<0.005	0.003	0.015	18.5	<0.002	<0.05	8.4	<0.03	<0.04	14.4	0.117	<0.005	<0.01
<0.01	<0.005	0.014	0.004	0.005	18.8	<0.002	<0.05	8.9	<0.03	<0.04	15.7	0.116	<0.005	0.01
<0.01	<0.005	0.519	0.003	0.014	19.2	0.069	<0.05	9.1	<0.03	<0.04	17.1	0.121	<0.005	<0.01
<0.01	<0.005	0.593	0.003	0.015	18.8	0.099	<0.05	8.4	<0.03	<0.04	16.1	0.122	0.006	<0.01
<0.01	<0.005	0.013	0.005	0.014	19.0	0.008	<0.05	9.1	<0.03	<0.04	15.6	0.127	<0.005	<0.01
<0.01	<0.005	0.014	0.003	0.013	18.9	0.012	<0.05	8.7	<0.03	<0.04	15.4	0.126	<0.005	<0.01

Table 4.9.--*Concentration of major and trace elements Mississippi River between Cairo, Ill. and*

Location												
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
											October 4, 1991	
700.0	3,080	0.5	0121	940	439	14	0.041	0.047	<0.001	50.9	<0.01	<0.01
710.0	3,098	0.5	0232	930	435	15	0.033	0.046	<0.001	51.1	<0.01	<0.01
723.2	3,121	0.5	0410	940	432	15	0.032	0.043	<0.001	49.8	<0.01	<0.01
735.7	3,146	0.5	0545	940	445	15	0.040	0.046	<0.001	50.2	<0.01	<0.01
745.5	3,166	0.5	0902	920	458	13	0.035	0.048	<0.001	53.6	<0.01	<0.01
755.5	3,182	0.5	1108	900	419	13	0.037	0.043	<0.001	47.5	<0.01	<0.01
764.5	3,199	0.5	1215	720	507	13	0.042	0.051	<0.001	57.7	<0.01	<0.01
776.4	3,219	0.5	1319	670	522	15	0.038	0.052	<0.001	59.8	<0.01	<0.01
786.2	3,236	0.5	1431	630	535	14	0.043	0.051	<0.001	59.6	<0.01	<0.01
793.1	3,248	0.5	1520	600	544	15	0.045	0.054	<0.001	58.6	<0.01	<0.01
805.5	3,270	0.5	1642	510	520	14	0.040	0.048	<0.001	56.6	<0.01	<0.01
812.5	3,282	0.5	1729	360	660	14	0.060	0.073	<0.001	74.5	<0.01	<0.01
826.1	3,306	0.5	1900	350	659	15	0.055	0.067	<0.001	76.3	<0.01	<0.01
838.0	3,327	0.5	2023	360	657	15	0.077	0.079	<0.001	102.3	<0.01	<0.01
846.0	3,342	0.5	2213	230	472	14	0.032	0.054	<0.001	55.9	<0.01	<0.01

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 88.5 upriver from Head of Passes, La., on September 25, 1991, at 0647 hours.

[2]X indicates three samples were collected across the river at this location. These individual values appear in table 4.16; the values of specific conductance, temperature, and chemical concentrations in this table are the mean values. Values below the detection limit were NOT included in the mean.

[3]Water discharges are linearly interpolated values between discharges listed in table 1.5 in chapter 1.

in approximately midchannel of the Upper
Minneapolis, Minn., September-October 1991 cruise--Continued

Concentration														
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (μg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
<0.01	<0.005	0.013	0.003	0.014	20.5	<0.002	<0.05	9.6	<0.03	<0.04	17.5	0.134	<0.005	<0.01
<0.01	<0.005	0.017	0.004	0.016	19.7	<0.002	<0.05	9.7	<0.03	<0.04	16.5	0.136	<0.005	<0.01
<0.01	<0.005	0.024	0.004	0.016	19.3	<0.002	<0.05	9.1	<0.03	<0.04	16.1	0.132	<0.005	<0.01
<0.01	<0.005	0.027	0.003	0.014	20.3	<0.002	<0.05	9.1	<0.03	<0.04	16.9	0.132	<0.005	<0.01
<0.01	<0.005	0.084	0.004	0.016	21.0	0.014	<0.05	10.3	<0.03	<0.04	17.1	0.144	<0.005	0.01
<0.01	<0.005	0.069	0.004	0.007	19.1	0.003	<0.05	9.1	<0.03	<0.04	17.0	0.127	<0.005	<0.01
0.01	<0.005	0.027	0.004	0.016	22.8	0.006	<0.05	10.8	<0.03	<0.04	17.9	0.161	<0.005	<0.01
<0.01	<0.005	0.023	0.006	0.016	23.9	0.003	<0.05	11.4	<0.03	<0.04	16.7	0.164	<0.005	<0.01
<0.01	<0.005	0.037	0.003	0.015	24.5	0.002	<0.05	11.7	<0.03	<0.04	15.6	0.164	<0.005	<0.01
<0.01	<0.005	0.033	0.003	0.014	24.5	0.005	<0.05	11.7	<0.03	<0.04	16.0	0.158	<0.005	<0.01
<0.01	<0.005	0.059	0.004	0.015	23.4	0.004	<0.05	11.3	<0.03	0.06	15.0	0.156	<0.005	<0.01
<0.01	<0.005	0.522	0.003	0.017	32.2	0.087	<0.05	16.3	<0.03	<0.04	19.1	0.212	<0.005	<0.01
<0.01	<0.005	0.022	0.004	0.022	31.8	0.007	<0.05	15.8	<0.03	<0.04	16.4	0.221	<0.005	<0.01
<0.01	<0.005	0.012	0.003	0.030	47.1	0.005	<0.05	20.4	<0.03	<0.04	21.6	0.349	<0.005	<0.01
<0.01	<0.005	0.054	0.003	0.015	22.4	0.006	<0.05	8.9	<0.03	<0.04	11.6	0.135	<0.005	<0.01

Table 4.10.--*Concentration of major and trace elements Mississippi River between New Orleans,*

[km, kilometers; CDT, Central Daylight Time; m^3/s, cubic meters per second; µS/cm, microsiemens per centimeter

Location													
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Temperature (°C)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
											March 25, 1992	
90.0	0	[2]X	0705	22,300	288	16	0.024	0.051	<0.001	33.4	<0.01	<0.01
100.0	23	0.5	0829	22,300	--	15	0.027	0.059	<0.001	35.2	<0.01	<0.01
110.0	45	0.5	0938	22,300	--	15	0.023	0.061	<0.001	34.0	<0.01	<0.01
119.0	65	0.5	1044	22,300	--	14	0.022	0.046	<0.001	33.4	<0.01	<0.01
130.0	90	0.5	1205	22,300	--	14	0.021	0.047	<0.001	34.2	<0.01	<0.01
139.8	112	0.5	1312	22,300	--	14	0.030	0.048	<0.001	34.6	<0.01	<0.01
149.7	134	0.6	1424	22,300	--	13	0.019	0.046	<0.001	33.8	<0.01	<0.01
160.1	157	0.5	1539	22,300	--	13	0.024	0.045	<0.001	34.8	<0.01	<0.01
170.0	179	0.5	1649	22,300	--	12	0.021	0.054	<0.001	33.8	<0.01	<0.01
179.5	200	0.5	1752	22,300	--	12	0.027	0.046	<0.001	33.3	<0.01	<0.01
190.0	223	0.5	1900	22,300	--	13	0.025	0.050	<0.001	34.1	<0.01	<0.01
200.0	245	0.5	2011	22,300	--	13	0.022	0.044	<0.001	31.9	<0.01	<0.01
210.0	267	0.5	2124	22,300	--	14	0.025	0.046	<0.001	33.8	<0.01	<0.01
220.0	290	0.5	2236	22,300		14	0.027	0.044	<0.001	33.2	<0.01	<0.01
228.0	309	[2]X	2348	22,300	306	13	0.021	0.044	<0.001	32.0	<0.01	<0.01
											March 26, 1992	
240.3	358	0.5	0532	22,200	305	13	0.029	0.045	<0.001	33.2	<0.01	<0.01
250.0	380	0.5	0647	22,100	303	13	0.028	0.048	<0.001	35.2	<0.01	<0.01
260.8	404	0.5	0804	21,900	308	13	0.024	0.047	<0.001	34.8	<0.01	<0.01
270.0	424	0.5	0907	21,800	306	13	0.025	0.046	<0.001	34.6	<0.01	<0.01
280.0	446	0.5	1018	21,700	293	13	0.027	0.052	<0.001	34.4	<0.01	<0.01
290.0	468	0.5	1131	21,600	311	12	0.020	0.046	<0.001	33.4	<0.01	<0.01
300.0	490	0.5	1243	21,500	309	12	0.020	0.045	<0.001	33.0	<0.01	<0.01
310.0	513	0.5	1354	21,400	311	12	0.024	0.045	<0.001	35.7	<0.01	<0.01
321.1	538	0.5	1515	25,800	312	12	0.022	0.045	<0.001	34.2	<0.01	<0.01
330.4	559	0.6	1620	25,600	312	13	0.019	0.045	<0.001	33.9	<0.01	<0.01
340.0	581	0.5	1731	25,500	311	12	0.024	0.044	<0.001	34.4	<0.01	<0.01
351.3	607	0.8	1853	25,400	311	12	0.022	0.043	<0.001	34.6	<0.01	<0.01
360.0	628	[2]X	2011	25,200	308	12	0.029	0.045	<0.001	34.6	<0.01	<0.01
371.2	661	0.5	2252	25,300	311	12	0.020	0.044	<0.001	34.6	<0.01	<0.01
											March 27, 1992	
380.8	684	0.3	0019	25,400	313	12	0.023	0.044	<0.001	34.0	<0.01	<0.01
389.8	705	0.5	0117	25,500	311	12	0.026	0.044	<0.001	34.4	<0.01	<0.01

in approximately midchannel of the Lower La., and Cairo, Ill., March-April 1992 cruise

at 25 degrees Celsius; °C, degrees Celsius; mg/L, milligrams per liter; and --, no measurement]

Concentration														
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (µg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
<0.01	<0.005	0.303	0.004	<0.005	10.1	0.027	<0.05	14.7	<0.03	<0.04	6.0	0.130	<0.005	<0.01
<0.01	<0.005	0.487	0.003	0.006	10.2	0.079	<0.05	14.3	<0.03	<0.04	6.7	0.136	<0.005	0.02
<0.01	<0.005	0.815	0.002	0.006	10.2	0.105	<0.05	13.8	<0.03	<0.04	6.9	0.131	<0.005	0.03
<0.01	<0.005	0.010	0.003	<0.005	10.0	<0.002	<0.05	14.0	<0.03	0.06	5.8	0.129	<0.005	<0.01
<0.01	<0.005	0.013	0.006	0.007	10.2	0.003	<0.05	14.4	<0.03	<0.04	6.1	0.131	<0.005	<0.01
<0.01	<0.005	<0.005	0.003	<0.005	9.9	0.003	<0.05	13.6	<0.03	<0.04	6.2	0.133	<0.005	<0.01
<0.01	<0.005	0.008	0.006	<0.005	10.0	0.002	<0.05	13.7	<0.03	<0.04	6.0	0.130	<0.005	<0.01
<0.01	<0.005	0.006	0.003	<0.005	10.1	<0.002	<0.05	14.2	<0.03	<0.04	6.1	0.135	<0.005	<0.01
<0.01	<0.005	0.397	0.006	<0.005	10.1	0.059	<0.05	13.5	<0.03	<0.04	6.7	0.130	<0.005	<0.01
0.02	<0.005	0.097	0.002	0.006	9.8	0.010	<0.05	13.3	<0.03	<0.04	6.4	0.129	<0.005	<0.01
<0.01	<0.005	0.261	0.002	<0.005	10.0	0.028	<0.05	13.8	<0.03	<0.04	6.7	0.132	<0.005	<0.01
<0.01	<0.005	0.041	0.002	0.006	9.4	0.003	<0.05	13.0	<0.03	<0.04	5.9	0.124	<0.005	<0.01
<0.01	<0.005	0.019	0.002	0.006	9.9	0.002	<0.05	12.8	<0.03	<0.04	6.2	0.131	<0.005	<0.01
<0.01	<0.005	0.010	0.002	0.006	9.7	<0.002	<0.05	12.5	<0.03	<0.04	6.1	0.129	<0.005	<0.01
<0.01	<0.005	0.018	0.003	<0.005	9.4	0.002	<0.05	11.8	<0.03	<0.04	5.8	0.123	<0.005	<0.01
<0.01	<0.005	<0.005	0.003	<0.005	9.4	<0.002	<0.05	11.5	<0.03	<0.04	6.1	0.127	<0.005	<0.01
<0.01	<0.005	0.005	0.006	0.006	10.0	<0.002	<0.05	12.3	<0.03	<0.04	6.5	0.134	<0.005	0.01
<0.01	<0.005	0.006	0.003	0.006	9.8	<0.002	<0.05	11.9	<0.03	<0.04	6.3	0.132	<0.005	<0.01
<0.01	<0.005	0.007	0.002	<0.005	10.1	<0.002	<0.05	12.1	<0.03	<0.04	6.3	0.132	<0.005	<0.01
<0.01	<0.005	0.350	0.002	<0.005	10.1	0.047	<0.05	11.8	<0.03	<0.04	6.9	0.131	0.005	<0.01
<0.01	<0.005	0.009	0.006	0.006	9.9	<0.002	<0.05	11.4	<0.03	0.05	6.0	0.127	<0.005	<0.01
<0.01	<0.005	0.076	0.006	0.006	9.8	0.007	<0.05	11.2	<0.03	<0.04	6.2	0.125	<0.005	<0.01
<0.01	<0.005	0.005	0.003	<0.005	10.4	<0.002	<0.05	12.6	<0.03	<0.04	6.2	0.136	<0.005	<0.01
<0.01	<0.005	0.009	0.003	<0.005	10.1	<0.002	<0.05	11.4	<0.03	<0.04	6.2	0.129	0.005	<0.01
<0.01	<0.005	0.017	0.006	0.006	10.0	0.003	<0.05	12.0	<0.03	<0.04	6.1	0.127	<0.005	<0.01
<0.01	<0.005	0.013	0.003	0.006	10.0	<0.002	<0.05	12.1	<0.03	<0.04	6.2	0.131	<0.005	<0.01
<0.01	<0.005	0.062	0.002	<0.005	9.9	0.006	<0.05	12.4	<0.03	<0.04	6.2	0.130	<0.005	<0.01
<0.01	<0.005	0.142	0.002	0.005	10.0	0.006	<0.05	12.3	<0.03	<0.04	6.9	0.131	<0.005	<0.01
<0.01	<0.005	0.007	0.002	<0.005	10.0	<0.002	<0.05	12.0	<0.03	<0.04	6.0	0.130	<0.005	<0.01
<0.01	<0.005	0.011	0.002	<0.005	10.1	<0.002	<0.05	11.3	<0.03	<0.04	6.2	0.127	<0.005	<0.01
<0.01	<0.005	0.006	0.003	0.006	10.2	<0.002	<0.05	11.8	<0.03	<0.04	6.2	0.129	0.005	<0.01

Table 4.10.--*Concentration of major and trace elements*
Mississippi River between New Orleans,

Location												
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
399.4	728	0.5	0234	25,600	311	12	0.025	0.047	<0.001	36.2	<0.01	<0.01
409.5	754	0.5	0402	25,800	316	12	0.023	0.045	<0.001	34.3	<0.01	<0.01
421.8	784	0.5	0531	25,900	319	12	0.024	0.046	<0.001	36.4	<0.01	<0.01
435.3	819	[2]X	0729	26,100	316	12	0.024	0.043	<0.001	33.4	<0.01	<0.01
445.2	844	0.5	0847	25,800	323	12	0.024	0.045	<0.001	33.8	<0.01	<0.01
454.3	867	0.5	0957	25,800	321	12	0.027	0.048	<0.001	35.2	<0.01	<0.01
464.8	893	0.5	1121	25,900	324	13	0.024	0.048	<0.001	37.2	<0.01	<0.01
475.0	920	0.5	1246	26,000	326	14	0.027	0.046	<0.001	36.7	<0.01	<0.01
485.5	946	0.6	1410	26,000	337	13	0.028	0.046	<0.001	36.9	<0.01	<0.01
495.1	971	0.5	1532	26,200	334	12	0.027	0.046	<0.001	36.8	<0.01	<0.01
504.5	995	0.8	1651	26,300	338	11	0.022	0.046	<0.001	35.6	<0.01	<0.01
514.1	1,021	0.6	1823	26,300	336	11	0.020	0.047	<0.001	35.9	<0.01	<0.01
525.0	1,049	0.5	1951	26,300	343	11	0.028	0.046	<0.001	36.2	<0.01	<0.01
535.0	1,076	[2]X	2128	26,300	340	11	0.024	0.048	<0.001	36.6	<0.01	<0.01
											March 28, 1992	
544.9	1,111	0.5	0009	26,400	338	12	0.029	0.048	<0.001	37.0	<0.01	<0.01
555.0	1,137	0.5	0139	26,400	339	12	0.019	0.046	<0.001	35.2	<0.01	<0.01
565.1	1,165	0.5	0317	26,400	338	12	0.022	0.046	<0.001	37.4	<0.01	<0.01
582.0	1,213	0.5	0613	25,300	341	11	0.016	0.046	<0.001	22.2	<0.01	<0.01
592.1	1,238	0.5	0734	25,000	340	11	0.020	0.047	<0.001	37.3	<0.01	<0.01
602.0	1,264	0.5	0858	23,800	358	11	0.031	0.050	<0.001	40.1	<0.01	<0.01
614.1	1,295	0.5	1040	23,600	356	11	0.021	0.047	<0.001	39.0	<0.01	<0.01
626.6	1,328	0.5	1229	23,500	363	12	0.030	0.050	<0.001	41.0	<0.01	<0.01
638.7	1,358	0.5	1401	23,400	366	13	0.023	0.048	<0.001	39.3	<0.01	<0.01
650.1	1,387	0.6	1540	23,200	360	15	0.026	0.065	<0.001	39.7	<0.01	<0.01
659.8	1,412	[2]X	1659	23,100	360	11	0.031	0.049	<0.001	38.8	<0.01	<0.01
672.7	1,445	0.5	1843	23,100	351	12	0.032	0.049	<0.001	39.5	<0.01	<0.01
683.4	1,472	0.5	2011	23,100	358	12	0.031	0.048	<0.001	39.6	<0.01	<0.01
695.0	1,501	0.6	2138	23,100	358	12	0.030	0.049	<0.001	39.9	<0.01	<0.01
705.0	1,527	0.5	2308	23,200	352	12	0.029	0.048	<0.001	38.7	<0.01	<0.01
											March 29, 1992	
714.3	1,549	0.8	0029	23,200	356	12	0.030	0.047	<0.001	39.3	<0.01	<0.01
723.3	1,571	[2]X	0143	23,300	355	14	0.032	0.048	<0.001	39.0	<0.01	<0.01
735.0	1,613	0.5	0544	23,300	338	13	0.027	0.047	<0.001	41.2	<0.01	<0.01
742.0	1,630	0.5	0640	23,100	348	14	0.026	0.055	<0.001	40.2	<0.01	<0.01

Concentration														
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (µg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
<0.01	<0.005	0.008	0.002	<0.005	10.8	<0.002	<0.05	12.5	<0.03	<0.04	6.8	0.135	<0.005	<0.01
<0.01	<0.005	0.011	0.003	<0.005	10.2	<0.002	<0.05	11.6	<0.03	<0.04	6.2	0.127	<0.005	<0.01
<0.01	<0.005	0.015	0.002	<0.005	11.0	<0.002	<0.05	12.3	<0.03	<0.04	6.9	0.133	<0.005	<0.01
<0.01	<0.005	0.021	0.002	<0.005	9.8	<0.002	<0.05	11.5	<0.03	<0.04	6.0	0.123	<0.005	<0.01
<0.01	<0.005	0.009	0.002	0.006	10.2	<0.002	<0.05	11.3	<0.03	0.05	6.4	0.125	0.005	<0.01
<0.01	<0.005	0.224	0.003	<0.005	10.6	0.025	<0.05	11.6	<0.03	<0.04	7.0	0.129	0.005	<0.01
<0.01	<0.005	0.133	0.002	0.006	11.0	0.011	<0.05	12.6	<0.03	<0.04	7.0	0.136	<0.005	<0.01
0.01	<0.005	0.014	0.002	<0.005	11.1	0.002	<0.05	12.3	<0.03	<0.04	6.8	0.134	<0.005	<0.01
<0.01	<0.005	0.008	0.003	<0.005	11.1	<0.002	<0.05	12.6	<0.03	<0.04	6.8	0.135	<0.005	<0.01
<0.01	<0.005	0.009	0.002	0.006	11.2	0.002	<0.05	12.5	<0.03	<0.04	6.9	0.134	0.006	<0.01
<0.01	<0.005	0.013	0.002	0.006	10.9	<0.002	<0.05	11.9	<0.03	<0.04	6.5	0.130	<0.005	<0.01
<0.01	<0.005	0.020	0.002	<0.005	11.0	0.002	<0.05	11.8	<0.03	<0.04	6.6	0.131	<0.005	<0.01
<0.01	<0.005	0.008	0.006	0.006	10.8	<0.002	<0.05	11.0	<0.03	<0.04	6.6	0.131	<0.005	<0.01
<0.01	<0.005	0.049	0.005	0.008	11.1	0.008	<0.05	12.0	<0.03	<0.04	6.9	0.132	<0.005	<0.01
<0.01	<0.005	0.008	0.003	<0.005	10.9	<0.002	<0.05	12.3	<0.03	<0.04	6.8	0.134	<0.005	<0.01
<0.01	<0.005	0.011	0.002	0.006	10.8	0.002	<0.05	12.5	<0.03	<0.04	6.6	0.130	<0.005	<0.01
<0.01	<0.005	0.010	0.002	<0.005	11.4	<0.002	<0.05	12.7	<0.03	<0.04	7.1	0.137	<0.005	<0.01
<0.01	<0.005	0.019	0.003	<0.005	5.5	<0.002	<0.05	29.7	<0.03	<0.04	2.2	0.141	<0.005	<0.01
<0.01	<0.005	0.014	0.006	<0.005	11.6	<0.002	<0.05	10.8	<0.03	<0.04	7	0.133	<0.005	<0.01
<0.01	<0.005	0.007	0.003	0.006	11.8	<0.002	<0.05	11.9	<0.03	<0.04	7.6	0.145	<0.005	0.01
<0.01	<0.005	0.014	0.002	<0.005	11.9	<0.002	<0.05	11.5	<0.03	<0.04	7.3	0.142	<0.005	<0.01
<0.01	<0.005	0.017	0.004	<0.005	12.0	0.003	<0.05	12.1	<0.03	<0.04	7.8	0.149	<0.005	<0.01
<0.01	<0.005	0.010	0.006	<0.005	12.0	<0.002	<0.05	11.6	<0.03	<0.04	7.4	0.145	<0.005	<0.01
<0.01	<0.005	0.754	0.002	<0.005	11.9	0.132	<0.05	12.2	<0.03	<0.04	8.6	0.147	<0.005	0.01
<0.01	<0.005	0.102	0.004	0.006	11.2	0.020	<0.05	12.0	<0.03	<0.04	7.7	0.144	<0.005	<0.01
<0.01	<0.005	0.013	0.003	0.006	11.4	<0.002	<0.05	12.1	<0.03	<0.04	7.5	0.149	<0.005	<0.01
<0.01	<0.005	0.016	0.006	<0.005	11.3	<0.002	<0.05	12.0	<0.03	<0.04	7.6	0.149	<0.005	<0.01
<0.01	<0.005	0.043	0.004	0.006	11.3	0.004	<0.05	12.3	<0.03	<0.04	7.8	0.151	<0.005	<0.01
<0.01	<0.005	0.015	0.003	<0.005	11.0	0.002	<0.05	11.4	<0.03	<0.04	7.3	0.146	<0.005	<0.01
<0.01	<0.005	<0.005	0.003	<0.005	11.1	<0.002	<0.05	11.5	<0.03	<0.04	7.4	0.149	<0.005	<0.01
<0.01	<0.005	0.007	0.004	<0.005	10.9	<0.002	<0.05	11.7	<0.03	<0.04	7.3	0.148	<0.005	<0.01
<0.01	<0.005	0.006	0.002	<0.005	11.9	<0.002	<0.05	13.8	<0.03	<0.04	7.8	0.157	<0.005	<0.01
<0.01	<0.005	0.626	0.001	<0.005	11.6	0.050	<0.05	12.4	<0.03	<0.04	8.9	0.155	<0.005	0.02

Table 4.10.--*Concentration of major and trace elements Mississippi River between New Orleans,*

Location													
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
752.9	1,657	0.5	0820	22,700	345	13	0.023	0.046	<0.001	40.0	<0.01	<0.01
763.0	1,681	0.5	0940	22,400	349	12	0.030	0.054	0.001	43.3	<0.01	<0.01
774.0	1,707	0.5	1103	22,000	347	12	0.025	0.056	<0.001	41.5	<0.01	<0.01
784.6	1,732	0.8	1227	21,700	349	14	0.023	0.048	<0.001	42.5	<0.01	<0.01
795.5	1,758	0.5	1356	21,300	352	11	0.028	0.055	<0.001	45.0	<0.01	<0.01
804.7	1,780	0.3	1513	21,100	349	12	0.028	0.076	<0.001	38.4	<0.01	0.01
815.8	1,807	0.5	1644	20,700	354	15	0.027	0.052	<0.001	45.6	<0.01	<0.01
828.0	1,835	0.5	1810	20,300	360	12	0.028	0.059	<0.001	36.3	<0.01	<0.01
837.4	1,857	0.6	1926	20,000	369	12	0.024	0.044	<0.001	36.1	<0.01	<0.01
848.0	1,884	[2]X	2105	19,700	341	12	0.026	0.050	0.001	41.3	<0.01	<0.01
											March 30, 1992	
878.1	1,956	[2]X	0107	18,700	347	10	0.023	0.043	0.001	37.0	<0.01	<0.01
898.9	2,006	[2]X	0400	18,000	389	11	0.026	0.050	<0.001	39.2	<0.01	<0.01
923.0	2,063	[2]X	0713	17,300	349	11	0.026	0.049	<0.001	43.3	<0.01	<0.01
950.5	2,128	[2]X	1047	17,000	417	10	0.025	0.058	<0.001	46.6	<0.01	<0.01

[1]Distance are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 90.0 upriver from Head of Passes. La., on March 25, 1992, at 0705 hours.

[2]X indicates three samples were collected across the river at this location. These individual values appear in table 4.17; the values of specific conductance, temperature, and chemical concentration in this table are the mean values. Values below the detection limit were NOT included in the mean.

[3]Water discharges are linearly interpolated values between discharges listed in table 1.5 in chapter 1.

in approximately midchannel of the Lower
La., and Cairo, Ill., March-April 1992 cruise--Continued

Concentration														
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (μg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
<0.01	<0.005	0.011	0.003	0.007	11.4	<0.002	<0.05	12.5	<0.03	<0.04	7.5	0.152	<0.005	<0.01
<0.01	<0.005	0.292	<0.001	<0.005	12.2	0.022	<0.05	15.2	<0.03	<0.04	8.7	0.166	<0.005	<0.01
<0.01	<0.005	0.724	0.002	0.009	12.0	0.065	<0.05	13.5	<0.03	<0.04	9.4	0.158	0.006	<0.01
<0.01	<0.005	0.019	0.002	<0.005	12.1	<0.002	<0.05	14.2	<0.03	<0.04	8.0	0.161	<0.005	<0.01
<0.01	<0.005	0.323	0.002	<0.005	13.0	0.028	<0.05	14.6	<0.03	<0.04	9.0	0.169	<0.005	<0.01
<0.01	<0.005	2.127	0.001	0.006	11.6	0.210	<0.05	10.2	<0.03	<0.04	12.2	0.146	<0.005	0.02
<0.01	<0.005	0.021	0.003	<0.005	13.2	0.005	<0.05	14.7	<0.03	<0.04	8.4	0.169	<0.005	<0.01
<0.01	<0.005	1.157	<0.001	<0.005	11.1	0.105	<0.05	9.4	<0.03	<0.04	9.6	0.135	<0.005	<0.01
<0.01	<0.005	0.024	<0.001	0.006	10.9	0.003	<0.05	10.0	<0.03	<0.04	7.2	0.133	<0.005	0.01
<0.01	0.007	0.109	0.003	<0.005	12.2	0.023	<0.05	12.9	<0.03	<0.04	8.0	0.152	<0.005	0.01
<0.01	<0.005	0.060	0.003	<0.005	11.1	0.010	<0.05	11.2	<0.03	<0.04	7.2	0.135	<0.005	<0.01
<0.01	<0.005	0.366	0.002	<0.005	11.6	0.046	<0.05	12.2	<0.03	<0.04	8.4	0.144	<0.005	<0.01
<0.01	<0.005	0.062	0.002	0.005	12.8	<0.002	<0.05	14.3	<0.03	0.05	8.4	0.157	<0.005	<0.01
<0.01	<0.005	0.008	0.002	0.005	15.4	<0.002	<0.05	13.9	<0.03	<0.04	9.0	0.157	<0.005	0.01

Table 4.11.--*Concentration of major and trace elements Mississippi River between Cairo, Ill. and*

[km, kilometers; CDT, Central Daylight Time;

µS/cm, microsiemens per centimeter at 25 degrees

Location: River miles upriver from mouth of Ohio River	Location: Distance upriver from first sample[1] (km)	Location: Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Temperature (°C)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
												March 30, 1992
11.6	2,173	0.6	1422	8,000	487	9	0.031	0.071	<0.001	53.0	<0.01	<0.01
19.8	2,192	0.5	1528	7,900	474	10	0.028	0.070	<0.001	54.0	<0.01	<0.01
34.3	2,226	0.5	1719	7,700	514	9	0.034	0.096	<0.001	55.4	<0.01	<0.01
49.4	2,261	0.5	1920	7,600	528	9	0.034	0.073	<0.001	55.4	<0.01	<0.01
65.4	2,299	0.5	2138	7,600	514	9	0.030	0.074	<0.001	54.6	<0.01	<0.01
80.5	2,335	0.5	2346	7,500	521	10	0.037	0.068	<0.001	52.4	<0.01	<0.01
												March 31, 1992
96.2	2,371	0.5	0143	7,700	509	10	0.033	0.072	<0.001	53.8	<0.01	<0.01
109.8	2,404	[2]X	0340	7,800	506	10	0.043	0.067	<0.001	52.0	<0.01	<0.01
127.7	2,448	[2]X	0629	7,500	513	11	0.034	0.070	<0.001	54.9	<0.01	<0.01
145.7	2,491	[2]X	0903	7,600	518	10	0.036	0.078	<0.001	57.1	<0.01	<0.01
169.7	2,548	[2]X	1229	7,700	533	11	0.039	0.081	<0.001	59.1	<0.01	<0.01
180.3	2,574	[2]X	1405	7,800	518	11	0.042	0.079	<0.001	60.6	<0.01	<0.01
198.3	2,620	0.5	1717	5,900	492	11	0.020	0.060	<0.001	54.7	<0.01	<0.01
207.1	2,640	0.2	1850	5,900	--	--	0.023	0.070	<0.001	65.3	<0.01	<0.01
221.0	2,673	0.5	2125	5,300	451	10	0.019	0.059	<0.001	59.3	<0.01	<0.01
233.5	2,699	0.4	2248	5,000	469	8	0.019	0.057	<0.001	56.4	<0.01	<0.01
												April 1, 1992
246.0	2,729	0.5	0123	4,700	448	10	0.016	0.053	<0.001	52.6	<0.01	<0.01
258.5	2,759	0.5	0250	4,400	468	8	0.013	0.056	<0.001	56.3	<0.01	<0.01
270.0	2,782	0.6	0454	4,200	498	9	0.018	0.059	<0.001	57.7	<0.01	<0.01
282.6	2,809	0.5	0630	4,100	465	10	0.022	0.055	0.0010	57.8	<0.01	<0.01
293.0	2,830	0.5	0745	4,000	485	9	0.020	0.054	<0.001	57.8	<0.01	<0.01
307.0	2,861	0.7	0943	3,900	486	8	0.021	0.060	<0.001	62.1	<0.01	<0.01
324.6	2,897	[2]X	1143	3,600	486	8	0.018	0.053	<0.001	54.8	<0.01	<0.01
336.0	2,921	0.5	1311	3,500	506	9	0.021	0.063	<0.001	62.0	<0.01	<0.01
347.0	2,945	0.5	1437	3,500	462	9	0.017	0.045	<0.001	50.9	<0.01	<0.01
361.7	2,975	0.7	1620	3,300	494	7	0.016	0.057	<0.001	55.8	<0.01	<0.01
374.0	3,003	0.5	1823	3,400	489	7	0.020	0.046	<0.001	54.9	<0.01	<0.01
388.0	3,031	0.4	1948	3,400	485	8	0.015	0.050	<0.001	55.6	<0.01	<0.01
403.0	3,060	0.7	2121	3,400	475	8	0.018	0.053	<0.001	53.7	<0.01	<0.01

at approximately midchannel of the Upper
Minneapolis, Minn., March-April 1992 cruise

m^3/s, cubic meters per second;

Celsius; °C, degree Celsius and mg/L, milligrams per liter;--, no sample analyzed]

Concentration														
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (µg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
<0.01	<0.005	0.007	0.002	<0.005	19.3	<0.002	<0.05	16.2	<0.03	<0.04	10.3	0.167	<0.005	<0.01
<0.01	<0.005	0.013	0.002	<0.005	19.3	0.0020	<0.05	16.8	<0.03	<0.04	10.3	0.168	<0.005	<0.01
<0.01	<0.005	1.433	0.004	0.0070	20.0	0.1220	<0.05	17.7	<0.03	<0.04	14.2	0.176	<0.005	0.02
<0.01	<0.005	0.009	0.003	0.0130	19.3	<0.002	<0.05	17.7	<0.03	<0.04	10.5	0.171	<0.005	<0.01
<0.01	<0.005	<0.005	0.002	<0.005	19.8	<0.002	<0.05	16.8	<0.03	<0.04	10.8	0.171	<0.005	<0.01
<0.01	<0.005	0.010	0.003	<0.005	19.4	<0.002	<0.05	17.6	<0.03	0.06	9.8	0.164	<0.005	<0.01
<0.01	<0.005	0.012	0.002	0.015	18.7	0.003	<0.05	17.7	<0.03	<0.04	10.2	0.176	<0.005	<0.01
<0.01	<0.005	0.010	0.002	<0.005	19.8	0.013	<0.05	16.8	<0.03	<0.04	9.5	0.154	<0.005	<0.01
<0.01	<0.005	0.009	0.002	0.007	19.9	<0.002	<0.05	18.2	<0.03	0.05	10.5	0.169	<0.005	<0.01
<0.01	<0.005	0.008	0.002	0.015	20.4	<0.002	0.05	20.0	<0.03	0.09	10.8	0.185	<0.005	<0.01
<0.01	<0.005	0.481	0.002	0.013	21.4	0.045	<0.05	20.5	<0.03	<0.04	12.2	0.190	0.006	<0.01
<0.01	<0.005	0.044	0.002	0.024	21.0	0.005	0.07	22.7	<0.03	<0.04	11.4	0.210	<0.005	<0.01
<0.01	<0.005	0.019	0.002	0.007	18.9	0.003	<0.05	10.0	<0.03	<0.04	11.6	0.122	<0.005	<0.01
<0.01	<0.005	0.368	0.003	<0.005	23.5	0.038	<0.05	12.1	<0.03	<0.04	14.9	0.141	<0.005	0.01
<0.01	<0.005	0.014	0.002	<0.005	21.4	<0.002	<0.05	12.0	<0.03	<0.04	13.0	0.127	<0.005	<0.01
<0.01	<0.005	0.010	0.001	<0.005	20.2	<0.002	<0.05	10.0	<0.03	<0.04	12.3	0.122	<0.005	<0.01
<0.01	<0.005	0.223	0.003	<0.005	19.2	0.023	<0.05	9.7	<0.03	<0.04	11.8	0.113	<0.005	<0.01
<0.01	<0.005	0.084	<0.001	0.007	20.1	0.007	<0.05	10.1	<0.03	<0.04	12.2	0.121	<0.005	0.02
<0.01	<0.005	0.010	0.002	0.007	21.0	<0.002	<0.05	9.7	<0.03	<0.04	12.5	0.128	<0.005	<0.01
<0.01	<0.005	0.017	0.003	0.005	21.3	<0.002	<0.05	11.4	<0.03	<0.04	12.2	0.122	<0.005	<0.01
<0.01	<0.005	0.013	0.002	<0.005	21.6	<0.002	<0.05	11.2	<0.03	<0.04	11.9	0.121	<0.005	<0.01
<0.01	<0.005	0.039	0.002	<0.005	22.0	0.003	<0.05	11.4	<0.03	<0.04	12.8	0.136	<0.005	<0.01
<0.01	<0.005	0.037	0.002	0.010	20.5	0.004	<0.05	9.3	<0.03	<0.04	11.7	0.120	<0.005	<0.01
<0.01	<0.005	0.015	0.004	0.007	21.9	<0.002	<0.05	10.3	<0.03	<0.04	13.1	0.143	<0.005	<0.01
<0.01	<0.005	0.026	0.003	<0.005	20.0	<0.002	<0.05	10.0	<0.03	<0.04	10.5	0.106	<0.005	<0.01
<0.01	<0.005	0.016	0.004	0.007	20.3	<0.002	<0.05	8.8	<0.03	<0.04	12.3	0.119	<0.005	0.01
<0.01	<0.005	0.021	0.001	<0.005	21.6	<0.002	<0.05	10.9	<0.03	<0.04	10.9	0.115	<0.005	0.01
<0.01	<0.005	0.025	0.002	<0.005	20.4	<0.002	<0.05	10.1	<0.03	<0.04	11.9	0.118	<0.005	<0.01
<0.01	<0.005	0.029	0.003	<0.005	19.6	0.002	<0.05	8.4	<0.03	<0.04	12.1	0.115	<0.005	<0.01

Table 4.11.--*Concentration of major and trace elements*
Mississippi River between Cairo, Ill. and

Location			Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank										
												April 2, 1992
413.0	3,088	0.5	0035	3,400	445	9	0.017	0.042	<0.001	47.8	<0.01	<0.01
425.0	3,113	0.5	0156	3,200	445	9	0.017	0.047	<0.001	51.3	<0.01	<0.01
441.2	3,147	0.6	0423	2,800	448	7	0.018	0.046	<0.001	51.5	<0.01	<0.01
453.0	3,169	0.5	0539	2,900	446	7	0.019	0.044	<0.001	48.4	<0.01	<0.01
462.8	3,188	0.7	0650	2,900	448	7	0.014	0.041	<0.001	46.4	<0.01	<0.01
481.6	3,224	[2]X	0908	2,500	472	7	0.018	0.045	<0.001	51.2	<0.01	<0.01
490.7	3,242	0.2	1031	2,600	438	7	0.021	0.041	<0.001	50.9	<0.01	<0.01
506.4	3,272	0.5	1228	2,600	434	7	0.018	0.040	<0.001	49.4	<0.01	<0.01
520.0	3,298	0.5	1403	2,700	433	7	0.019	0.039	<0.001	48.1	<0.01	<0.01
533.0	3,323	0.5	1530	2,700	434	7	0.017	0.041	<0.001	49.9	<0.01	<0.01
549.0	3,353	0.5	1716	2,700	456	7	0.016	0.042	<0.001	51.2	<0.01	<0.01
561.3	3,377	0.5	1838	2,700	435	8	--	--	--	--	--	--
572.9	3,398	0.5	1951	2,700	433	7	0.020	0.043	<0.001	55.4	<0.01	<0.01
581.5	3,415	0.5	2046	2,700	433	7	0.018	0.043	<0.001	52.2	<0.01	<0.01
597.0	3,444	0.9	2237	2,700	441	7	0.019	0.043	<0.001	52.4	<0.01	<0.01
												April 3, 1992
610.0	3,472	0.5	0120	2,600	439	7	0.018	0.038	<0.001	47.5	<0.01	<0.01
621.0	3,494	0.4	0245	2,600	443	6	0.020	0.049	<0.001	53.6	<0.01	<0.01
631.9	3,514	0.5	0406	2,200	453	7	0.022	0.043	<0.001	53.5	<0.01	<0.01
644.9	3,538	0.5	0532	2,200	459	7	0.020	0.041	<0.001	52.1	<0.01	<0.01
653.0	3,553	0.5	0628	2,200	468	6	0.019	0.041	<0.001	50.7	<0.01	<0.01
669.9	3,583	0.5	0813	2,100	453	7	0.022	0.042	<0.001	53.3	<0.01	<0.01
684.3	3,609	0.5	0955	2,100	446	7	0.024	0.042	0.001	56.2	<0.01	<0.01
696.1	3,630	[2]X	1116	2,000	438	7	0.021	0.041	<0.001	50.5	<0.01	<0.01
709.5	3,655	0.5	1307	1,800	505	7	0.026	0.051	<0.001	66.5	<0.01	<0.01
723.6	3,681	[2]X	1449	1,700	509	7	0.026	0.045	<0.001	54.8	<0.01	<0.01
735.7	3,703	0.5	1614	1,800	502	8	0.024	0.046	<0.001	59.5	<0.01	<0.01
745.5	3,721	0.5	1726	1,700	548	8	0.027	0.050	<0.001	62.7	<0.01	<0.01
755.5	3,740	0.5	1859	1,600	525	7	0.027	0.043	<0.001	56.2	<0.01	<0.01
764.5	3,756	0.7	2005	1,300	578	6	0.034	0.054	<0.001	69.4	<0.01	<0.01
776.4	3,777	0.5	2107	1,200	548	7	0.028	0.050	<0.001	65.7	<0.01	<0.01
793.1	3,806	0.5	2210	1,000	554	8	0.031	0.053	0.001	68.8	<0.01	<0.01

Concentration														
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (µg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
<0.01	<0.005	0.193	0.002	<0.005	19.3	0.020	<0.05	9.1	<0.03	<0.04	10.8	0.102	<0.005	<0.01
<0.01	<0.005	0.482	0.002	0.009	19.4	0.050	<0.05	9.1	<0.03	<0.04	12.4	0.110	<0.005	<0.01
<0.01	<0.005	0.278	0.001	0.015	18.8	0.024	<0.05	8.9	<0.03	<0.04	12.7	0.114	<0.005	<0.01
<0.01	<0.005	0.142	<0.001	0.006	18.8	0.012	<0.05	7.3	<0.03	<0.04	12.6	0.106	<0.005	<0.01
<0.01	<0.005	0.054	0.001	0.007	16.9	0.004	<0.05	7.9	<0.03	0.05	11.1	0.103	<0.005	0.01
<0.01	<0.005	0.048	0.002	0.011	19.0	0.004	<0.05	8.9	<0.03	<0.04	12.2	0.114	<0.005	0.02
<0.01	<0.005	0.043	0.002	<0.005	19.0	0.002	<0.05	9.3	<0.03	<0.04	12.0	0.114	0.005	<0.01
<0.01	<0.005	0.008	0.001	<0.005	19.2	<0.002	<0.05	8.5	<0.03	0.04	12.3	0.111	<0.005	<0.01
<0.01	<0.005	0.041	0.002	<0.005	18.5	0.002	<0.05	8.4	<0.03	<0.04	11.9	0.109	<0.005	<0.01
<0.01	<0.005	0.052	0.002	0.013	18.6	0.009	<0.05	8.3	<0.03	<0.04	12.2	0.112	<0.005	0.01
<0.01	<0.005	0.035	0.005	0.013	18.8	0.002	<0.05	9.4	<0.03	<0.04	12.5	0.117	<0.005	<0.01
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<0.01	<0.005	0.030	0.003	0.015	20.8	0.004	<0.05	10.6	<0.03	0.07	13.7	0.127	<0.005	<0.01
<0.01	<0.005	0.044	0.002	0.017	19.0	0.003	<0.05	9.2	<0.03	<0.04	12.6	0.121	<0.005	<0.01
<0.01	<0.005	0.034	0.002	0.010	19.8	0.004	<0.05	9.4	<0.03	<0.04	12.8	0.123	<0.005	<0.01
<0.01	<0.005	0.077	0.002	<0.005	18.4	0.007	<0.05	8.2	<0.03	0.06	12.0	0.112	<0.005	<0.01
<0.01	<0.005	0.078	0.002	0.007	19.9	0.006	<0.05	10.2	<0.03	<0.04	13.2	0.126	<0.005	<0.01
<0.01	<0.005	0.038	0.002	0.013	20.3	0.006	<0.05	9.0	<0.03	<0.04	12.8	0.129	<0.005	<0.01
<0.01	<0.005	0.039	0.002	0.013	20.1	0.007	<0.05	9.0	<0.03	0.06	13.2	0.128	<0.005	<0.01
<0.01	<0.005	0.038	0.003	0.013	19.5	0.007	<0.05	7.7	<0.03	<0.04	13.2	0.125	<0.005	<0.01
<0.01	<0.005	0.098	0.002	0.013	20.5	0.013	<0.05	9.3	<0.03	<0.04	13.8	0.134	<0.005	<0.01
<0.01	<0.005	0.046	0.004	0.013	20.8	0.011	<0.05	10.6	<0.03	<0.04	14.0	0.143	<0.005	<0.01
<0.01	<0.005	0.184	<0.001	0.014	19.0	0.017	<0.05	8.7	<0.03	<0.04	13.6	0.127	<0.005	0.01
<0.01	<0.005	0.080	0.003	0.015	24.6	0.011	<0.05	12.3	<0.03	<0.04	15.6	0.169	<0.005	<0.01
<0.01	<0.005	0.054	0.001	0.015	21.2	0.008	<0.05	8.3	<0.03	<0.04	13.4	0.139	<0.005	<0.01
<0.01	<0.005	0.064	0.001	0.013	22.4	0.009	<0.05	10.5	<0.03	<0.04	14.1	0.153	<0.005	0.01
<0.01	<0.005	0.078	0.003	0.013	23.9	0.012	<0.05	10.9	<0.03	<0.04	14.2	0.164	<0.005	<0.01
<0.01	<0.005	0.061	0.003	0.013	21.7	0.006	<0.05	10.1	<0.03	0.04	14.2	0.152	<0.005	<0.01
<0.01	<0.005	0.098	<0.001	0.015	26.2	0.013	<0.05	12.5	<0.03	<0.04	15.5	0.188	<0.005	<0.01
<0.01	<0.005	0.045	0.001	0.017	24.6	0.011	<0.05	11.6	<0.03	<0.04	13.4	0.172	<0.005	<0.01
<0.01	<0.005	0.124	0.002	0.013	26.8	0.022	<0.05	12.1	<0.03	<0.04	13.6	0.179	<0.005	<0.01

Table 4.11.--*Concentration of major and trace elements Mississippi River between Cairo, Ill. and*

Location: River miles upriver from mouth of Ohio River	Location: Distance upriver from first sample[1] (km)	Location: Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
												April 4, 1992
805.5	3,829	0.5	0015	1,000	559	8	0.028	0.045	<0.001	61.2	<0.01	<0.01
813.0	3,843	0.5	0117	690	699	7	0.044	0.065	<0.001	91.6	<0.01	<0.01
826.1	3,868	0.8	0304	650	694	8	0.039	0.055	<0.001	76.6	<0.01	<0.01
835.1	3,887	[2]X	0548	630	711	8	0.048	0.054	<0.001	75.9	<0.01	<0.01
845.6	3,907	0.5	0733	310	437	8	0.023	0.049	<0.001	55.7	<0.01	<0.01

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 90.0 upriver from Head of Passes, La., on March 25, 1992, at 0705 hours.

[2]X indicates two to three samples were collected across the river at this location. These individual values appear in table 4.18; the values of specific conductance, temperature, and chemical concentrations in this table are the mean values. Values below the detection limit were NOT included in the mean.

[3]Water discharges are linearly interpolated values between dishcharges listed in table 1.5 in chapter 1.

at approximately midchannel of the Upper Minneapolis, Minn., March-April 1992 cruise--Continued

Concentration														
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (μg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
<0.01	<0.005	0.104	0.001	0.017	23.1	0.020	<0.05	11.2	<0.03	<0.04	12.6	0.166	<0.005	<0.01
<0.01	<0.005	0.042	0.001	0.025	36.0	0.022	<0.05	18.7	<0.03	<0.04	15.1	0.260	<0.005	<0.01
<0.01	<0.005	0.049	0.001	0.020	29.6	0.016	<0.05	15.4	<0.03	<0.04	12.4	0.221	<0.005	<0.01
<0.01	<0.005	0.053	0.002	0.017	30.0	0.018	<0.05	18.7	<0.03	<0.04	12.6	0.215	<0.005	0.03
<0.01	<0.005	0.066	0.003	<0.005	19.8	0.028	<0.05	9.1	<0.03	<0.04	9.1	0.117	<0.005	<0.01

Table 4.12.--*Cross-channel variability of major and trace elements between Cairo, Ill., and Grafton,*

[km, kilometers; CDT, Central Daylight Time; µS/cm, microsiemens per

Location										
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (µS/cm)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
										June 5, 1990
50.0	119	0.1	0052	417	0.043	0.094	<0.001	46.3	<0.01	<0.01
		0.5	0048	419	0.044	0.094	<0.001	46.4	<0.01	<0.01
		0.9	0057	420	0.046	0.096	<0.001	46.3	<0.01	<0.01
100.8	242	0.1	0730	437	0.047	0.087	<0.001	46.9	<0.01	<0.01
		0.5	~0734	440	0.041	0.086	<0.001	47.1	<0.01	<0.01
		0.9	0738	420	0.040	0.096	<0.001	47.0	<0.01	<0.01
119.5	289	0.1	1018	466	0.039	0.083	<0.001	47.5	<0.01	<0.01
		0.9	1022	425	0.040	0.094	<0.001	44.0	<0.01	<0.01
130.7	316	0.1	1150	468	0.038	0.083	<0.001	48.0	<0.01	<0.01
		0.4	1153	431	0.033	0.088	<0.001	42.2	<0.01	<0.01
140.0	339	0.1	1309	486	0.036	0.093	<0.001	41.6	<0.01	<0.01
		0.9	1305	423	0.037	0.075	<0.001	46.8	<0.01	<0.01
150.0	363	0.1	1425	498	0.034	0.093	<0.001	40.6	<0.01	<0.01
		0.9	1422	418	0.050	0.083	0.001	56.7	<0.01	<0.01
160.0	390	0.1	1610	505	0.059	0.085	<0.001	54.3	<0.01	<0.01
		0.9	1613	406	0.049	0.110	0.002	43.7	<0.01	<0.01
170.0	415	0.1	1742	521	0.054	0.107	<0.001	44.5	<0.01	<0.01
		0.9	1738	426	0.054	0.082	0.001	54.8	<0.01	<0.01
179.3	438	0.1	1858	518	0.059	0.079	<0.001	56.7	<0.01	<0.01
		0.9	1900	428	0.054	0.116	<0.001	47.7	<0.01	<0.01
										June 6, 1990
196.0	476	0.1	2055	596	0.041	0.089	<0.001	50.6	<0.01	<0.01
		0.9	2050	406	0.067	0.069	<0.001	65.3	<0.01	<0.01

in the Upper Mississippi River
Ill., May-June 1990 cruise

centimeter at 25 degrees Celsius; and mg/L, milligrams per liter]

Concentration													
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
<0.01	<0.005	<0.005	<0.005	14.5	<0.002	<0.05	13.3	<0.03	<0.04	7.9	0.152	<0.005	<0.01
<0.01	<0.005	<0.005	<0.005	14.7	<0.002	<0.05	13.6	<0.03	<0.04	8.1	0.152	<0.005	<0.01
<0.01	<0.005	<0.005	<0.005	14.4	<0.002	<0.05	13.2	0.03	<0.04	8.0	0.154	<0.005	<0.01
<0.01	<0.005	<0.005	<0.005	15.6	<0.002	<0.05	13.4	<0.03	<0.04	7.3	0.142	<0.005	<0.01
<0.01	<0.005	<0.005	<0.005	15.5	<0.002	<0.05	13.4	<0.03	<0.04	7.8	0.144	<0.005	<0.01
<0.01	<0.005	<0.005	0.021	15.8	<0.002	<0.05	14.3	<0.03	<0.04	8.5	0.169	<0.005	0.02
<0.01	<0.005	<0.005	<0.005	15.7	<0.002	<0.05	12.8	<0.03	<0.04	7.4	0.138	<0.005	<0.01
<0.01	<0.005	<0.005	<0.005	13.3	<0.002	<0.05	13.7	0.04	<0.04	7.4	0.160	<0.005	<0.01
<0.01	<0.005	<0.005	<0.005	15.7	<0.002	<0.05	13.2	0.03	<0.04	7.6	0.142	<0.005	<0.01
<0.01	<0.005	<0.005	<0.005	12.7	<0.002	<0.05	13.4	<0.03	<0.04	7.3	0.154	<0.005	<0.01
<0.01	<0.005	<0.005	0.006	12.2	<0.002	<0.05	13.7	<0.03	<0.04	7.3	0.160	<0.005	<0.01
<0.01	<0.005	<0.005	0.005	15.8	<0.002	<0.05	12.3	0.03	<0.04	7.1	0.126	<0.005	<0.01
<0.01	<0.005	<0.005	0.012	11.7	<0.002	<0.05	14.1	0.03	<0.04	7.5	0.163	<0.005	<0.01
<0.01	<0.005	<0.005	0.019	21.2	<0.002	<0.05	14.9	<0.03	<0.04	9.2	0.148	<0.005	<0.01
<0.01	0.014	0.318	<0.005	20.1	0.003	0.07	14.2	0.05	<0.04	8.1	0.141	0.006	<0.01
<0.01	<0.005	<0.005	<0.005	13.7	<0.002	0.05	15.6	0.04	<0.04	7.9	0.182	0.005	<0.01
<0.01	0.005	<0.005	0.006	12.7	<0.002	0.05	18.4	0.04	<0.04	7.8	0.207	0.006	<0.01
<0.01	<0.005	<0.005	<0.005	20.7	<0.002	<0.05	14.6	0.05	0.05	7.8	0.137	<0.005	<0.01
<0.01	0.006	<0.005	<0.005	21.4	<0.002	<0.05	14.7	0.06	<0.04	7.8	0.140	<0.005	<0.01
<0.01	<0.005	<0.005	<0.005	13.1	<0.002	<0.05	21.0	0.04	<0.04	8.9	0.231	<0.005	<0.01
<0.01	0.006	<0.005	<0.005	17.2	<0.002	<0.05	9.8	0.06	0.07	9.0	0.117	0.006	<0.01
<0.01	<0.005	<0.005	0.019	26.7	<0.002	<0.05	18.2	<0.03	<0.04	8.8	0.157	<0.005	0.01

Table 4.12.--*Cross-channel variability of major and trace elements between Cairo, Ill., and Grafton,*

Location											
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (μS/cm)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
										June 6, 1990
196.0	520	0.1	0810	604	0.034	0.077	<0.001	44.4	<0.01	<0.01
		0.9	0812	405	0.063	0.070	<0.001	61.6	<0.01	<0.01
206.0	543	0.1	0955	625	0.067	0.069	<0.001	63.8	<0.01	<0.01
		0.4	1000	394	0.030	0.077	<0.001	44.8	<0.01	<0.01
216.0	564	0.1	1110	705	0.078	0.067	<0.001	70.9	<0.01	<0.01
		0.4	1114	393	0.029	0.075	<0.001	43.1	<0.01	<0.01

[1]Since there was a 6-day break between the last Lower Mississippi River sample and the first Upper Mississippi River sample, the first sample was collected at Mile 0.0 upriver from mouth of Ohio River on June 4, 1990, at 1840 hours.

in the Upper Mississippi River
Ill., May-June 1990 cruise--Continued

Concentration													
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
<0.01	<0.005	<0.005	<0.005	14.8	<0.002	<0.05	8.7	0.04	<0.04	8.2	0.103	<0.005	<0.01
<0.01	<0.005	<0.005	<0.005	24.5	<0.002	<0.05	17.5	0.04	<0.04	7.7	0.150	<0.005	<0.01
<0.01	<0.005	<0.005	<0.005	25.6	<0.002	<0.05	18.2	0.04	<0.04	7.6	0.156	<0.005	<0.01
<0.01	<0.005	<0.005	<0.005	14.7	<0.002	<0.05	8.5	0.03	<0.04	8.0	0.103	<0.005	0.01
<0.01	<0.005	<0.005	<0.005	29.4	<0.002	<0.05	21.7	0.04	<0.04	7.3	0.177	<0.005	<0.01
<0.01	<0.005	<0.005	<0.005	14.0	<0.002	<0.05	8.1	<0.03	<0.04	8.2	0.099	<0.005	<0.01

Table 4.13.--*Cross-channel variability of major and trace elements between Baton Rouge, La., and Cairo,*

[km, kilometers; CDT, Central Daylight Time; µS/cm, microsiemens per

Location											
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (µS/cm)	Temperature (° C)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
											June 23, 1991
230.0	0	0.2	1030	393	--	0.036	0.073	<0.001	43.3	<0.01	<0.01
		0.5	1040	--	--	--	--	--	--	--	--
		0.8	1045	--	--	--	--	--	--	--	--
											June 24, 1991
360.0	279	0.2	1326	396	24	--	--	--	--	--	--
		0.5	1320	395	26	0.043	0.093	<0.001	43.9	<0.01	<0.01
		0.9	1315	399	25	--	--	--	--	--	--
											June 25, 1991
475.0	532	0.2	0355	396	25	--	--	--	--	--	--
		0.5	0400	402	25	0.042	0.119	<0.001	45.8	<0.01	<0.01
		0.9	0407	399	25	--	--	--	--	--	--
580.8	766	0.2	1712	391	26	--	--	--	--	--	--
		0.5	1718	388	27	0.044	0.113	<0.001	46.7	<0.01	<0.01
		1	1724	536	27	--	--	--	--	--	--
											June 26, 1991
712.9	1,072	0.1	1035	424	24	--	--	--	--	--	--
		0.5	1029	434	24	0.070	0.188	<0.001	47.8	<0.01	<0.01
		0.9	1023	428	25	--	--	--	--	--	--
											June 27, 1991
839.0	1,360	0.1	0410	414	26	--	--	--	--	--	--
		0.5	0403	413	25	0.055	0.177	<0.001	47.2	<0.01	<0.01
		0.9	0355	411	25	--	--	--	--	--	--
898.9	1,489	0.1	1118	396	25	--	--	--	--	--	--
		0.5	1124	408	26	0.053	0.187	<0.001	46.9	<0.01	<0.01
		0.9	1130	416	26	--	--	--	--	--	--
937.6	1,572	0.1	1559	362	26	--	--	--	--	--	--
		0.5	1553	368	26	0.046	0.168	<0.001	40.4	<0.01	<0.01
		0.9	1543	402	25	--	--	--	--	--	--

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 230.0 upriver from Head of Passes, La., on June 23, 1991, at 2240 hours.

in the Lower Mississippi River
Ill., June-July 1991 cruise

centimeter at 25 degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; and dashes indicate no measurement]

Concentration														
Cr (mg/L)	**Cu (mg/L)**	**Fe (mg/L)**	**Hg (µg/L)**	**Li (mg/L)**	**Mg (mg/L)**	**Mn (mg/L)**	**Mo (mg/L)**	**Na (mg/L)**	**Ni (mg/L)**	**Pb (mg/L)**	**SiO_2 (mg/L)**	**Sr (mg/L)**	**V (mg/L)**	**Zn (mg/L)**
<0.01	<0.005	<0.005	<0.001	<0.005	14.1	<0.002	<0.05	14.4	<0.03	<0.04	8.6	0.164	<0.005	<0.01
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<0.01	<0.005	<0.005	<0.001	0.012	14.4	<0.002	<0.05	14.8	<0.03	<0.04	8.6	0.166	<0.005	<0.01
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<0.01	<0.005	<0.005	0.004	<0.005	14.8	<0.002	<0.05	14.6	<0.03	<0.04	9.2	0.168	<0.005	0.02
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<0.01	<0.005	<0.005	0.039	0.006	14.9	<0.002	<0.05	13.4	<0.03	<0.04	9.5	0.163	<0.005	0.02
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<0.01	<0.005	0.009	0.061	<0.005	15.5	<0.002	<0.05	16.8	<0.03	0.04	9.7	0.188	<0.005	0.05
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<0.01	<0.005	<0.005	0.088	<0.005	15.4	<0.002	<0.05	13.6	<0.03	<0.04	8.6	0.181	<0.005	<0.01
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<0.01	<0.005	<0.005	0.056	<0.005	15.3	<0.002	<0.05	13.7	<0.03	<0.04	8.4	0.177	<0.005	0.01
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<0.01	<0.005	<0.005	0.062	<0.005	13.2	<0.002	<0.05	10.7	<0.03	0.05	7.3	0.147	0.007	0.03
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Table 4.14.--*Cross-channel variability of major and trace elements between Cairo, Ill., and Minneapolis,*

[km, kilometers; CDT, Central Daylight Time; µS/cm, microsiemens per

Location												
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conduc-tance (µS/cm)	Temper ature (°C)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
										June 28, 1991	
100.7	1,846	0.4	0818	457	25	0.052	0.179	<0.001	52.6	<0.01	<0.01
		0.9	0811	460	24	0.055	0.196	<0.001	51.8	<0.01	<0.01
150.0	1,961	0.1	1439	470	26	0.089	0.219	<0.001	54.8	<0.01	<0.01
		0.9	1434	498	25	0.056	0.170	<0.001	54.6	<0.01	<0.01

[1]Distances are computed using velocities listed in table 4 in chapter 1, and the first sample was collected at Mile 230.0 upriver from Head of Passes, La., on June 23, 1991, at 2240 hours.

in the Upper Mississippi River
Minn., June-July 1991 cruise

centimeter at 25 degrees Celsius; mg/L, milligrams per liter; and µg/L, micrograms per liter; and --, indicates no measurement]

Concentration														
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (µg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
<0.01	<0.005	<0.005	0.054	<0.005	18.5	<0.002	<0.05	13.6	<0.03	<0.04	11.8	0.162	<0.005	0.02
<0.01	<0.005	<0.005	0.019	0.017	17.4	<0.002	<0.05	15.8	<0.03	<0.04	11.8	0.186	0.008	<0.01
<0.01	<0.005	<0.005	--	0.016	17.2	<0.002	<0.05	23.4	<0.03	<0.04	12.6	0.240	<0.005	0.04
<0.01	<0.005	<0.005	0.076	<0.005	20.4	<0.002	<0.05	11.9	<0.03	<0.04	11.8	0.135	<0.005	0.02

Table 4.15.--*Cross-channel variability of major and trace elements between New Orleans, La., and Cairo, Ill.,*

[km, kilometers; CDT, Central Daylight Time; µS/cm, microsiemens per

Location											
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (µS/cm)	Temperature (° C)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
										September 25, 1991	
88.5	0	0.9	0655	465	27	0.053	0.069	<0.001	38.2	<0.01	<0.01
		0.5	0647	463	25	0.058	0.069	<0.001	38.7	<0.01	<0.01
		0.1	0640	443	27	--	--	--	--	--	--
184.8	172	0.1	1628	453	25	0.063	0.070	<0.001	41.0	<0.01	<0.01
		0.5	1635	451	26	0.056	0.067	<0.001	39.7	<0.01	<0.01
		0.9	1642	450	26	0.066	0.079	<0.001	46.4	<0.01	<0.01
230.0	254	0.1	2114	439	25	0.060	0.067	<0.001	39.1	<0.01	<0.01
		0.5	2122	426	25	0.059	0.073	<0.001	42.5	<0.01	<0.01
		0.9	2130	429	25	0.063	0.066	<0.001	38.4	<0.01	<0.01
										September 26, 1991	
360.0	503	0.1	1550	420	22	0.061	0.066	<0.001	38.2	<0.01	<0.01
		0.5	1555	420	23	0.060	0.062	<0.001	36.3	<0.01	<0.01
		0.9	1600	422	24	0.053	0.056	<0.001	33.9	<0.01	<0.01
										September 27, 1991	
460.8	706	0.1	0428	440	20	0.061	0.064	<0.001	39.8	<0.01	<0.01
		0.5	0433	437	21	0.068	0.068	<0.001	41.9	<0.01	<0.01
		0.9	0437	438	21	0.067	0.065	<0.001	40.1	<0.01	<0.01
580.8	948	0.1	1950	444	20	0.069	0.074	<0.001	44.7	<0.01	<0.01
		0.5	1957	441	21	0.071	0.074	<0.001	44.8	<0.01	<0.01
		0.9	2005	481	20	0.071	0.085	<0.001	45.4	<0.01	<0.01
										September 28, 1991	
712.9	1,215	0.3	1322	444	19	0.065	0.071	<0.001	41.9	<0.01	<0.01
		0.5	1327	404	20	0.066	0.068	<0.001	41.3	<0.01	<0.01
		0.8	1331	405	20	0.069	0.075	<0.001	45.2	<0.01	<0.01
										September 29, 1991	
846.5	1,489	0.1	0746	449	19	0.067	0.070	<0.001	43.5	<0.01	<0.01
		0.5	0752	396	20	0.065	0.068	<0.001	42.5	<0.01	<0.01
		0.9	0758	396	20	0.064	0.068	<0.001	42.5	<0.01	<0.01

in the Lower Mississippi River
Ill., September-October 1991 cruise

centimeter at 25 degrees Celsius; mg/L, milligrams per liter; dashes indicate no measurement; and µg/L, micrograms per liter]

Concentration														
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (µg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
<0.01	<0.005	0.132	0.002	0.012	14.1	0.018	<0.05	28.6	<0.03	<0.04	3.9	0.182	<0.005	0.03
<0.01	<0.005	<0.005	0.010	0.014	14.7	<0.002	<0.05	31.4	<0.03	<0.04	3.3	0.187	<0.005	0.01
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<0.01	<0.005	<0.005	0.032	0.014	14.8	<0.002	<0.05	27.1	<0.03	<0.04	2.6	0.194	<0.005	0.02
<0.01	<0.005	0.020	0.012	0.015	15.0	0.004	<0.05	23.1	<0.03	<0.04	2.5	0.188	<0.005	<0.01
<0.01	<0.005	<0.005	0.023	0.015	16.8	<0.002	<0.05	30.1	<0.03	<0.04	2.6	0.220	<0.005	0.01
<0.01	<0.005	<0.005	0.007	0.014	14.2	0.019	<0.05	26.0	<0.03	<0.04	2.2	0.190	<0.005	<0.01
<0.01	<0.005	0.050	0.003	0.015	15.7	0.006	<0.05	26.0	<0.03	<0.04	2.5	0.208	<0.005	<0.01
<0.01	<0.005	<0.005	0.011	0.014	14.0	0.002	<0.05	22.4	<0.03	<0.04	2.1	0.188	<0.005	<0.01
0.01	<0.005	0.019	0.013	0.014	14.1	0.002	<0.05	23.9	<0.03	<0.04	3.1	0.190	<0.005	0.02
<0.01	<0.005	0.007	0.013	0.014	13.8	<0.002	<0.05	19.2	<0.03	<0.04	2.8	0.180	<0.005	<0.01
0.01	<0.005	<0.005	0.011	0.014	13.3	0.008	<0.05	16.1	<0.03	<0.04	2.4	0.168	<0.005	<0.01
<0.01	<0.005	<0.005	0.013	0.015	15.5	<0.002	<0.05	22.4	<0.03	<0.04	3.9	0.195	0.007	<0.01
<0.01	<0.005	<0.005	0.002	0.014	15.6	<0.002	<0.05	25.0	<0.03	<0.04	3.9	0.206	<0.005	<0.01
<0.01	<0.005	<0.005	0.007	0.014	15.4	0.003	<0.05	24.4	<0.03	<0.04	3.7	0.196	<0.005	0.02
0.01	<0.005	<0.005	0.006	0.014	18.4	0.006	<0.05	24.4	<0.03	<0.04	6.6	0.215	<0.005	<0.01
0.01	<0.005	0.015	0.011	0.016	18.0	0.003	<0.05	25.0	<0.03	0.06	6.6	0.216	<0.005	<0.01
0.01	<0.005	0.416	0.006	0.016	17.1	0.070	<0.05	37.5	<0.03	<0.04	7.1	0.249	<0.005	0.01
<0.01	<0.005	0.017	0.009	0.016	16.6	0.002	<0.05	25.3	<0.03	<0.04	4.6	0.201	<0.005	<0.01
0.01	<0.005	0.013	0.011	0.017	16.1	<0.002	<0.05	25.2	<0.03	0.06	4.4	0.198	<0.005	<0.01
<0.01	<0.005	<0.005	0.010	0.017	17.7	<0.002	<0.05	27.4	<0.03	0.07	4.9	0.216	<0.005	<0.01
<0.01	<0.005	0.014	0.013	0.017	17.0	<0.002	<0.05	26.5	<0.03	0.05	3.0	0.206	0.006	<0.01
<0.01	<0.005	0.024	0.012	0.017	16.6	0.003	<0.05	25.9	<0.03	<0.04	3.1	0.202	0.007	0.01
<0.01	<0.005	0.005	0.010	0.017	16.6	<0.002	<0.05	24.9	<0.03	<0.04	3.0	0.202	0.007	<0.01

Table 4.15.--*Cross-channel variability of major and trace elements between New Orleans, La., and Cairo, Ill.,*

Location												
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (μS/cm)	Temperature (° C)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
									September 29, 1991		
875.4	1,549	0.1	1115	444	20	0.069	0.070	<0.001	44.6	<0.01	<0.01
		0.5	1121	447	20	0.065	0.068	<0.001	43.2	<0.01	<0.01
		0.9	1128	449	20	0.064	0.069	<0.001	43.7	<0.01	<0.01
898.9	1,596	0.1	1413	440	20	0.065	0.068	<0.001	43.1	<0.01	<0.01
		0.5	1419	458	20	0.070	0.073	<0.001	46.1	<0.01	<0.01
		0.9	1425	461	21	0.069	0.071	<0.001	45.0	<0.01	<0.01
922.6	1,644	0.1	1710	444	20	0.067	0.071	<0.001	44.8	<0.01	<0.01
		0.5	1715	461	20	0.068	0.071	<0.001	44.8	<0.01	<0.01
		0.9	1719	478	20	0.070	0.076	<0.001	47.4	<0.01	<0.01
950.5	1,699	0.1	2023	396	19	0.060	0.058	<0.001	39.1	<0.01	<0.01
		0.5	2029	510	19	0.066	0.081	<0.001	50.6	<0.01	<0.01
		0.8	2034	548	20	0.071	0.090	<0.001	54.9	<0.01	<0.01

[1]Distances are computed using velocities in table 1.4 in chapter 1, and the first sample was collected at Mile 88.5 upriver from Head of Passes, La., on September 25, 1991, at 0647 hours.

in the Lower Mississippi River
Ill., September-October 1991 cruise--Continued

Concentration														
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (µg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
<0.01	<0.005	0.007	0.015	0.017	17.7	0.003	<0.05	26.4	<0.03	<0.04	3.4	0.212	<0.005	<0.01
<0.01	<0.005	0.007	0.010	0.017	16.8	<0.002	<0.05	25.9	<0.03	<0.04	3.3	0.205	<0.005	0.02
<0.01	<0.005	<0.005	0.011	0.017	17.0	<0.002	<0.05	26.7	<0.03	<0.04	3.3	0.208	0.007	<0.01
<0.01	<0.005	0.006	0.008	0.017	16.8	0.004	<0.05	25.1	<0.03	<0.04	3.6	0.204	0.007	<0.01
0.03	<0.005	0.007	0.010	0.016	18.8	<0.002	<0.05	25.6	<0.03	<0.04	4.0	0.219	<0.005	0.02
0.02	<0.005	<0.005	0.011	0.016	18.2	<0.002	<0.05	26.9	<0.03	<0.04	3.6	0.216	<0.005	<0.01
<0.01	<0.005	0.019	0.010	0.017	17.9	0.012	<0.05	24.7	<0.03	0.07	4.0	0.211	<0.005	<0.01
<0.01	<0.005	0.022	0.009	0.017	17.8	0.004	<0.05	26.2	<0.03	<0.04	3.9	0.212	0.006	<0.01
<0.01	<0.005	0.012	0.036	0.017	18.9	0.004	<0.05	27.9	<0.03	<0.04	4.3	0.224	0.006	0.01
<0.01	<0.005	0.007	0.009	0.015	15.0	0.003	<0.05	23.5	<0.03	0.07	3.8	0.188	<0.005	<0.01
<0.01	<0.005	0.011	0.008	0.017	20.7	0.003	<0.05	28.4	<0.03	<0.04	5.2	0.233	0.006	<0.01
<0.01	<0.005	0.008	0.017	0.021	22.6	0.016	<0.05	31.0	<0.03	<0.04	5.7	0.252	0.007	<0.01

Table 4.16.--*Cross-channel variability of major and trace elements between Cairo, Ill., and Minneapolis,*

[km, kilometers; CDT, Central Daylight Time; µS/cm, microsiemens per

Location											
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (µS/cm)	Temperature (°C)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
									September 30, 1991		
80.8	1,882	0.1	0914	559	18	0.078	0.088	0.001	57.3	<0.01	<0.01
		0.5	0924	558	19	0.072	0.083	<0.001	53.7	<0.01	<0.01
		0.9	0935	564	19	0.083	0.092	<0.001	57.7	<0.01	<0.01
104.5	1,932	0.1	1217	549	18	0.075	0.089	<0.001	58.8	<0.01	<0.01
		0.6	1222	568	19	0.076	0.091	<0.001	57.5	<0.01	<0.01
		0.9	1226	578	18	0.077	0.088	<0.001	55.0	<0.01	<0.01
128.9	1,983	0.2	1510	556	18	0.068	0.081	<0.001	54.1	<0.01	<0.01
		0.5	1521	556	19	0.068	0.080	<0.001	53.5	<0.01	<0.01
		0.9	1532	572	18	0.077	0.087	<0.001	54.5	<0.01	<0.01
155.0	2,037	0.1	1830	527	18	0.060	0.075	<0.001	54.9	<0.01	<0.01
		0.5	1835	542	18	0.066	0.077	<0.001	54.1	<0.01	<0.01
		0.9	1840	627	19	0.091	0.094	<0.001	53.8	<0.01	<0.01
180.3	2,090	0.1	2131	523	18	0.062	0.078	<0.001	57.1	<0.01	<0.01
		0.5	2148	557	18	0.069	0.078	<0.001	51.4	<0.01	<0.01
		0.9	2139	651	19	0.103	0.102	<0.001	57.6	<0.01	<0.01
									October 1, 1991		
283.3	2,293	0.1	1400	463	17	0.038	0.059	<0.001	49.6	<0.01	<0.01
		0.5	1407	460	17	0.041	0.058	<0.001	47.8	<0.01	<0.01
		0.9	1412	461	17	0.033	0.059	<0.001	48.4	<0.01	<0.01

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 88.5 upriver from Head of Passes, La., on September 25, 1991, at 0647 hours.

in the Upper Mississippi River
Minn., September-October 1991 cruise

centimeter at 25 degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter]

Concentration														
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (µg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
<0.01	<0.005	<0.005	0.009	0.017	24.7	<0.002	<0.05	30.4	<0.03	<0.04	6.0	0.250	0.007	<0.01
0.01	<0.005	0.006	0.008	0.018	22.5	<0.002	<0.05	30.2	<0.03	<0.04	5.5	0.246	<0.005	<0.01
<0.01	<0.005	0.012	0.007	0.025	23.7	<0.002	<0.05	34.5	<0.03	0.08	6.0	0.275	<0.005	<0.01
0.01	<0.005	0.007	0.010	0.019	24.4	<0.002	<0.05	30.1	<0.03	0.12	6.2	0.247	<0.005	<0.01
<0.01	<0.005	<0.005	0.012	0.025	23.5	<0.002	<0.05	35.7	<0.03	0.07	6.3	0.273	<0.005	<0.01
<0.01	<0.005	<0.005	0.010	0.021	22.4	<0.002	<0.05	34.7	<0.03	0.11	6.1	0.273	<0.005	<0.01
<0.01	<0.005	0.008	0.008	0.017	22.4	0.002	<0.05	28.0	<0.03	<0.04	6.2	0.227	<0.005	<0.01
0.01	<0.005	0.009	0.009	0.016	22.6	<0.002	<0.05	27.2	<0.03	0.07	6.2	0.226	<0.005	<0.01
<0.01	<0.005	0.009	0.007	0.025	22.2	0.002	<0.05	34.0	0.04	<0.04	6.4	0.270	0.011	0.01
<0.01	<0.005	0.010	0.007	0.017	23.2	0.005	<0.05	21.8	<0.03	<0.04	6.8	0.179	0.006	0.01
<0.01	<0.005	0.021	0.008	0.017	22.5	0.005	<0.05	27.4	<0.03	<0.04	6.9	0.219	0.008	<0.01
0.02	<0.005	0.010	0.005	0.034	21.5	<0.002	<0.05	42.8	<0.03	0.09	7.1	0.330	0.006	<0.01
<0.01	<0.005	0.015	0.011	0.017	25.1	0.040	<0.05	22.4	<0.03	0.06	8.2	0.193	<0.005	<0.01
<0.01	<0.005	0.010	0.022	0.021	21.7	0.005	<0.05	29.6	<0.03	<0.04	7.5	0.235	<0.005	<0.01
0.02	<0.005	0.013	0.011	0.034	23.3	0.002	<0.05	49.1	<0.03	<0.04	7.7	0.397	<0.005	<0.01
<0.01	<0.005	<0.005	0.018	0.005	22.4	<0.002	<0.05	12.3	<0.03	<0.04	11.3	0.123	<0.005	<0.01
<0.01	<0.005	0.010	0.004	0.009	21.4	<0.002	<0.05	11.9	<0.03	<0.04	10.9	0.120	<0.005	0.01
<0.01	<0.005	<0.005	0.020	0.014	20.4	0.003	<0.05	12.2	<0.03	<0.04	10.0	0.127	<0.005	<0.01

Table 4.17.--*Cross-channel variability of major and trace elements between New Orleans, La., and Cairo, Ill.,*

[km, kilometers; CDT, Central Daylight Time; µS/cm, microsiemens per

Location											
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (µS/cm)	Temperature (° C)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
										March 25, 1992	
90.0	0	0.1	0705	337	16	0.023	0.055	<0.001	34.3	<0.01	<0.01
		0.5	0655	267	17	0.026	0.048	<0.001	33.4	<0.01	<0.01
		0.9	0713	261	16	0.022	0.050	<0.001	32.6	<0.01	<0.01
228.0	309	0.1	2344	305	13	0.021	0.042	<0.001	30.5	<0.01	<0.01
		0.5	2336	306	13	0.020	0.046	<0.001	32.8	<0.01	<0.01
		0.9	2352	306	13	0.023	0.045	<0.001	32.5	<0.01	<0.01
										March 26, 1992	
360.0	628	0.1	2000	308	12	0.030	0.046	<0.001	34.4	<0.01	<0.01
		0.5	2022	309	12	0.026	0.042	<0.001	33.3	<0.01	<0.01
		0.9	2011	--	--	0.030	0.047	<0.001	36.1	<0.01	<0.01
										March 27, 1992	
435.3	819	0.1	0737	298	12	0.022	0.042	<0.001	31.3	<0.01	<0.01
		0.5	0729	323	12	--	--	--	--	--	--
		0.9	0722	326	12	0.030	0.044	<0.001	35.6	<0.01	<0.01
535.0	1,076	0.1	2117	340	11	0.029	0.050	<0.001	37.4	<0.01	<0.01
		0.5	2128	340	11	0.022	0.046	<0.001	35.7	<0.01	<0.01
		0.8	2139	341	11	0.021	0.047	<0.001	36.6	<0.01	<0.01
										March 28, 1992	
659.8	1,412	0.1	1653	358	11	0.034	0.048	<0.001	39.7	<0.01	<0.01
		0.5	1659	358	11	0.030	0.053	<0.001	40.0	<0.01	<0.01
		1.0	1705	365	11	0.028	0.045	<0.001	36.8	<0.01	<0.01
										March 29, 1992	
723.3	1,571	0.3	0143	354	12	0.031	0.047	<0.001	38.7	<0.01	<0.01
		0.5	--	354	15	0.032	0.048	<0.001	39.2	<0.01	<0.01
		0.7	--	357	14	--	--	--	--	--	--
848.0	1,884	0.1	2100	329	13	0.027	0.048	0.001	41.7	<0.01	<0.01
		0.5	2105	348	11	0.026	0.048	<0.001	41.9	<0.01	<0.01
		0.9	2110	347	12	0.025	0.053	<0.001	40.2	<0.01	<0.01

in the Lower Mississippi River
Ill., March-April 1992 cruise

centimeter at 25 degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; and dashes indicate no measurement]

Concentration														
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (µg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
<0.01	<0.005	0.394	0.002	<0.005	10.4	0.053	<0.05	13.9	<0.03	<0.04	6.35	0.133	<0.005	0.01
<0.01	<0.005	<0.005	0.003	<0.005	9.7	0.004	<0.05	14.1	<0.03	<0.04	5.72	0.128	<0.005	<0.01
<0.01	<0.005	0.213	0.006	<0.005	10.2	0.025	<0.05	16.1	<0.03	<0.04	6.01	0.128	<0.005	<0.01
<0.01	<0.005	0.020	0.002	<0.005	9.0	<0.002	<0.05	11.5	<0.03	<0.04	5.52	0.118	<0.005	<0.01
<0.01	<0.005	0.022	0.005	0.006	9.6	0.002	<0.05	12.0	<0.03	<0.04	5.95	0.126	<0.005	<0.01
<0.01	<0.005	0.013	0.002	<0.005	9.6	<0.002	<0.05	12.0	<0.03	<0.04	5.96	0.125	<0.005	<0.01
<0.01	<0.005	0.117	0.002	<0.005	10.0	0.011	<0.05	12.2	<0.03	<0.04	6.52	0.130	<0.005	<0.01
<0.01	<0.005	0.037	0.002	<0.005	9.6	0.003	<0.05	11.8	<0.03	<0.04	5.99	0.125	<0.005	<0.01
<0.01	<0.005	0.273	0.002	<0.005	10.5	0.005	<0.05	12.8	<0.03	<0.04	8.23	0.137	<0.005	<0.01
<0.01	<0.005	0.023	0.003	<0.005	9.2	<0.002	<0.05	10.8	<0.03	<0.04	5.91	0.117	<0.005	<0.01
--	--	--	0.002	--	--	--	--	--	--	--	--	--	--	--
<0.01	<0.005	0.019	0.002	<0.005	10.4	0.002	<0.05	12.2	<0.03	<0.04	6.20	0.130	<0.005	<0.01
<0.01	<0.005	0.121	0.003	0.008	11.1	0.013	<0.05	11.6	<0.03	<0.04	7.33	0.134	<0.005	0.01
<0.01	<0.005	0.012	0.005	<0.005	11.0	<0.002	<0.05	11.9	<0.03	<0.04	6.58	0.130	<0.005	<0.01
<0.01	<0.005	0.014	0.006	<0.005	11.2	0.002	<0.05	12.6	<0.03	<0.04	6.73	0.133	<0.005	<0.01
<0.01	<0.005	0.006	0.006	<0.005	11.5	<0.002	<0.05	12.1	<0.03	<0.04	7.53	0.149	<0.005	<0.01
<0.01	<0.005	0.283	0.003	<0.005	11.6	0.037	<0.05	12.4	<0.03	<0.04	8.60	0.148	<0.005	<0.01
<0.01	<0.005	0.017	0.004	0.006	10.6	0.004	<0.05	11.5	<0.03	<0.04	7.01	0.136	<0.005	<0.01
<0.01	<0.005	0.007	0.006	<0.005	10.8	<0.002	<0.05	11.7	<0.03	<0.04	7.20	0.147	<0.005	<0.01
<0.01	<0.005	<0.005	0.003	<0.005	11.0	0.002	<0.05	11.7	<0.03	<0.04	7.33	0.149	<0.005	<0.01
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<0.01	0.007	0.014	0.003	<0.005	12.1	<0.002	<0.05	13.4	<0.03	<0.04	7.59	0.155	<0.005	0.01
<0.01	<0.005	0.007	<0.001	<0.005	12.2	<0.002	<0.05	14.0	<0.03	<0.04	7.75	0.155	<0.005	<0.01
<0.01	<0.005	0.307	<0.001	<0.005	12.3	0.023	<0.05	11.4	<0.03	<0.04	8.70	0.147	<0.005	<0.01

Table 4.17.--*Cross-channel variability of major and trace elements between New Orleans, La., and Cairo, Ill.,*

Location												
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conduc-tance (μS/cm)	Temper ature (° C)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
											March 30, 1992
878.1	1,956	0.2	0056	331	11	0.020	0.039	<0.001	34.4	<0.01	<0.01
		0.5	0106	344	10	0.023	0.044	0.001	39.1	<0.01	<0.01
		0.9	0117	367	10	0.026	0.047	<0.001	37.5	<0.01	<0.01
898.9	2,006	0.1	0406	378	12	0.022	0.035	<0.001	32.3	<0.01	<0.01
		0.5	0359	380	11	0.030	0.064	<0.001	46.2	<0.01	<0.01
		0.9	0353	409	10	--	--	--	--	--	--
923.0	2,063	0.1	0722	273	11	0.019	0.032	<0.001	35.4	<0.01	<0.01
		0.5	0713	331	11	0.029	0.044	<0.001	40.6	<0.01	<0.01
		0.9	0705	442	10	0.031	0.070	<0.001	54.0	<0.01	<0.01
950.5	2,128	0.1	1040	288	11	0.019	0.029	<0.001	30.7	<0.01	<0.01
		0.5	1047	477	9	0.028	0.070	<0.001	53.2	<0.01	<0.01
		0.9	1055	485	9	0.029	0.074	<0.001	56.0	<0.01	<0.01

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 90.0 upriver from Head of Passes, La., on March 25, 1992, at 0705 hours.

in the Lower Mississippi River
Ill., March-April 1992 cruise--Continued

Concentration														
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (µg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
<0.01	<0.005	0.015	0.002	<0.005	10.2	<0.002	<0.05	9.4	<0.03	<0.04	6.8	0.127	<0.005	<0.01
<0.01	<0.005	0.009	0.003	<0.005	11.3	<0.002	<0.05	12.8	<0.03	<0.04	7.2	0.142	<0.005	<0.01
<0.01	<0.005	0.156	0.004	<0.005	11.8	0.010	<0.05	11.3	<0.03	<0.04	7.6	0.136	<0.005	<0.01
<0.01	<0.005	0.027	0.002	<0.005	8.9	<0.002	<0.05	9.3	<0.03	<0.04	6.4	0.125	<0.005	<0.01
<0.01	<0.005	0.704	0.001	<0.005	14.4	0.046	<0.05	15.1	<0.03	<0.04	10.5	0.163	<0.005	<0.01
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<0.01	<0.005	<0.005	0.002	<0.005	8.6	<0.002	<0.05	11.7	<0.03	0.05	6.4	0.140	<0.005	<0.01
<0.01	<0.005	0.010	0.003	0.005	11.5	<0.002	<0.05	13.6	<0.03	<0.04	7.4	0.152	<0.005	<0.01
<0.01	<0.005	0.114	0.001	<0.005	18.3	<0.002	<0.05	17.6	<0.03	<0.04	11.4	0.179	<0.005	<0.01
<0.01	<0.005	0.007	0.002	<0.005	7.9	<0.002	<0.05	9.0	<0.03	<0.04	5.7	0.126	<0.005	<0.01
<0.01	<0.005	0.010	0.003	0.005	18.8	<0.002	<0.05	16.2	<0.03	<0.04	10.4	0.168	<0.005	<0.01
<0.01	<0.005	<0.005	0.001	<0.005	19.5	<0.002	<0.05	16.6	<0.03	<0.04	10.9	0.177	<0.005	0.01

Table 4.18.--*Cross-channel variability of major and trace elements between Cairo, Ill., and Minneapolis,*

[km, kilometers; CDT, Central Daylight Time; µS/cm, microsiemens per

Location											
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (µS/cm)	Temperature (° C)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
											March 31, 1992
109.8	2,404	0.1	0335	519	10	0.043	0.067	<0.001	52.0	<0.01	<0.01
		0.5	0345	503	11	--	--	--	--	--	--
		0.9	0340	497	9	--	--	--	--	--	--
127.7	2,448	0.1	0636	521	11	0.031	0.064	<0.001	52.6	<0.01	<0.01
		0.5	0629	511	11	0.037	0.068	<0.001	55.6	<0.01	<0.01
		0.9	0622	506	10	0.034	0.077	<0.001	56.6	<0.01	<0.01
145.7	2,491	0.1	0855	529	10	0.034	0.060	<0.001	55.0	<0.01	<0.01
		0.5	0903	518	10	--	--	--	--	--	--
		0.9	0912	507	10	0.038	0.095	<0.001	59.2	<0.01	<0.01
169.7	2,548	0.1	1237	544	11	0.040	0.060	<0.001	62.1	<0.01	<0.01
		0.5	1229	518	10	0.030	0.062	<0.001	57.2	<0.01	<0.01
		0.9	1221	536	12	0.048	0.120	<0.001	58.1	<0.01	<0.01
180.3	2,574	0.1	1410	541	10	0.036	0.059	<0.001	61.2	<0.01	<0.01
		0.5	1405	487	10	0.029	0.059	<0.001	55.1	<0.01	<0.01
		0.9	1359	521	13	0.060	0.118	<0.001	65.5	<0.01	<0.01
											April 1, 1992
324.6	2,897	0.1	1147	458	8	0.017	0.045	<0.001	47.5	<0.01	<0.01
		0.5	1142	459	8	0.015	0.049	<0.001	52.0	<0.01	<0.01
		0.9	1138	535	9	0.022	0.066	<0.001	64.9	<0.01	<0.01
											April 2, 1992
481.6	3,224	0.1	0902	520	8	0.017	0.041	<0.001	47.3	<0.01	<0.01
		0.5	0908	443	7	0.017	0.046	<0.001	51.7	<0.01	<0.01
		0.9	0914	453	7	0.020	0.047	<0.001	54.6	<0.01	<0.01
											April 3, 1992
696.1	3,630	0.1	1122	389	7	0.016	0.037	<0.001	42.0	<0.01	<0.01
		0.5	1116	425	7	0.021	0.039	<0.001	49.6	<0.01	<0.01
		0.9	1110	499	7	0.025	0.046	<0.001	60.0	<0.01	<0.01

in the Upper Mississippi River
Minn., March-April 1992 cruise

centimeter at 25 degrees Celsius; and mg/L, milligrams per liter; --, no sample analyzed]

Concentration														
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (μg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
<0.01	<0.005	0.010	0.002	<0.005	19.8	0.013	<0.05	16.8	<0.03	<0.04	9.5	0.154	<0.005	<0.01
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<0.01	<0.005	0.010	0.003	<0.005	19.6	<0.002	<0.05	15.0	<0.03	<0.04	10.2	0.150	<0.005	<0.01
<0.01	<0.005	0.008	0.001	<0.005	20.7	<0.002	<0.05	18.0	<0.03	0.05	10.4	0.163	<0.005	<0.01
<0.01	<0.005	0.010	--	0.007	19.3	<0.002	<0.05	21.7	<0.03	<0.04	10.9	0.194	<0.005	<0.01
<0.01	<0.005	0.009	0.002	<0.005	21.2	<0.002	0.05	15.3	<0.03	<0.04	10.3	0.139	<0.005	<0.01
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<0.01	<0.005	0.006	0.003	0.015	19.7	<0.002	<0.05	24.7	<0.03	0.09	11.4	0.231	<0.005	<0.01
<0.01	<0.005	0.007	0.001	<0.005	23.6	0.003	<0.05	20.8	<0.03	<0.04	10.3	0.147	<0.005	<0.01
<0.01	<0.005	0.195	<0.001	<0.005	22.0	0.018	<0.05	15.3	<0.03	<0.04	11.2	0.138	<0.005	<0.01
<0.01	<0.005	1.240	0.003	0.013	18.5	0.116	<0.05	25.3	<0.03	<0.04	15.0	0.285	0.006	<0.01
<0.01	<0.005	0.050	0.002	<0.005	23.1	0.006	<0.05	19.8	<0.03	<0.04	10.2	0.145	<0.005	<0.01
<0.01	<0.005	0.044	0.002	<0.005	19.9	0.004	<0.05	14.6	<0.03	<0.04	10.7	0.140	<0.005	<0.01
<0.01	<0.005	0.038	0.002	0.024	20.1	0.004	0.07	33.8	<0.03	<0.04	13.4	0.345	<0.005	<0.01
<0.01	<0.005	0.083	0.003	0.007	19.4	0.007	<0.05	8.6	<0.03	<0.04	10.4	0.099	<0.005	<0.01
<0.01	<0.005	0.016	<0.001	0.006	20.4	<0.002	<0.05	9.1	<0.03	<0.04	11.4	0.108	<0.005	<0.01
<0.01	<0.005	0.012	0.002	0.017	21.7	0.002	<0.05	10.2	<0.03	<0.04	13.2	0.152	<0.005	<0.01
<0.01	<0.005	0.050	<0.001	<0.005	18.4	0.003	<0.05	7.2	<0.03	<0.04	12.2	0.104	<0.005	0.01
<0.01	<0.005	0.028	0.003	0.011	19.1	<0.002	<0.05	9.1	<0.03	<0.04	12.2	0.116	<0.005	<0.01
<0.01	<0.005	0.065	0.002	<0.005	19.6	0.004	<0.05	10.3	<0.03	<0.04	12.1	0.121	<0.005	0.02
<0.01	<0.005	0.354	<0.001	0.007	16.2	0.030	<0.05	7.5	<0.03	<0.04	13.0	0.104	<0.005	<0.01
<0.01	<0.005	0.161	<0.001	0.017	18.7	0.016	<0.05	8.1	<0.03	<0.04	13.3	0.125	<0.005	0.01
<0.01	<0.005	0.036	<0.001	0.017	22.0	0.006	<0.05	10.4	<0.03	<0.04	14.4	0.153	<0.005	0.01

Table 4.18.--*Cross-channel variability of major and trace elements between Cairo, Ill., and Minneapolis,*

Location											
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (µS/cm)	Temperature (° C)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
											April 3, 1992
723.6	3,681	0.5	1445	498	8	--	--	--	--	--	--
		0.9	1452	519	7	0.026	0.045	<0.001	54.8	<0.01	<0.01
											April 4, 1992
835.1	3,887	0.1	0540	743	8	0.071	0.053	<0.001	76.6	<0.01	<0.01
		0.5	0548	694	8	0.035	0.056	<0.001	75.6	<0.01	<0.01
		0.8	0556	696	7	0.037	0.054	<0.001	75.4	<0.01	<0.01

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 90.0 upriver from Head of Passes, La., on March 25, 1992, at 0705 hours.

in the Upper Mississippi River
Minn., March-April 1992 cruise--Continued

Concentration														
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (µg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
<0.01	<0.005	0.054	0.001	0.015	21.2	0.008	<0.05	8.3	<0.03	<0.04	13.4	0.139	<0.005	<0.01
<0.01	<0.005	0.054	0.002	0.017	29.4	0.024	<0.05	31.7	<0.03	<0.04	13.3	0.206	<0.005	0.03
<0.01	<0.005	0.032	0.001	0.018	31.0	0.014	<0.05	11.8	<0.03	<0.04	12.4	0.220	<0.005	<0.01
<0.01	<0.005	0.073	0.002	0.017	29.7	0.017	<0.05	12.7	<0.03	<0.04	12.1	0.218	<0.005	<0.01

Table 4.19.--*Concentration of major and trace elements*
Mississippi River between Baton Rouge, La. and

[km, kilometers; CDT, Central Daylight Time; µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L,

Name of tributary	Location: River miles	Location: Distance upriver from first sample (km)	Location: Fraction of distance from left to right bank	Date 1990	Time (CDT)	Specific conductance (µS/cm)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
											Upriver from	
Yazoo	433.5	[1]499	BT	5-27	0021	292	--	--	--	--	--	--
Arkansas	581.0	[1]890	BT	5-27	1850	247	--	--	--	--	--	--
										Upriver from Mouth		
Kaskaskia	117.5	[2]284	0.5	6-05	0952	326	0.048	0.047	<0.001	29.4	<0.01	<0.01
Meramec[3]	160.9	[2]391	0.5	6-05	1622	318	0.028	0.138	<0.001	32.7	<0.01	<0.01
Missouri	195.3	[2]474	0.5	6-05	2045	426	0.055	0.119	<0.001	49.0	<0.01	<0.01
										Upriver from Mouth		
Illinois	5.0	[4]0	0.5	6-06	1243	704	0.076	0.066	<0.001	69.8	<0.01	<0.01
	15.0	19	0.5	6-06	1348	712	0.074	0.064	<0.001	69.9	<0.01	<0.01
	25.0	39	0.5	6-06	1455	712	0.077	0.064	<0.001	67.7	<0.01	<0.01
	35.0	58	0.5	6-06	1555	721	0.091	0.068	0.001	70.8	<0.01	<0.01
	45.0	77	0.5	6-06	1700	729	0.094	0.065	<0.001	73.1	<0.01	<0.01
	55.0	96	0.5	6-06	1800	733	0.092	0.064	<0.001	72.8	<0.01	<0.01
	61.3	108	0.9	6-06	1840	700	0.085	0.067	0.001	70.7	<0.01	<0.01

[1]Distances, to the mouth of the tributary are computed using velocities in table 1.4 in chapter 1, and the first sample was collected at Mile 230.0 upriver from Head of Passes, La., on May 26, 1990, at 0006 hours.

[2]First sample was collected at mouth of the Ohio River on June 4, 1990 at 1840 hours.

[3]Sample collected from small boat.

[4]Distances calculated using a constant water speed of 3.2 km/hr based on discharge of Illinois River in table 1.4 of this report and velocity in table 2 published by Stall and Hiestand (1969).

in some of the tributaries of the Grafton, Ill., May-June 1990 cruise

milligrams per liter; and BT, below the mouth of the tributary but near the bank; and dashes indicate no measurement]

Concentration													
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
Head of Passes													
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of Ohio River													
<0.01	<0.005	<0.005	<0.005	11.0	<0.002	<0.05	11.3	<0.03	<0.04	7.0	0.083	<0.005	<0.01
<0.01	<0.005	<0.005	<0.005	16.0	<0.002	<0.05	5.2	0.04	<0.04	9.9	0.058	0.007	<0.01
<0.01	<0.005	<0.005	<0.005	13.2	<0.002	<0.05	21.4	0.06	<0.04	8.7	0.243	0.008	<0.01
of Illinois River													
<0.01	<0.005	<0.005	<0.005	29.1	<0.002	<0.05	21.5	0.05	<0.04	7.0	0.174	<0.005	0.01
<0.01	<0.005	<0.005	<0.005	29.3	<0.002	<0.05	21.7	0.05	<0.04	7.0	0.174	<0.005	<0.01
<0.01	<0.005	<0.005	<0.005	28.4	<0.002	<0.05	21.3	0.06	<0.04	6.7	0.169	<0.005	<0.01
<0.01	<0.005	<0.005	0.008	30.5	<0.002	<0.05	22.8	0.06	<0.04	6.9	0.180	<0.005	0.01
<0.01	<0.005	<0.005	0.010	31.6	<0.002	<0.05	23.9	0.05	<0.04	6.9	0.188	<0.005	<0.01
<0.01	<0.005	<0.005	0.018	31.4	<0.002	<0.05	23.9	0.05	<0.04	6.9	0.187	<0.005	<0.01
<0.01	<0.005	<0.005	0.014	30.1	<0.002	<0.05	22.3	0.04	<0.04	7.0	0.179	<0.005	<0.01

Table 4.20.--*Concentration of major and trace elements*
Mississippi River between Baton Rouge, La. and

[km, kilometers; CDT, Central Daylight Time; µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L,

Name of tributary	Location: River miles	Location: Distance upriver from first sample[1] (km)	Location: Fraction of distance from left to right bank	Date 1991	Time (CDT)	Specific conductance (µS/cm)	Temperature (°C)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
												Upriver from	
Arkansas	580.0	766	BT	6-25	1724	536	27	--	--	--	--	--	--
								--	--	--	--	--	--
Ohio	953.8	1,613	0.1	6-27	1909	231	26	--	--	--	--	--	--
			0.5		1903	243	25	0.026	0.041	<0.001	28.0	<0.01	<0.01
			0.9		1858	323	26	--	--	--	--	--	--
											Upriver from Mouth		
Missouri	195.3	2,062	0.5	6-28	1945	563	25	0.083	0.184	<0.001	55.6	<0.01	<0.01
Illinois	217.9	2,132	0.5	6-29	0550	650	--	0.112	0.089	<0.001	61.8	<0.01	<0.01
Des Moines	361.4	2,433	BT	6-30	0111	505	23	0.042	0.118	<0.001	66.0	<0.01	<0.01
Skunk	395.8	2,501	BT	6-30	0533	622	27	0.041	0.150	<0.001	84.1	<0.01	<0.01
Rock	479.0	2,679	BT	6-30	2035	481	27	0.036	0.074	<0.001	49.0	<0.01	<0.01
Wisconsin	630.6	2,979	BT	7-01	1614	247	26	0.018	0.030	<0.001	26.5	<0.01	<0.01
Black	698.2	3,104	BT	7-01	2359	418	25	0.036	0.068	<0.001	48.9	<0.01	<0.01
Chippewa	763.4	3,230	BT	7-02	1035	439	22	0.035	0.054	0.001	55.8	<0.01	<0.01
St. Croix	811.5	3,318	0.5	7-02	1605	167	22	0.010	0.026	<0.001	21.9	<0.01	<0.01
Minnesota	844.0	3,379	0.7	7-02	2058	745	24	0.076	0.104	<0.001	86.7	<0.01	<0.01

[1]Distances, to the mouth of the tributary, are computed using velocities in table 1.4 in chapter 1, and the first sample was collected at Mile 230.0 upriver from Head of Passes, La., on June 23, 1991, at 2240 hours.

in some of the tributaries of the
Minneapolis, Minn., June-July 1991 cruise

milligrams per liter; µg/L, micrograms per liter; and BT, below the mouth of the tributary but near the bank; and dashes indicate no measurement]

Concentration														
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (µg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
Head of Passes														
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<0.01	<0.005	0.005	0.023	<0.005	6.8	<0.002	<0.05	7.4	<0.03	<0.04	2.8	0.114	<0.005	<0.01
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of Ohio River														
<0.01	<0.005	<0.005	0.090	0.029	16.4	<0.002	<0.05	32.6	<0.03	<0.04	12.6	0.317	<0.005	0.02
<0.01	<0.005	<0.005	0.049	<0.005	29.0	0.012	<0.05	25.9	<0.03	<0.04	4.4	0.170	0.007	0.02
0.02	<0.005	<0.005	0.067	0.017	20.3	0.004	<0.05	6.6	<0.03	<0.04	16.5	0.177	0.009	<0.01
<0.01	<0.005	<0.005	0.067	0.008	27.6	0.010	<0.05	9.6	<0.03	0.05	18.2	0.192	<0.005	<0.01
<0.01	<0.005	<0.005	0.021	<0.005	28.2	0.004	<0.05	12.5	<0.03	<0.04	8.5	0.114	<0.005	0.02
0.01	<0.005	0.082	0.051	<0.005	12.5	0.012	<0.05	6.0	<0.03	<0.04	5.0	0.047	<0.005	0.02
<0.01	<0.005	0.030	0.016	0.010	18.5	<0.002	<0.05	8.2	<0.03	<0.04	13.5	0.134	<0.005	0.02
<0.01	<0.005	0.072	0.022	0.016	21.2	0.026	<0.05	9.4	<0.03	0.04	16.3	0.157	<0.005	0.01
<0.01	<0.005	0.751	0.048	<0.005	7.5	0.016	<0.05	3.1	<0.03	<0.04	10.7	0.042	<0.005	<0.01
0.01	<0.005	<0.005	0.020	0.033	36.0	0.000	<0.05	13.7	<0.03	<0.04	23.3	0.300	0.008	<0.01

Table 4.21.--*Concentration of major and trace elements between New Orleans, La. and*

[km, kilometers; CDT, Central Daylight Time; µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L,

Name of tributary	Location: River miles	Location: Distance upriver from first sample[1] (km)	Location: Fraction of distance from left to right bank	Date 1991	Time (CDT)	Specific conductance (µS/cm)	Temperature (°C)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
												Upriver from	
Arkansas	580.8	948	BT	9-27	2005	481	20	0.071	0.085	<0.001	45.4	<0.01	<0.01
Ohio	953.8	1,712	0.1	9-29	2130	277	22	0.051	0.035	<0.001	25.8	<0.01	<0.01
			0.5		2121	266	22	0.053	0.036	0.001	27.0	<0.01	<0.01
			0.9		2115	275	20	0.052	0.034	<0.001	26.3	<0.01	<0.01
											Upriver from Mouth		
Missouri	195.3	2,125	0.5	9-30	2333	707	18	0.116	0.108	<0.001	56.4	<0.01	<0.01
Illinois	217.9	2,171	0.5	10-01	0415	671	19	0.165	0.056	<0.001	52.5	<0.01	<0.01
Des Moines	361.4	2,441	BT	10-02	0118	447	16	0.037	0.057	<0.001	47.6	<0.01	<0.01
Rock	479.0	2,669	BT	10-02	2005	665	17	0.064	0.065	<0.001	63.0	<0.01	<0.01
Wisconsin	630.6	2,956	BT	10-03	1645	333	15	0.022	0.029	<0.001	33.8	<0.01	<0.01
Black	698.2	3,076	0.5	10-04	0316	316	14	0.023	0.037	<0.001	35.1	<0.01	<0.01
Chippewa	763.4	3,197	BT	10-04	1205	150	--	0.010	0.014	<0.001	16.4	<0.01	<0.01
St. Croix	811.5	3,280	0.5	10-04	1720	168	15	0.012	0.018	<0.001	20.1	<0.01	<0.01
Minnesota	844.0	3,338	0.5	10-04	2155	945	14	0.077	0.079	<0.001	102.3	<0.01	<0.01

[1]Distances to the mouth of the tributary, are computed using velocities in table 1.4 in chapter 1, and the first sample was collected at Mile 88.5 upriver from Head of Passes, La., on September 25, 1991, at 0647 hours.

in some of the tributaries of the Mississippi River
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milligrams per liter; µg/L, micrograms per liter; and BT, below the mouth of the tributary but near the bank; and dashes indicate no measurement]

Concentration														
Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (µg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
Head of Passes														
0.01	<0.005	0.416	0.006	0.016	17.1	0.070	<0.05	37.5	<0.03	<0.04	7.1	0.249	<0.005	0.01
<0.01	<0.005	0.007	0.008	<0.005	9.0	0.041	<0.05	15.5	<0.03	<0.04	2.4	0.130	0.006	0.01
<0.01	<0.005	0.013	0.007	<0.005	9.3	0.008	<0.05	16.4	<0.03	0.10	3.0	0.137	<0.005	<0.01
0.01	<0.005	0.020	0.008	<0.005	9.1	0.002	<0.05	15.5	<0.03	0.04	2.6	0.134	<0.005	0.01
of Ohio River														
<0.01	<0.005	0.016	0.024	0.047	20.8	0.004	<0.05	64.5	<0.03	<0.04	6.9	0.472	<0.005	<0.01
<0.01	<0.005	<0.005	0.023	<0.005	23.8	<0.002	<0.05	45.0	<0.03	<0.04	0.8	0.196	<0.005	0.02
<0.01	<0.005	<0.005	0.010	<0.005	21.0	<0.002	<0.05	12.4	<0.03	<0.04	10.2	0.119	<0.005	<0.01
<0.01	<0.005	<0.005	0.003	<0.005	41.6	0.003	<0.05	24.2	<0.03	<0.04	12.0	0.104	<0.005	0.02
<0.01	<0.005	0.005	0.004	0.006	15.3	0.005	<0.05	8.4	<0.03	<0.04	6.1	0.071	0.005	<0.01
<0.01	<0.005	0.371	0.006	<0.005	13.8	0.062	<0.05	7.1	<0.03	<0.04	13.2	0.087	<0.005	<0.01
<0.01	<0.005	0.239	0.005	<0.005	6.4	0.008	<0.05	3.5	<0.03	<0.04	11.2	0.035	<0.005	0.02
<0.01	<0.005	0.398	0.004	<0.005	7.3	0.032	<0.05	2.8	<0.03	<0.04	13.8	0.038	<0.005	0.02
<0.01	<0.005	0.012	0.006	0.030	47.1	0.005	<0.05	20.4	<0.03	<0.04	21.6	0.349	<0.005	<0.01

Table 4.22.--*Concentration of major and trace elements between New Orleans, La. and*

[km, kilometers; CDT, Central Daylight Time; µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L,milligrams

per dashes indicate no

Name of tributary	Location			Date 1992	Time (CDT)	Specific conductance (µS/cm)	Temperature (°C)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)
	River miles	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank										
													Upriver from
Yazoo	435.3	819	BT	3-27	0737	298	12	0.022	0.042	<0.001	31.3	<0.01	<0.01
Arkansas	582.0	1,213	1.0	3-28	0550	323	14	0.016	0.046	<0.001	22.2	<0.01	<0.01
Ohio	953.8	2,150	0.1	3-30	1258	237	11	0.018	0.030	<0.001	27.8	<0.01	<0.01
			0.5		1246	266	11	0.020	0.029	<0.001	29.8	<0.01	<0.01
			0.9		1252	328	10	0.028	0.039	0.001	38.1	<0.01	<0.01
											Upriver from Mouth		
Kaskaskia	117.5	2,423	0.5	3-31	0450	478	11	--	--	--	--	--	--
Missouri	195.3	2,612	0.4	3-31	1554	528	12	0.051	0.106	<0.001	55.0	<0.01	<0.01
Illinois	217.9	2,666	0.5	3-31	2035	778	12	0.077	0.056	<0.001	79.2	<0.01	<0.01
Des Moines	361.4	2,880	0.5	4-01	1615	726	9	0.026	0.081	<0.001	87.5	<0.01	<0.01
Iowa	433.9	3,132	BT	4-02	0307	448	7	0.017	0.043	<0.001	51.2	<0.01	<0.01
Rock	479.0	3,219	BT	4-02	0838	535	7	0.018	0.041	<0.001	53.0	<0.01	<0.01
Wisconsin	630.6	3,512	BT	4-03	0356	241	6	0.007	0.020	<0.001	22.6	<0.01	<0.01
Chippewa	763.4	3,754	BT	4-03	1953	243	7	0.011	0.019	<0.001	21.3	<0.01	<0.01
St. Croix	811.5	3,840	0.6	4-04	0103	162	5	0.009	0.017	<0.001	17.3	<0.01	<0.01
Minnesota	844.0	3,904	0.5	4-04	0711	901	7	0.050	0.074	<0.001	109.5	<0.01	<0.01

[1]Distances, to the mouth of the tributary, are computed using velocities in table 1.4 in chapter 1, and the first sample was collected at Mile 90.0 upriver from Head of Passes, La., on March 25, 1992, at 0705 hours.

in some of the tributaries of the Mississippi River
Minneapolis, Minn., March-April 1992 cruise

liter; µg/L, micrograms per liter; and BT, below the mouth of the tributary but near the bank; and

measurement]

Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (µg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)	Pb (mg/L)	SiO_2 (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)
							Concentration							
Head of Passes														
<0.01	<0.005	0.023	0.003	<0.005	9.2	<0.002	<0.05	10.8	<0.03	<0.04	5.9	0.117	<0.005	<0.01
<0.01	<0.005	0.019	0.002	<0.005	5.5	<0.002	<0.05	29.7	<0.03	<0.04	2.2	0.141	<0.005	<0.01
<0.01	<0.005	0.437	<0.001	<0.005	6.3	0.041	<0.05	8.0	<0.03	<0.04	5.9	0.109	<0.005	0.01
<0.01	<0.005	0.009	0.003	<0.005	7.4	<0.002	<0.05	8.7	<0.03	<0.04	5.7	0.121	<0.005	<0.01
<0.01	<0.005	0.387	0.003	<0.005	10.1	0.039	<0.05	14.1	<0.03	<0.04	6.7	0.161	<0.005	<0.01
of Ohio River														
--	--	--	0.003	--	--	--	--	--	--	--	--	--	--	--
<0.01	<0.005	0.046	0.003	0.017	17.6	0.005	<0.05	27.7	<0.03	<0.04	11.7	0.304	<0.005	<0.01
<0.01	<0.005	<0.005	0.003	<0.005	35.5	<0.002	<0.05	38.1	<0.03	<0.04	4.0	0.223	<0.005	<0.01
<0.01	<0.005	0.045	0.003	0.015	28.4	0.010	<0.05	10.9	<0.03	<0.04	17.2	0.242	<0.005	<0.01
<0.01	<0.005	0.041	0.001	0.009	19.2	<0.002	<0.05	9.1	<0.03	<0.04	11.7	0.110	<0.005	<0.01
<0.01	<0.005	0.029	0.001	0.006	28.6	0.003	<0.05	11.2	<0.03	<0.04	5.4	0.098	<0.005	<0.01
<0.01	<0.005	0.284	0.003	<0.005	10.1	0.008	<0.05	9.8	<0.03	<0.04	9.5	0.038	<0.005	<0.01
<0.01	<0.005	0.338	0.002	<0.005	8.3	0.015	<0.05	4.2	<0.03	<0.04	12.0	0.050	<0.005	<0.01
<0.01	<0.005	0.561	0.001	<0.005	6.2	0.044	<0.05	2.8	<0.03	0.05	12.1	0.033	<0.005	<0.01
<0.01	<0.005	0.007	0.002	0.035	45.0	0.005	<0.05	17.5	<0.03	<0.04	17.3	0.354	<0.005	<0.01

(page 211 follows)

CHAPTER 5 - ORGANIC COMPOUNDS AND SEWAGE-DERIVED CONTAMINANTS

by Larry B. Barber,II, Jerry A. Leenheer, Charles F. Tabor, Jr., Greg K. Brown, Ted I. Noyes, and Mary C. Noriega

ABSTRACT

Water samples were collected from near New Orleans, La., to Minneapolis, Minn., during three cruises timed to coincide with low, mid, and high flow conditions. Dissolved organic compounds were measured in the Mississippi River using a hierarchical analytical approach. Details on the analytical methods used, the results from analysis of laboratory quality-assurance samples, and the results from analysis of field samples are presented in this chapter.

INTRODUCTION

The spatial and temporal variability of dissolved organic compounds in the Mississippi River was evaluated by analyzing water samples collected during three sampling cruises for a variety of general-indicator and specific-compound measurements. The investigation used a hierarchical approach (Leenheer, 1984; Barber, 1992) starting with dissolved organic carbon, the most general measure of organic compounds, progressing through class-specific measurements, and ultimately focusing on specific compound analysis.

In this study, several general organic parameters and specific organic compounds were selected as indicators of contamination from domestic and industrial wastewater sources. Dissolved organic carbon (DOC) was used as a measure of the total carbon load, adsorbable organic halogen (AOX) was a gross measure of organic chlorine compounds that are common water-disinfectant byproducts, and methylene-blue active substances (MBAs) provided a measure of total anionic surfactant concentrations. Specific compounds also were determined. Linear alkylbenzene sulfonate (LAS) is the major surfactive active ingredient in household and commercial detergent formulations, and thus provides an indication of contamination arising from domestic and commercial wastewater. Alkylphenol polyethoxylates are common nonionic surfactants, and although used in domestic detergent formulations, they are more widely used in commercial and industrial applications. Volatile organic compounds (VOC) typically have mixed sources: chlorinated hydrocarbons are widely used in commercial industrial applications and aromatic compounds are commonly associated with fuels and manufacturing.

ANALYTICAL PROCEDURES

General sampling methods are discussed in chapter 1. This chapter describes more detailed procedures for sample collection and preservation and the measurement procedures for field parameters, dissolved organic carbon, color, adsorbable organic halide, methylene-blue active substances, volatile organic compounds, and anionic and nonionic surfactant-derived compounds.

Sample Collection and Preservation

Water samples were collected from the Mississippi River between New Orleans, La., and Minneapolis, Minn., during three sampling cruises: (1) June-July 1991, (2) September-October 1991, and (3) March-April 1992, as described in Chapter 1. Water samples for DOC, AOX, color, MBAS, LAS, alkylphenols (AP), and C_8 and C_9 alkylphenolpolyethoxylates (APEO) analysis were collected in a 20-L stainless steel bucket, immediately filtered through 0.7-µm glass-fiber membrane, into pre-cleaned amber-glass bottles with Teflon-lined caps. Samples for DOC, AOX, and color analysis received no additional processing. Samples for MBAS and LAS analysis were preserved by addition of 1 percent formalin (10 mL/L) and samples for AP and APEO analysis were preserved by acidification to pH <2 with concentrated HCl (1 mL/L). Samples for VOC analyses were collected separately in sewage samplers (ACE Scientific Supply, Catalog number 22-4960-01) lowered to a depth of 1.5 m below water surface, preserved by addition of 0.2 mL of concentrated HCl and 125 mg ascorbic acid, and capped without headspace. All samples were stored at 4°C until analysis.

Field Parameters

Measurements of temperature and specific conductance were made on all samples immediately after collection using a temperature-compensated conductivity meter. The specific conductance meter was calibrated against U.S. Geological Survey standard reference material.

Dissolved Organic Carbon Analysis

DOC was measured on all of the water samples by heated persulfate oxidation using an Oceanographic International Model 700 Carbon Analyzer. This method involves acidifying a 5 mL filtered water sample with 0.5 mL, 2.4 N, phosphoric acid to convert inorganic carbon to carbon dioxide (CO_2) and purging with nitrogen gas (N_2). The N_2 purge gas passes through a molecular sieve where the CO_2 is trapped, and the CO_2 is thermally desorbed at 200°C and measured by infrared (IR) detector. After removal of inorganic carbon, 0.5 mL of saturated sodium persulfate solution is added, and the sample heated to 100°C to oxidize the organic carbon to CO_2, which is then measured in the same way as inorganic carbon. Samples were analyzed in duplicate, and concentrations were calculated using a 3 to 6 point calibration curve prepared using potassium hydrogen phthalate as the carbon standard. Distilled water blanks and quality-assurance (QA) standards were analyzed approximately every 10 field samples. The detection limit for this method is about 0.1 mg/L.

Color

The color of the filtered water samples was measured against a platinum/cobalt standard (Standard Method 204A; American Public Health Association, 1985) using UV/VIS spectroscopy. This measurement provides an indication of the humic and fulvic acid contribution to the total DOC (Thurman, 1985). The color standard was prepared from potassium chloroplatinate and cobaltous chloride to give a stock concentration of 500 platinum-cobalt units (1 mg/L platinum, 0.5 mg/L cobalt). The stock solution was serially diluted to give a standard calibration curve. Color was determined by measuring adsorbance of standards and filtered water samples at a wavelength of 400 nm using a Bausch and Lomb Spectronics Model 710 spectrophotometer. The detection limit for this method is about 1 Pt/Co color unit. Color is a qualitative indicator of natural organic matter such as fulvic and humic acids, and no QA standards were available for analysis.

Adsorbable Organic Halide

AOX is a bulk measurement of purgeable and nonpurgeable halogen-containing organic compounds, including trihalomethanes, chlorinated hydrocarbons, chlorophenols, as well as a wide range of poorly characterized halogenated compounds of natural and synthetic origin. AOX analysis was performed using a Dohrmann Model DX-20 A/B Organic Halide Analyzer using an AB-3 adsorption module. The method involved passing a 40 to 100 mL water sample through two minicolumns packed with 40 mg of 100 to 200 mesh granular activated carbon (GAC) mounted in series. Organic and inorganic halides were removed from the water sample by adsorption onto the GAC and the GAC was rinsed with a potassium nitrate solution to remove inorganic halide ions. The GAC was transferred to a pyrolysis system and combusted at 900°C in a two-step process: (1) In a CO_2-rich atmosphere to enhance the conversion of organic bromides to titratable species; and (2) in an O_2-rich atmosphere to form hydrogen halide (HX) and CO_2. The HX products were trapped in an on-line titration cell and titrated with silver ion, and the amount of AOX was measured by microcoulometry. Concentration of AOX was determined relative to organic (trichlorophenol) and inorganic chloride (ammonium chloride) standards analyzed under identical conditions. QA samples including replicates, blanks, and reference standards were analyzed daily. The detection limit for this method is about 1 μg/L.

Methylene-Blue Active Substances

MBAS analysis is a measurement of total anionic surfactants, and includes linear- and branch-chained alkylbenzenesulfonic acids (LAS and ABS), sulfophenyl carboxylic acid (SPC) degradation products of LAS and ABS, dialkyltetralin- and dialkylindanesulfonates (DATS) which are impurities in LAS and ABS formulations, alkylsulfates, and other natural and synthetic strong acid hydrophobic compounds. Filtered formalin-preserved samples were analyzed for MBAS using the method described in Wershaw and others (1983). This method involves acidifying the water samples to pH <2 by addition of sulfuric acid, adding methylene blue to form an ion pair with anionic compounds in the acidified water sample, and extracting the methylene-blue ion pair into chloroform. The amount of extracted ion pair is measured by a spectrophotometer (Bausch and Lomb Spectronics Model 710) at a wavelength of 635 nm. The acidification step removes interferences from weak organic acids which become protonated, and the chloroform extraction isolates the hydrophobic organic ion pairs, and removes interferences from inorganic anions at low inorganic ion concentration. Quantification was based on a 3 to 6 point standard curve. Each set of 12 to 18 samples had a distilled water blank and from 1 to 3 QA standards. Replicate analysis was performed on selected samples. The detection limit for this method is about 20 µg/L.

Volatile Organic Compounds

VOC analysis was performed by purge-and-trap gas chromatography and mass spectrometry using U.S. Environmental Protection Agency (EPA) Method 524.2 (USEPA, 1984). A 25-mL sample was loaded into a syringe and spiked with an internal/surrogate standard solution (5 µg/L). The internal standards were fluorobenzene and 1,2-dichlorobenzene-D4; the surrogates were 1,2-dibromoethane-D4, toluene-D8, and bromofluorobenzene.

The sample was loaded onto a liquid autosampler interfaced to a purge and trap concentrator and isolated under conditions given in table 5.1. After desorption from the trap, VOCs were transferred through a 0.32-mm inside-diameter fused-silica line to the gas chromatograph (GC) and analyzed under conditions listed in table 5.1. The GC column was directly coupled to a Fennigan Model Incos 50 mass spectrometer where electron impact mass spectrometry was performed under the conditions listed in table 5.1.

All samples were screened for 65 target compounds (table 5.2). Identification of each compound was based on matching of chromatographic retention time and mass spectra of peaks detected in the samples against retention times and mass spectra of standards analyzed under identical conditions. In addition, compounds detected in the sample that were not target compounds were identified by matching of the unknown mass spectra against a computerized mass spectra library.

Concentrations of target compounds were calculated as follows:

$$C_x = (A_x)(C_{is})/(A_{is})(RF)$$

Table 5.1.--*Instrumental conditions for volatile organic compound analysis by purge and trap gas chromatography and mass spectometry*

[°C, degrees Celsius; mL, milliliter; m, meter; mm, millimeter; µm, micrometer]

Condition	Value
	Purge and Trap Concentrator
Purge time	1 minute
Desorb	1 minute at 180°C
Trap bakeout	15 minutes at 225°C
Sample temperature	40°C
Valve temperature	100°C
Line temperature	100°C
Purge gas	Helium
Purge gas flow rate	40 mL/minute
Purge gas pressure	20 pound per square inch
Trap dimensions	0.125 inches by 12 inches
Trap packing	OV-1, Tenax, silica gel, charcoal
	Gas Chromatography
Column	J&W Scientific, DB-624 30 m by 0.53 mm inside-diameter fused silica, 3 µm film
Initial temperature	-20°C for 1 minute
Ramp 1	-20°C to 20°C at 20°C/minute
Ramp2	20°C to 100°C at 5°C/minute
Ramp 3	100°C to 160°C at 20°C/minute, hold for 2 minutes
Ramp 4	160°C to 200°C at 40°C/minute, hold for 3 minutes
Carrier gas	Helium
Flow rate	15 mL/minute
	Mass Spectrometer
Scan range	Positive ions from 45–310 atomic mass units
Scan time	0.75 seconds
Ion source temperature	175°C
Transfer line temperature	220°C
Transfer nozzle temperature	180°C
Separator temperature	200°C
Injector temperature	125°C

Table 5.2.--*List of target volatile organic compounds determined by purge and trap gas chromatography/mass spectrometry*

Halogenated hydrocarbons aliphatic	Alkyl and halogenated aromatic hydrocarbons	Miscellaneous compounds
chloromethane	benzene	2-chloroethylvinylether
bromomethane	toluene	naphthalene
dichloromethane	m- and p-xylene	hexachlorobutadiene
trichloromethane	o-xylene	styrene
dibromomethane	ethylbenzene	
bromodichloromethane	n-propylbenzene	
tribromomethane	isopropylbenzene	
dicholorodifluoromethane	n-butylbenzene	
dibromochloromethane	1,2,3,-trimethylbenzene	
tricholorodifluoromethane	1,2,4-trimethylbenzene	
bromochloromethane	1,3,5-trimethylbenzene	
carbon tetrachloride	2-Ethyltoluene	
choroethane	sec-butylbenzene	
1,2-dibromoethane	tert-butylbenzene	
1,1-dichloroethane	p-isopropyltoluene	
1,2-dichloroethane	2-ethyl-1,4-dimethylbenzene	
1,1-dichloroethene	1,2,3,4-tetramethylbenzene	
cis-1,2-dichloroethene	1,2,3,5-tetramethylbenzene	
trans-1,2-dichloroethene	chlorobenzene	
1,1,1-trichloroethane	bromobenzene	
1,1,2-trichloroethane	1,2-chlorotoluene	
trichloroethene	1,4-chlorotoluene	
1,1,1,2-tetrachloroethane	o-dichlorobenzene	
1,1,2,2-tetrachloroethane	m-dichlorobenzene	
tetrachloroethane	p-dichlorobenzene	
1,2-dichloropropane	1,2,3-trichlorobenzene	
1,3-dichloropropane	1,2,4-trichlorobenzene	
2,2-dichloropropane		
1,1-dichloropropene		
trans-1,3-dichloropropene		
cis-1,3-dichloropropene		
1,2,3-trichloropropane		
1,2-dibromo-3-chloropropane		
vinyl chloride		

where,

C_x= concentration of analyte x in the sample (g/L),

A_x= integrated abundance of quantitation ion for analyte x in the sample,

C_{is}= integrated abundance of quantitation ion for the internal standard, and

RF= average response factor of analyte x determined from a 5-point calibration curve.

For nontarget compounds, RF was assumed to be one.

QA involved running a blank at the beginning of each sample set, a daily standard of the 65 target compound mix at 2 μg/L for each compound, and a quality control (QC) standard (5 μg/L) from a second source. The acceptance criteria for recovery of compounds in the daily standard was 20 percent; the acceptance criteria for recovery of the compounds in the QC standard was 40 percent. In addition, a second daily standard of 1 μg/L and duplicate samples of selected field samples were analyzed. The detection limit for this method is about 0.2 μg/L for each compound.

Anionic and Nonionic Surfactant-Derived Compounds

LAS anionic surfactants and their synthesis impurities and degradation products were analyzed using a modification of the solid-phase extraction (SPE), derivatization, gas chromatography and mass spectrometry (GC/MS) method of Trehy and others (1990). The samples also were analyzed for APEO nonionic surfactant degradation products using SPE-GC/MS.

The SPE component of this method was performed using a Waters (Milford, Mass.) Millilab 1A robotics workstation. Octadecyl surface-modified-silica cartridges (C_{18}) containing 1 g of adsorbent were used for reverse-phase isolation, and quaternary methylamine surface-modified-silica cartridges (QMA) containing 500 mg of adsorbent were used for anion exchange. GC/MS grade acetonitrile, methylene chloride, methanol, and ethyl acetate were obtained from Burdick and Jackson (Muskegon, Mich.). Reagent grade hydrochloric acid, sodium sulfate, and potassium carbonate were obtained from J.T. Baker (Phillipsburg, N.J.), and formalin was obtained from Mallinckrodt (Paris, Ky.). Phosphorous pentachloride and 2,2,2-trifluoroethanol were obtained from Aldrich (Milwaukee, Wis.). All chemicals were used as received. Water used for reagent blanks and recovery experiments was distilled in glass.

Immediately prior to processing the 1-L formalin-preserved water samples for anionic surfactants, the C_{18} cartridges were conditioned with 5 mL of acetonitrile, 5 mL of methanol, and 5 mL of distilled water. The samples were passed through the cartridges at a flow rate of 20 mL/min and the aqueous effluent was collected. The C_{18} cartridge was eluted with 5 mL of acetonitrile followed by 5 mL of methylene chloride and the eluant was taken to dryness under a stream of nitrogen. This fraction was derivatized and analyzed for LAS, SPC, and DATS. The C_{18} aqueous effluent was passed through a QMA cartridge (conditioned with 5 mL 1:1 (v:v) 2N HCl: methanol, 5 mL methanol, and 5 mL distilled water) at a flow rate of 20 mL/min and the aqueous effluent discarded, the QMA cartridge was eluted with 5 mL of 1:1 2N HCl: methanol, and the eluant was processed as for C_{18}. This fraction was derivatized and analyzed for SPC and LAS breakthrough from the C_{18} cartridge.

The C_{18} and QMA residues were derivatized with phosphorous pentachloride and trifluoroethanol to form the trifluoroethyl esters of LAS, DATS, and SPC (Trehy and others, 1990). In the first step of the derivatization, sulfonyl chlorides were formed by adding 250 mg of phosphorous pentachloride and heating for 10 min at 100 °C. The sample was cooled, extracted with 4 mL pentane, and the pentane phase transferred to a separate vial and taken to dryness under nitrogen. The pentane residue was dosed with 0.2 mL of trifluoroethanol and heated for 20 min at 70 °C. The reaction mixture was cooled and then extracted with 4 mL of pentane after adding 1.5 mL of distilled water. The pentane layer was transferred to another vial and evaporated to dryness under a stream of nitrogen and then redissolved in 100 L of isooctane. The isooctane extract was analyzed by GC/MS.

Processing the 1-L HCl preserved water samples for nonionic surfactants by C_{18} extraction and elution with acetonitrile followed by methylene chloride was the same as for the formalin-preserved samples. The eluant was dried over anhydrous sodium sulfate and the sample volume was reduced to 200 L under a stream of nitrogen.

The derivatized (anionic surfactants) and underivatized (nonionic surfactants) SPE extracts were analyzed by electron impact GC/MS using a Hewlett Packard 5890 GC with a 5970 Mass Selective Detector in both the full scan and selected ion monitoring (SIM) modes. Table 5.3 lists the conditions for the analysis. Table 5.4 lists the ions monitored in the SIM mode for LAS, DATS, SPC, AP, and APEO. SIM analyses were performed scanning for the molecular ions [M^+] and the base peaks. To enhance sensitivity for analysis of the derivatized anionic surfactants, the [M^+-99] ions representing loss of the trifluoroethyl ester also were monitored although there was loss of specificity with respect to [M^+]. The underivatized fraction also was screened for other semivolatile organic contaminants but none were detected. The chromatographic conditions were optimized to provide rapid analysis while still maintaining sufficient separation of isomers and homologues in the complex mixture.

A number of QA and quantitation standards were used in these analyses. LAS was obtained from the USEPA (Cincinnati, OH). Nonylphenol (C_9-AP), octylphenol (C_8-AP), C8-LAS, 2,2,2-triflouro-ethyltoluenesulfonic acid, and C_9-benzene were obtained from Aldrich (Milwaukee, Wis.). C_9-LAS was obtained from the Procter and Gamble Company (Cincinnati, Ohio), C_6-, C_8-, and C_{10}-SPC were synthesized in our laboratory (Field, 1990), and C_4, C_5, and C_{11}-SPC were obtained from Monsanto (St. Louis, Mo.). The 1-3 ethyleneoxide NPEO standard (Imbentin-N/7A) was obtained from Chemische Fabrik, Dr. W. Kolb, AG (Hedingen, Switzerland). The C_9-LAS and C_4-SPC surrogate standards for LAS, DATS, and SPC analysis were added to the aqueous sample prior to SPE to evaluate whole method recovery. The C_8-LAS derivatization standard was added to the SPE extract prior to derivatization, and the C_2-LAS internal standard was added to the final solvent extract prior to GC/MS analysis. External standards were spiked into distilled water or natural water matrices and processed through the entire procedure in the same manner as field samples. Quantitation of LAS and SPC was based on C_9-LAS using equation 1, and either the molecular ion or the base peaks for the individual isomers and homologues. Although SPC and DATS were analyzed for, and were detected in several of the water samples, because of difficulty in quantitation and providing unambiguous identification, data for these compounds are not presented in this report. AP and APEO quantitation was based on C_9-benzene using the sum of the molecular ion for the various isomers and response factors determined from the external standards. The detection limit for LAS was about 0.1 μg/L and the detection limit for AP and APEO was about 0.5 μg/L.

Table 5.3.--*Gas chromatography and mass spectrometry operating conditions for solid-phase extraction analysis*

[µm, micrometer; cm, centimeter; °C, degrees Celsius]

Condition	Value
	Gas Chromatograph
Column	Hewlett Packard Ultra II, 25-m by 0.2-mm inside diameter, 20-µ film
Carries gas	Ultra high purity helium
Flow rate	27 cm/second
Injector temperature	280°C
Mass spectrometer interface temperature	280°C
Initial temperature	110°C
Initial time	1 minute
Ramp rate	8°C/minute
Final temperature	300°C
Final time	5 minutes
	Mass Spectrometer
Source temperature	250°C
Source pressure	1×10^{-5} torr
Ionization energy	70 electron volts
	Full Scan Mode
Scan range	45 to 550 atomic mass units
Scan time	1 scan per second
	Selected Ion Monitoring Mode
Ions	see table 5.4 for molecular ions and base peaks
Dwell time	50 milliseconds

Table 5.4.--*Summary of molecular ions [M+]; molecular ions minus the trifluoroethyl ester moiety [M+ -99] for trifluoroethyl derivatives of linear alkylbenzenesulfonate, dialkyltetralinsulfonates, and sulfophenyl carboxylic acids; and [M+] and base peaks for alkylphenol and alkylphenol mono-, di-, and triethoxylates*

[--, homologue does not occur in commercial surfactant formulations, na, does not apply; and --, no measurement]

Alkyl chain length	Linear-alkybenzene-sulfonate [M+]	Linear-alkybenzene-sulfonate [M+-99]	Dialkyl-tetralin-sulfonates [M+]	Dialkyl-tetralin-sulfonates [M+-99]	Sulfo-phenyl-carboxylic acids [M+]	Sulfo-phenyl-carboxylic acids [M+-99]	Alkyl-phenol[f] [M+]	Alkylphenol		
								Mono-ethoxy-late[g] [M+]	Di-ethoxy-late[h] [M+]	Tri-ethoxy-late [M+]
1	--	--	--	--	366.25	267.21	na	na	na	na
2	254.24[a]	155.20[a]	--	--	380.28	281.24	na	na	na	na
3	--	--	--	--	394.31	295.27	na	na	na	na
4	--	--	--	--	408.34	309.30	na	na	na	na
5	--	--	--	--	422.37	323.33	na	na	na	na
6	--	--	--	--	436.40	337.36	na	na	na	na
7	--	--	--	--	450.43	351.39	na	na	na	na
8	352.45[b]	253.41[b]	--	--	464.46	365.42	na	na	na	na
9	366.48[c]	267.44[c]	364.46[d]	265.42[d]	478.49	379.45	na	na	na	na
10	380.51	281.47	378.49	279.45	492.52	393.48	na	na	na	na
11	394.54	295.50	392.52	293.48	506.55	407.51	na	na	na	na
12	408.57	309.53	408.55	307.51	520.58	421.54	na	na	na	na
13	422.60	323.56	420.58	321.54	534.61	435.57	na	na	na	na
14	436.63	337.59	436.61	335.57	548.64	449.60	na	na	na	na
C_8	na	na	na	na	na	na	206	250	294	338
C_9	na	na	na	na	na	na	220	264	308	352

[a] C_2-Linear alkybenzenesulfonate standard.

[b] C_8-Linear alkybenzenesulfonate standard.

[c] C_9-Linear alkybenzene sulfonate standard.

[d] C_9-Dialkyltetralinsulfonate standard.

[e] Linear alkybenzene sulfonate, dialkytetralinsulfonate, and sulfophenyl carboxylic acid base peak for 2-phenyl isomers is at a mass to charge ratio (m/z) of 267 and for greater than 2-phenyl isomers is at a mass to charge ratio (m/z) of 253.

[f] Alkylphenol base peaks are at mass to charge ratio (m/z) of 107, 121, 135, 149, and 163.

[g] Alkylphenol monoethoxylate base peaks are at mass to charge ratio (m/z) of 165, 179, 193, and 207.

[h] Alkylphenol diethoxylate base peaks are at mass to charge ratio (m/z) of 223, 237, and 251.

RESULTS

A summary of accuracy, precision, and recovery data from analysis of quality-assurance samples for the three upriver cruises is presented in tables 5.5–5.8. Results from the analysis of the three upriver cruises of the Mississippi River are listed in tables 5.9 to 5.23.

Longitudinal Variability

Data collected in approximately mid-channel are listed in two tables for each cruise, with one table for the Lower Mississippi River (tables 5.9, 5.11, and 5.13) and one table for the Upper Mississippi River (tables 5.10, 5.12, and 5.14). The longitudinal variability of these mid-channel samples for DOC, color, AOX, and MBAS are shown in figures 5.1, 5.2, 5.3, and 5.4.

Cross-Channel Variability

Data collected at two to three locations across the channel are listed in two tables for each cruise, with one table for the Lower Mississippi River (tables 5.15, 5.17, and 5.19) and one table for the Upper Mississippi River (tables 5.16, 5.18, and 5.20). The mean of these cross-channel values appears in the corresponding tables for longitudinal variability.

Tributary Concentrations

Data collected in a tributary or just downstream from the mouth of a tributary near the bank are listed in one table for each cruise (tables 5.21, 5.22, and 5.23).

Table 5.5.--*Summary of accuracy and precision data for quality-assurance samples, June-July 1991 cruise*

[mg/L, milligram per liter; %, percent; LAS, linear alkylbenzene sulfonate; C_9-LAS, C_9 LAS surrogate standard; DOC, potassium hydrogen phthalate organic carbon standard; AOX, trichlorophenol adsorbable organic halogen standard; and --, not determined]

Standard concentration	Mean measured concentration (mg/L)	Mean recovery (%)	Standard deviation (mg/L)	Relative standard deviation (%)	Number of samples
		Dissolved Organic Carbon			
Blank	0.34	--	0.22	64.0	35
1.0 mg/L DOC	0.97	97.0	0.15	11.0	10
5.0 mg/L DOC	4.93	98.6	0.18	3.0	27
		Methylene Blue Active Substances			
Blank	5	--	3	64.8	18
20 μg/L LAS	21	100.5	1	4.7	3
50 μg/L LAS	49	98.0	2	4.0	13
70 μg/L LAS	72	102.8	1	1.6	6
100 μg/L LAS	100	100.0	1	1.3	10
200 μg/L LAS	210	105.0	20	10.6	8
500 μg/L LAS	519	103.8	53	10.3	4
1000 μg/L LAS	1126	112.6	30	2.7	5
		Linear Alkylbenzene Sulfonate[1]			
DIW Blank	--	--	--	--	--
0.1 μg/L LAS	0.08	84.1	--	--	1
1.0 μg/L LAS	1.0	103.0	--	--	1
10 μg/L LAS	9.4	93.6	--	24.0	6
20 μg/L LAS	15.8	79.1	--	18.2	7
50 μg/L LAS	30.0	78.9	--	4.7	2
100 μg/L LAS	71.0	71.0	--	20.8	2
20 μg/L C_9-LAS	18.7	90.8	--	30.2	284
		Adsorbable Organic Halogen			
DIW Blank	1.6	--	4.3	2.7	14
10 μg/L AOX	11.3	113.0	2.8	0.2	17

[1] Because LAS analysis was not carried out as a single set for each cruise, the quality-assurance data for all three cruises are summarized in this table.

Table 5.6.--*Summary of accuracy and precision data for quality-assurance samples, September-October 1991 cruise*

[mg/L, milligram per liter; %, percent; LAS, linear alkylbenzene sulfonate; C_9-LAS, C_9 LAS surrogate standard; DOC, potassium hydrogen phthalate organic carbon standard; AOX, trichlorophenol adsorbable organic halogen standard; and --, not determined]

Standard concentration	Mean measured concentration (mg/L)	Mean recovery (%)	Standard deviation (mg/L)	Relative standard deviation (%)	Number of samples
		Dissolved Organic Carbon			
Blank	0.18	---	0.17	91.8	78
1.0 mg/L DOC	1.06	106.0	0.31	24.9	4
5.0 mg/L DOC	5.20	104.0	0.35	6.6	52
10.0 mg/L DOC	10.04	100.4	0.47	4.6	26
		Methylene Blue Active Substances			
DIW Blank	6	---	6	99.5	11
20 μg/L LAS	21	105.0	4	18.0	5
30 μg/L LAS	30	100.0	1	2.9	11
50 μg/L LAS	51	102.0	3	5.4	22
70 μg/L LAS	71	101.4	3	4.3	11
100 μg/L LAS	94	94.0	7	7.7	4
200 μg/L LAS	196	98.0	12	6.0	4
500 μg/L LAS	514	102.8	22	4.3	3
1000 μg/L LAS	980	98.0	--	--	1
2000 μg/L LAS	1999	99.5	--	--	1
Vicksburg[1]	46	--	5	11	9
		Linear Alkylbenzene Sulfonate			
		see table 5-5 for summary			
		Adsorbable Organic Halogen			
DIW Blank	2.6	--	--	--	11
10 μg/L AOX	12.4	124.0	2.1	0.2	19

[1]This sample was used for replicate analyses of natural water.

Table 5.7.--*Summary of accuracy and precision data for quality-assurance samples, March-April 1992 cruise*

[mg/L, milligram per liter; %, percent; LAS, linear alkylbenzene sulfonate; C_9-LAS, C_9 LAS surrogate standard; DOC, potassium hydrogen phthalate organic carbon standard; AOX, trichlorophenol adsorbable organic halogen standard; and --, not determined]

Standard concentration	Mean measured concentration (mg/L)	Mean recovery (%)	Standard deviation (mg/L)	Relative standard deviation (%)	Number of samples
		Dissolved Organic Carbon			
Field blank	--	--	--	--	--
Blank	0.34	--	0.22	64.0	69
1.0 mg/L DOC	0.97	97.0	0.15	11.0	18
5.0 mg/L DOC	4.93	98.6	0.18	3.0	51
		Methylene Blue Active Substances			
Blank	9	--	6	70.2	12
20 μg/L LAS	21	105.0	3	12.4	13
30 μg/L LAS	31	103.3	1	2.6	4
50 μg/L LAS	50	100.0	3	6.3	13
70 μg/L LAS	70	100.0	2	2.6	4
100 μg/L LAS	98	98.0	7	6.7	14
200 μg/L LAS	170	85.0	19	11.1	3
500 μg/L LAS	469	93.8	--	--	1
1000 μg/L LAS	944	94.4	--	--	1
Vicksburg[1]	39	--	4	10.4	13
Belle Chasse[1]	46	--	7	14.8	16
		Linear Alkylbenzene Sulfonate			
		see Table 5.5 for summary			
		Adsorbable Organic Halogen			
DIW Blank	0.5	--	2.0	4.3	8
10 μg/L AOX	14.8	148.0	4.1	0.3	14

[1]These samples were used for replicate analyses of natural water.

Table 5.8.--*Summary of recovery data for distilled water spiked with 1 microgram per liter of volatile organic compound standard mix and analyzed as quality-assurance samples for June-July 1991; September-October 1991, and March-April 1992 cruises*

[n, number of samples; Std dev, standard deviation; RSD, relative standard deviation; and %, percent]

Compound	June-July 1991 n=10			September-October 1991 n=15			March-April 1992 n=9		
	Mean recovery (%)	Std dev (%)	RSD (%)	Mean recovery (%)	Std dev (%)	RSD (%)	Mean recovery (%)	Std dev (%)	RSD (%)
dichlorodifluoromethane	101	9	9	111	33	30	88	10	12
chloromethane	119	28	24	108	26	24	83	6	7
vinyl chloride	104	11	11	100	19	19	84	7	9
bromomethane	106	9	9	104	10	10	89	12	13
chloroethane	110	10	9	105	8	7	95	6	6
trichlorofluoromethane	92	4	5	112	27	24	73	4	6
1,1-dichloroethene	85	15	18	91	13	14	87	8	9
methylene chloride	104	12	11	101	10	10	102	9	9
1,2-trans-dichloroethene	98	5	5	101	7	7	88	5	5
1,1-dichloroethane	100	7	7	102	6	6	92	7	7
2,2-dichloropropane	100	20	20	96	15	16	75	8	11
1,2-cis-dichloroethene	105	8	7	102	6	6	93	4	5
bromochoromethane	98	5	5	106	7	7	97	7	8
chloroform	104	7	7	102	5	5	96	6	6
1,1,1-trichloroethane	106	6	6	100	6	6	94	10	11
carbon tetrachloride	103	6	6	100	7	7	83	8	9
1,1-dichloropropene	103	7	6	100	7	7	91	6	6
benzene	105	8	8	103	5	4	100	6	6
1,2-dichloroethane	103	7	10 7	105	5	5	94	7	8
trichloroethene	106	7	7	103	6	6	97	11	11
1,2-dichloropropane	105	6	6	101	4	4	95	5	5
dibromomethane	103	9	8	103	6	5	90	5	6
bromodichloromethane	98	10	10	104	8	8	83	5	6

Table 5.8.--*Summary of recovery data for distilled water spiked with 1 microgram per liter of volatile organic compound standard mix and analyzed as quality-assurance samples for June-July 1991; September-October 1991, and March-April 1992 cruises--Continued*

Compound	June-July 1991 n=10			September-October 1991 n=15			March-April 1992 n=9		
	Mean recovery (%)	Std dev (%)	RSD (%)	Mean recovery (%)	Std dev (%)	RSD (%)	Mean recovery (%)	Std dev (%)	RSD (%)
2-chloroethyl-vinylether	60	24	41	108	15	14	73	12	17
cis-1,3-dichloro-propene	79	5	6	91	12	14	73	3	4
toluene	107	8	7	103	4	4	99	6	6
trans-1,3-dichloro-propene	48	26	53	81	39	48	76	8	11
1,1,2-trichloroethane	95	6	7	100	8	8	95	8	8
tetrachloroethene	106	9	8	100	9	9	94	5	6
1,3-dichloropropane	97	6	6	101	3	3	99	8	8
1,2-dibromoethane	98	8	9	102	9	8	87	5	6
chlorodibro-momethane	93	13	14	97	11	11	74	4	5
chlorobenzene	105	9	9	103	8	7	96	5	5
1,1,2-tetrachloro-ethane	98	10	10	101	8	8	86	4	5
ethylbenzene	110	12	11	102	9	9	100	5	5
m- and p-xylene	107	11	10	101	7	7	98	4	4
o-xylene	104	10	9	100	7	7	98	5	5
styrene	91	29	32	100	9	9	71	26	37
bromoform	87	13	15	93	10	10	77	5	6
isopropylbenzene	119	14	11	106	13	12	98	5	5
bromobenzene	106	8	8	101	4	4	93	4	5
1,2,3-trichloro-propane	90	12	13	101	11	11	83	8	9
1,1,2,2-tetrachloro-ethane	95	7	7	100	7	7	85	15	18

Table 5.8.--*Summary of recovery data for distilled water spiked with 1 microgram per liter of volatile organic compound standard mix and analyzed as quality-assurance samples for June-July 1991; September-October 1991, and March-April 1992 cruises--Continued*

Compound	June-July 1991 n=10			September-October 1991 n=15			March-April 1992 n=9		
	Mean recovery (%)	Std dev (%)	RSD (%)	Mean recovery (%)	Std dev (%)	RSD (%)	Mean recovery (%)	Std dev (%)	RSD (%)
propylbenzene	105	13	13	100	11	11	90	5	5
o-chlorotoluene	107	6	6	102	7	7	96	4	5
p-chlorotoluene	105	9	8	103	9	9	91	4	4
1,3,5-trimethyl-benzene	109	6	6	102	8	8	100	5	5
t-butylbenzene	112	10	9	103	10	10	98	5	6
1,2,4-trimethyl-benzene	108	7	7	103	8	7	101	6	6
s-butylbenzene	118	10	8	105	10	10	103	7	7
m-dichlorobenzene	103	7	7	101	8	8	94	3	3
p-dichlorobenzene	100	8	8	99	7	7	92	5	5
p-isopropyltoluene	112	8	7	102	8	7	100	7	7
o-dichlorobenzene	105	7	7	103	4	4	99	5	5
n-butylbenzene	115	15	13	102	10	10	98	6	6
1,2-dibromo-3-chloropropane	83	12	14	95	13	14	76	4	5
1,2,4-trichlorobenzene	100	6	6	104	5	5	104	9	9
naphthalene	97	7	7	100	6	6	99	5	5
hexachlorobutadiene	103	7	7	101	8	8	103	15	14
1,2,3-trichlorobenzene	97	5	5	101	3	3	106	13	12
Average for all compounds	80	42	52	81	41	50	73	37	51

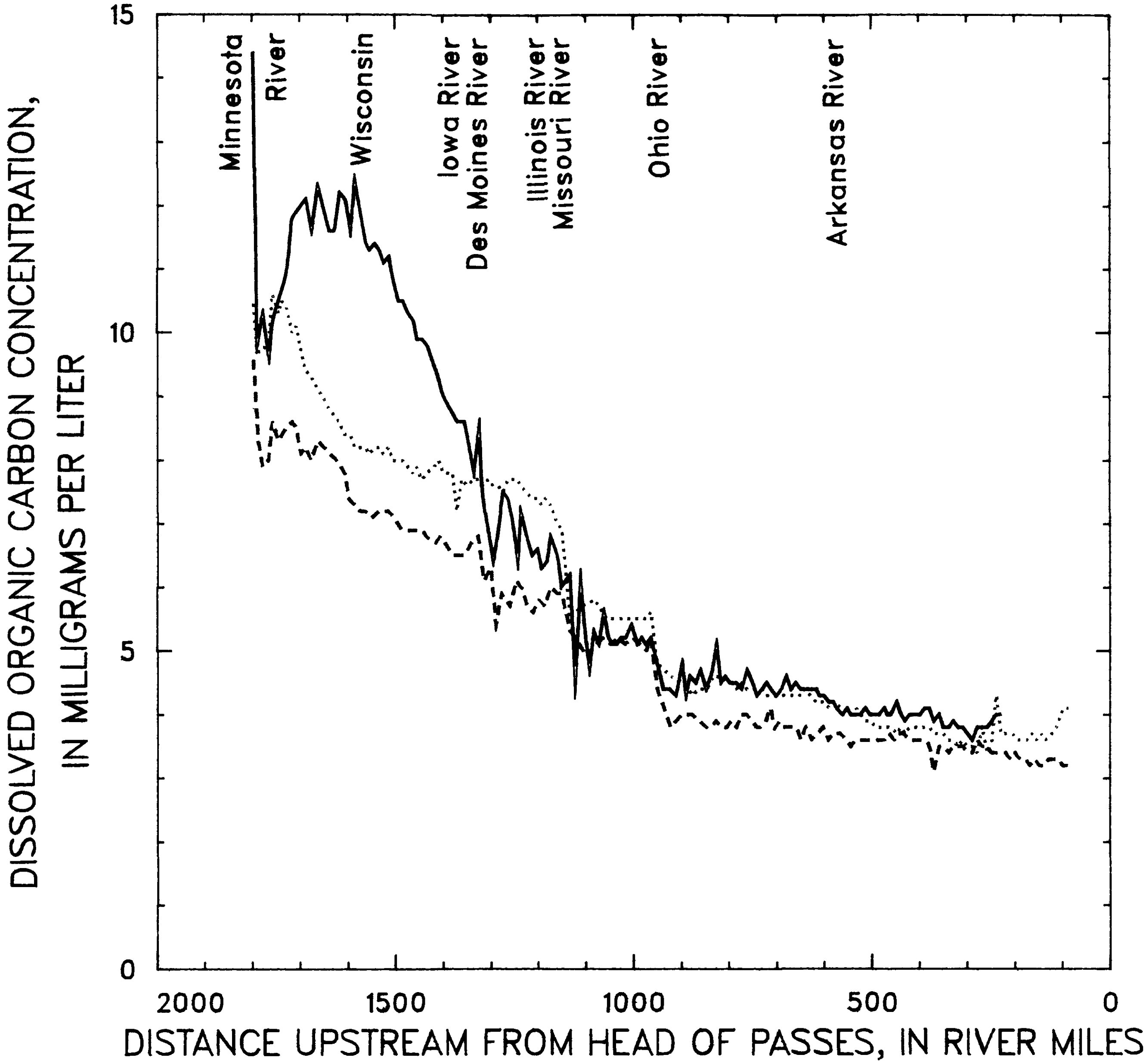

Figure 5.1.--Longitudinal variability of dissolved organic carbon in the Mississippi River upstream from Head of Passes, La., during cruises in June-July 1991 (solid line), September-October 1991 (dotted line), and March-April 1992 (dashed line).

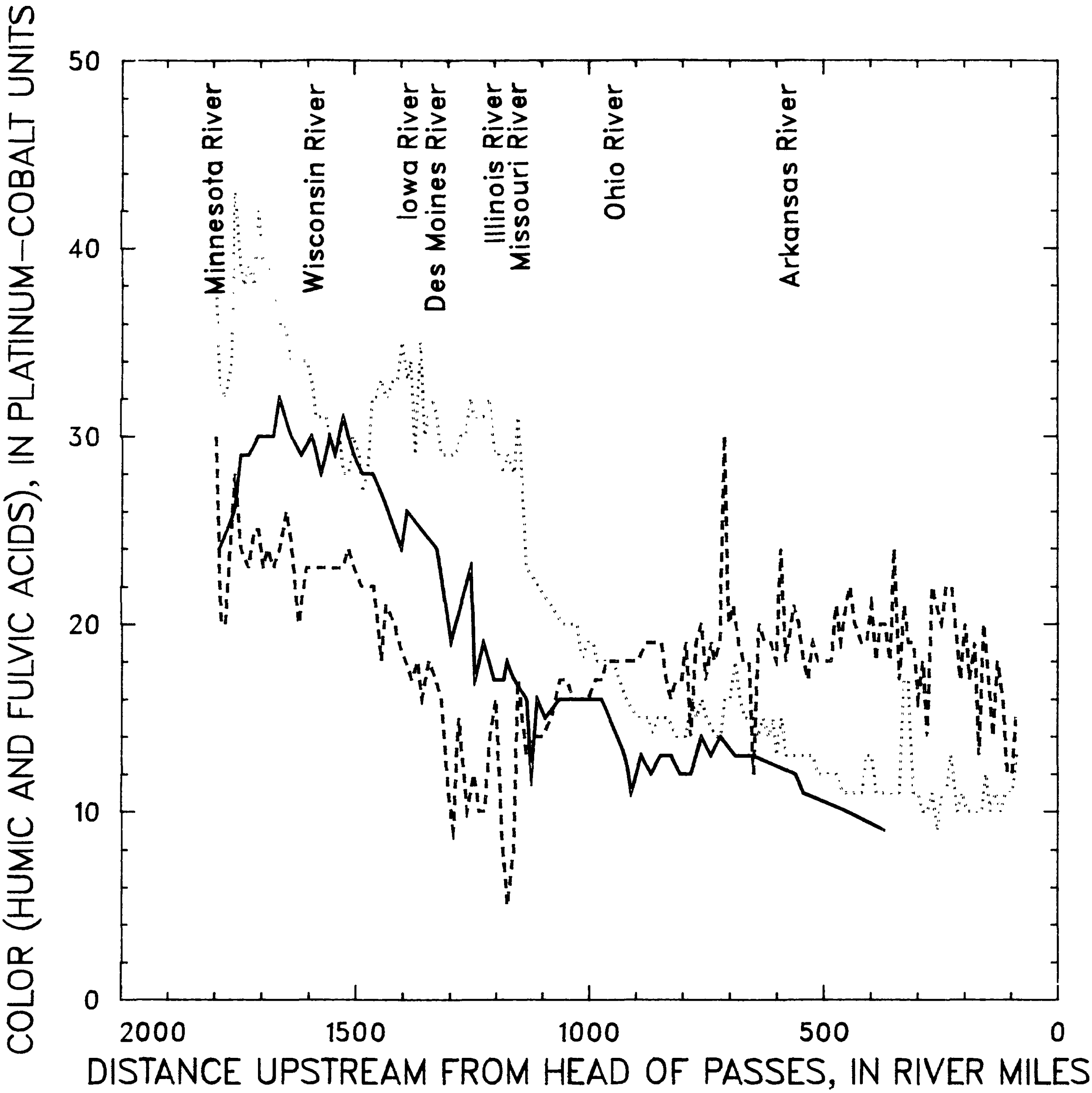

Figure 5.2.--Longitudinal variability of color (humic and fulvic acids) in the Mississippi River upstream from Head of Passes, La., during cruises in June-July 1991 (solid line), September-October 1991 (dotted line), and March-April 1992 (dashed line).

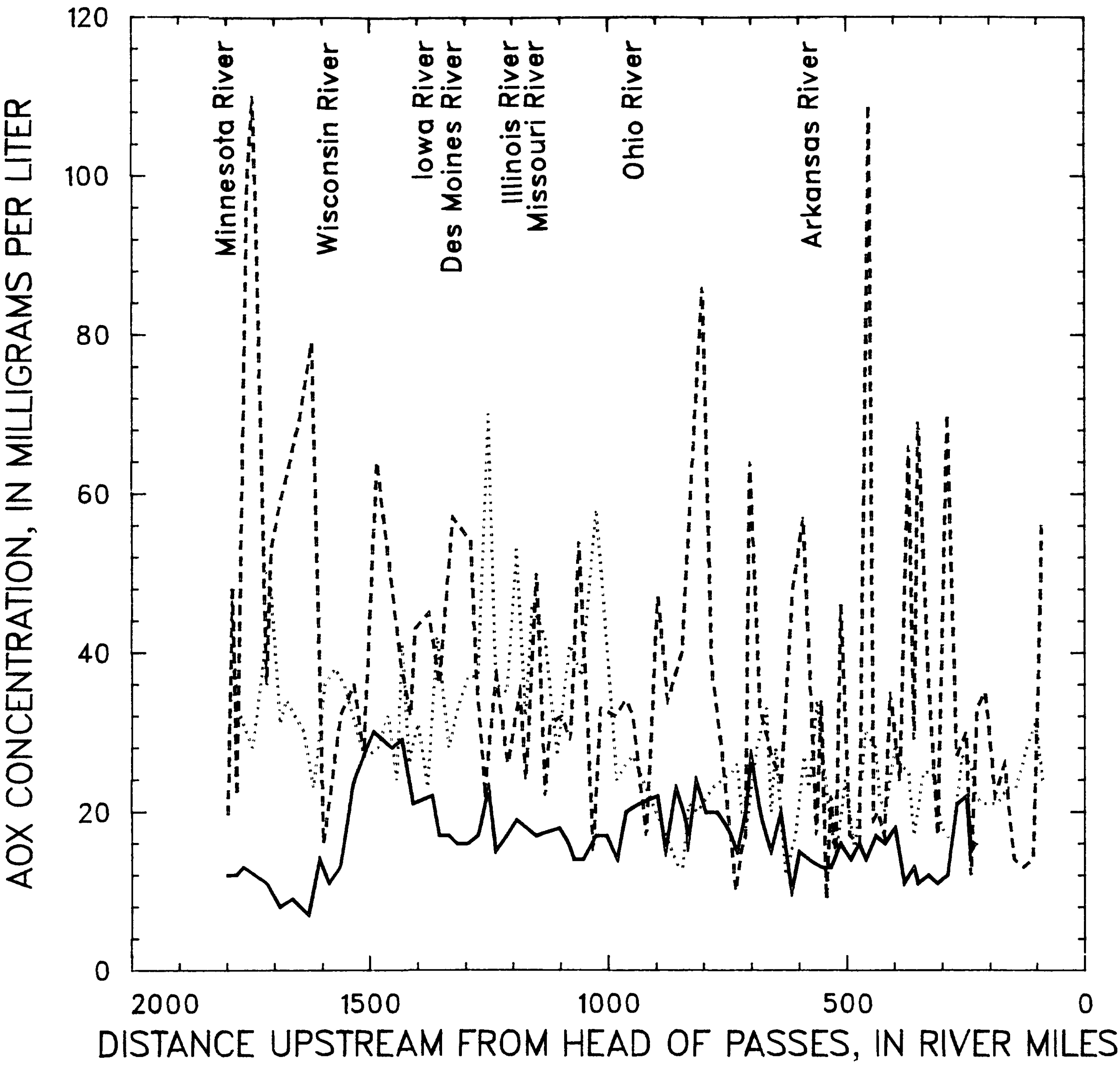

Figure 5.3.--Longitudinal variability of AOX (halogen-containing compounds) in the Misssissippi River upstream from Head of Passes, La., during cruises in June-July 1991 (solid line), September-October 1991 (dotted line), and March-April 1992 (dashed line).

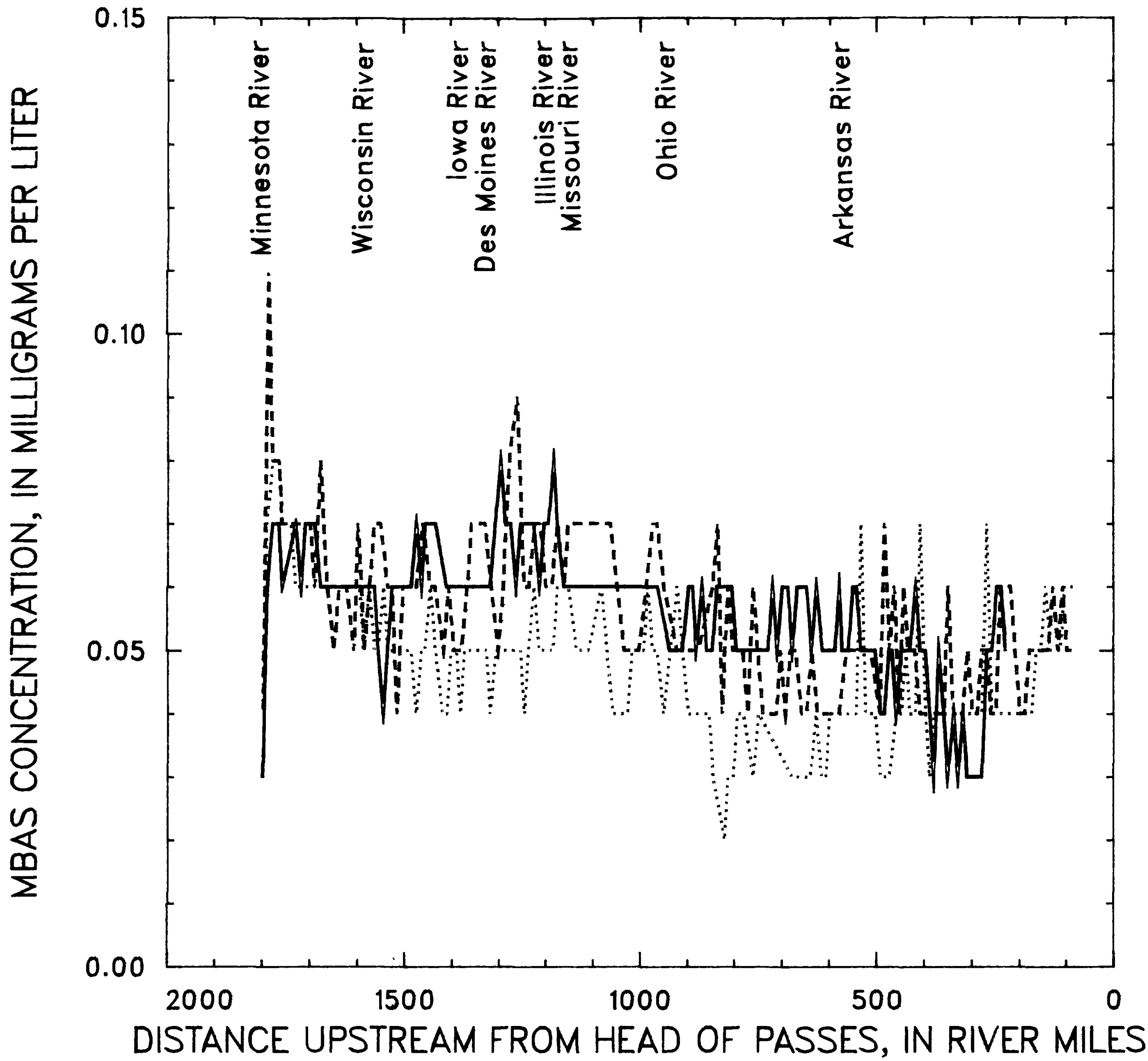

Figure 5.4.--Longitudinal variability of MBAS (anionic surfactants) in the Mississippi River upstream from Head of Passes, La., during cruises in June-July 1991 (solid line), September-October 1991 (dotted line), and March-April 1992 (dashed line).

SUMMARY

During the June-July 1991 cruise, 180 water samples were collected from the Mississippi River. DOC measurements were made on 173 samples; concentrations in the Mississippi River ranged from 3.6 to 14.4 mg/L, and concentrations in the tributaries ranged from 2.5 to 20.8 mg/L (see also Leenheer and others, 1994). Color measurements were made on 62 samples; concentrations in the Mississippi River ranged from 9 to 32 Pt/Co units, and concentrations in the tributaries was measured only in the Missouri River and was 10 Pt/Co units. MBAS measurements were made on 173 samples; concentrations in the Mississippi River ranged from 0.03 to 0.08 mg/L, and concentrations in the tributaries ranged from 0.03 to 0.10 mg/L. AOX measurements were made on 101 samples; concentrations in the Mississippi River ranged from 7 to 30 μg/L, and concentrations in the tributaries ranged from 7 to 50 μg/L. VOC measurements were made on 109 samples, and 21 of the samples had individual VOCs at concentrations ranging from 0.2 to 1 μg/L. The VOCs that were detected include benzene, toluene, xylene, 1,2,4-trimethylbenzene, 1,2-dichloroethane, 1,1,1-tri-chloroethane, and several cyclohexanes. LAS measurements were made on 95 samples; concentrations in the Mississippi River ranged from less than 0.07 to 10 μg/L, and concentrations in the tributaries ranged from not detected to one value of 2.8 μg/L. AP and APEO measurements were made on 99 samples, and there were no detectable concentrations.

During the September-October 1991 cruise, 206 water samples were collected from the Mississippi River. DOC measurements were made on 200 samples; concentrations in the Mississippi River ranged from 3.4 to 10.6 mg/L, and concentrations in the tributaries ranged from 2.7 to 12.1 mg/L (see also Leenheer and others, 1994). Color measurements were made on 191 samples; concentrations in the Mississippi River ranged from 9 to 43 Pt/Co units, and concentrations in the tributaries ranged from 11 to 73 Pt/Co units. MBAS measurements were made on 191 samples; concentrations in the Mississippi River ranged from 0.02 to 0.08 mg/L, and concentrations in the tributaries ranged from 0.03 to 0.11 mg/L. AOX measurements were made on 105 samples; concentrations in the Mississippi River ranged from 12 to 70 μg/L, and concentrations in the tributaries ranged from 9 to 71 μg/L. VOC measurements were made on 136 samples, and individual VOCs were detected in 54 of the samples at concentrations ranging from 0.2 to 2.2 μg/L. The VOCs that were detected include benzene, toluene, 1,2-dichloroethane, 1,1,1-tri-chloroethane, dichloromethane, trichloromethane, dichlorodifluoromethane, trichlorofluoromethane, furan, and several hydrocarbons. LAS measurements were made on 124 samples; concentrations in the Mississippi River ranged from not detected to 7.2 μg/L, and concentrations in the tributaries ranged from not detected to 4.7 μg/L. AP and APEO measurements were made on 41 samples, and no samples had concentrations above the 0.5 μg/L detection limit.

During the March-April 1992 cruise, 201 water samples were collected from the Mississippi River. DOC measurements were made on 196 samples; concentrations in the Mississippi River ranged from 3.5 to 9.6 mg/L, and concentrations in the tributaries ranged from 2.6 to 9.6 mg/L (see also Leenheer and others, 1994). Color measurements were made on 196 samples; concentrations in the Mississippi River ranged from 5 to 163 Pt/Co units, and concentrations in the tributaries ranged from 7 to 51 Pt/Co units. MBAS measurements were made on 193 samples; concentrations in the Mississippi River ranged from 0.04 to 0.11 mg/L, and concentrations in the tributaries ranged from 0.02 to 0.13 mg/L. AOX measurements were made on 130 samples; concentrations in the Mississippi River ranged from 9 to 110 μg/L, and concentrations in the tributaries ranged from 14 to 146 μg/L. VOC measurements were made on 139 samples, and individual VOCs were detected in 7 samples at concentrations ranging from 0.2 to 0.4 μg/L. The

VOCs that were detected include toluene, 1,2,4-trichlorobenzene, 1,2,3-trichlorobenzene, 1,1,1-trichloroethane, tetrachloroethene, and hexachlorobutadiene. LAS measurements were made on 105 samples; concentrations in the Mississippi River ranged from not detected to 4.23 µg/L, and concentrations in the tributaries ranged from not detected to 0.18 µg/L. No AP and APEO measurements were made on samples from this cruise.

Data for the specific LAS homologs and isomers used to calculate the internal/external isomer ratios and average chain length values given in tables 5.9 to 5.23 are summarized in table 5.24. These data represent all samples collected during the three cruises that have LAS concentrations above 0.1 µg/L.

REFERENCES

American Public Health Association, 1985, Standard Methods for the Examination of Water and Wastewater, 16th Edition; American Public Health Association, Washington, D.C., p. 67–72.

Barber, L.B., II, 1992, Hierarchical analytical approach to evaluating the transport and biogeochemical fate of organic compounds in sewage-contaminated groundwater, Cape Cod, Massachusetts; in S. Lesage and R.E. Jackson, eds., Groundwater Contamination and Analysis at Hazardous Waste Sites, Marcel Dekker, New York, chapter 4, p. 73–120.

Field, J.A., 1990, Fate and transformation of surfactants in sewage-contaminated groundwater; PhD Dissertation, Colorado School of Mines, Golden, Colo., 207 p.

Leenheer, J.A., 1984, Concentration, partitioning, and isolation techniques; in Water Analysis, vol. III, chapter 3, Academic Press, p. 83–166.

Leenheer, J.A., Barber, L.B., Rostad, C.E., and Noyes, T.I., 1994, Data on natural organic substances in dissolved, colloidal, suspended-silt and clay, and bed-sediment phases in the Mississippi River and some of its tributaries, 1991–92: U.S. Geological Survey Water-Resources Investigations Report 94-4191, 47 p.

Thurman, E.M., 1985, Organic geochemistry of Natural Waters, Martinus Nijhoff/Dr W. Junk Publ., Dordrecht, 497 p.

Trehy, M.L., Gledhill, W.E., and Orth, R.G., 1990, Determination of linear alkylbenzenesulfonates and dialkyltetralinsulfonates in water and sediments by gas chromatography/mass spectrometry: Analytical Chemistry, v. 62, p. 2581.

U.S. Environmental Protection Agency, 1984, Guidelines establishing test procedures for the analysis of pollutants under the clean water act; Final rule and interm final rule and proposed rule: Federal Register, v. 49, no. 209, p. 2–210.

Wershaw, R.L., Fishman, M.J., Grabbe, R.R., and Lowe, L.E., eds., 1983, Methods for the Determination of Organic Substances in Water and Fluvial Sediments: U.S. Geological Survey, Techniques in Water Resources Investigations, book 5, chapter A3, 173 p.

Table 5.9.--*Concentration of dissolved organic*
Mississippi River between Baton Rouge,

[km, kilometers; CDT, Central Daylight Time; m^3/s, cubic meters per second; µS/cm, microsiemens per centimeter
Pt/Co units, Platinum-cobalt units; AOX, adsorbable organic halide; µg/L, microgram per liter; MBAS, methylene blue
APEO alykylphenol polyethoxylate homologues and isomers; --, no measurement; nd, not detected;

Location													
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Temperature (°C)	DOC (mg/L)	Color (Pt/Co units)	AOX (µg/L)	MBAS (mg/L)	LAS (µg/L)	LAS avg chain length (carbon units)
												June 23, 1991
230.0	0	[2]X	2240	16,000	393	--	4.0	--	16	0.05	dnq	nd
240.3	22	0.5	2345	16,100	386	25	4.0	--	15	0.06	--	--
												June 24, 1991
248.8	40	0.5	0045	16,100	382	23	3.9	--	22	0.06	nd	nd
258.6	60	0.5	0146	16,200	385	23	3.9	--	--	0.05	--	--
269.6	83	0.5	0300	16,300	388	25	3.9	--	21	0.05	nd	nd
279.7	107	0.5	0415	16,300	385	25	3.8	--	--	0.03	--	--
289.8	130	0.5	0525	16,400	380	25	3.6	--	12	0.03	nd	nd
300.0	152	0.5	0640	16,500	397	25	3.7	--	--	0.03	--	--
310.0	173	0.5	0745	16,500	383	25	3.8	--	11	0.03	nd	nd
320.0	193	0.5	0833	18,500	390	24	3.8	--	--	0.04	--	--
330.4	217	0.5	1010	18,300	393	25	3.9	--	12	0.03	nd	nd
340.0	237	0.5	1105	18,100	399	25	3.8	--	--	0.04	--	--
351.2	260	0.5	1215	17,800	395	25	3.8	--	11	0.03	nd	nd
360.0	279	[2]X	1320	17,700	397	25	4.0	--	13	0.04	dnq	nd
371.2	310	0.5	1605	17,500	398	26	3.9	9	--	0.05	--	--
380.4	329	0.5	1704	17,400	392	26	4.1	--	11	0.03	dnq	nd
389.8	349	0.5	1810	17,300	388	25	4.1	--	--	0.04	--	--
399.4	370	0.5	1915	17,300	383	25	4.0	--	18	0.05	dnq	nd
409.5	392	0.5	2029	17,200	393	24	4.0	--	--	0.05	--	--
420.1	414	0.5	2135	17,100	404	24	4.0	--	16	0.06	--	--
432.0	440	0.5	2259	16,900	400	25	3.9	--	--	0.05	--	--
439.8	457	0.5	2352	14,900	400	24	4.0	--	17	0.05	nd	nd
												June 25, 1991
449.1	476	0.5	0050	15,000	399	25	4.2	10	--	0.05	--	--
460.8	501	0.5	0215	15,000	399	24	4.0	--	14	0.04	--	--
469.0	519	0.5	0315	15,100	396	24	4.0	--	--	0.05	--	--
475.0	532	[2]X	0400	15,100	399	25	4.1	--	16	0.05	dnq	nd
485.5	554	0.5	0512	15,200	396	25	4.0	--	--	0.04	--	--
493.0	571	0.5	0618	15,200	397	23	4.0	--	14	0.04	nd	nd
504.5	595	0.7	0725	15,300	389	25	4.0	--	--	0.05	--	--
514.1	616	0.5	0837	15,300	388	24	4.1	--	16	0.05	nd	nd
525.3	640	0.5	1000	15,400	390	24	4.0	--	--	0.05	--	--

compounds in approximately midchannel of the Lower
La., and Cairo, Ill., June-July 1991 cruise

at 25 degrees Celsius; °C, degrees Celsius; DOC, dissolved organic carbon; mg/L, milligrams per liter;
active substances; LAS, linear alkylbenzene sulfonate; I/E ratio, internal/external isomer ratio; AP alykylphenol;
dnq, detected but not quantified]

Concentration of volatile organic compounds										
LAS I/E ratio	Total AP (μg/L)	Sum total APEO (μg/L)	Methylene chloride (μg/L)	Benzene (μg/L)	Toluene (μg/L)	Total xylene isomers (μg/L)	1,2,4-trimethyl benzene (μg/L)	1,2-dichloro-ethane (μg/L)	Cyclo-alkanes (μg/L)	1,1,1-tri-chloro-ethane (μg/L)
nd	--	--	1.0	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
--	--	--	nd	nd	nd	nd	nd	nd	0.8	nd
--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	0.2	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--

Table 5.9.--*Concentration of dissolved organic*
Mississippi River between Baton Rouge,

Location												
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	DOC (mg/L)	Color (Pt/Co units)	AOX (μg/L)	MBAS (mg/L)	LAS (μg/L)	LAS avg chain length (carbon units)
534.5	660	0.5	1106	15,400	391	24	4.0	--	13	0.05	nd	nd
545.0	687	0.5	1310	15,500	390	23	4.0	11	--	0.06	--	--
552.5	705	0.5	1420	15,500	389	24	4.1	--	13	0.06	nd	nd
562.2	726	0.5	1528	15,600	395	25	4.0	12	--	0.05	--	--
575.0	753	0.5	1635	15,600	399	25	4.1	--	--	0.05	--	--
580.8	766	[2]X	1718	15,600	438	27	4.2	--	14	0.06	nd	nd
590.3	788	0.6	1834	15,100	394	26	4.2	--	--	0.05	--	--
600.2	808	0.5	1932	14,600	398	25	4.3	--	15	0.05	nd	nd
610.0	833	0.5	2109	14,400	391	26	4.3	--	--	0.05	--	--
616.5	850	0.5	2223	14,300	391	25	4.4	--	10	0.05	nd	nd
629.3	875	0.5	2314	14,200	395	25	4.4	--	--	0.06	--	--
												June 26, 1991
639.7	903	0.5	0113	13,900	409	22	4.4	1	20	0.05	nd	nd
650.2	928	0.5	0241	13,800	421	25	4.4	13	--	0.06	--	--
660.2	951	0.5	0353	13,700	421	25	4.5	--	15	0.06	nd	nd
669.9	973	0.5	0505	13,700	428	25	4.4	13	--	0.06	--	--
680.0	996	0.5	0616	13,600	435	25	4.6	--	19	0.05	nd	nd
689.9	1,018	0.5	0725	13,600	435	25	4.4	13	--	0.06	--	--
702.0	1,047	0.5	0903	13,500	439	24	4.3	--	27	0.06	nd	nd
712.9	1,072	[2]X	1023	13,500	429	24	4.4	--	20	0.05	nd	nd
721.5	1,093	0.5	1135	13,500	443	23	4.5	14	--	0.06	--	--
731.5	1,116	0.5	1248	13,400	434	24	4.4	--	15	0.05	nd	nd
742.0	1,148	0.5	1525	13,300	427	25	4.3	13	--	0.05	--	--
751.1	1,168	0.5	1640	13,300	422	25	4.5	--	18	0.05	nd	nd
762.2	1,192	0.5	1802	13,200	421	25	4.7	14	--	0.05	--	--
773.0	1,215	0.5	1919	13,100	418	25	4.4	--	20	0.05	nd	nd
785.0	1,241	0.7	2042	12,900	412	25	4.5	12	--	0.05	--	--
797.4	1,269	0.6	2224	12,700	405	25	4.5	--	20	0.05	dnq	nd
807.9	1,292	0.8	2345	12,600	401	24	4.6	12	--	0.06	--	--
												June 27, 1991
817.5	1,312	0.7	0105	12,500	415	24	4.5	--	24	0.06	dnq	nd
826.7	1,332	0.5	0221	12,400	412	24	5.1	13	--	0.06	--	--
835.5	1,351	0.5	0324	12,300	413	25	4.7	--	16	0.06	dnq	nd
839.0	1,360	[2]X	0403	12,300	413	25	4.6	--	19	0.06	nd	nd
848.5	1,381	0.5	0525	12,200	413	25	4.4	13	--	0.05	--	--

compounds in approximately midchannel of the Lower La., and Cairo, Ill., June-July 1991 cruise--Continued

Concentration of volatile organic compounds										
LAS I/E ratio	Total AP (μg/L)	Sum total APEO (μg/L)	Methylene chloride (μg/L)	Benzene (μg/L)	Toluene (μg/L)	Total xylene isomers (μg/L)	1,2,4-trimethyl banzene (μg/L)	1,2-dichloro-ethane (μg/L)	Cyclo-alkanes (μg/L)	1,1,1-tri-chloro-ethane (μg/L)
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	nd	nd	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	0.2	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--

Table 5.9.--*Concentration of dissolved organic Mississippi River between Baton Rouge,*

Location												
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	DOC (mg/L)	Color (Pt/Co units)	AOX (μg/L)	MBAS (mg/L)	LAS (μg/L)	LAS avg chain length (carbon units)
												June 27, 1991
860.2	1,407	0.5	0653	12,000	412	25	4.7	--	23	0.05	nd	nd
870.0	1,427	0.5	0757	11,900	410	25	4.5	12	--	0.06	--	--
882.4	1,453	0.5	0919	11,800	405	25	4.6	--	15	0.05	nd	nd
890.5	1,471	0.5	1017	11,700	398	26	4.3	13	--	0.06	--	--
898.9	1,489	[2]X	1118	11,600	407	26	4.8	--	22	0.06	nd	nd
911.9	1,517	0.1	1255	11,500	386	23	4.3	11	--	0.05	--	--
924.5	1,544	0.5	1418	11,400	378	25	4.4	13	--	0.05	--	--
937.6	1,572	[2]X	1553	11,500	377	26	4.4	--	21	0.05	nd	nd

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 230.0 upriver from Head of Passes, La., on June 23, 1991, at 2240 hours.

[2]X indicates three samples were collected across the river at this location. These individual values appear in table 5.15; the values of specific conductance, temperature, and chemical concentrations in this table are the mean values. Values below the detection limit were NOT included in the mean.

[3] Water discharges are linearly interpolated values between discharges listed in table 1.5 in chapter 1.

compounds in approximately midchannel of the Lower La., and Cairo, Ill., June-July 1991 cruise--Continued

Concentration of volatile organic compounds										
LAS I/E ratio	Total AP (μg/L)	Sum total APEO (μg/L)	Methylene chloride (μg/L)	Benzene (μg/L)	Toluene (μg/L)	Total xylene isomers (μg/L)	1,2,4-trimethyl benzene (μg/L)	1,2-dichloro-ethane (μg/L)	Cyclo-alkanes (μg/L)	1,1,1-tri-chloro-ethane (μg/L)
				nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	--	--	--	--	--	--	--
--	--	--	--	nd	--	--	--	--	--	--
nd	nd	nd	nd	nd	0.2	nd	nd	0.2	nd	nd
--	--	--	--	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	0.2	nd	nd
--	--	--	--	--	--	--	--	--	--	--
--	--	--	nd	nd	0.3	nd	nd	nd	nd	nd
nd	dnq	dnq	nd	nd	nd	nd	nd	0.3	nd	nd

Table 5.10.--*Concentration of dissolved organic*
Mississippi River between Cairo, Ill.,

[km, kilometers; CDT, Central Daylight Time; m^3/s, cubic meters per second; µS/cm, microsiemens per centimeter

Pt/Co units, Platinum-cobalt units; AOX, adsorbable organic halide; µg/L, microgram per liter; MBAS, methylene blue

APEO alykylphenol polyethoxylate homologues and isomers; --, no measurement; nd, not detected;

Location													
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Temperature (°C)	DOC (mg/L)	Color (Pt/Co units)	AOX (µg/L)	MBAS (mg/L)	LAS (µg/L)	LAS avg chain length (carbon units)
												June 27, 1991
10.8	1,638	0.5	2034	7,800	432	25	5.2	--	20	0.06	dnq	nd
20.9	1,661	0.5	2151	7,800	439	23	5.1	16	--	0.06	--	--
29.6	1,682	0.5	2304	7,800	429	23	5.2	--	14	0.06	nd	nd
												June 28, 1991
39.0	1,704	0.5	0024	7,800	442	24	5.1	16	--	0.06	--	--
51.6	1,735	0.5	0214	7,800	441	24	5.4	16	17	0.06	nd	nd
63.3	1,761	0.5	0334	7,700	442	24	5.2	16	--	0.06	--	--
73.7	1,785	0.5	0452	7,700	445	23	5.2	--	17	0.06	nd	nd
82.8	1,806	0.5	0603	7,700	448	24	5.1	16	--	0.06	--	--
91.0	1,824	0.5	0702	7,500	449	24	5.1	16	--	0.06	nd	nd
100.7	1,846	[2]X	0814	7,500	458	24	5.3	--	14	0.06	nd	nd
110.0	1,868	0.1	0928	7,500	444	25	5.6	16	--	0.06	--	--
120.1	1,891	0.9	1045	7,400	461	24	5.1	--	14	0.06	0.07	10.2
130.6	1,916	0.1	1205	7,400	473	25	5.3	--	16	0.06	0.34	10.9
140.4	1,938	0.9	1321	7,400	497	24	4.7	15	--	0.06	--	--
150.0	1,961	[2]X	1437	7,400	484	26	5.4	--	18	0.06	dnq	nd
158.2	1,980	0.1	1541	7,400	468	25	6.1	16	--	0.06	--	--
170.0	2,006	0.9	1706	7,300	526	25	4.5	12	--	0.06	10.3	10.8
180.3	2,031	0.1	1832	7,300	472	25	6.2	16	--	0.06	nd	nd
198.4	2,077	0.3	2245	5,500	461	23	6.0	--	17	0.06	nd	nd
												June 29, 1991
207.2	2,097	0.3	0012	5,400	466	23	6.5	17	--	0.06	--	--
221.6	2,144	0.3	0709	5,000	443	24	6.8	18	--	0.07	dnq	nd
229.2	2,160	0.5	0802	4,900	450	23	6.4	17	--	0.08	--	--
240.2	2,182	0.5	0915	4,800	451	24	6.3	--	19	0.07	nd	nd
249.2	2,200	0.5	1026	4,800	451	24	6.3	17	--	0.07	--	--
260.2	2,223	0.5	1145	4,700	449	25	6.5	--	17	0.06	dnq	nd
272.0	2,246	0.5	1257	4,600	459	25	6.8	19	--	0.07	--	--
283.3	2,272	0.5	1514	4,500	451	25	7.2	--	15	0.07	dnq	nd
291.0	2,288	0.5	1606	4,400	466	25	6.4	17	--	0.07	--	--
299.0	2,304	0.5	1701	4,400	460	26	6.9	23	23	0.07	nd	nd
310.0	2,327	0.5	1842	4,200	452	26	7.4	22	--	0.06	--	--

compounds in approximately midchannel of the Upper and Minneapolis, Minn., June-July 1991 cruise

at 25 degrees Celsius; °C, degrees Celsius; DOC, dissolved organic carbon; mg/L, milligrams per liter;

active substances; LAS, linear alkylbenzene sulfonate; I/E ratio, LAS, internal/external isomer ratio; AP, alykylphenol;

dnq, detected but not quantified; NE, no external isomers; no-C_{12}, no C_{12} homolog]

			Concentration of volatile organic compounds							
LAS I/E Ratio	Total AP (μg/L)	Sum total APEO (μg/L)	Methylene chloride (μg/L)	Benzene (μg/L)	Toluene (μg/L)	Total xylene isomers (μg/L)	1,2,4-trimethyl benzene (μg/L)	1,2-dichloro-ethane (μg/L)	Cyclo-alkanes (μg/L)	1,1,1-tri-chloro-ethane (μg/L)
nd	--	--	nd	nd	0.2	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
no-C_{12}	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
0.62	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
NE	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	0.2	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	0.2	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--

Table 5.10.--*Concentration of dissolved organic*
Mississippi River between Cairo, Ill.,

Location: River miles upriver from mouth of Ohio River	Location: Distance upriver from first sample[1] (km)	Location: Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	DOC (mg/L)	Color (Pt/Co units)	AOX (μg/L)	MBAS (mg/L)	LAS (μg/L)	LAS avg chain length (carbon units)
321.0	2,350	0.5	1959	3,900	445	25	7.5	--	17	0.07	nd	nd
331.0	2,371	0.5	2120	3,900	446	25	6.9	20	--	0.07	--	--
341.5	2,394	0.5	2312	4,000	444	24	6.4	19	16	0.08	0.73	11.1
												June 30, 1991
363.9	2,438	0.6	0123	3,000	463	26	7.4	--	16	0.06	dnq	nd
370.9	2,454	0.5	0302	3,000	458	25	8.5	24	--	0.06	--	--
381.8	2,474	0.8	0405	3,000	465	24	7.8	--	17	0.06	dnq	nd
402.8	2,515	0.5	0620	3,000	450	25	8.6	--	17	0.06	0.49	11.4
417.2	2,553	0.5	1139	3,000	434	25	8.6	--	22	0.06	nd	nd
435.2	2,588	0.5	1349	2,400	444	25	4.3	26	--	0.06	dnq	nd
447.6	2,615	0.5	1613	2,400	435	26	9.2	24	--	0.06	--	--
457.1	2,638	0.5	1842	2,500	440	27	9.3	--	21	0.06	nd	nd
480.0	2,681	0.5	2046	2,500	423	27	9.8	--	29	0.07	nd	nd
491.1	2,703	0.5	2219	2,600	403	26	9.9	27	--	0.07	--	--
501.0	2,724	0.5	2355	2,500	419	26	9.9	--	28	0.07	0.24	11.6
												July 1, 1991
509.3	2,740	0.5	0056	2,400	418	25	10.2	28	--	0.06	--	--
520.0	2,760	0.5	0204	2,300	423	25	10.3	--	29	0.07	nd	nd
531.0	2,783	0.5	0340	2,300	422	24	10.5	28	--	0.06	--	--
539.8	2,800	0.5	0440	2,300	413	24	10.5	--	30	0.06	nd	nd
551.0	2,821	0.5	0555	2,300	416	25	10.8	29	--	0.06	--	--
560.7	2,840	0.7	0700	2,300	422	24	11.2	--	27	--	--	--
572.0	2,862	0.5	0813	2,300	409	26	11.1	31	--	0.06	--	--
581.5	2,880	0.5	0914	2,300	392	26	11.3	--	24	0.05	nd	nd
590.5	2,898	0.7	1030	2,300	408	25	11.4	29	--	0.04	--	--
602.2	2,921	0.5	1145	2,300	407	26	11.3	30	--	0.05	--	--
610.0	2,938	0.5	1329	2,300	442	24	11.4	--	13	0.06	nd	nd
621.3	2,961	0.6	1509	2,300	458	25	--	28	--	0.06	--	--
633.0	2,984	0.5	1634	2,100	463	26	12.4	--	11	0.06	--	--
641.8	3,000	0.5	1735	1,900	464	25	11.6	30	--	0.06	--	--
653.0	3,021	0.5	1855	1,800	467	27	12.1	--	14	0.06	dnq	nd
664.7	3,043	0.5	2014	1,800	471	25	12.2	29	--	0.06	--	--
675.5	3,063	0.5	2123	1,800	452	26	11.6	--	7	0.06	--	--
686.1	3,082	0.5	2238	1,700	478	25	11.6	30	--	--	--	--

Concentration of volatile organic compounds										
LAS I/E Ratio	Total AP (μg/L)	Sum total APEO (μg/L)	Methylene chloride (μg/L)	Benzene (μg/L)	Toluene (μg/L)	Total xylene isomers (μg/L)	1,2,4-trimethyl benzene (μg/L)	1,2-dichloro-ethane (μg/L)	Cyclo-alkanes (μg/L)	1,1,1-tri-chloro-ethane (μg/L)
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
0.69	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	nd	nd	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	0.2	nd	nd	nd	nd	nd
0.46	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	nd	nd	nd	--	--	--	--	--	--	--
nd	nd	nd	nd	0.4	1.0	0.7	0.2	nd	nd	0.2
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
0.63	nd	nd	nd	nd	0.2	nd	nd	nd	nd	nd
--	nd	nd	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
--	nd	nd	--	--	--	--	--	--	--	--
nd	dnq	dnq	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
--	--	--	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--

Location												
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	DOC (mg/L)	Color (Pt/Co units)	AOX (μg/L)	MBAS (mg/L)	LAS (μg/L)	LAS avg chain length (carbon units)
												July 2, 1991
710.0	3,126	0.5	0133	1,600	491	23	12.3	32	9	0.06	--	--
723.2	3,152	0.5	0347	1,600	501	22	11.6	30	--	0.06	--	--
735.7	3,176	0.5	0535	1,600	501	22	12.1	--	8	0.07	dnq	nd
745.5	3,196	0.5	0813	1,600	513	23	--	--	--	--	--	--
755.5	3,215	0.5	0939	1,600	488	23	11.9	30	--	0.07	--	--
764.9	3,233	0.8	1049	1,300	526	23	11.8	--	11	0.06	nd	nd
776.4	3,253	0.5	1154	1,200	567	24	10.9	29	--	0.07	--	--
793.2	3,284	0.5	1344	1,100	579	23	--	29	--	--	0.64	10.6
805.5	3,307	0.5	1519	1,100	576	23	10.2	26	--	0.06	--	--
812.4	3,320	0.5	1614	900	633	23	9.6	--	13	0.07	nd	nd
826.1	3,345	0.5	1757	1,000	629	23	10.3	--	13	0.07	0.55	10.9
838.0	3,368	0.5	2008	1,000	606	23	9.8	24	--	0.06	--	--
846.0	3,383	0.5	2115	400	402	23	14.4	--	12	0.03	nd	nd

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 230.0 upriver from Head of Passes, La., on June 23, 1991, at 2240 hours.

[2]X indicates three samples were collected across the river at this location. These individual values appear in table 5.16; the values of specific conductance, temperature, and chemical concentration in this table are the mean values. Values below the detection limit were NOT included in the mean.

[3]Water discharges are linearly interpolated values between discharges listed in table 1.5 in chapter 1.

compounds in approximately midchannel of the Upper and Minneapolis, Minn., June-July 1991 cruise--Continued

Concentration of volatile organic compounds										
LAS I/E Ratio	Total AP (μg/L)	Sum total APEO (μg/L)	Methylene chloride (μg/L)	Benzene (μg/L)	Toluene (μg/L)	Total xylene isomers (μg/L)	1,2,4-trimethyl benzene (μg/L)	1,2-dichloro-ethane (μg/L)	Cyclo-alkanes (μg/L)	1,1,1-tri-chloro-ethane (μg/L)
--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	nd	nd	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
NE	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	dnq	dnq	nd	nd	nd	nd	nd	nd	nd	nd
NE	dnq	dnq	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

Table 5.11.--*Concentration of dissolved organic* *Mississippi River between New Orleans,*

[km, kilometers; CDT, Central Daylight Time; m^3/s, cubic meters per second; µS/cm, microsiemens per centimeter Pt/Co units, Platinum-cobalt units; AOX, adsorbable organic halide; µg/L, microgram per liter; MBAS, methylene blue APEO, alykylphenol polyethoxylate homologues and isomers; --, no measurement; nd, not detected;

Location													
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Temperature (°C)	DOC (mg/L)	Color (Pt/Co Units)	AOX (µg/L)	MBAS (mg/L)	LAS (µg/L)	LAS avg chain length (carbon units)
												September 25, 1991
88.5	0	[2]X	0647	4,500	457	26	4.1	13	24	0.06	1.44	11.6
99.1	19	0.6	0757	4,500	444	26	4.1	11	--	0.06	--	--
105.1	30	0.6	0853	4,500	444	25	--	--	31	0.06	nd	nd
113.9	45	0.5	0922	4,500	450	26	3.8	11	--	0.05	--	--
123.1	61	0.5	1019	4,500	441	25	3.7	10	28	0.05	dnq	nd
134.9	82	0.4	1126	4,500	432	25	3.6	11	--	0.05	--	--
146.0	100	0.5	1235	4,500	431	24	3.7	10	23	0.06	0.10	12.0
155.6	119	0.6	1325	4,500	433	25	3.6	12	--	0.05	--	--
164.7	136	0.5	1430	4,500	441	25	3.7	10	23	0.05	dnq	nd
175.4	155	0.5	1532	4,500	451	23	3.6	10	--	0.04	--	--
184.8	172	[2]X	1635	4,500	451	26	3.6	10	21	0.04	nd	nd
195.1	191	0.4	1742	4,500	448	23	3.6	10	21	0.04	--	--
206.8	212	0.5	1850	4,500	449	24	3.7	11	--	0.04	nd	nd
216.2	229	0.5	1950	4,500	425	24	3.7	10	21	0.04	--	--
230.0	254	[2]X	2120	4,500	431	25	3.7	13	22	0.04	dng	nd
												September 26, 1991
240.0	280	0.5	0241	4,700	415	23	4.3	11	26	0.04	--	--
249.0	296	0.3	0337	4,900	417	23	3.6	11	--	0.04	nd	nd
258.8	314	0.7	0435	5,100	417	23	3.4	9	27	0.04	--	--
269.9	334	0.5	0545	5,400	416	23	3.8	11	--	0.07	0.42	11.4
279.7	352	0.5	0655	5,600	412	23	3.4	10	16	0.04	--	--
289.6	370	0.5	0758	5,800	419	22	3.5	10	--	0.04	nd	nd
301.0	389	0.7	0924	6,100	406	23	3.5	11	18	0.04	--	--
310.0	405	0.5	1019	6,300	416	23	3.6	11	--	0.04	nd	nd
321.1	426	0.5	1128	7,500	404	23	3.5	17	25	0.04	--	--
330.4	444	0.5	1229	7,400	397	23	3.6	17	--	0.04	0.19	11.1
340.0	463	0.5	1334	7,400	415	22	3.6	11	25	0.04	--	--
351.3	485	0.8	1447	7,300	423	23	3.7	11	--	0.04	nd	nd
360.0	503	[2]X	1555	7,200	421	23	3.7	11	17	0.04	nd	nd
371.2	525	0.5	1704	7,200	----	---	3.7	11	25	0.04	--	--
380.5	546	0.4	1900	7,200	425	22	3.8	11	--	0.04	nd	nd
389.6	564	0.5	2007	7,200	428	22	3.8	11	26	0.03	--	--
398.8	582	0.8	2111	7,200	421	22	3.8	13	28	0.04	nd	nd

compounds in approximately midchannel of the Lower La., and Cairo, Ill., September-October 1991 cruise

at 25 degrees Celsius; °C, degrees Celsius; DOC, dissolved organic carbon; mg/L, milligrams per liter; active substances; LAS, linear alkylbenzene sulfonate; I/E ratio, LAS, internal/external isomer ratio; AP, alykylphenol; dnq, detected but not quantified]

Concentration of volatile organic compounds												
LAS I/E Ratio	**Total AP (μg/L)**	**Sum total APEO (μg/L)**	**Benzene (μg/L)**	**Toluene (μg/L)**	**1,2-dichloro-ethane (μg/L)**	**1,1,1-trichloro-ethane (μg/L)**	**dichloro-methane (μg/L)**	**trichloro-methane (μg/L)**	**dichloro-difluoro-methane (μg/L)**	**trichloro-fluoro-methane (μg/L)**	**Furan (μg/L)**	**Miscel-laneous hydro-carbons (μg/L)**
1.8	nd	nd	nd	nd	0.2	nd	nd	0.2	0.3	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	0.4	0.3	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	0.3	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
1.3	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	0.2	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	0.2	0.2	0.2	nd	nd	nd	nd	nd	nd	0.5
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	0.2	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	0.5	nd	0.3	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
1.7	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	0.2	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	0.3	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
NE	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

Location													
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Temperature (°C)	DOC (mg/L)	Color (Pt/Co Units)	AOX (µg/L)	MBAS (mg/L)	LAS (µg/L)	LAS avg chain length (carbon units)
409.5	604	0.4	2235	7,100	418	22	3.8	13	--	0.04	--	--
420.1	625	0.6	2345	7,100	431	22	3.8	11	20	0.04	nd	nd
												September 27, 1991
432.0	649	0.4	0114	7,100	436	22	3.7	11	22	0.04	--	--
439.8	664	0.2	0208	6,600	444	21	3.8	11	28	0.05	nd	nd
449.2	683	0.6	0312	6,600	441	21	3.7	--	--	0.04	--	--
460.8	706	[2]X	0433	6,600	438	21	3.8	11	30	0.04	nd	nd
474.5	733	0.5	0615	6,500	440	21	3.8	12	--	0.03	nd	nd
485.2	754	0.5	0730	6,500	441	21	3.8	--	15	0.03	--	--
493.0	770	0.5	0825	6,500	440	21	3.8	12	--	0.03	nd	nd
504.5	793	0.8	0953	6,400	452	20	3.9	--	24	0.04	--	--
514.1	812	0.7	1059	6,400	445	21	3.9	12	--	0.04	dnq	nd
524.9	834	0.5	1225	6,300	448	21	4.0	13	14	0.04	--	--
534.5	853	0.1	1335	6,300	453	20	4.1	13	--	0.07	0.90	11.5
545.0	877	0.3	1544	6,300	458	20	4.0	13	23	0.04	--	--
551.8	891	0.5	1630	6,300	451	20	4.0	13	--	0.04	nd	nd
562.8	913	0.3	1750	6,200	451	20	4.1	13	34	0.04	--	--
574.0	935	0.5	1903	6,200	453	20	--	--	--	0.04	nd	nd
580.8	948	[2]X	1957	6,100	455	20	4.2	13	23	0.04	dnq	nd
590.3	968	0.5	2111	6,100	449	21	4.1	15	27	0.04	--	--
601.0	991	0.5	2309	6,000	448	20	4.2	13	--	0.04	nd	nd
												September 28, 1991
608.8	1,009	0.5	0047	5,900	448	20	4.2	15	17	0.03	--	--
617.7	1,025	0.5	0122	5,900	450	20	4.2	14	--	0.03	nd	nd
629.3	1,049	0.2	0252	5,800	448	21	4.3	15	12	0.04	--	--
641.7	1,072	0.5	0427	5,700	451	20	4.4	15	--	0.03	nd	nd
650.2	1,089	0.5	0527	5,700	453	20	4.3	15	29	0.03	--	--
660.2	1,109	0.5	0640	5,600	453	20	4.3	--	20	--	nd	nd
669.9	1,128	0.5	0752	5,600	447	20	4.3	15	33	--	--	--
679.4	1,147	0.5	0858	5,600	457	20	4.3	16	--	0.03	nd	nd
689.9	1,169	0.5	1031	5,600	456	20	4.3	18	28	--	--	--
702.0	1,193	0.7	1200	5,600	448	20	4.3	16	--	--	dnq	nd
712.9	1,215	[2]X	1327	5,600	418	20	4.3	16	18	0.04	nd	nd
721.5	1,235	0.5	1436	5,600	452	20	4.3	14	20	--	--	--
731.5	1,255	0.5	1546	5,600	464	20	4.4	15	26	--	nd	nd

compounds in approximately midchannel of the Lower La., and Cairo, Ill., September-October 1991 cruise--Continued

			Concentration of volatile organic compounds									
LAS I/E Ratio	Total AP (µg/L)	Sum total APEO (µg/L)	Benzene (µg/L)	Toluene (µg/L)	1,2-dichloro-ethane (µg/L)	1,1,1-trichloro-ethane (µg/L)	dichloro-methane (µg/L)	trichloro-methane (µg/L)	dichloro-difluoro-methane (µg/L)	trichloro-fluoro-methane (µg/L)	Furan (µg/L)	Miscel-laneous hydro-carbons (µg/L)
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
2.5	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

Table 5.11.--*Concentration of dissolved organic Mississippi River between New Orleans,*

Location													
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Temperature (°C)	DOC (mg/L)	Color (Pt/Co Units)	AOX (µg/L)	MBAS (mg/L)	LAS (µg/L)	LAS avg chain length (carbon units)
742.0	1,277	0.5	1811	5,600	462	19	4.4	--	25	--	--	--
751.1	1,298	0.5	1920	5,600	457	19	4.4	15	--	0.04	nd	nd
762.2	1,319	0.5	2036	5,600	458	20	4.4	16	--	0.03	--	--
773.0	1,343	0.5	2240	5,600	453	20	4.5	15	--	--	nd	nd
783.0	1,362	0.7	2344	5,600	460	19	4.4	16	23	0.04	--	--
										September 29, 1991		
795.5	1,387	0.2	0124	5,600	464	19	4.5	14	--	0.04	nd	nd
804.5	1,405	0.3	0234	5,600	458	20	4.5	14	--	0.03	--	--
814.8	1,426	0.4	0350	5,600	458	19	4.6	15	20	0.03	dnq	nd
822.2	1,441	0.5	0455	5,500	454	19	--	--	--	0.02	--	--
833.6	1,463	0.5	0610	5,500	449	19	4.6	15	21	--	nd	nd
846.5	1,489	[2]X	0752	5,500	414	20	4.4	15	20	0.03	nd	nd
855.0	1,506	0.5	0852	5,500	450	19	4.4	15	13	0.04	--	--
866.5	1,529	0.5	1010	5,500	446	19	4.4	15	--	0.04	dnq	nd
875.4	1,549	[2]X	1121	5,500	447	20	4.3	15	24	0.04	nd	nd
898.9	1,596	[2]X	1419	5,500	453	20	4.5	15	[2]16	0.04	nd	nd
922.6	1,644	[2]X	1715	5,500	461	20	4.6	16	[2]16	0.04	nd	nd
950.5	1,699	[2]X	2029	5,500	484	19	4.8	18	27	0.04	nd	nd

[1] Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 88.5 upriver from Head of Passes, La., on September 25, 1991, at 0647 hours..

[2] X indicates three to five samples were collected across the river at this location. These individual values appear in table 5.17; the values of specific conductance, temperature, and chemical concentrations in this table are the mean values. Values below the detection limit were NOT included in the mean.

[3] Water discharges are linearly interpolated values between discharges listed in table 1.5 in chapter 1.

compounds in approximately midchannel of the Lower La., and Cairo, Ill., September-October 1991 cruise--Continued

Concentration of volatile organic compounds												
LAS I/E Ratio	Total AP (μg/L)	Sum total APEO (μg/L)	Benzene (μg/L)	Toluene (μg/L)	1,2-dichloro-ethane (μg/L)	1,1,1-trichloro-ethane (μg/L)	dichloro-methane (μg/L)	trichloro-methane (μg/L)	dichloro-difluoro-methane (μg/L)	trichloro-fluoro-methane (μg/L)	Furan (μg/L)	Miscel-laneous hydro-carbons (μg/L)
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	0.2	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	0.3	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	0.2	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	0.2	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	0.2	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	0.2	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	0.2	nd	nd	nd	nd	nd	nd	nd

[km, kilometers; CDT, Central Daylight Time; m^3/s, cubic meters per second; µS/cm, microsiemens per centimeter
Pt/Co units, Platinum-cobalt units; AOX, adsorbable organic halide; µg/L, microgram per liter; MBAS, methylene blue
APEO, alykylphenol polyethoxylate homologues and isomers; --, no measurement; nd, not detected;

Location												
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Temperature (°C)	DOC (mg/L)	Color (Pt/Co Units)	AOX (µg/L)	MBAS (mg/L)	LAS (µg/L)	LAS avg chain length (carbon units)
												September 30, 1991
10.8	1,736	0.5	0039	3,700	550	19	5.6	--	26	0.05	nd	nd
19.8	1,755	0.5	0148	3,700	555	18	5.5	--	--	0.05	--	--
30.8	1,778	0.7	0315	3,700	559	18	5.5	18	24	0.06	nd	nd
39.0	1,795	0.5	0413	3,700	570	18	5.5	19	--	0.05	--	--
51.6	1,822	0.8	0550	3,700	562	18	5.5	19	41	0.05	0.50	11.3
63.6	1,846	0.5	0712	3,600	572	18	5.5	18	--	0.05	--	--
73.7	1,867	0.6	0823	3,600	556	18	5.5	20	58	0.04	nd	nd
80.8	1,882	[2]x	0924	3,600	560	19	5.5	20	--	0.04	nd	nd
104.5	1,932	[2]x	1222	3,500	565	18	5.5	20	37	0.04	nd	nd
128.9	1,983	[2]x	1521	3,400	561	18	5.8	21	41	0.06	0.45	10.6
155.0	2,037	[2]x	1835	3,300	565	18	5.7	22	27	0.05	2.82	[4]10.9
180.3	2,090	[2]x	2139	3,200	577	18	5.5	23	42	0.05	7.20	[4]10.7
												October 1, 1991
198.4	2,134	0.5	0127	2,000	481	18	6.9	31	--	0.06	nd	nd
207.2	2,151	0.3	0253	2,000	493	17	7.0	28	46	0.06	--	--
221.6	2,179	0.5	0507	2,000	457	17	7.3	29	32	0.06	nd	nd
230.5	2,195	0.5	0600	2,000	452	17	7.4	28	--	0.05	--	--
240.2	2,210	0.5	0700	2,000	454	17	7.3	29	53	0.05	nd	nd
249.2	2,230	0.5	1000	2,000	462	17	7.4	29	--	0.05	--	--
260.2	2,250	0.5	1109	2,000	456	17	7.4	32	35	0.05	nd	nd
272.0	2,272	0.5	1225	2,000	454	17	7.5	31	--	0.06	--	--
283.3	2,293	[2]x	1407	2,000	461	17	7.6	31	36	0.05	[4]4.82	11.3
292.0	2,309	0.5	1504	2,100	468	17	7.7	31	--	0.04	--	--
299.5	2,323	0.5	1553	2,100	461	17	7.7	32	70	0.05	dnq	nd
310.0	2,343	0.5	1740	2,000	462	17	7.7	30	--	0.05	--	--
321.0	2,363	0.5	1852	2,000	462	16	7.5	30	37	0.05	dnq	nd
331.0	2,384	0.5	2107	1,900	467	16	7.6	29	--	0.05	--	--
341.0	2,404	0.5	2212	1,800	452	16	7.6	--	37	0.05	nd	nd
												October 2, 1991
351.0	2,421	0.5	0000	1,800	447	16	7.7	--	--	0.05	--	--
363.0	2,444	0.7	0136	1,800	447	16	7.6	29	33	0.04	dnq	nd
371.0	2,459	0.5	0245	1,700	436	16	7.7	31	--	0.05	--	--

compounds in approximately midchannel of the Upper Minneapolis, Minn., September-October 1991 cruise

at 25 degrees Celsius; °C, degrees Celsius; DOC, dissolved organic carbon; mg/L, milligrams per liter;
active substances; LAS, linear alkylbenzene sulfonate; I/E ratio, LAS, internal/external isomer ratio; AP, alykylphenol;
dnq, detected but not quantified; NE, no external isomers; and no-C_{12}, no-C_{12} homolog]

Concentration of volatile organic compounds												
LAS I/E ratio	Total AP (μg/L)	Sum total APEO (μg/L)	Benzene (μg/L)	Toluene (μg/L)	1,2-dichloro-ethane (μg/L)	1,1,1-trichloro-ethane (μg/L)	dichloro-methane (μg/L)	trichloro-methane (μg/L)	dichloro-difluoro-methane (μg/L)	trichloro-fluoro-methane (μg/L)	Furan (μg/L)	Miscel-laneous hydro-carbons (μg/L)
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
2.0	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	1.3	nd
NE	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	1.8	nd
NE	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
[4]3.2	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
2.3	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	0.6	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	1.1	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
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Table 5.12.--*Concentration of dissolved organic Mississippi River between Cairo, Ill. and*

Location: River miles upriver from mouth of Ohio River	Location: Distance upriver from first sample[1] (km)	Location: Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	DOC (mg/L)	Color (Pt/Co Units)	AOX (μg/L)	MBAS (mg/L)	LAS (μg/L)	LAS avg chain length (carbon units)
											October 2, 1991	
382.0	2,479	0.5	0347	1,700	428	16	7.7	33	28	0.05	nd	nd
397.0	2,507	0.5	0532	1,600	422	16	7.6	30	--	0.05	--	--
407.0	2,531	0.5	0928	1,600	417	15	7.7	35	42	0.05	dnq	nd
418.0	2,555	0.5	1218	1,600	435	16	7.2	29	--	0.05	--	--
427.0	2,572	0.5	1321	1,600	424	16	7.8	34	23	0.04	nd	nd
435.0	2,586	0.5	1413	1,600	405	16	7.8	33	--	0.05	--	--
447.0	2,610	0.5	1626	1,500	407	16	7.8	35	31	0.05	nd	nd
456.5	2,626	0.5	1720	1,500	398	16	8.0	33	--	0.05	--	--
465.7	2,644	0.5	1837	1,500	398	16	7.9	33	26	0.04	0.06	11.0
480.0	2,671	0.5	2013	1,400	401	16	7.8	32	41	0.05	dnq	nd
491.0	2,692	0.5	2141	1,400	399	15	7.7	33	24	0.06	--	--
502.0	2,713	0.5	2322	1,400	401	15	7.9	32	--	0.05	nd	nd
											October 3, 1991	
509.3	2,727	0.5	0016	1,300	399	15	7.8	32	32	0.05	--	--
520.0	2,746	0.5	0129	1,300	395	15	--	28	--	0.04	nd	nd
531.0	2,767	0.5	0248	1,300	395	15	8.0	27	28	0.05	--	--
539.2	2,782	0.5	0343	1,300	396	15	--	29	--	0.05	0.14	11.3
551.0	2,805	0.5	0537	1,300	393	15	8.0	30	27	0.05	--	--
560.7	2,823	0.5	0656	1,300	394	15	8.2	28	27	0.05	dnq	nd
572.0	2,846	0.5	0805	1,300	400	14	8.1	28	--	0.05	--	--
581.5	2,863	0.5	0904	1,300	396	15	8.2	30	--	0.05	--	--
590.5	2,883	0.5	1131	1,300	396	14	8.2	29	--	0.06	--	--
602.2	2,904	0.5	1246	1,200	387	15	8.1	30	36	0.05	0.43	11.2
610.0	2,920	0.5	1412	1,200	402	15	8.2	31	--	0.05	--	--
621.3	2,939	0.5	1548	1,200	400	15	8.2	31	38	0.06	dnq	nd
632.0	2,963	0.5	1703	1,100	417	15	8.2	31	--	0.05	--	--
641.8	2,976	0.5	1807	1,000	415	15	8.4	33	36	0.06	nd	nd
653.0	2,996	0.5	1932	1,000	417	15	8.4	34	--	0.06	--	--
665.5	3,018	0.5	2050	1,000	418	15	8.6	34	23	0.06	nd	nd
675.5	3,036	0.5	2158	1,000	425	15	--	34	--	0.06	--	--
686.1	3,055	0.5	2313	1,000	427	14	8.8	34	30	0.06	1.14	11.1

compounds in approximately midchannel of the Upper Minneapolis, Minn., September-October 1991 cruise--Continued

			Concentration of volatile organic compounds									
LAS I/E ratio	Total AP (µg/L)	Sum total APEO (µg/L)	Benzene (µg/L)	Toluene (µg/L)	1,2-dichloro-ethane (µg/L)	1,1,1-trichloro-ethane (µg/L)	dichloro-methane (µg/L)	trichloro-methane (µg/L)	dichloro-difluoro-methane (µg/L)	trichloro-fluoro-methane (µg/L)	Furan (µg/L)	Miscel-laneous hydro-carbons (µg/L)
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	nd	nd	0.2	nd	nd	nd	1.4	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	0.2	nd	nd	nd	2.1	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	0.2	nd	nd	nd	1.9	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
NE	--	--	nd	nd	nd	nd	0.2	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	1.8	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
0.88	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
1.6	--	--	nd	nd	nd	nd	0.2	nd	nd	nd	nd	nd

Table 5.12.--*Concentration of dissolved organic*
Mississippi River between Cairo, Ill. and

Location												
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Temperature (°C)	DOC (mg/L)	Color (Pt/Co Units)	AOX (µg/L)	MBAS (mg/L)	LAS (µg/L)	LAS avg chain length (carbon units)
												October 4, 1991
700.0	3,080	0.5	0121	940	439	14	9.0	37	--	0.06	dnq	nd
710.0	3,098	0.5	0232	930	435	15	9.1	37	--	0.06	--	--
723.2	3,121	0.5	0410	940	432	15	9.3	38	34	0.06	dnq	nd
735.7	3,146	0.5	0545	940	445	15	9.4	39	31	0.06	--	--
745.5	3,166	0.5	0902	920	458	13	9.7	39	--	0.06	dnq	nd
755.5	3,182	0.5	1108	900	419	13	10.1	42	48	0.06	--	--
764.5	3,199	0.5	1215	720	507	13	10.0	38	--	0.06	nd	nd
776.4	3,219	0.5	1319	670	522	15	10.4	39	36	0.06	--	--
786.2	3,236	0.5	1431	630	535	14	10.5	38	--	0.07	nd	nd
793.1	3,248	0.5	1520	600	544	15	10.3	39	28	0.07	--	--
805.5	3,270	0.5	1642	510	520	14	10.6	43	--	0.07	nd	nd
812.5	3,282	0.5	1729	360	660	14	9.9	34	31	0.08	--	--
826.1	3,306	0.5	1900	350	659	15	9.7	32	33	0.08	nd	nd
838.0	3,327	0.5	2023	360	657	15	9.7	33	48	0.07	dnq	nd
846.0	3,342	0.5	2213	230	472	14	10.5	38	--	0.04	dnq	nd

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 88.5 upriver from Head of Passes, La., on September 25, 1991, at 0647 hours.

[2]X indicates three to five samples were collected across the river at this location. These individual values appear in table 5.18; the values of specific conductance, temperature, and chemical concentrations in this table are the mean values. Values below the detection limit were NOT included in the mean.

[3]Water discharges are linearly interpolated values between discharges listed in table 1.5 in chapter 1.

compounds in approximately midchannel of the Upper Minneapolis, Minn., September-October 1991 cruise--Continued

Concentration of volatile organic compounds												
LAS I/E ratio	Total AP (µg/L)	Sum total APEO (µg/L)	Benzene (µg/L)	Toluene (µg/L)	1,2-dichloro-ethane (µg/L)	1,1,1-trichloro-ethane (µg/L)	dichloro-methane (µg/L)	trichloro-methane (µg/L)	dichloro-difluoro-methane (µg/L)	trichloro-fluoro-methane (µg/L)	Furan (µg/L)	Miscel-laneous hydro-carbons (µg/L)
nd	--	--	nd	nd	nd	nd	0.8	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	0.9	nd	nd	nd	2.2	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	0.2	0.8	nd	nd	nd	1.0	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	1.0	nd	nd	nd	1.7	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	0.2	1.1	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	nd	0.8	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--	--	--
nd	--	--	nd	nd	nd	0.2	0.8	0.3	nd	nd	nd	nd
nd	--	--	nd	0.2	nd	0.2	0.6	nd	nd	nd	nd	nd
nd	--	--	nd	nd	nd	nd	0.3	nd	nd	nd	nd	nd

Table 5.13.--*Concentration of dissolved organic Mississippi River between New Orleans,*

[km, kilometers; CDT, Central Daylight Time; m^3/s, cubic meters per second; µS/cm, microsiemens per centimeter Pt/Co units, Platinum-cobalt units; AOX, adsorbable organic halide; µg/L, microgram per liter; MBAS, methylene blue --, no measurement; nd, not detected;

Location													
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Temperature (°C)	DOC (mg/L)	Color (Pt/Co units)	AOX (µg/L)	MBAS (mg/L)	LAS (µg/L)	LAS avg chain length (carbon units)
												March 25, 1992
90.0	0	[2]X	0705	22,300	--	16	3.3	15	56	0.05	0.68	11.4
100.0	23	0.5	0829	22,300	--	15	3.2	12	--	0.05	nd	nd
110.0	45	0.5	0938	22,300	--	15	3.3	12	14	0.06	--	--
119.0	65	0.5	1044	22,300	--	14	3.3	16	--	0.05	--	--
130.0	90	0.5	1205	22,300	--	14	3.3	18	13	0.06	nd	nd
139.8	112	0.5	1312	22,300	--	14	3.2	14	--	0.05	--	--
149.7	134	0.6	1424	22,300	--	13	3.2	17	14	0.05	nd	nd
160.1	157	0.5	1539	22,300	--	13	3.3	20	--	0.05	--	--
170.0	179	0.5	1649	22,300	--	12	3.2	13	26	0.05	nd	nd
179.5	200	0.5	1752	22,300	--	12	3.3	19	--	0.05	--	--
190.0	223	0.5	1900	22,300	--	13	3.3	17	22	0.04	nd	nd
200.0	245	0.5	2011	22,300	--	13	3.4	20	--	0.05	--	--
210.0	267	0.5	2124	22,300	--	14	3.3	17	35	0.05	dnq	nd
220.0	290	0.5	2236	22,300	--	14	3.4	20	--	0.06	--	--
228.0	309	[2]X	2348	22,300	306	13	3.4	22	34	0.06	dnq	nd
												March 26, 1992
240.3	358	0.5	0532	22,200	305	13	3.5	22	12	0.06	--	nd
250.0	380	0.5	0647	22,100	303	13	3.4	20	30	0.04	0.19	11.4
260.8	404	0.5	0804	21,900	308	13	3.5	21	--	0.04	--	--
270.0	424	0.5	0907	21,800	306	13	3.5	22	27	0.05	nd	nd
280.0	446	0.5	1018	21,700	293	13	3.6	14	--	0.05	--	--
290.0	468	0.5	1131	21,600	311	12	3.5	18	70	0.05	nd	nd
300.0	490	0.5	1243	21,500	309	12	3.4	16	--	0.05	--	--
310.0	513	0.5	1354	21,400	311	12	3.5	19	17	0.05	nd	nd
321.1	538	0.5	1515	25,800	312	12	3.5	19	--	0.04	--	--
330.4	559	0.6	1620	25,600	312	13	3.5	21	37	0.04	nd	nd
340.0	581	0.5	1731	25,500	311	12	3.4	17	--	0.04	--	--
351.3	607	0.8	1853	25,400	311	12	3.5	24	69	0.06	--	--
360.0	628	[2]X	2011	25,200	308	12	3.5	18	29	0.04	dnq	nd
371.2	661	0.5	2252	25,300	311	12	3.1	20	66	0.04	--	--
												March 27, 1992
380.0	684	0.3	0019	25,400	313	12	3.5	20	--	0.04	dnq	nd
389.0	705	0.5	0117	25,500	311	12	3.6	18	24	0.04	--	--

compounds in approximately midchannel of the Lower La., and Cairo, Ill., March-April 1992 cruise

at 25 degrees Celsius; °C, degrees Celsius; DOC, dissolved organic carbon; mg/L, milligrams per liter; active substances; LAS, linear alkylbenzene sulfonate; I/E ratio, LAS, internal/external isomer ratio; dnq, detected but not quantified; NE, no external isomers]

	Concentration of volatile organic compounds					
LAS I/E Ratio	Toluene (μg/L)	1,2,4-trichloro-benzene (μg/L)	1,2,3-trichloro-benzene (μg/L)	1,1,1-trichloro-ethane (μg/L)	Tetrachloro-ethene (μg/L)	Hexachloro-butadiene (μg/L)
2.2	nd	nd	nd	nd	nd	nd
--	nd	nd	nd	nd	nd	nd
nd	--	--	--	--	--	--
--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--
nd	nd	nd	nd	nd	0.8	nd
--	--	--	--	--	--	--
nd	nd	nd	nd	nd	0.5	nd
--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd
nd	--	--	--	--	--	--
0.76	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--
--	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--

Table 5.13.--*Concentration of dissolved organic*
Mississippi River between New Orleans,

Location												
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance ($\mu S/cm$)	Temperature (°C)	DOC (mg/L)	Color (Pt/Co units)	AOX ($\mu g/L$)	MBAS (mg/L)	LAS ($\mu g/L$)	LAS avg chain length (carbon units)
399.4	728	0.5	0234	25,600	311	12	3.7	21	--	0.04	nd	nd
409.5	754	0.5	0402	25,800	316	12	3.6	19	35	0.04	--	--
421.8	784	0.5	0531	25,900	319	12	3.6	19	17	0.05	--	--
435.3	819	[2]X	0729	26,100	316	12	3.7	20	20	0.05	dnq	nd
445.2	844	0.5	0847	25,800	323	12	3.7	22	19	0.06	--	--
454.3	867	0.5	0957	25,800	321	12	3.6	21	109	0.04	nd	nd
464.8	893	0.5	1121	25,900	324	13	3.7	19	--	0.06	--	--
475.0	920	0.5	1246	26,000	326	14	3.6	21	16	0.05	--	--
485.5	946	0.6	1410	26,000	337	13	3.6	18	--	0.07	--	--
495.1	971	0.5	1532	26,200	334	12	3.6	18	17	0.05	nd	nd
504.5	995	0.8	1651	26,300	338	11	3.6	19	--	0.04	--	--
514.1	1,021	0.6	1823	26,300	336	11	3.6	18	46	0.05	nd	nd
525.0	1,049	0.5	1951	26,300	343	11	3.6	19	15	0.05	--	--
535.0	1,076	[2]X	2128	26,300	340	11	3.6	17	22	0.05	dnq	nd
March 28, 1992												
544.9	1,111	0.5	0009	26,400	338	12	3.5	18	9	0.05	--	--
555.0	1,137	0.5	0139	26,400	339	12	3.6	20	34	0.05	nd	nd
565.1	1,165	0.5	0317	26,400	338	12	3.7	21	17	0.05	--	--
582.0	1,213	0.5	0613	25,300	341	11	3.7	18	--	0.04	nd	nd
592.1	1,238	0.5	0734	25,000	340	11	3.6	24	57	0.04	--	--
602.0	1,264	0.5	0858	23,800	358	11	3.8	18	--	0.04	nd	nd
614.1	1,295	0.5	1040	23,600	356	11	3.7	19	48	0.05	--	--
626.6	1,328	0.5	1229	23,500	363	12	3.6	19	--	0.04	nd	nd
638.7	1,358	0.5	1401	23,400	366	13	3.8	20	24	0.05	--	--
650.1	1,387	0.6	1540	23,200	360	15	3.6	12	--	0.04	nd	nd
659.8	1,412	[2]X	1659	23,100	360	11	3.8	18	27	0.04	0.90	10.9
672.7	1,445	0.5	1843	23,100	351	12	3.8	18	--	0.05	--	--
683.4	1,472	0.5	2011	23,100	358	12	3.8	19	33	0.05	nd	nd
695.0	1,501	0.6	2138	23,100	358	12	3.9	21	--	0.04	--	--
705.0	1,527	0.5	2308	23,200	352	12	3.9	20	65	0.05	nd	nd
March 29, 1992												
714.3	1,549	0.8	0029	23,200	356	12	4.1	20	17	0.05	--	nd
723.3	1,571	[2]X	0143	23,300	355	14	3.9	19	15	0.04	0.12	11.7
735.0	1,613	0.5	0544	23,300	338	13	3.8	18	10	0.05	--	--
742.0	1,630	0.5	0640	23,100	348	14	3.8	19	15	0.04	nd	nd

compounds in approximately midchannel of the Lower La., and Cairo, Ill., March-April 1992 cruise--Continued

Concentration of volatile organic compounds						
LAS I/E Ratio	Toluene (µg/L)	1,2,4-trichloro-benzene (µg/L)	1,2,3-trichloro-benzene (µg/L)	1,1,1-trichloro-ethane (µg/L)	Tetrachloro-ethene (µg/L)	Hexachloro-butadiene (µg/L)
nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--
--	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--
--	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--
nd	--	--	--	--	--	--
--	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd
1.6	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd
nd	--	--	--	--	--	--
NE	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd

Table 5.13.--*Concentration of dissolved organic*
Mississippi River between New Orleans,

Location											
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (μS/cm)	Temperature (°C)	DOC (mg/L)	Color (Pt/Co units)	AOX (μg/L)	MBAS (mg/L)	LAS (μg/L)	LAS avg chain length (carbon units)
752.9	1,657	0.5	0820	22,700	345	13	3.9	17	--	0.05	--	--
763.0	1,681	0.5	0940	22,400	349	12	4.0	20	27	0.06	--	--
774.0	1,707	0.5	1103	22,000	347	12	4.0	19	--	0.04	--	--
784.6	1,732	0.8	1227	21,700	349	14	3.8	14	38	0.05	--	--
795.5	1,758	0.5	1356	21,300	352	11	3.9	19	--	0.05	--	--
804.7	1,780	0.3	1513	21,100	349	12	3.8	17	86	0.05	nd	nd
815.8	1,807	0.5	1644	20,700	354	15	3.8	17	--	0.06	--	--
828.0	1,835	0.5	1810	20,300	360	12	3.9	16	62	0.04	nd	nd
837.4	1,857	0.6	1926	20,000	369	12	3.8	17	--	0.07	--	--
848.0	1,884	[2]X	2105	19,700	341	12	3.8	19	40	0.06	nd	nd
											March 30, 1992	
878.1	1,956	[2]X	0107	18,700	347	10	4.0	19	34	0.05	nd	nd
898.9	2,006	[2]X	0400	18,000	389	11	4.0	18	71	0.05	nd	nd
923.0	2,063	[2]X	0713	17,300	349	11	3.8	18	17	0.05	nd	nd
950.5	2,128	[2]X	1047	17,000	417	10	4.4	18	32	0.06	dnq	nd

[1]Distance are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 90.0 upriver from Head of Passes, La., on March 25, 1992, at 0705 hours.

[2]X indicates three samples were collected across the river at this location. These individual values appear in table 5.19; the values of specific conductance, temperature, and chemical concentration in this table are the mean values. Values below the detection limit were NOT included in the mean.

[3]Water discharges are linearly interpolated values between discharges listed in table 1.5 in chapter 1.

Concentration of volatile organic compounds						
LAS I/E Ratio	Toluene (μg/L)	1,2,4-trichloro-benzene (μg/L)	1,2,3-trichloro-benzene (μg/L)	1,1,1-trichloro-ethane (μg/L)	Tetrachloro-ethene (μg/L)	Hexachloro-butadiene (μg/L)
--	--	--	--	--	--	--
--	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--
--	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd

Table 5.14.--*Concentration of dissolved organic*
Mississippi River between Cairo, Ill. and

[km, kilometers; CDT, Central Daylight Time; m^3/s, cubic meters per second; µS/cm, microsiemens per centimeter

Pt/Co units, Platinum-cobalt units; AOX, adsorbable organic halide; µg/L, microgram per liter; MBAS, methylene blue

--, no measurement; nd, not detected;

Location													
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance (µS/cm)	Temperature (°C)	DOC (mg/L)	Color (Pt/Co units)	AOX (µg/L)	MBAS (mg/L)	LAS (µg/L)	LAS avg chain length (carbon units)
												March 30, 1992
11.6	2,173	0.6	1422	8,000	487	9	5.2	18	34	0.07	nd	nd
19.8	2,192	0.5	1528	7,900	474	10	5.1	17	--	0.07	--	--
34.3	2,226	0.5	1719	7,700	514	9	5.1	17	32	0.06	0.18	10.4
49.4	2,261	0.5	1920	7,600	528	9	5.2	16	--	0.05	--	--
65.4	2,299	0.5	2138	7,600	514	9	5.1	16	33	--	nd	nd
80.5	2,335	0.5	2346	7,500	521	10	5.2	16	15	0.05	--	--
												March 31, 1992
96.2	2,371	0.5	0143	7,700	509	10	5.1	17	36	0.06	1.58	10.9
109.8	2,404	[2]X	0340	7,800	506	10	5.2	17	54	0.07	4.23	11.5
127.7	2,448	[2]X	0629	7,500	513	11	5.1	15	29	0.07	0.86	11.5
145.7	2,491	[2]X	0903	7,600	518	10	4.9	14	32	0.07	1.82	10.8
169.7	2,548	[2]X	1229	7,700	533	11	5.2	14	31	0.07	2.57	11.0
180.3	2,574	[2]X	1405	7,800	516	11	5.3	13	22	0.07	2.36	11.4
198.3	2,620	0.5	1717	5,900	492	11	5.9	17	50	0.07	nd	nd
207.1	2,640	0.2	1850	5,900	--	--	5.9	8	--	0.06	--	--
221.0	2,673	0.5	2125	5,300	451	10	6.0	5	24	0.07	nd	nd
233.5	2,699	0.4	2248	5,000	469	8	5.7	9	35	0.06	--	--
												April 1, 1992
246.0	2,729	0.5	0123	4,700	448	10	5.8	16	--	0.06	--	--
258.5	2,759	0.5	0250	4,400	468	8	5.6	14	26	0.07	--	--
270.0	2,782	0.6	0454	4,200	498	9	5.7	10	--	0.07	nd	nd
282.6	2,809	0.5	0630	4,100	465	10	6.0	10	37	0.07	--	--
293.0	2,830	0.5	0745	4,000	485	9	6.1	12	--	0.06	nd	nd
307.0	2,861	0.7	0943	3,900	486	8	5.7	10	23	0.09	--	--
324.6	2,897	[2]X	1143	3,600	484	8	5.9	15	37	0.08	0.34	11.4
336.0	2,921	0.5	1311	3,500	506	9	5.4	9	54	0.07	--	--
347.0	2,945	0.5	1437	3,500	462	9	6.3	11	--	0.05	dnq	nd
361.7	2,975	0.7	1620	3,300	494	7	6.1	16	--	0.06	nd	nd
374.0	3,003	0.5	1823	3,400	489	7	6.8	17	57	0.07	--	--
388.0	3,031	0.4	1948	3,400	485	8	6.7	18	--	0.07	nd	nd
403.0	3,060	0.7	2121	3,400	475	8	6.5	16	36	0.07	--	--

compounds in approximately midchannel of the Upper Minneapolis, Minn., March-April 1992 cruise

at 25 degrees Celsius; °C, degrees Celsius; DOC, dissolved organic carbon; mg/L, milligrams per liter; active substances; LAS, linear alkylbenzene sulfonate; I/E ratio, LAS, internal/external isomer ratio; dnq, detected but not quantified; NE, no external isomers; and no-C_{12}, no-C_{12} homolog]

Concentration of volatile organic compounds							
LAS I/E Ratio	Toluene (μg/L)	1,2,4-trichloro-benzene (μg/L)	1,2,3-trichloro-benzene (μg/L)	1,1,1-trichloro-ethane (μg/L)	Tetrachloro-ethene (μg/L)	Hexachloro-butadiene (μg/L)	Methylene chloride (μg/L)
nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--
no-C_{12}	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--
nd	nd	0.5	0.9	nd	nd	0.4	nd
--	--	--	--	--	--	--	--
NE	nd	nd	nd	nd	nd	nd	--
41.0	nd	nd	nd	nd	nd	nd	nd
NE	nd	nd	nd	nd	nd	nd	nd
NE	nd	nd	nd	nd	nd	nd	nd
3.0	nd	nd	nd	nd	nd	nd	nd
3.4	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--
--	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--
0.81	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--

Table 5.14.--*Concentration of dissolved organic*
Mississippi River between Cairo, Ill. and

Location: River miles upriver from mouth of Ohio River	Location: Distance upriver from first sample[1] (km)	Location: Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conductance ($\mu S/cm$)	Temperature (°C)	DOC (mg/L)	Color (Pt/Co units)	AOX ($\mu g/L$)	MBAS (mg/L)	LAS ($\mu g/L$)	LAS avg chain length (carbon units)
											April 2, 1992	
413.0	3,088	0.5	0035	3,400	445	9	6.5	18	--	0.06	dnq	nd
425.0	3,113	0.5	0156	3,200	445	9	6.5	17	45	0.05	--	--
441.2	3,147	0.6	0423	2,800	448	7	--	--	--	0.05	nd	nd
453.0	3,169	0.5	0539	2,900	446	7	6.8	19	43	0.06	--	--
462.8	3,188	0.7	0650	2,900	448	7	6.7	20	32	0.05	nd	nd
481.6	3,224	[2]X	0908	2,500	472	7	6.6	21	38	0.06	dnq	nd
490.7	3,242	0.2	1031	2,600	438	7	6.9	18	--	0.06	--	--
506.4	3,272	0.5	1228	2,600	434	7	6.9	22	--	0.07	nd	nd
520.0	3,298	0.5	1403	2,700	433	7	6.9	22	--	0.06	--	--
533.0	3,323	0.5	1530	2,700	434	7	6.9	22	65	--	nd	nd
549.0	3,353	0.5	1716	2,700	456	7	7.1	23	--	0.06	--	--
561.3	3,377	0.5	1838	2,700	435	8	7.2	24	27	0.04	nd	nd
572.9	3,398	0.5	1951	2,700	433	7	7.2	23	--	0.06	--	--
581.5	3,415	0.5	2046	2,700	433	7	7.3	23	36	0.06	nd	nd
597.0	3,444	0.9	2237	2,700	441	7	7.1	23	--	0.07	--	--
											April 3, 1992	
610.0	3,472	0.5	0120	2,600	439	7	7.3	23	32	0.07	nd	nd
621.0	3,494	0.4	0245	2,600	443	6	7.3	23	--	0.06	--	--
631.9	3,514	0.5	0406	2,200	453	7	7.3	22	--	0.05	nd	nd
644.9	3,538	0.5	0532	2,200	459	7	7.4	23	16	0.07	--	--
653.0	3,553	0.5	0628	2,200	468	6	7.8	23	--	0.05	nd	nd
669.9	3,583	0.5	0813	2,100	453	7	8.0	20	79	0.06	--	--
684.3	3,609	0.5	0955	2,100	446	7	8.1	24	--	0.06	nd	nd
696.1	3,630	[2]X	1116	2,000	438	7	8.2	26	69	0.05	0.14	10.9
709.5	3,655	0.5	1307	1,800	505	7	8.3	24	--	0.06	dnq	nd
723.6	3,681	[2]X	1449	1,700	508	8	8.0	24	38	0.08	dnq	nd
735.7	3,703	0.5	1614	1,800	502	8	8.2	24	59	0.06	--	--
745.5	3,721	0.5	1726	1,700	548	8	8.1	23	--	0.07	nd	nd
755.5	3,740	0.5	1859	1,600	525	7	8.5	25	53	0.07	--	--
764.5	3,756	0.7	2005	1,300	578	6	8.6	25	37	0.07	nd	nd
776.4	3,777	0.5	2107	1,200	548	7	8.5	23	--	0.07	--	--
793.1	3,806	0.5	2210	1,000	554	8	8.3	24	110	0.07	0.31	10.6

compounds in approximately midchannel of the Upper Minneapolis, Minn., March-April 1992 cruise--Continued

Concentration of volatile organic compounds							
LAS I/E Ratio	Toluene (µg/L)	1,2,4-trichloro-benzene (µg/L)	1,2,3-trichloro-benzene (µg/L)	1,1,1-trichloro-ethane (µg/L)	Tetrachloro-ethene (µg/L)	Hexachloro-butadiene (µg/L)	Methylene chloride (µg/L)
nd	nd	nd	nd	nd	nd	nd	nd
--	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd
NE	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--
NE	nd	nd	nd	nd	nd	nd	nd

Table 5.14.--*Concentration of dissolved organic*
Mississippi River between Cairo, Ill. and

Location													
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Water discharge[3] (m^3/s)	Specific conduc-tance (μS/cm)	Temper-ature (°C)	DOC (mg/L)	Color (Pt/Co units)	AOX (μg/L)	MBAS (mg/L)	LAS (μg/L)	LAS avg chain length (carbon units)
												April 4, 1992
805.5	3,829	0.5	0015	1,000	559	8	8.6	28	98	0.07	--	--
813.0	3,843	0.5	0117	690	699	7	8.0	163	--	0.08	--	--
826.1	3,868	0.8	0304	650	694	8	7.9	20	22	0.08	0.60	10.8
835.1	3,887	[2]X	0548	630	711	8	8.3	20	48	0.11	1.36	10.8
845.6	3,907	0.5	0733	310	437	8	9.6	30	19	0.04	0.73	10.7

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 90.0 upriver from Head of Passes, La., on March 25, 1992, at 0705 hours.

[2]X indicates three to five samples were collected across the river at this location. These individual values appear in table 5.20; the values of specific conductance, temperature, and chemical concentrations in this table are the mean values. Values below the detection limit were NOT included in the mean.

[3]Water discharges are linearly interpolated values between dishcharges listed in table 1.5 in chapter 1.

compounds in approximately midchannel of the Upper Minneapolis, Minn., March-April 1992 cruise--Continued

Concentration of volatile organic compounds							
LAS I/E Ratio	Toluene (µg/L)	1,2,4-trichloro-benzene (µg/L)	1,2,3-trichloro-benzene (µg/L)	1,1,1-trichloro-ethane (µg/L)	Tetrachloro-ethene (µg/L)	Hexachloro-butadiene (µg/L)	Methylene chloride (µg/L)
--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--
NE	0.2	nd	nd	0.4	nd	nd	nd
3.1	0.3	nd	nd	nd	nd	nd	0.4
NE	nd	nd	nd	nd	nd	nd	nd

Table 5.15.--*Cross-channel variability of dissolved organic between Baton Rouge, La., and Cairo,*

[km, kilometers; CDT, Central Daylight Time; m^3/s, cubic meters per second; µS/cm, microsiemens per centimeter Pt/Co units, Platinum-cobalt units; AOX, adsorbable organic halide; µg/L, microgram per liter; MBAS, methylene blue APEO, alykylphenol polyethoxylate homologues and isomers; --, no measurement; nd, not detected;

Location											
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (µS/cm)	Temperature (°C)	DOC (mg/L)	Color (Pt/Co units)	AOX (µg/L)	MBAS (mg/L)	LAS (µg/L)	LAS avg chain length (carbon units)
										June 23, 1991	
230.0	0	0.2	1030	393	--	4.1	--	18	0.05	dnq	nd
		0.5	1040	--	--	--	--	--	--	--	--
		0.8	1045	--	--	4.0	--	13	0.05	nd	nd
										June 24, 1991	
360.0	279	0.2	1326	396	24	4.1	--	--	0.05	--	--
		0.5	1320	395	26	3.9	--	13	0.04	dnq	nd
		0.9	1315	399	25	3.9	--	--	0.04	--	--
										June 25, 1991	
475.0	532	0.2	0355	396	25	--	--	--	0.05	--	--
		0.5	0400	402	25	4.0	--	14	0.04	nd	nd
		0.9	0407	399	25	4.2	--	18	0.05	dnq	nd
580.8	766	0.2	1712	391	26	4.2	--	12	0.06	nd	nd
		0.5	1718	388	27	4.2	--	16	0.06	nd	nd
		1	1724	536	27	--	--	--	0.05	nd	nd
										June 26, 1991	
712.9	1,072	0.1	1035	424	24	4.4	--	21	0.06	nd	nd
		0.5	1029	434	24	4.5	--	21	0.05	nd	nd
		0.9	1023	428	25	4.4	--	18	0.05	nd	nd
										June 27, 1991	
839.0	1,360	0.1	0410	414	26	4.8	--	21	0.05	nd	nd
		0.5	0403	413	25	4.4	--	23	0.06	nd	nd
		0.9	0355	411	25	4.5	--	14	0.06	--	--
898.9	1,489	0.1	1118	396	25	4.3	--	22	0.06	nd	nd
		0.5	1124	408	26	4.6	--	18	0.06	--	--
		0.9	1130	416	26	5.4	--	27	0.05	nd	nd
937.6	1,572	0.1	1559	362	26	4.0	--	19	0.05	nd	nd
		0.5	1553	368	26	4.1	--	15	0.05	nd	nd
		0.9	1543	402	25	5.0	--	29	0.06	nd	nd

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 230.0 upriver from Head of Passes, La., on June 23, 1991, at 2240 hours.

compounds in the Lower Mississippi River
Ill., June-July 1991 cruise

at 25 degrees Celsius; °C, degrees Celsius; DOC, dissolved organic carbon; mg/L, milligrams per liter;

active substances; LAS, linear alkylbenzene sulfonate; I/E ratio, LAS, internal/external isomer ratio; AP, alykylphenol;

dnq, detected but not quantified]

Concentration of volatile organic compounds										
LAS I/E Ratio	Total AP (μg/L)	Sum total APEO (μg/L)	Methylene chloride (μg/L)	Benzene (μg/L)	Toluene (μg/L)	Total xylene isomers (μg/L)	1,2,4-trimethyl banzene (μg/L)	1,2-dichloro-ethane (μg/L)	Cyclo-alkanes (μg/L)	1,1,1-trichloro-ethane (μg/L)
nd	--	--	1.0	nd	nd	nd	nd	nd	nd	nd
--	--	--	nd	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	nd	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	nd	0.2	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	0.2	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	0.2	nd	nd
--	nd	nd	nd	nd	nd	nd	nd	0.2	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	0.2	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	0.3	nd	nd
nd	dnq	dnq	nd	nd	nd	nd	nd	0.3	nd	nd
nd	dnq	dnq	--	--	--	--	--	--	--	--

Table 5.16.--*Cross-channel variability of dissolved organic between Cairo, Ill., and Minneapolis,*

[km, kilometers; CDT, Central Daylight Time; m^3/s, cubic meters per second; µS/cm, microsiemens per centimeter Pt/Co units, Platinum-cobalt units; AOX, adsorbable organic halide; µg/L, microgram per liter; MBAS, methylene blue APEO, alykylphenol polyethoxylate homologues and isomers; --, no measurement; nd, not detected;

Location											
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (µS/cm)	Temperature (°C)	DOC (mg/L)	Color (Pt/Co units)	AOX (µg/L)	MBAS (mg/L)	LAS (µg/L)	LAS avg chain length (carbon units)
											June 28, 1991
100.7	1,846	0.4	0818	457	25	5.5	--	15	0.06	nd	nd
		0.9	0811	460	24	5.1	--	13	0.06	nd	nd
150.0	1,961	0.1	1439	470	26	4.7	--	17	0.05	nd	nd
		0.9	1434	498	25	6.0	--	20	0.06	dnq	nd

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 230.0 upriver from Head of Passes, La., on June 23, 1991, at 2240 hours.

compounds in the Upper Mississippi River
Minn., June-July 1991 cruise

at 25 degrees Celsius; °C, degrees Celsius; DOC, dissolved organic carbon; mg/L, milligrams per liter;

active substances; LAS, linear alkylbenzene sulfonate; I/E ratio, LAS, internal/external isomer ratio; AP, alykylphenol;

dnq, detected but not quantified]

Concentration of volatile organic compounds										
LAS I/E Ratio	Total AP (μg/L)	Sum total APEO (μg/L)	Methylene chloride (μg/L)	Benzene (μg/L)	Toluene (μg/L)	Total xylene isomers (μg/L)	1,2,4-trimethyl benzene (μg/L)	1,2-dichloro-ethane (μg/L)	Cyclo-alkanes (μg/L)	1,1,1-trichloro-ethane (μg/L)
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

Table 5.17.--*Cross-channel variability*
Mississippi River between New Orleans,

[km, kilometers; CDT, Central Daylight Time; m^3/s, cubic meters per second; µS/cm, microsiemens per centimeter Pt/Co units, Platinum-cobalt units; AOX, adsorbable organic halide; µg/L, microgram per liter; MBAS, methylene blue APEO, alykylphenol polyethoxylate homologues and isomers; --, no measurement; nd, not detected

Location											
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (µS/cm)	Temperature (° C)	DOC (mg/L)	Color (Pt/Co units)	AOX (µg/L)	MBAS (mg/L)	LAS (µg/L)	LAS avg chain length (carbon units)
											September 25, 1991
88.5	0	0.1	0655	465	27	4.4	12	27	0.06	1.06	11.6
		0.5	0647	463	25	3.8	12	25	0.05	--	--
		0.9	0640	443	27	4.2	14	20	0.08	1.81	11.6
184.8	172	0.1	1628	453	25	3.6	10	21	0.04	nd	nd
		0.5	1635	451	26	3.7	9	--	0.04	nd	nd
		0.9	1642	450	26	3.6	10	21	0.04	nd	nd
230.0	254	0.1	2114	439	25	3.7	10	22	0.05	nd	nd
		0.5	2122	426	25	3.6	17	--	0.04	dnq	nd
		0.9	2130	429	25	3.7	11	21	0.04	nd	nd
											September 26, 1991
360.0	503	0.1	1550	420	22	3.7	11	18	0.03	nd	nd
		0.5	1555	420	23	3.7	11	19	0.04	nd	nd
		0.9	1600	422	24	3.7	10	14	0.04	nd	nd
											September 27, 1991
460.8	706	0.1	0428	440	20	3.8	11	30	0.03	nd	nd
		0.5	0433	437	21	3.7	11	--	0.04	nd	nd
		0.9	0437	438	21	3.8	11	31	0.04	nd	nd
580.8	948	0.1	1950	444	20	4.1	13	16	0.04	nd	nd
		0.5	1957	441	21	4.1	13	--	0.04	dnq	nd
		0.9	2005	481	20	4.4	13	30	0.04	nd	nd
											September 28, 1991
712.9	1,215	0.3	1322	444	19	4.3	16	14	--	nd	nd
		0.5	1327	404	20	4.3	16	--	0.04	nd	nd
		0.8	1331	405	20	4.3	16	21	--	nd	nd
											September 29, 1991
846.5	1,489	0.1	0746	449	19	4.4	16	17	0.04	nd	nd
		0.5	0752	396	20	4.4	15	--	0.03	nd	nd
		0.9	0758	396	20	4.4	14	22	0.03	nd	nd

of dissolved organic compounds in the Lower
La., and Cairo, Ill., September-October 1991 cruise

at 25 degrees Celsius; °C, degrees Celsius; DOC, dissolved organic carbon; mg/L, milligrams per liter;

active substances; LAS, linear alkylbenzene sulfonate; I/E ratio, LAS, internal/external isomer ratio; AP, alykylphenol;

dnq, detected but not quantified]

			Concentration of volatile organic compounds									
LAS I/E Ratio	Total AP (µg/L)	Sum total APEO (µg/L)	Benzene (µg/L)	Toluene (µg/L)	1,2-dichloro-ethane (µg/L)	1,1,1-trichloro-ethane (µg/L)	dichloro-methane (µg/L)	trichloro-methane (µg/L)	dichloro-difluoro-methane (µg/L)	trichloro-fluoro-methane (µg/L)	Furan (µg/L)	Miscel-laneous hydro-carbons (µg/L)
2.7	nd	nd	nd	nd	0.2	nd	nd	0.2	0.2	nd	nd	nd
--	--	--	nd	nd	0.2	nd	nd	nd	0.3	nd	nd	nd
1.0	nd	nd	nd	nd	0.2	nd	nd	nd	0.3	nd	nd	nd
nd	--	--	nd	0.2	0.2	nd	nd	nd	nd	nd	nd	0.5
nd	--	--	0.2	0.2	0.3	nd	nd	nd	nd	nd	nd	0.5
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.5
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	nd	0.5	nd	0.3	nd	nd	nd	nd
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	0.3	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	0.3	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	0.3	nd	nd	nd	nd	nd	nd	nd

Table 5.17.--*Cross-channel variability Mississippi River between New Orleans,*

Location			Time (CDT)	Specific conductance (µS/cm)	Temperature (° C)	DOC (mg/L)	Color (Pt/Co units)	AOX (µg/L)	MBAS (mg/L)	LAS (µg/L)	LAS avg chain length (carbon units)
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank									
									September 29, 1991		
875.4	1,549	0.1	1115	444	20	4.3	16	27	--	nd	nd
		0.5	1121	447	20	4.3	16	--	0.04	nd	nd
		0.9	1128	449	20	4.4	14	20	0.03	nd	nd
898.9	1,596	0.1	1413	440	20	4.5	15	19	0.04	nd	nd
		0.5	1419	458	20	4.5	15	--	0.04	nd	nd
		0.9	1425	461	21	4.6	15	14	0.04	nd	nd
922.6	1,644	0.1	1710	444	20	4.4	16	18	0.04	nd	nd
		0.5	1715	461	20	4.5	15	--	0.03	nd	nd
		0.9	1719	478	20	4.8	16	14	0.05	nd	nd
950.5	1,699	0.1	2023	396	19	3.9	14	25	0.04	nd	nd
		0.5	2029	510	19	5.1	21	33	0.04	nd	nd
		0.8	2034	548	20	5.5	18	24	0.05	nd	nd

[1]Distances are computed using velocities in table 1.4 in chapter 1, and the first sample was collected at Mile 88.5 upriver from Head of Passes, La., on September 25, 1991, at 0647 hours.

Concentration of volatile organic compounds												
LAS I/E Ratio	Total AP (µg/L)	Sum total APEO (µg/L)	Benzene (µg/L)	Toluene (µg/L)	1,2-dichloro-ethane (µg/L)	1,1,1-trichloro-ethane (µg/L)	dichloro-methane (µg/L)	trichloro-methane (µg/L)	dichloro-difluoro-methane (µg/L)	trichloro-fluoro-methane (µg/L)	Furan (µg/L)	Miscel-laneous hydro-carbons (µg/L)
nd	--	--	nd	nd	0.2	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	0.3	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	0.2	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	0.2	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	0.2	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	0.2	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	0.2	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	0.2	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	0.2	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	0.2	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

Table 5.18.--*Cross-channel variability of dissolved organic between Cairo, Ill., and Minneapolis,*

[km, kilometers; CDT, Central Daylight Time; m^3/s, cubic meters per second; μS/cm, microsiemens per centimeter Pt/Co units, Platinum-cobalt units; AOX, adsorbable organic halide; μg/L, microgram per liter; MBAS, methylene blue APEO, alykylphenol polyethoxylate homologues and isomers; --, no measurement; nd, not detected

Location											
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (μS/cm)	Temperature (°C)	DOC (mg/L)	Color (Pt/Co units)	AOX (μg/L)	MBAS (mg/L)	LAS (μg/L)	LAS avg chain length (carbon units)
											September 30, 1991
80.8	1,882	0.1	0914	559	18	5.7	21	--	0.05	nd	nd
		0.5	0924	558	19	5.5	20	--	0.04	nd	nd
		0.9	0935	564	19	5.4	18	--	0.04	nd	nd
104.5	1,932	0.1	1217	549	18	5.8	23	47	0.05	nd	nd
		0.6	1222	568	19	5.5	19	--	0.04	nd	nd
		0.9	1226	578	18	5.3	19	27	0.04	nd	nd
128.9	1,983	0.2	1510	556	18	5.9	21	36	0.06	0.32	10.6
		0.5	1521	556	19	5.9	22	--	0.05	0.35	10.7
		0.9	1532	572	18	5.5	21	46	--	0.68	10.6
155.0	2,037	0.1	1830	527	18	6.4	25	34	0.06	nd	nd
		0.5	1835	542	18	6.0	23	--	0.05	0.37	10.7
		0.9	1840	627	19	4.6	19	20	0.05	5.26	11.1
180.3	2,090	0.1	2131	523	18	6.5	24	25	0.05	dnq	nd
		0.5	2148	557	18	5.7	24	26	0.04	dnq	nd
		0.9	2139	651	19	4.3	20	75	0.05	7.20	10.7
											October 1, 1991
283.3	2,293	0.1	1400	463	17	7.6	30	42	--	dnq	nd
		0.5	1407	460	17	7.6	32	--	0.05	dnq	nd
		0.9	1412	461	17	7.5	32	31	0.05	4.82	11.3

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 88.5 upriver from Head of Passes, La., on September 25, 1991, at 0647 hours.

compounds in the Upper Mississippi River
Minn., September-October 1991 cruise

at 25 degrees Celsius; °C, degrees Celsius; DOC, dissolved organic carbon; mg/L, milligrams per liter;

active substances; LAS, linear alkylbenzene sulfonate; I/E ratio, LAS, internal/external isomer ratio; AP, alykylphenol;

dnq, detected but not quantified; NE, no external isomers; No-C_{12} means no C_{12}-LAS homolog]

Concentration of volatile organic compounds												
LAS I/E Ratio	Total AP (µg/L)	Sum total APEO (µg/L)	Benzene (µg/L)	Toluene (µg/L)	1,2-dichloro-ethane (µg/L)	1,1,1-trichloro-ethane (µg/L)	dichloro-methane (µg/L)	trichloro-methane (µg/L)	dichloro-difluoro-methane (µg/L)	trichloro-fluoro-methane (µg/L)	Furan (µg/L)	Miscel-laneous hydro-carbons (µg/L)
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	1.3	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
No-C_{12}	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
NE	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	2.0	nd
No-C_{12}	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	1.7	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
NE	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
NE	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
3.2	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
2.3	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

Table 5.19.--*Cross-channel variability of dissolved organic between New Orleans, La., and Cairo, Ill.,*

[km, kilometers; CDT, Central Daylight Time; m^3/s, cubic meters per second; µS/cm, microsiemens per centimeter Pt/Co units, Platinum-cobalt units; AOX, adsorbable organic halide; µg/L, microgram per liter; MBAS, methylene blue --, no measurement; nd, not detected;

Location											
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (µS/cm)	Temperature (° C)	DOC (mg/L)	Color (Pt/Co units)	AOX (µg/L)	MBAS (mg/L)	LAS (µg/L)	LAS avg chain length (carbon units)
											March 25, 1992
90.0	0	0.1	0705	337	16	3.3	11	15	0.05	dnq	nd
		0.5	0655	267	17	3.3	16	108	0.05	0.68	11.4
		0.9	0713	261	16	3.2	18	44	0.05	dnq	nd
228.0	309	0.1	2344	305	13	3.4	24	12	0.05	dnq	nd
		0.5	2336	306	13	3.5	23	13	0.05	dnq	nd
		0.9	2352	306	13	3.4	18	76	0.07	dnq	nd
											March 26, 1992
360.0	628	0.1	2000	308	12	3.4	18	13	0.04	nd	nd
		0.5	2022	309	12	3.5	17	38	0.04	dnq	nd
		0.9	2011	--	--	3.5	20	35	0.05	dnq	nd
											March 27, 1992
435.3	819	0.1	0737	298	12	3.5	22	15	0.05	dnq	nd
		0.5	0729	323	12	3.6	18	31	0.06	--	--
		0.9	0722	326	12	3.7	19	14	0.05	dnq	nd
535.0	1,076	0.1	2117	340	11	3.6	17	16	0.04	dnq	nd
		0.5	2128	340	11	3.7	18	31	0.06	nd	nd
		0.8	2139	341	11	3.6	17	18	0.05	dnq	nd
											March 28, 1992
659.8	1,412	0.1	1653	358	11	3.8	18	49	0.04	0.90	10.9
		0.5	1659	358	11	3.8	18	19	0.04	nd	nd
		1.0	1705	365	11	3.8	17	13	0.05	dnq	nd
											March 29, 1992
723.3	1,571	0.3	0143	354	12	3.8	17	21	0.04	0.12	11.7
		0.5	--	354	15	4.0	22	11	0.04	dnq	nd
		0.7	--	357	14	4.0	19	14	0.05	nd	nd
848.0	1,884	0.1	2100	329	13	3.8	20	41	--	nd	nd
		0.5	2105	348	11	--	--	--	0.05	nd	nd
		0.9	2110	347	12	3.9	18	38	0.06	nd	nd

compounds in the Lower Mississippi River
Ill., March-April 1992 cruise

at 25 degrees Celsius; °C, degrees Celsius; DOC, dissolved organic carbon; mg/L, milligrams per liter; active substances; LAS, linear alkylbenzene sulfonate; I/E ratio, LAS, internal/external isomer ratio; dnq, detected but not quantified; NE, no external isomers]

	Concentration of volatile organic compounds					
LAS I/E ratio	Toluene (µg/L)	1,2,4-trichloro-benzene (µg/L)	1,2,3-trichloro-benzene (µg/L)	1,1,1-trichloro-ethane (µg/L)	Tetrachloro-ethene (µg/L)	Hexachloro-butadiene (µg/L)
nd	nd	nd	nd	nd	nd	nd
2.2	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
--	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
1.6	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
NE	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd

Table 5.19.--*Cross-channel variability of dissolved organic between New Orleans, La., and Cairo, Ill.,*

Location											
River miles upriver from Head of Passes, La.	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (μS/cm)	Temperature (° C)	DOC (mg/L)	Color (Pt/Co units)	AOX (μg/L)	MBAS (mg/L)	LAS (μg/L)	LAS avg chain length (carbon units)
										March 30, 1992	
878.1	1,956	0.2	0056	331	11	3.7	20	--	0.05	nd	nd
		0.5	0106	344	10	4.0	19	34	0.05	nd	nd
		0.9	0117	367	10	4.4	18	--	--	nd	nd
898.9	2,006	0.1	0406	378	12	3.3	18	104	0.04	nd	nd
		0.5	0359	380	11	4.1	17	--	0.06	nd	nd
		0.9	0353	409	10	4.6	19	38	0.05	nd	nd
923.0	2,063	0.1	0722	273	11	2.9	18	--	0.04	nd	nd
		0.5	0713	331	11	3.5	18	17	0.04	nd	nd
		0.9	0705	442	10	4.9	17	--	0.06	nd	nd
950.5	2,128	0.1	1040	288	11	2.7	17	24	0.04	--	--
		0.5	1047	477	9	5.2	19	22	0.07	dnq	nd
		0.9	1055	485	9	5.2	17	51	0.07	nd	nd

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 90.0 upriver from Head of Passes, La., on March 25, 1992, at 0705 hours.

Concentration of volatile organic compounds						
LAS I/E ratio	Toluene (µg/L)	1,2,4-trichloro-benzene (µg/L)	1,2,3-trichloro-banzene (µg/L)	1,1,1-trichloro-ethane (µg/L)	Tetrachloro-ethene (µg/L)	Hexachloro-butadiene (µg/L)
nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
--	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd

Table 5.20.--*Cross-channel variability of dissolved organic between Cairo, Ill., and Minneapolis,*

[km, kilometers; CDT, Central Daylight Time; m^3/s, cubic meters per second; µS/cm, microsiemens per centimeter Pt/Co units, Platinum-cobalt units; AOX, adsorbable organic halide; µg/L, microgram per liter; MBAS, methylene blue --, no measurement; nd, not detected;

Location											
River miles upriver from mouth of Ohio River	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank	Time (CDT)	Specific conductance (µS/cm)	Temperature (° C)	DOC (mg/L)	Color (Pt/Co units)	AOX (µg/L)	MBAS (mg/L)	LAS (µg/L)	LAS avg chain length (carbon units)
											March 31, 1992
109.8	2,404	0.1	0335	519	10	5.5	17	41	0.06	1.31	11.8
		0.5	0345	503	11	5.1	17	75	0.08	7.14	11.2
		0.9	0340	497	9	5.1	17	47	0.06	nd	nd
127.7	2,448	0.1	0636	521	11	5.1	14	--	0.06	0.22	11.6
		0.5	0629	511	11	5.1	16	29	0.07	0.60	11.3
		0.9	0622	506	10	5.1	16	--	0.08	1.75	11.6
145.7	2,491	0.1	0855	529	10	5.2	14	28	0.08	nd	nd
		0.5	0903	518	10	4.9	14	33	0.08	0.96	10.8
		0.9	0912	507	10	4.6	13	36	0.06	2.68	10.9
169.7	2,548	0.1	1237	544	11	5.2	14	24	0.08	0.40	11.0
		0.5	1229	518	10	5.3	14	38	0.06	dnq	nd
		0.9	1221	536	12	--	13	--	0.07	4.74	10.9
180.3	2,574	0.1	1410	541	10	5.5	12	30	0.08	0.72	11.3
		0.5	1405	487	10	5.6	12	21	0.08	0.35	11.6
		0.9	1359	521	13	4.8	14	16	0.06	6.04	11.2
											April 1, 1992
324.6	2,897	0.1	1147	458	8	6.3	16	59	0.06	nd	nd
		0.5	1142	459	8	6.1	16	28	0.07	0.34	11.4
		0.9	1138	535	9	5.3	12	23	0.10	nd	nd
											April 2, 1992
481.6	3,224	0.1	0902	520	8	7.0	21	32	--	dnq	nd
		0.5	0908	443	7	6.4	21	35	0.05	dnq	nd
		0.9	0914	453	7	6.5	21	47	0.06	dnq	nd
											April 3, 1992
696.1	3,630	0.1	1122	389	7	8.5	29	76	0.05	dnq	nd
		0.5	1116	425	7	8.1	25	73	0.05	dnq	nd
		0.9	1110	499	7	8.1	24	58	0.06	0.14	10.9

compounds in the Upper Mississippi River
Minn., March-April 1992 cruise

at 25 degrees Celsius; °C, degrees Celsius; DOC, dissolved organic carbon; mg/L, milligrams per liter;

active substances; LAS, linear alkylbenzene sulfonate; I/E ratio, LAS, internal/external isomer ratio;

dnq, detected but not quantified; NE, no external isomers]

	Concentration of volatile organic compounds						
LAS I/E Ratio	Toluene (µg/L)	1,2,4-trichloro-benzene (µg/L)	1,2,3-trichloro-benzene (µg/L)	1,1,1-trichloro-ethane (µg/L)	Tetrachloro-ethene (µg/L)	Hexachloro-butadiene (µg/L)	Methylene chloride (µg/L)
NE	nd	nd	nd	nd	nd	nd	nd
41.0	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd
NE	nd	nd	nd	nd	nd	nd	nd
NE	nd	nd	nd	nd	nd	nd	nd
NE	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd
NE	nd	nd	nd	nd	nd	nd	nd
NE	nd	nd	nd	nd	nd	nd	nd
NE	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd
3.0	nd	nd	nd	nd	nd	nd	nd
5.1	nd	nd	nd	nd	nd	nd	nd
1.9	nd	nd	nd	nd	nd	nd	nd
3.3	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd
0.81	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd
NE	nd	nd	nd	nd	nd	nd	nd

Table 5.20.--*Cross-channel variability of dissolved organic between Cairo, Ill., and Minneapolis,*

Location: River miles upriver from mouth of Ohio River	Location: Distance upriver from first sample[1] (km)	Location: Fraction of distance from left to right bank	Time (CDT)	Specific conductance (μS/cm)	Temperature (° C)	DOC (mg/L)	Color (Pt/Co units)	AOX (μg/L)	MBAS (mg/L)	LAS (μg/L)	LAS avg chain length (carbon units)
											April 3, 1992
723.6	3,681	0.5	1445	498	8	7.9	24	43	0.08	dnq	nd
		0.9	1452	519	7	8.0	23	33	0.07	dnq	nd
											April 4, 1992
835.1	3,887	0.1	0540	743	8	8.9	21	46	0.13	3.02	10.8
		0.5	0548	694	8	8.0	18	57	0.09	0.44	10.8
		0.8	0556	696	7	8.0	20	41	0.10	0.62	10.7

[1]Distances are computed using velocities listed in table 1.4 in chapter 1, and the first sample was collected at Mile 90.0 upriver from Head of Passes, La., on March 25, 1992, at 0705 hours.

compounds in the Upper Mississippi River
Minn., March-April 1992 cruise--Continued

	Concentration of volatile organic compounds						
LAS I/E Ratio	**Toluene (μg/L)**	**1,2,4-trichloro-benzene (μg/L)**	**1,2,3-trichloro-benzene (μg/L)**	**1,1,1-trichloro-ethane (μg/L)**	**Tetrachloro-ethene (μg/L)**	**Hexachloro-butadiene (μg/L)**	**Methylene chloride (μg/L)**
nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd
3.1	0.3	nd	nd	nd	nd	nd	0.4
NE	nd	nd	nd	nd	nd	nd	nd
NE	nd	nd	nd	0.3	nd	nd	nd

Table 5.21.--*Concentration of dissolved organic Mississippi River between Baton Rouge, La., and*

[km, kilometers; CDT, Central Daylight Time; m[3]/s, cubic meters per second; μS/cm, microsiemens per centimeter

Pt/Co units, Platinum-cobalt units; AOX, adsorbable organic halide; μg/L, microgram per liter; MBAS, methylene blue

APEO, alykylphenol polyethoxylate homologues and isomers; --, no measurement; nd, not detected;

Name of tributary	Location			Date 1991	Time (CDT)	Specific conductance (μS/cm)	Temperature (°C)	DOC (mg/L)	Color (Pt/Co units)	AOX (μg/L)	MBAS (mg/L)	LAS (μg/L)	LAS avg chain length (carbon units)
	River miles	Distance upriver from first sample[1] (km)	Fraction of distance from left to right bank										
													Upriver from
Arkansas	580.0	766	BT	6-25	1724	536	27	4.2	--	12	0.06	--	--
Ohio	953.8	1,613	0.1	6-27	1909	231	26	2.5	--	10	0.03	nd	nd
			0.5		1903	243	25	2.5	--	10	0.04	nd	nd
			0.9		1858	323	26	2.6	--	9	0.04	--	--
											Upriver from Mouth		
Missouri	195.3	2,062	0.5	6-28	1945	563	25	3.6	10	--	0.05	nd	nd
Illinois	217.9	2,132	0.5	6-29	0550	650	--	4.7	--	16	0.06	nd	nd
Des Moines	361.4	2,433	BT	6-30	0111	505	23	4.3	--	17	--	nd	nd
Skunk	395.8	2,501	BT	6-30	0533	622	27	3.0	--	19	0.10	nd	nd
Rock	479.0	2,679	BT	6-30	2035	481	27	9.9	--	27	0.06	2.78	11.7
Wisconsin	630.6	2,979	BT	7-01	1614	247	26	9.9	--	50	0.04	--	--
Black	698.2	3,104	BT	7-01	2359	418	25	12.8	--	7	0.06	nd	nd
Chippewa	763.4	3,230	BT	7-02	1035	439	22	12.4	--	10	0.05	nd	nd
St. Croix	811.5	3,318	0.5	7-02	1605	167	22	20.8	--	14	--	nd	nd
Minnesota	844.0	3,379	0.7	7-02	2058	745	24	7.3	--	8	0.08	nd	nd

[1]Distances, to the mouth of the tributary, are computed using velocities in table 1.4 in chapter 1, and the first sample was collected at Mile 230.0 upriver from Head of Passes, La., on June 23, 1991, at 2240 hours.

compounds in some of the tributaries of the Minneapolis, Minn., June-July 1991 cruise

at 25 degrees Celsius; °C, degrees Celsius; DOC, dissolved organic carbon; mg/L, milligrams per liter;

active substances; LAS, linear alkylbenzene sulfonate; I/E ratio, LAS, internal/external isomer ratio; AP, alykylphenol;

dnq, detected but not quantified; and BT, below the mouth of the tributary but near the bank]

			Concentration of volatile organic compounds							
LAS I/E Ratio	Total AP (µg/L)	Sum total APEO (µg/L)	Methylene chloride (µg/L)	Benzene (µg/L)	Toluene (µg/L)	Total xylene isomers (µg/L)	1,2,4-trimethyl benzene (µg/L)	1,2-dichloro-ethane (µg/L)	Cyclo-alkanes (µg/L)	1,1,1-trichloro-ethane (µg/L)
Head of Passes										
--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	0.8	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	nd	nd	nd	nd	nd	nd	nd	0.8	nd	nd
of Ohio River										
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	0.3	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	0.2	nd	nd	nd	nd	nd
--	--	--	--	--	--	--	--	--	--	--
1.1	nd	nd	nd	0.2	0.3	nd	nd	nd	nd	nd
--	nd	nd	--	--	--	--	--	--	--	--
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

Table 5.22.--*Concentration of dissolved organic between New Orleans, La., and*

[km, kilometers; CDT, Central Daylight Time; m^3/s, cubic meters per second; µS/cm, microsiemens per centimeter

Pt/Co units, Platinum-cobalt units; AOX, adsorbable organic halide; µg/L, microgram per liter; MBAS, methylene blue

APEO, alykylphenol polyethoxylate homologues and isomers; --, no measurement; nd, not detected

BT, below the mouth of

Name of tributary	Location: River miles	Location: Distance upriver from first sample[1] (km)	Location: Fraction of distance from left to right bank	Date 1991	Time (CDT)	Specific conductance (µS/cm)	Temperature (°C)	DOC (mg/L)	Color (Pt/Co units)	AOX (µg/L)	MBAS (mg/L)	LAS (µg/L)	LAS avg chain length (carbon units)
												Upriver from	
Arkansas	580.8	948	BT	9-27	2005	481	20	4.4	13	31	0.04	nd	nd
Ohio	953.8	1,712	0.1	9-29	2130	277	22	2.7	13	14	0.04	nd	nd
			0.5		2121	266	22	2.7	13	--	0.03	nd	nd
			0.9		2115	275	20	2.7	11	17	0.03	nd	nd
											Upriver from Mouth		
Missouri	195.3	2,125	0.5	9-30	2333	707	18	3.1	15	25	0.03	4.73	10.2
Illinois	217.9	2,171	0.5	10-01	0415	671	19	4.8	17	23	0.09	--	--
Des Moines	361.4	2,441	BT	10-02	0118	447	16	7.7	32	--	0.04	0.10	11.4
Rock	479.0	2,669	BT	10-02	2005	665	17	6.7	--	--	0.07	dnq	nd
Wisconsin	630.6	2,956	BT	10-03	1645	333	15	7.7	--	13	0.04	0.57	10.8
Black	698.2	3,076	0.5	10-04	0316	316	14	7.7	31	9	0.04	dnq	nd
Chippewa	763.4	3,197	BT	10-04	1205	150	--	--	--		0.03	nd	nd
St. Croix	811.5	3,280		10-04	1720	168	15	12.1	73	71	0.04	nd	nd
Minnesota	844.0	3,338	0.5	10-04	2155	945	14	7.7	23	--	0.11	nd	nd

[1]Distances to the mouth of the tributary, are computed using velocities in table 1.4 in chapter 1, and the first sample was collected at Mile 88.5 upriver from Head of Passes, La., on September 25, 1991, at 0647 hours.

compounds in some of the tributaries of the Mississippi River Minneapolis, Minn., September-October 1991 cruise

at 25 degrees Celsius; °C, degrees Celsius; DOC, dissolved organic carbon; mg/L, milligrams per liter;

active substances; LAS, linear alkylbenzene sulfonate; I/E ratio, LAS, internal/external isomer ratio; AP, alykylphenol;

dnq, detected but not quantified; and BT, below the mouth of the tributary but near the bank]

Concentration of volatile organic compounds												
LAS I/E Ratio	Total AP (μg/L)	Sum total APEO (μg/L)	Benzene (μg/L)	Toluene (μg/L)	1,2-dichloro-ethane (μg/L)	1,1,1-trichloro-ethane (μg/L)	dichloro-methane (μg/L)	trichloro-methane (μg/L)	dichloro-difluoro-methane (μg/L)	trichloro-fluoro-methane (μg/L)	Furan (μg/L)	Miscel-laneous hydro-carbons (μg/L)
Head of Passes												
nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	nd	nd	nd	nd	0.7	nd	nd	nd	nd	nd	nd	nd
--	nd	nd	nd	nd	0.6	nd	nd	nd	nd	nd	nd	nd
--	nd	nd	nd	nd	0.6	nd	nd	nd	nd	nd	nd	nd
of Ohio River												
NoC_{12}	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
--	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
1.5	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
0.38	--	--	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
nd	--	--	nd	nd	nd	nd	0.4	nd	nd	nd	nd	nd
nd	--	--	nd	nd	nd	0.3	0.9	nd	nd	nd	1.3	nd
nd	--	--	nd	nd	nd	nd	0.7	nd	nd	nd	nd	nd
nd	--	--	nd	nd	nd	nd	0.2	0.2	nd	nd	nd	nd

Table 5.23.--*Concentration of dissolved organics between New Orleans, La., and*

[km, kilometers; CDT, Central Daylight Time; m^3/s, cubic meters per second; µS/cm, microsiemens per centimeter

Pt/Co units, Platinum-cobalt units; AOX, adsorbable organic halide; µg/L, microgram per liter; MBAS, methylene blue

--, no measurement; nd, not detected; dnq, detected but not quantified; and BT, below the mouth

Name of tributary	Location: River miles	Location: Distance upriver from first sample[1] (km)	Location: Fraction of distance from left to right bank	Date 1992	Time (CDT)	Specific conductance (µS/cm)	Temperature (°C)	DOC (mg/L)	Color (Pt/Co units)	AOX (µg/L)	MBAS (mg/L)	LAS (µg/L)	LAS avg chain length (carbon units)
													Upriver from
Yazoo	435.3	819	BT	3-27	0737	298	12	3.7	19	14	0.05	dnq	nd
Arkansas	582.0	1,213	1.0	3-28	0550	323	14	4.2	22	--	0.02	nd	nd
Ohio	953.8	2,150	0.1	3-30	1258	237	11	2.6	18	28	0.04	nd	nd
			0.5		1246	266	11	2.8	19	30	0.05	nd	nd
			0.9		1252	328	10	3.0	18	28	0.07	nd	nd
													Upriver from Mouth
Kaskaskia	117.5	2,423	0.5	3-31	0450	478	11	7.3	26	62	0.05	dnq	nd
Missouri	195.3	2,612	0.4	3-31	1554	528	12	4.9	14	20	0.04	0.10	10.8
Illinois	217.9	2,666	0.5	3-31	2035	778	12	4.4	9	31	0.10	dnq	nd
Des Moines	361.4	2,880	0.5	4-01	1615	726	9	3.9	7	81	0.11	nd	nd
Iowa	433.9	3,132	BT	4-02	0307	448	7	6.6	20	28	0.06	nd	nd
Rock	479.0	3,219	BT	4-02	0838	535	7	6.3	16	22	0.06	dnq	nd
Wisconsin	630.6	3,512	BT	4-03	0356	241	6	7.5	23	146	0.04	dnq	nd
Chippewa	763.4	3,754	BT	4-03	1953	243	7	8.3	41	--	0.05	nd	nd
St. Croix	811.5	3,840	0.6	4-04	0103	162	5	9.6	51	79	--	dnq	nd
Minnesota	844.0	3,904	0.5	4-04	0711	901	7	6.5	11	39	0.13	0.18	10.6

[1]Distances, to the mouth of the tributary, are computed using velocities in table 1.4 in chapter 1, and the first sample was collected at Mile 90.0 upriver from Head of Passes, La., on March 25, 1992, at 0705 hours.

compounds in some of the tributaries of the Mississippi River
Minneapolis, Minn., March-April 1992 cruise

at 25 degrees Celsius; °C, degrees Celsius; DOC, dissolved organic carbon; mg/L, milligrams per liter;

active substances; LAS, linear alkylbenzene sulfonate; I/E ratio, LAS, internal/external isomer ratio;

of the tributary but near the bank; NE no external isomers; no-C_{12}, no C_{12}-LAS homolog]

Concentration of volatile organic compounds							
LAS I/E Ratio	Toluene (µg/L)	1,2,4-trichloro-benzene (µg/L)	1,2,3-trichloro-benzene (µg/L)	1,1,1-trichloro-ethane (µg/L)	Tetrachloro-ethene (µg/L)	Hexachloro-butadiene (µg/L)	Methylene chloride (µg/L)
Head of Passes							
nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd
of Ohio River							
nd	nd	nd	nd	nd	nd	nd	nd
no-C_{12}	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	nd	nd	nd	nd
nd	nd	nd	nd	0.3	nd	nd	nd
NE	nd	nd	nd	nd	nd	nd	nd

Table 5.24.--*Concentration of dissolved linear alkylbenzene sulfonate, homologs as percent of total linear samples in which linear*

[LAS, linear alkylbenzene sulfonate; I/E ratio, internal/external isomer ratio; C_{iik}, where ii is the homolog, k is the phenyl

River miles upstream from						Homolog			
Head of Passess, La.	Mouth of Ohio		LAS concentration (g/L)	Average chain length	C_{12} I/E ratio	C_{10}	C_{11}	C_{12}	C_{13}
							June-July 1991 cruise		
--	120.1		0.07	10.2	--	77	23	00	00
--	130.6		0.34	10.9	62	30	52	18	00
--	170.0		10.3	10.8	4.1	35	47	18	00
--	341.5		0.73	11.1	69	22	41	37	00
--	402.8		0.49	11.4	46	08	46	45	00
--	479.0	Rock	2.78	11.72	58	11	21	52	15
--	501.0		0.24	11.6	63	00	45	55	00
--	793.2		0.64	10.6	--	46	45	10	00
--	826.1		0.55	10.9	2.0	25	57	18	00
							September-October 1991		
88.5	--		1.81	11.6	52	12	25	55	08
88.5	--		1.06	11.6	1.5	07	41	40	11
146.0	--		0.10	12.0	7	00	00	100	00
269.9	--		0.42	11.4	7	16	32	46	06
330.4	--		0.19	11.1	2.0	22	45	33	00
534.5	--		0.90	11.5	1.2	13	37	36	13
--	51.6		0.50	11.3	1.1	18	37	45	00
--	128.9		0.32	10.6	NE	43	57	00	00
--	128.9		0.35	10.7	NE	40	49	11	00
--	128.9		0.68	10.6	No-C_{12}	43	49	08	00
--	155.0		0.37	10.7	NE	42	46	12	00
--	155.0		5.26	11.1	5.7	25	43	30	02
--	180.3		7.20	10.7	1.3	51	26	23	00
--	195.3	Missouri	4.73	10.2	NE	75	25	00	00
--	283.3		4.82	11.3	1.1	18	39	39	04
--	361.4	Des Moines	0.10	11.4	1.5	00	62	38	00
--	465.7		0.06	11.0	NE	00	100	00	00
--	539.2		0.14	11.3	NE	36	00	64	00
--	602.2		0.43	11.2	88	00	78	22	00
--	630.6	Wisconsin	0.57	10.8	38	44	36	20	00
--	686.1		1.14	11.1	76	21	49	30	00

alkylbenzene sulfonate, and isomers as a fraction of C_{12} linear alkylbenzene sulfonate homolog for alkylbenzene sulfonate was detected

position; the C14 LAS homolog was not found in any water sample; NE, no external isomers; No-C_{12} means no C_{12} homolog]

C_{10}-5	C_{10}-4	C_{10}-3	C_{10}-2	C_{11}-5&6	C_{11}-4	C_{11}-3	C_{11}-2	C_{12}-6	C_{12}-5	C_{12}-4	C_{12}-3	C_{12}-2	C_{13}-6&7	C_{13}-5	C_{13}-4	C_{13}-3	C_{13}-2
77	00	00	00	23	00	00	00	00	00	00	00	00	00	00	00	00	00
23	00	00	07	26	13	00	13	07	00	00	00	11	00	00	00	00	00
15	12	08	00	27	14	06	00	08	06	04	00	00	00	00	00	00	00
06	05	05	07	15	06	09	11	08	06	07	06	09	00	00	00	00	00
00	00	00	08	10	09	10	17	07	08	08	08	16	00	00	00	00	00
03	02	03	03	07	04	04	06	10	09	09	10	14	04	03	02	03	03
00	00	00	00	15	10	11	09	13	09	10	11	12	00	00	00	00	00
38	07	00	00	45	00	00	00	10	00	00	00	00	00	00	00	00	00
10	04	03	08	23	07	14	13	06	05	06	00	00	00	00	00	00	00
00	03	02	07	07	04	05	08	10	09	09	09	18	05	03	00	00	00
00	04	00	03	22	08	04	07	14	11	05	05	06	08	04	00	00	00
00	00	00	00	00	00	00	00	21	20	16	23	20	00	00	00	00	00
00	00	05	11	11	05	07	09	09	10	10	07	10	06	00	00	00	00
00	00	10	12	17	08	11	08	11	11	11	00	00	00	00	00	00	00
00	00	05	09	13	08	08	08	13	07	07	05	05	10	03	00	00	00
10	05	00	03	16	10	05	06	11	12	06	07	08	00	00	00	00	00
43	00	00	00	57	00	00	00	00	00	00	00	00	00	00	00	00	00
32	08	00	00	49	00	00	00	11	00	00	00	00	00	00	00	00	00
32	12	00	00	49	00	00	00	08	00	00	00	00	00	00	00	00	00
28	14	00	00	46	00	00	00	12	00	00	00	00	00	00	00	00	00
12	09	05	00	30	12	01	00	14	11	04	00	00	02	00	00	00	00
16	13	11	11	12	06	05	03	06	07	04	05	00	00	00	00	00	00
75	00	00	00	25	00	00	00	00	00	00	00	00	00	00	00	00	00
04	04	04	06	15	08	07	09	11	10	07	06	06	02	02	00	00	00
00	00	00	00	36	00	00	26	23	00	00	00	15	00	00	00	00	00
00	00	00	00	00	00	44	56	00	00	00	00	00	00	00	00	00	00
36	00	00	00	00	00	00	00	42	22	00	00	00	00	00	00	00	00
00	00	00	00	26	18	18	16	00	11	00	00	12	00	00	00	00	00
08	08	13	14	12	07	07	09	06	00	00	09	06	00	00	00	00	00
05	03	06	06	16	14	12	07	07	06	06	06	05	00	00	00	00	00

Table 5.24.--*Concentration of dissolved linear alkylbenzene sulfonate, homologs as percent of total linear samples in which linear*

River miles upstream from						Homolog			
Head of Passess, La.	Mouth of Ohio		LAS concentration (g/L)	Average chain length	C_{12} I/E ratio	C_{10}	C_{11}	C_{12}	C_{13}
						March-April 1992 cruise			
90.0	--		0.68	11.4	1.1	17	35	37	11
250.0	--		0.19	11.4	76	00	56	44	00
659.8	--		0.90	10.9	85	39	33	28	00
723.3	--		0.12	11.7	NE	00	30	70	00
--	34.3		0.18	10.4	NE	60	40	00	00
--	96.2		1.58	10.9	NE	32	42	26	00
--	109.8		1.31	11.8	4.6	00	23	77	00
--	109.8		7.14	11.2	3.9	24	35	34	07
--	127.7		1.75	11.6	3.4	09	21	70	00
--	127.7		0.60	11.3	NE	16	39	45	00
--	127.7		0.22	11.6	NE	00	43	57	00
--	145.7		0.96	10.8	NE	52	17	31	00
--	145.7		2.68	10.9	2.7	47	19	34	00
--	169.7		4.74	10.9	1.3	40	33	27	00
--	169.7		0.40	11.0	NE	31	42	27	00
--	180.3		6.04	11.2	1.4	30	25	40	05
--	180.3		0.35	11.6	77	00	43	57	00
--	180.3		0.72	11.3	1.8	23	27	51	00
--	195.3	Missouri	0.10	10.8	No-C_{12}	24	76	00	00
--	324.6		0.34	11.4	32	12	35	53	00
--	696.1		0.14	10.9	NE	29	47	24	00
--	793.1		0.31	10.6	NE	56	30	15	00
--	826.1		0.60	10.8	NE	46	32	22	00
--	835.1		3.02	10.8	1.3	47	27	26	00
--	835.1		0.44	10.8	NE	44	34	22	00
--	835.1		0.62	10.7	NE	49	33	18	00
--	844.0	Minnesota	0.18	10.6	NE	55	32	13	00
--	845.6		0.73	10.7	NE	48	35	17	00

alkylbenzene sulfonate, and isomers as a fraction of C_{12} linear alkylbenzene sulfonate homolog for alkylbenzene sulfonate was detected--Continued

C_{10}-5	C_{10}-4	C_{10}-3	C_{10}-2	C_{11}-5&6	C_{11}-4	C_{11}-3	C_{11}-2	C_{12}-6	C_{12}-5	C_{12}-4	C_{12}-3	C_{12}-2	C_{13}-6&7	C_{13}-5	C_{13}-4	C_{13}-3	C_{13}-2
00	04	05	08	13	07	07	09	10	09	06	06	06	05	03	02	00	00
00	00	00	00	12	11	13	20	09	10	00	12	13	00	00	00	00	00
13	10	05	10	09	06	11	06	07	06	04	05	06	00	00	00	00	00
00	00	00	00	00	00	00	30	40	30	00	00	00	00	00	00	00	00
33	26	00	00	40	00	00	00	00	00	00	00	00	00	00	00	00	00
19	13	00	00	29	13	00	00	14	12	00	00	00	00	00	00	00	00
00	00	00	00	23	00	00	00	35	28	14	00	00	00	00	00	00	00
11	07	05	01	23	10	03	00	14	12	06	01	00	04	02	01	00	00
09	00	00	00	21	00	00	00	28	27	16	00	00	00	00	00	00	00
00	16	00	00	39	00	00	00	24	21	00	00	00	00	00	00	00	00
00	00	00	00	43	00	00	00	37	20	00	00	00	00	00	00	00	00
28	00	25	00	17	00	00	00	18	13	00	00	00	00	00	00	00	00
21	16	10	00	15	04	00	00	14	11	09	00	00	00	00	00	00	00
13	10	10	07	15	07	06	05	08	07	05	04	02	00	00	00	00	00
19	11	00	00	25	17	00	00	14	13	00	00	00	00	00	00	00	00
10	07	07	07	11	05	05	05	13	11	07	05	04	02	01	01	00	01
00	00	00	00	19	11	07	06	13	12	12	11	08	00	00	00	00	00
08	07	00	08	13	07	07	00	17	16	10	08	00	00	00	00	00	00
24	00	00	00	76	00	00	00	00	00	00	00	00	00	00	00	00	00
00	00	00	12	00	13	09	13	00	13	11	15	14	00	00	00	00	00
29	00	00	00	27	20	00	00	00	24	00	00	00	00	00	00	00	00
34	22	00	00	30	00	00	00	15	00	00	00	00	00	00	00	00	00
34	12	00	00	25	07	00	00	13	09	00	00	00	00	00	00	00	00
25	10	05	07	14	04	05	04	08	07	05	03	03	00	00	00	00	00
32	12	00	00	28	06	00	00	13	08	00	00	00	00	00	00	00	00
23	13	07	06	27	06	00	00	11	07	00	00	00	00	00	00	00	00
55	00	00	00	32	00	00	00	13	00	00	00	00	00	00	00	00	00
29	19	00	00	27	08	00	00	10	07	00	00	00	00	00	00	00	00

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