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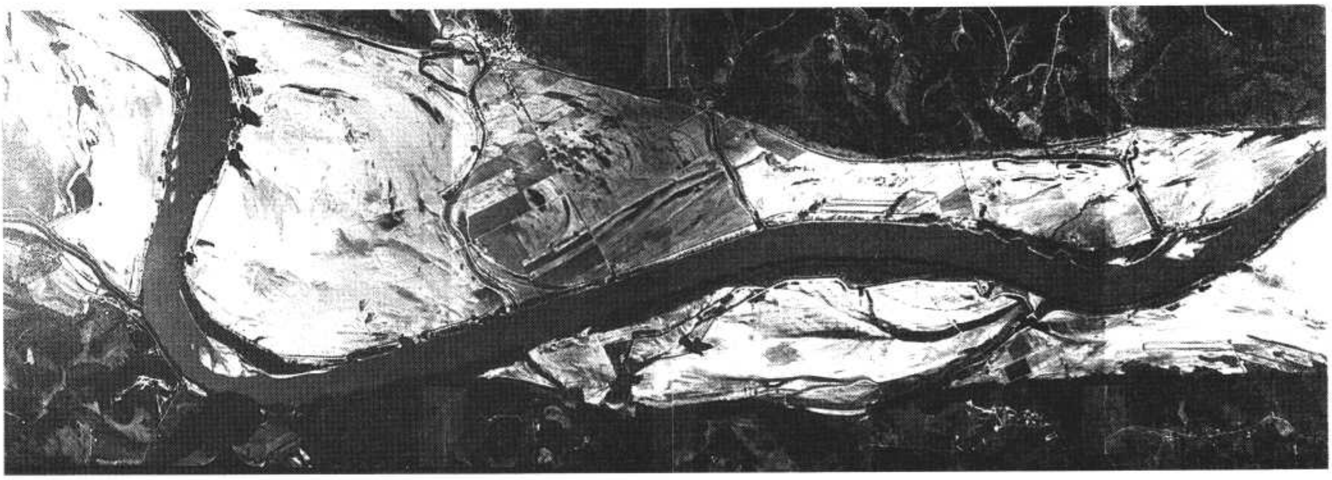
Physical and Chemical Data on Sediments Deposited in the Missouri and the Mississippi River Flood Plains During the July Through August 1993 Flood

Floods in the Upper Mississippi River Basin 1993

Circular 1120-L



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PHYSICAL AND CHEMICAL DATA ON SEDIMENTS DEPOSITED IN THE MISSOURI AND THE MISSISSIPPI RIVER FLOOD PLAINS DURING THE JULY THROUGH AUGUST 1993 FLOOD

By Gregg K. Schalk, Robert R. Holmes, Jr., and Gary P. Johnson

Floods in the Upper Mississippi River Basin, 1993

U.S. GEOLOGICAL SURVEY CIRCULAR 1120–L

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FOREWORD

During spring and summer 1993, record flooding inundated much of the upper Mississippi River Basin. The magnitude of the damages—in terms of property, disrupted business, and personal trauma—was unmatched by any other flood disaster in United States history. Property damage alone is expected to exceed $10 billion. Damaged highways and submerged roads disrupted overland transportation throughout the flooded region. The Mississippi and the Missouri Rivers were closed to navigation before, during, and after the flooding. Millions of acres of productive farmland remained under water for weeks during the growing season. Rills and gullies in many tilled fields are the result of the severe erosion that occurred throughout the Midwestern United States farmbelt. The hydrologic effects of extended rainfall throughout the upper Midwestern United States were severe and widespread. The banks and channels of many rivers were severely eroded, and sediment was deposited over large areas of the basin's flood plain. Record flows submerged many areas that had not been affected by previous floods. Industrial and agricultural areas were inundated, which caused concern about the transport and fate of industrial chemicals, sewage effluent, and agricultural chemicals in the floodwaters. The extent and duration of the flooding caused numerous levees to fail. One failed levee on the Raccoon River in Des Moines, Iowa, led to flooding of the city's water treatment plant. As a result, the city was without drinking water for 19 days.

As the Nation's principal water-science agency, the U.S. Geological Survey (USGS) is in a unique position to provide an immediate assessment of some of the hydrological effects of the 1993 flood. The USGS maintains a hydrologic data network and conducts extensive water-resources investigations nationwide. Long-term data from this network and information on local and regional hydrology provide the basis for identifying and documenting the effects of the flooding. During the flood, the USGS provided continuous streamflow and related information to the National Weather Service (NWS), the U.S. Army Corps of Engineers, the Federal Emergency Management Agency (FEMA), and many State and local agencies as part of its role to provide basic information on the Nation's surface- and ground-water resources at thousands of locations across the United States. The NWS has used the data in forecasting floods and issuing flood warnings. The data have been used by the Corps of Engineers to operate water diversions, dams, locks, and levees. The FEMA and many State and local emergency management agencies have used USGS hydrologic data and NWS forecasts as part of the basis of their local flood-response activities. In addition, USGS hydrologists are conducting a series of investigations to document the effects of the flooding and to improve understanding of the related processes. The major initial findings from these studies will be reported in this Circular series as results become available.

U.S. Geological Survey Circular 1120, *Floods in the Upper Mississippi River Basin, 1993*, consists of individually published chapters that will document the effects of the 1993 flooding. The series includes data and findings on the magnitude and frequency of peak discharges; precipitation; water-quality characteristics, including nutrients and man-made contaminants; transport of sediment; assessment of sediment deposited on flood plains; effects of inundation on ground-water quality; flood-discharge volume; effects of reservoir storage on flood peaks; stream-channel scour at selected bridges; extent of flood-plain inundation; and documentation of geomorphologic changes.

Charles G. Groat
Dirctor

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CONVERSION FACTORS AND VERTICAL DATUM

Multiply	By	To obtain
millimeter (mm)	0.03937	inch
meter (m)	3.281	foot
square meter (m^2)	10.76	square foot
kilometer (km)	0.6214	mile
kilogram (kg)	2.205	pound
gram (g)	0.03527	ounce
square kilometer (km^2)	0.3861	square mile

Temperature in degrees Celsius (°C) can be converted to degrees Fahrenheit (°F) as follows:

Celsius temperature (°C) $°F = 1.8°C + 32$ Fahrenheit temperature (°F)

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)—a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called Sea Level Datum of 1929.

Physical and Chemical Data on Sediments Deposited in the Missouri and the Mississippi River Flood Plains During the July through August 1993 Flood

By Gregg K. Schalk, Robert R. Holmes, Jr., *and* Gary P. Johnson

Abstract

In July and August 1993, Missouri and Mississippi River floodwaters overtopped or breached levees and inundated agricultural and urban areas in the flood plains. To assess the regional variability of quality of silt and clay sediments transported and deposited during inundation, sediment samples were collected in September 1993 at 25 sites in the Missouri and the Mississippi River flood plains. The samples were analyzed for physical properties and chemical constituents that included particle-size distribution, water content, volatile solids, nutrients, carbon, selected trace elements, pesticides, and semivolatile organic compounds for postflood sediment samples, and particle-size distribution for preflood soil samples. Pesticides were detected in samples from many of the sites, with alachlor detected in one sample at a concentration of 54 micrograms per kilogram. Many semivolatile organic compounds were detected in samples at several sites, with the concentration of fluoranthene in one sample at 270 milligrams per kilogram. Procedures for selecting sites, techniques developed for sampling, laboratory analytical methods, and quality-assurance sampling methods also are described.

INTRODUCTION

Peak discharges exceeded 100-year recurrence intervals at U.S. Geological Survey (USGS) streamflow-gaging stations on the Missouri and the Mississippi Rivers during July and August 1993 (Parrett and others, 1993). Floodwaters inundated the flood plain as a result of failed levees. Sediments transported by the floodwaters were deposited in varying thicknesses in these inundated areas. The deposited silt and clay sediments were thought to contain elevated concentrations of nutrients and trace elements. Also, because the floodwaters inundated various agricultural and urban areas, several pesticides and organic compounds were thought to have attached to silt and clay sediments that were mobilized and deposited downstream in the inundated flood plain. Large concentrations of these various constituents are of concern because of their potential effects on croplands and wildlife habitat in the flood plain. To obtain information that would be needed to address these concerns, the USGS conducted a study to assess the regional variability in the physical and chemical characteristics of silt- and clay-size (hereafter referred to as "silt and clay") sediments deposited in the Missouri and the Mississippi River flood plains. The study included determination of the presence of contaminants in the sediments and a comparison of particle-size distribution in postflood sediment and preflood soil at several locations.

Purpose and Scope

This report describes the sampling and analytical techniques, quality-assurance methods, and the results of analyses of sediment samples collected in September 1993 from 25 sites along the flood plains of the Missouri and the Mississippi Rivers. Data presented for the postflood sediment samples include particle-size distribution, water content, volatile solids, and concentrations of nutrients, carbon, other selected elements, pesticides, and semivolatile organic compounds. The particle-size distribution of preflood soil sampled beneath the postflood sediment samples also is presented.

Description of Study Area

The study area was the flood plains of the Missouri and the Mississippi Rivers that were inundated by floodwaters during the July through August 1993 flood—a 560-river mile reach of the Missouri River from Nebraska City, Nebraska, to St. Louis, Missouri, and a 578-river mile reach of the Mississippi River from Dubuque, Iowa, to Cairo, Illinois (fig. 1). These flood plains contain a series of levees constructed to

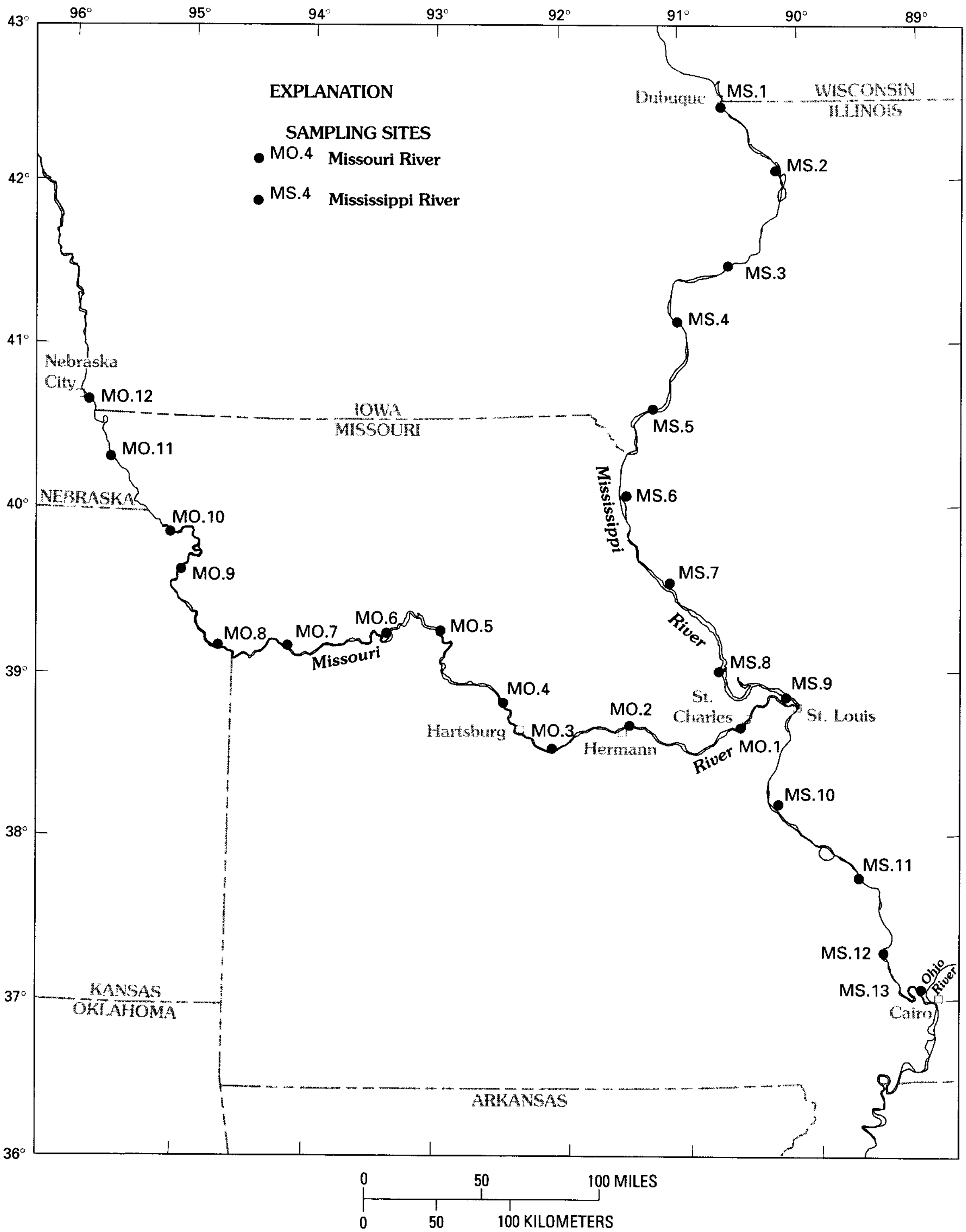

Figure 1. Location of study area and sediment deposition sites sampled during September 1993 in the Missouri and the Mississippi River flood plains.

withstand floodwaters from the rivers and their tributaries. The predominant land use in the flood plain is agriculture, interspersed with urban areas. Postflood sediment samples were collected along the flood plains at 25 sites.

Deposition of silt and clay sediment in the flood plain generally was associated with "slack water" areas where floodwaters entered with little velocity and pooled. These areas commonly were located near the flood-plain side of the levee adjacent to the levee break where the flow paths separated. Silt and clay deposition was determined to be as much as 140 mm deep in the flood plain of the Missouri River near Hermann, Missouri (fig. 2).

Although sites with sand deposition generally were not sampled, sand dunes as deep as 4 m were observed near many levee breaks, such as those near St. Charles, Missouri (fig. 3). Sand dunes along the flood plain near Hartsburg, Missouri, were as long as 3,000 m and as high as 3 m (fig. 4).

STUDY METHODS

For this study, 25 sites were selected to sample postflood sediment and preflood soil. Site selection and location techniques, sampling techniques, laboratory analytical methods, and quality-assurance samples are discussed in the following sections.

Figure 2. Silt and clay sediment deposited in the Missouri River flood plain near Hermann, Missouri, during the 1993 flood. The photograph was taken on September 7, 1993.

Figure 3. Sand dunes deposited in the Missouri River flood plain near St. Charles, Missouri, during the 1993 flood. The photograph was taken on September 7, 1993.

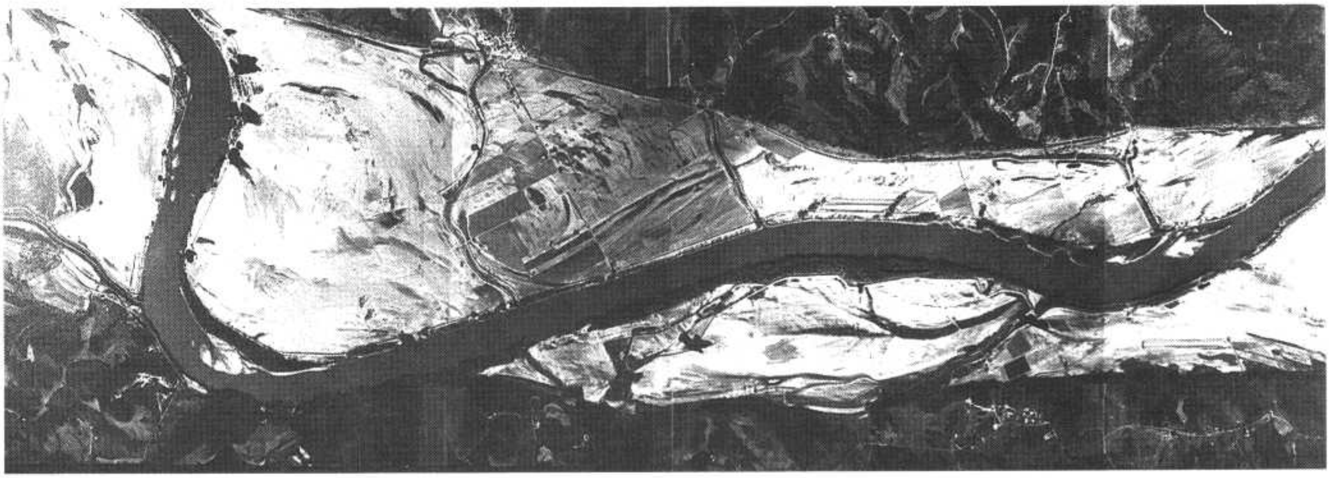

Figure 4. Aerial photograph showing the Missouri River flood plain near Hartsburg, Missouri, November 1993. The river length is about 20 kilometers.

Site Selection and Location

Twelve sites along the Missouri River flood plain and 13 sites along the Mississippi River flood plain, in areas where substantial quantities of silt and clay were deposited during the 1993 flood, were selected for sampling. Approximate locations for the sampling sites initially were selected from topographic maps. The sites were located about 45 river miles apart—those on the Missouri River extending upstream from the junction of the Missouri and the Mississippi Rivers, and the sites along the Mississippi River beginning at Dubuque, Iowa, and extending to the junction of the Mississippi and the Ohio Rivers (fig. 1; table 1).

Exact locations for sampling were chosen on the basis of onsite reconnaissance, which was limited to 5 river miles upstream or downstream from the initially selected approximate location. Factors considered in selection of the sampling location included the degree of disturbance, abundance of silt and clay, accessibility of the location, and the type of preflood land use. The preferred land use was agricultural production fields. Areas of possible contamination as a result of human or animal activities were avoided. After visual inspection of the surface of the silt and clay deposit, a hole was dug to permit inspection of the structure of the deposit and the total deposition depth (fig. 2). A deposition depth of at least 0.2 m was required before a sample was collected.

Table 1. Selected data for sampling sites in the Missouri and the Mississippi River flood plains

[MO, Missouri; MS, Mississippi]

Site no. (fig. 1)	U.S. Geological Survey station number	Latitude/longitude, in degrees, minutes, seconds[1]	Date sampled	Elevation, in feet	River mile[2]	Depth interval for postflood sediment samples, in millimeters[3]
		Missouri River flood-plain samples				
MO.1	384125090341401	384125.4 0903414.2	09–07–93	451	38	0–70
MO.2	384305091263301	384304.5 0912632.9	09–07–93	505	98	20–140
MO.3	383438092034301	383438.4 0920343.2	09–08–93	537	137	0–70
MO.4	385142092265701	385141.6 0922656.9	09–08–93	570	176	0–30
	385142092265702	385141.6 0922656.9	09–08–93	570	176	30–150
MO.5	391823092565401	391823.2 0925654.2	09–09–93	620	238	0–40
MO.6	391714093225301	391713.9 0932252.9	09–09–93	648	281	0–30
MO.7	391152094100401	391152.2 0941003.6	09–10–93	710	338	0–60
MO.8	391134094432401	391134.0 0944324.2	09–10–93	748	380	0–40
MO.9	393857095015401	393857.1 0950154.1	09–10–93	790	432	0–90
MO.10	395247095074001	395247.1 0950740.1	09–11–93	836	474	0–90
MO.11	401901095370101	401900.9 0953700.6	09–11–93	883	525	0–80
MO.12	404010095485601	404010.0 0954855.7	09–11–93	919	560	0–20

Table 1. Selected data for sampling sites in the Missouri and the Mississippi River flood plains—Continued

[MO, Missouri; MS, Mississippi]

Site no. (fig. 1)	U.S. Geological Survey station number	Latitude/longitude, in degrees, minutes, seconds[1]	Date sampled	Elevation, in feet	River mile[2]	Depth interval for postflood sediment samples, in millimeters[3]
Mississippi River flood-plain samples						
MS.1	422840090381801	422839.7 0903818.2	09–18–93	597	578	0–100
MS.2	420450090112601	420449.9 0901126.0	09–18–93	585	536	0–40
MS.3	413026090363201	413026.3 0903631.8	09–18–93	550	481	0–60
MS.4	411023091022301	411022.8 0910222.7	09–19–93	537	435	0–40
MS.5	403851091142501	403851.0 0911424.6	09–20–93	530	389	0–70
MS.6	400642091252201	400641.5 0912521.5	09–20–93	483	341	0–20
MS.7	393318091073101	393318.2 0910731.1	09–21–93	458	291	0–60
MS.8	390239090435901	390239.3 0904359.0	09–21–93	440	245	0–20
MS.9	385224090123801	385223.9 0901237.9	09–22–93	423	203	0–60
MS.10	381248090165601	381248.1 0901656.2	09–22–93	395	148	0–20
MS.11	374532089404501	374532.0 0894044.9	09–24–93	365	95	0–110
MS.12	371745089302201	371744.9 0893021.9	09–23–93	335	52	0–60
MS.13	370333089135201	370332.8 0891352.4	09–23–93	315	10	0–20

[1]The first number listed is latitude; the second number is longitude.
[2]For the Missouri River, 0 river mile is at the junction of the Missouri and the Mississippi Rivers; for the Mississippi River, 0 river mile is at the junction of the Mississippi and the Ohio Rivers.
[3]0 millimeter is the surface of the sediment deposition.

Once the exact sampling site was selected, a hand-held global positioning system (GPS), accurate to within 30 m, was used to determine the latitude and longitude of the site. Latitude, longitude, USGS station number, description, date sampled, elevation of the site, the location in river miles with respect to either the Missouri River (MO prefix site numbers) or the Mississippi River (MS prefix site numbers), and the sediment-deposition depth are given in table 1. Elevations were determined to ± 3 m from 7.5-minute USGS topographic maps. River miles were determined to ± 0.5 km from 7.5-minute USGS topographic maps.

Sampling Techniques

To collect a postflood sediment sample, a hole was dug to identify the interface between the postflood deposition and the preflood soil. The flood-deposited sediments were well consolidated, whereas the underlying, preflood soil typically had a "loose" structure and commonly contained roots and other organic debris. After digging the hole, the surface area was cleared of any organic debris. The vertical cut area was shaved with a clean plastic scraper to ensure no contamination. The plastic scraper, a plastic scoop, and latex gloves were used to collect a sample from the vertical cut. The sample was collected above the interface in a 1-m^2 area or less, depending on the quantity of sediment available. A scoop of the sediment was collected at various points in the sample area. The sediment was composited, placed in a sample container, and immediately chilled. After sample collection, the plastic scrapers and scoops were cleaned and rinsed with deionized water, methanol, and organic-free water. No samples were collected where water had not receded from the area. One postflood sediment sample was collected at all sites except site MO.4; at this site, two samples mostly composed of sand were collected—one from 0 to 30 mm and the other from 30 to 150 mm.

Samples collected for moisture and carbon content and for concentrations of volatile solids, nutrients, pesticides, and semivolatile organic compounds were analyzed only in the less than 2-mm size fraction. Because the postflood sediment samples were determined onsite to have a particle diameter of less than 2 mm, no samples were seived.

After the postflood sediment samples were collected, preflood soil samples were collected for particle-size distribution. All flood deposition was removed from the sample area with a clean plastic scraper to the postflood deposition and preflood soil interface. Preflood soil samples were collected by using the same collection procedures used for the postflood sediment samples.

Different sample containers were used for each analysis type. Samples for analysis of particle-size distribution were collected in a plastic bag and sealed. Samples for analysis of moisture content, volatile solids, nutrients, and carbon were collected in a widemouth polyethylene bottle with a plastic lid. Samples for analysis of pesticides and semivolatile organic compounds were collected in a 1-L wide-mouth glass bottle with a Teflon-lined lid that had been baked at 450° C. Samples for analysis of other selected elements were collected in a wide-mouth plastic bottle with a Teflon-lined lid.

Laboratory Analytical Methods

Samples for particle-size distribution were analyzed at the USGS laboratory in Rolla, Missouri. The following classification of particle-size diameter (Guy, 1969) was used to describe material in this report: gravel, 2 to less than 64 mm; sand, 0.062 to less than 2 mm; silt, 0.04 to less than 0.062 mm; and clay, less than 0.004 mm. Silt and clay material are considered to be fine grained; sand- and gravel-size (hereafter referred to as "sand and gravel") material are considered to be coarse. Samples that contained sand, silt, and clay material were analyzed by using a hydrometer, visual accumulation (VA) tube, and wet sieve (Guy, 1969). Samples that contained mostly silt and clay material were analyzed by using a hydrometer as described by the U.S. Army Corps of Engineers (1970).

Samples for analysis of water content and concentrations of volatile solids, nutrients, and carbon in the less than 2-mm size fraction were analyzed at the USGS laboratory in Arvada, Colorado, by using analytical methods having detection or reporting limits listed in table 2.

Table 2. Detection or reporting limits of analytical methods used for the determination of constituent concentrations in the less than 2-millimeter size fraction of postflood sediment samples

[Analysis done at the U.S. Geological Survey laboratory, Arvada, Colorado]

Constituent	Detection or reporting limit	Constituent	Detection or reporting limit
Moisture content by dry weight, in percent	0.1	Solids, volatile, in milligrams per kilogram	1.0
Nutrients, in milligrams per kilogram			
Nitrite plus nitrate as nitrogen	2.0	Ammonia plus organic nitrogen	20
Ammonia as nitrogen	.2	Phosphorus	40
Carbon, in grams per kilogram			
Total	0.1	Inorganic	0.1
Pesticides, in micrograms per kilogram[1]			
Alachlor	3.6	Dieldrin	3.2
Atrazine	6.8	Metolachlor	3.6
4,4'-DDE	4.0	Simazine	3.2
Desethylatrazine	1.2	Trifluralin	4.8

Table 2. Detection or reporting limits of analytical methods used for the determination of constituent concentrations in the less than 2-millimeter size fraction of postflood sediment samples—Continued

[Analysis done at the U.S. Geological Survey laboratory, Arvada, Colorado]

Constituent	Detection or reporting limit	Constituent	Detection or reporting limit
Semivolatile organic compounds, in micrograms per kilogram			
Acenaphthene	10	p-Cresol	10
Acenaphthylene	5.0	Dibenzo[*a,h*]anthracene	20
Acridine	10	Dibenzothiphene	5.0
Anthracene	5.0	Di-*n*-butylphthalate	10
Anthraquinone	20	1,2-Dichlorobenzene	10
Azo-benzene	20	1,3-Dichlorobenzene	10
Benzo[*a*]anthracene	10	1,4-Dichlorobenzene	10
Benzo[*b*]fluoranthene	10	2,4-Dichlorophenol	20
Benzo[*k*]fluoranthene	10	Diethyl phthalate	10
Benzo[*g,h,i*]perylene	20	1,2-Dimethylnaphthalene	10
Benzo[*a*]pyrene	10	1,6-Dimethylnaphthalene	10
Benzo[*c*]quinoline	10	2,6-Dimethylnaphthalene	10
2,2'-Biquinoline	20	3,5-Dimethylphenol	20
4-Bromophenyl phenyl ether	10	Dimethyl phthalate	10
Butylbenzylphthalate	10	4,6-Dinitro-2-methylphenol	200
C_8-Alkyl-phenol	10	2,4-Dinitrophenol	300
9H-Carbazole	10	2,4-Dinitrotoluene	20
bis(2-Chloroethoxy)methane	10	2,6-Dinitrotoluene	50
bis(2-Chloroethyl)ether	10	di-*n*-Octyl phthalate	20
bis(2-Chloroisopropyl)ether	20	bis(2-Ethylhexyl)phthalate	10
4-Chloro-3-methylphenol	30	2-Ethylnaphthalene	10
2-Chloronaphthalene	10	Fluoranthene	5.0
2-Chlorophenol	10	9H-Fluorene	10
4-Chlorophenyl phenyl ether	10	Hexachlorobenzene	10
Chrysene	10	Hexachlorobutadiene	20
Hexachlorocyclopentadiene	20	*n*-Nitrosodiphenylamine	10
Hexachloroethane	20	Pentachloroanisol	20
Indeno[*1,2,3-cd*]pyrene	20	Pentachloronitrobenzene	30
Isophorone	10	Pentachlorophenol	100
Isoquinoline	10	Phenanthrene	5.0
1-Methyl-9H-fluorene	10	Phenanthridine	10
2-Methylanthracene	10	Phenol	10
4,5-Methylenephenanthrene	20	Pyrene	5.0
1-Methylphenanthrene	10	Quinoline	10
1-Methylpyrene	10	2,3,5,6-Tetramethylphenol	30
Naphthalene	10	1,2,4-Trichlorobenzene	10
Nitrobenzene	10	2,4,6-Trichlorophenol	20
2-Nitrophenol	100	2,3,6-Trimethylnaphthalene	10
4-Nitrophenol	40	2,4,6-Trimethylphenol	30
n-Nitroso di-*n*-propylamine	10		

[1]Reporting limits are estimates (E.T. Furlong, U.S. Geological Survey, written commun., 1993).

Water content and volatile solids concentration were determined by using methods described in Fishman and Friedman (1989). Nutrient samples were analyzed by using methods described in Fishman (1993). Total and inorganic carbon samples were analyzed by using methods described in Wershaw and others (1987). Organic carbon concentrations were computed by subtracting the inorganic carbon from the total carbon concentrations.

The concentrations of selected elements and carbon in the less than 0.062-mm size fraction were determined at the USGS laboratory in Lakewood, Colorado, by using the methods described in Arbogast (1990). The constituents analyzed and descriptions of the different methods of analysis for each constituent are listed in table 3. The total carbon concentration was determined by using methods described in Wershaw and others (1987).

Table 3. Detection limits and methods used for the determination of element concentrations in the less than 62-millimeter size fraction of postflood sediment samples

[4N HCl, 4 normal hydrochloride acid; mg/kg, milligrams per kilogram; 0.1N HCl, 0.1 normal hydrochloric acid; ICP-AES, inductively coupled plasma-atomic emission spectrometry; IR, infrared spectrometry; n.a., not analyzed; HGAAS, hydride-generation atomic absorption spectrometry; FAAS, flame atomic absorption spectrometry; CVAAS, cold-vapor atomic absorption spectrometry; DN, delayed neutron activation–methods presented in Arbogast (1990). Analyzed at the U.S. Geological Survey laboratory, Lakewood, Colorado]

Element	Method	Detection limit		
		Total digestion[1]	4N HCl digestion[2] (mg/kg)	0.1N HCl digestion[3] (mg/kg)
Aluminum	ICP-AES	0.005 percent by weight	1.3	1.3
Calcium	—do—	.005 percent by weight	1.0	1.0
Iron	—do—	.02 percent by weight	.40	.40
Magnesium	—do—	.005 percent by weight	5.8	5.8
Phosphorus	—do—	.005 percent by weight	12.5	12.5
Potassium	—do—	.01 percent by weight	7.5	7.5
Sodium	—do—	.006 percent by weight	2.5	2.5
Sulfur	IR[4]	.05 percent by weight	n.a.	n.a.
Titanium	ICP-AES	.005 percent by weight	.25	.25
Antimony	HGAAS	0.2 mg/kg	n.a.	n.a.
	ICP-AES	n.a.	6.3	6.3
Arsenic	—do—	10 mg/kg	3.8	3.8
	HGAAS	.2 mg/kg	.05	.05
Barium	ICP-AES	1 mg/kg	.10	.10
Beryllium	—do—	1 mg/kg	.025	.025
Bismuth	—do—	10 mg/kg	7.5	7.5
Cadmium	—do—	2 mg/kg	.50	.50
	FAAS[5]	.1 mg/kg	n.a.	n.a.
Cerium	ICP-AES	5 mg/kg	5.0	5.0
Chromium	—do—	2 mg/kg	1.5	1.5
Cobalt	—do—	2 mg/kg	1.3	1.3
Copper	—do—	2 mg/kg	.25	.25
Europium	—do—	2 mg/kg	n.a.	n.a.
Gallium	—do—	4 mg/kg	n.a.	n.a.
Gold	—do—	8 mg/kg	n.a.	n.a.
Holmium	—do—	4 mg/kg	n.a.	n.a.
Lanthanum	—do—	2 mg/kg	.75	.75
Lead	—do—	4 mg/kg	6.3	6.3
Lithium	—do—	2 mg/kg	.38	.38
Manganese	—do—	4 mg/kg	.63	.63
Mercury	CVAAS[4]	.02 mg/kg	n.a.	.006
Molybdenum	ICP-AES	2 mg/kg	1.0	1.0

Table 3. Detection limits and methods used for the determination of element concentrations in the less than 62-millimeter size fraction of postflood sediment samples—Continued

[4N HCl, 4 normal hydrochloride acid; mg/kg, milligrams per kilogram; 0.1N HCl, 0.1 normal hydrochloric acid; ICP-AES, inductively coupled plasma-atomic emission spectrometry; IR, infrared spectrometry; n.a., not analyzed; HGAAS, hydride-generation atomic absorption spectrometry; FAAS, flame atomic absorption spectrometry; CVAAS, cold-vapor atomic absorption spectrometry; DN, delayed neutron activation-methods presented in Arbogast (1990). Analyzed at the U.S. Geological Survey laboratory, Lakewood, Colorado]

Element	Method	Detection limit: Total digestion[1]	Detection limit: 4N HCl digestion[2] (mg/kg)	Detection limit: 0.1N HCl digestion[3] (mg/kg)
Neodymium	—do—	9 mg/kg	n.a.	n.a.
Nickel	—do—	3 mg/kg	1.3	1.3
Niobium	—do—	4 mg/kg	n.a.	n.a.
Scandium	—do—	2 mg/kg	n.a.	n.a.
Selenium	HGAAS	.2 mg/kg	.05	.05
Silver	ICP-AES	2 mg/kg	0.50	0.50
	FAAS[5]	.1 mg/kg	n.a.	n.a.
Strontium	ICP-AES	2 mg/kg	.025	.025
Tantalum	—do—	40 mg/kg	n.a.	n.a.
Thorium	—do—	6 mg/kg	n.a.	n.a.
	DN	1 mg/kg	n.a.	n.a.
Tin	ICP-AES	5 mg/kg	10	10
Tungsten	—do—	n.a.	7.5	7.5
Uranium	—do—	100 mg/kg	n.a.	n.a.
	DN	.2 mg/kg	n.a.	n.a.
Vanadium	ICP-AES	2 mg/kg	.38	.38
Ytterbium	—do—	1 mg/kg	n.a.	n.a.
Yttrium	—do—	2 mg/kg	.25	.25
Zinc	—do—	2 mg/kg	.25	.25
Zirconium	—do—	n.a.	.63	.63
Carbon, total	Combustion[4]	.05 percent by weight	n.a.	n.a.
Carbon, organic	Difference[4]	.05 percent by weight	n.a.	n.a.
Carbon, carbonate as CO_2	Titration[4]	.01 percent by weight	n.a.	n.a.

[1]Concentrated hydrochloric, hydrofluoric, nitric, and perchloric acids.
[2]Conditionally available fraction in the sediments.
[3]Available fraction in the sediments.
[4]Method presented in Arbogast (1990).
[5]Method presented in O'Leary and Viets (1986).

Selected pesticide and semivolatile organic compound concentrations were determined for all sites in the less than 2-mm size fraction at the Enseco Analytical Laboratory, Arvada, Colorado. A list of constituents and the detection limits is given in table 4. Samples for pesticides were analyzed by using U.S. Environmental Protection Agency (USEPA) method SW8080, and samples for semivolatile organic compounds were analyzed by using USEPA method SW8270 (U.S. Environmental Protection Agency, 1986).

Concentrations of selected pesticides and semivolatile organic compounds were determined for 15 of 25 sites in the less than 2-mm size fraction at the USGS laboratory in Arvada. A list of constituents and the detection limits is given in table 2. The detection limits for 4,4'-DDE (hereafter referred to in this report as "DDE") and dieldrin were lower than the limits used by the Enseco Analytical Laboratory. A different procedure was used by the USGS to analyze for the pesticides and semivolatile organic compounds.

Table 4. Detection limits used for the determination of pesticide and semivolatile organic compound concentrations in the less than 2-millimeter size fraction of postflood sediment samples

[All detection limits in milligrams per kilogram. Analyzed at the Enseco Analytical Laboratory, Arvada, Colorado]

Compound	Detection limit	Compound	Detection limit
		Pesticides[1]	
Aldrin	0.010	Endosulfan II	0.020
alpha-BHC	.010	Endosulfan sulfate	.020
beta-BHC	.010	Heptachlor	.010
delta-BHC	.010	Heptachlor epoxide	.010
gamma-BHC (Lindane)	.010	Methoxychlor	
Chlordane	.10	PCB, Aroclor 1016	.10
4,4'-DDD	.020	PCB, Aroclor 1221	.10
4,4'-DDE	.020	PCB, Aroclor 1232	.10
4,4'-DDT	.020	PCB, Aroclor 1242	.10
Dieldrin	.020	PCB, Aroclor 1248	.10
Endrin	.020	PCB, Aroclor 1254	.10
Endrin aldehyde	.020	PCB, Aroclor 1260	.10
Endosulfan I	.010	Toxaphene	.20
		Semivolatile organic compounds[2]	
Acenaphthene	0.50	Chrysene	0.50
Acenaphthylene	.50	Dibenzofuran	.50
Acetophenone	2.5	Dibenzo[*a,h*]anthracene	.50
4-Aminobiphenyl	2.5	Di-*n*-butylphthalate	.50
Aniline	2.5	1,2-Dichlorobenzene	.50
Anthracene	.50	1,3-Dichlorobenzene	.50
Benzidine	5.6	1,4-Dichlorobenzene	.50
Benzo[*a*]anthracene	.50	2,4-Dichlorophenol	.50
Benzo[*b*]fluoranthene	.50	2,6-Dichlorophenol	2.5
Benzo[*k*]fluoranthene	.50	Diethyl phthalate	.50
Benzoic acid	2.5	*p*-Dimethylaminoazobenzene	2.5
Benzo[*g,h,i*]perylene	.50	7,12-Dimethylbenzo[*a*]anthracene	2.5
Benzo[*a*]pyrene	.50	2,4-Dimethylphenol	.50
Benzyl alcohol	1.0	Dimethyl phthalate	.50
4-Bromophenyl phenyl ether	.50	4,6-Dinitro-2-methylphenol	1.5
Butylbenzylphthalate	.50	2,4-Dinitrophenol	1.5
4-Chloroaniline	1.0	2,4-Dinitrotoluene	.50
bis(2-Chloroethoxy)methane	.50	2,6-Dinitrotoluene	.50
bis(2-Chloroethyl)ether	.50	Di-*n*-octyl phthalate	.50
bis(2-Chloroisopropyl)ether	.50	Diphenylamine	2.5
4-Chloro-3-methylphenol	.50	bis(2-Ethylhexyl)phthalate	.50
2-Chloronaphthalene	.50	Ethyl methanesulfonate	2.5
2-Chlorophenol	.50	Fluoranthene	.50
4-Chlorophenyl phenyl ether	.50	Fluorene	.50
1-Chloronaphthalene	2.5	Hexachlorobenzene	.50

Table 4. Detection limits used for the determination of pesticide and semivolatile organic compound concentrations in the less than 2-millimeter size fraction of postflood sediment samples—Continued

[All detection limits in milligrams per kilogram. Analyzed at the Enseco Analytical Laboratory, Arvada, Colorado]

Compound	Detection limit	Compound	Detection limit
	Semivolatile organic compounds[2]—Continued		
Hexachlorobutadiene	0.50	4-Nitrophenol	2.5
Hexachlorocyclopentadiene	.50	*n*-Nitrosodimethylamine	2.5
Hexachloroethane	.50	*n*-Nitrosodi-*n*-butylamine	2.5
Indeno[*1,2,3-cd*]pyrene	.50	*n*-Nitrosodi-*n*-propylamine	.50
Isophorone	.50	*n*-Nitrosodiphenylamine	.50
3-Methylcholanthrene	2.5	*n*-Nitrosodiperidine	2.5
Methyl methanesulfonate	2.5	Pentachlorobenzene	2.5
2-Methylnaphthalene	.50	Pentachloronitrobenzene	2.5
2-Methylphenol	.50	Pentachlorophenol	1.5
4-Methylphenol	.50	Phenacetin	2.5
Naphthalene	.50	Phenanthrene	.50
1-Naphthylamine	2.5	Phenol	.50
2-Naphthylamine	2.5	Pyrene	2.5
2-Nitroaniline	2.5	1,2,4,5-Tetrachlorobenzene	2.5
3-Nitroaniline	2.5	2,3,4,6-Tetrachlorophenol	2.5
4-Nitroaniline	2.5	1,2,4-Trichlorobenzene	.50
Nitrobenzene	.50	2,4,5-Trichlorophenol	1.5
2-Nitrophenol	.50	2,4,6-Trichlorophenol	.50

[1]Method SW8080 (U.S. Environmental Protection Agency, 1986).
[2]Method SW8270 (U.S. Environmental Protection Agency, 1986).

Quality-Assurance Samples

Quality-assurance samples were collected and analyzed to determine the variability in sampling and analytical techniques. Replicate samples were collected at sites MO.7, MS.1, MS.7, and MS.13 to determine the variability of sampling techniques. Duplicate samples were split from samples collected for analysis of concentrations of semivolatile organic compounds and selected elements to determine the variability in analytical techniques.

Sample set reagent spikes were used to determine the accuracy of the analyses for pesticides and semivolatile organic compounds. During the gel permeation chromatography (GPC) process, pentachlorophenol (chlorophenols) may have been sorbed and desorbed, which caused low and variable recoveries, and degradation of hexachlorocyclopentadiene and hexachlorobutadiene likely occurred in the injection port of the gas chromatography/mass spectrometry (GC/MS) (E.T. Furlong, U.S. Geological Survey, written commun., 1993) and affected the concentrations detected in the reagent spikes.

The effect of the sample matrix and gross processing errors in samples collected for pesticides and semivolatile organic compounds can be monitored by the results of the surrogate compound recoveries. Selected surrogate compounds with chemical properties similar to some of the analytes of interest are added to each sample at the beginning of extraction.

Standard reference materials (SRM) for elements, pesticides, and semivolatile organic compounds were analyzed to determine laboratory analytical accuracies. Analytical split analyses for the elemental SRM also were performed to determine precision of the analyses.

Analysis of sample set blanks was performed for samples collected for pesticides and semivolatile organic compounds. Analysis of a blank determines if any interferences occurred during the analytical process of the sample set. No interferences were detected in any of the blanks for either sample set.

PHYSICAL AND CHEMICAL DATA ON SEDIMENTS

The following sections present and summarize the results of analyses of particle-size distribution, water content, and the concentrations of nutrients, volatile solids, carbon, other selected elements, pesticides, and semivolatile organic compounds in postflood sediment samples and the particle-size distribution of preflood soil samples.

The mean and the standard deviation were computed for water content, volatile solids, nutrients, carbon, selected elements, and pesticides. The mean and the standard deviations were computed only for constituents detected in more than 50 percent of the samples. In those samples where the constituent concentration was less than the detection limit, one-half the detection limit was used to compute the mean and the standard deviation.

Particle-Size Distribution

The particle-size distribution data for the postflood sediment and preflood soil samples are presented in table 5. Because of the way the sample sites were selected, the postflood sediment samples primarily are silt and clay except for the deeper sample from MO.4, which contained 91.7 percent by weight sand. Postflood sediment samples that were greater than 50 percent by weight clay were from sites MO.3, MO.6, MO.8, MO.9, and MS.9 (fig. 1) and ranged from 52.3 to 78.2 percent by weight clay. All other postflood sediment samples ranged from 51.5 to 87.7 percent by weight silt. The sample from MO.1 had the lowest clay content of 8.0 percent by weight. Sand in postflood sediment samples ranged from 0 percent by weight at MO.6 to 28.4 percent by weight at MS.13.

Samples of preflood soil were collected from areas of various land uses, which included agricultural production fields, vacant urban areas, vacant land, and levees. The preflood soil sample collected from the base of a levee at MS.5 had the highest gravel content—7.5 percent by weight. Sand in preflood soil samples ranged from less than 1 to 82.5 percent by weight, silt content ranged from 9.0 to 85.2 percent by weight, and clay content ranged from 1.0 to 71.5 percent by weight.

Moisture Content and Volatile Solids, Nutrient, and Carbon Concentrations

The data for moisture content and for concentrations of volatile solids, nutrients, and carbon for all samples in the less than 2-mm size fraction are presented in table 6. Moisture content in the postflood sediment ranged from 7 to 51 percent by weight. Volatile solids concentrations ranged from 6,750 to 91,500 mg/kg. The deeper sample from MO.4 had the smallest nutrient concentrations detected in all samples. The nitrite plus nitrate as nitrogen concentration of 140 mg/kg in the MS.12 sample was about three times larger than the concentrations from other sites. For all samples except MO.4 layer 2, total carbon was present predominantly as organic carbon. The total carbon concentration from this sample (2.5 g/kg) was an order of magnitude less than the concentration in other samples.

Selected Element Concentrations

Generally, as grain size decreases in bottom-sediment material, element concentrations increase (Horowitz, 1991, p. 16). On the basis of this general correlation, postflood sediment samples were analyzed for concentrations of 12 selected elements in the silt and clay fraction. These data are listed in table 7, descriptive statistics are listed in table 8 (both follow "References Cited" section), and the results for SRM for elements are in listed table 9.

Pesticide Concentrations

Samples were analyzed for pesticides by two laboratories. The method and detection limit for the pesticides for samples analyzed at the Enseco Analytical Laboratory are listed in table 4 and at the USGS laboratory in Arvada are listed in table 2. No pesticides were detected by the Enseco Analytical Laboratory. Results of pesticide analyses by the USGS laboratory are listed in table 10. Some of the concentrations reported in table 10 are less than the detection or reporting limit listed in table 2 because pesticide concentrations were determined by a custom-USGS method that generally has lower detection limits. Only DDE and dieldrin were analyzed by both laboratories.

Alachlor was detected in 14 samples; the highest concentration of 54 μg/kg was in the MS.5 sample.

Table 5. Particle-size distribution of postflood sediment and preflood soil samples in the Missouri and the Mississippi River flood plains

[MO, Missouri; MS, Mississippi; —, no data. Analyzed at the U.S. Geological Survey sediment laboratory, Rolla, Missouri]

Site no. (fig. 1)	Sample type	Percentage of sample smaller than particle diameter Particle diameter, in millimeters: Gravel 8.0	Gravel 4.0	Sand 2.0	Sand 1.0	Sand 0.50	Sand 0.25	Sand 0.125	Silt 0.062	Silt 0.031	Silt 0.016	Silt 0.008	Clay 0.004	Clay 0.002
						Missouri River								
MO.1	Postflood......	100	100	100	100	99.4	99.3	98.2	89.4	60.4	30.7	12.3	8.0	5.0
	Preflood.......	100	100	100	100	100	100	87.9	45.0	42.9	27.0	20.0	15.2	—
MO.2	Postflood......	100	100	100	100	100	100	99.4	95.2	88.4	70.4	51.1	39.6	27.3
	Preflood.......	100	100	100	100	100	99.6	99.2	97.0	90.1	81.6	64.2	49.2	37.4
MO.3	Postflood......	100	100	100	100	100	100	99.8	99.4	97.3	79.9	63.3	52.3	38.8
	Preflood.......	100	100	100	100	100	98.8	93.3	89.9	87.9	82.1	72.2	60.4	50.6
MO.4	Postflood[1]....	100	100	100	100	100	99.7	99.0	92.4	75.6	31.1	16.6	11.8	11.5
	Postflood[2]....	100	99.5	99.2	98.4	93.8	85.6	24.9	7.5	.1	—	—	—	—
	Preflood.......	96.6	96.1	95.5	93.9	89.5	85.6	76.0	54.1	27.3	16.6	10.3	8.1	—
MO.5	Postflood......	100	100	100	100	99.7	99.2	98.9	98.8	75.0	67.7	51.5	38.1	30.8
	Preflood.......	100	100	100	100	100	96.9	69.7	36.9	29.1	15.9	10.8	7.9	—
MO.6	Postflood......	100	100	100	100	100	100	100	100	99.2	98.1	92.2	78.2	57.2
	Preflood.......	100	100	100	100	100	99.9	99.8	99.7	97.2	95.6	93.3	71.5	53.3
MO.7	Postflood......	100	100	100	100	99.9	99.5	99.0	98.8	94.9	72.6	52.4	39.7	29.1
	Replicate......	100	100	100	100	100	99.9	99.6	98.2	64.0	38.9	26.6	20.2	13.5
	Split............	100	100	100	100	100	100	99.8	97.2	85.2	43.4	30.7	23.9	21.1
	Preflood.......	100	100	100	99.6	99.6	98.4	96.5	84.0	38.8	32.6	25.2	16.2	7.7
MO.8	Postflood......	100	100	100	100	100	100	100	99.9	98.3	91.7	78.3	60.8	44.8
	Preflood.......	100	100	100	100	100	98.9	97.9	91.8	54.0	43.9	26.2	22.8	22.8
MO.9	Postflood......	100	100	100	100	100	100	99.9	99.9	96.7	93.3	83.6	66.3	48.4
	Preflood.......	100	100	100	100	100	100	100	39.2	23.4	21.4	18.2	15.2	13.8

Table 5. Particle-size distribution of postflood sediment and preflood soil samples in the Missouri and the Mississippi River flood plains—Continued

[MO, Missouri; MS, Mississippi; —, no data. Analyzed at the U.S. Geological Survey sediment laboratory, Rolla, Missouri]

Site no. (fig. 1)	Sample type	Percentage of sample smaller than particle diameter. Particle diameter, in millimeters: Gravel 8.0	Gravel 4.0	Sand 2.0	Sand 1.0	Sand 0.50	Sand 0.25	Sand 0.125	Silt 0.062	Silt 0.031	Silt 0.016	Silt 0.008	Clay 0.004	Clay 0.002
Missouri River—Continued														
MO.10	Postflood......	100	100	100	100	100	100	99.8	98.5	86.6	81.3	64.1	45.2	33.1
	Preflood	100	100	100	100	99.1	97.4	93.6	81.3	17.3	14.0	10.4	3.6	2.7
MO.11	Postflood......	100	100	100	99.9	99.9	99.9	99.8	99.5	87.7	48.8	34.1	24.4	19.1
	Preflood	100	100	100	100	100	96.6	87.9	71.1	62.0	50.8	45.4	30.4	25.7
MO.12	Postflood......	100	100	100	100	100	100	99.9	99.5	85.4	62.0	42.5	31.3	22.6
	Preflood	100	100	100	100	99.6	98.4	95.5	91.1	67.7	50.5	39.7	32.1	25.8
Mississippi River														
MS.1	Postflood......	100	100	100	100	100	99.8	99.7	99.7	67.6	40.0	21.0	12.0	6.8
	Replicate......	100	100	100	100	100	100	99.6	99.3	76.3	51.5	32.0	24.4	11.5
	Preflood	100	100	99.1	99.1	98.5	98.2	97.7	97.2	72.8	50.3	29.0	18.2	7.7
MS.2	Postflood......	100	100	100	100	99.9	99.9	99.8	99.8	95.2	83.0	63.0	35.4	9.9
	Preflood	100	100	99.2	98.6	95.7	93.7	91.8	89.3	46.5	25.7	15.8	15.1	7.8
MS.3	Postflood......	100	100	100	100	99.9	99.6	99.0	94.6	71.4	36.2	22.2	18.9	12.8
	Preflood	100	100	100	99.6	97.8	96.8	95.7	94.6	71.8	41.2	24.7	14.3	10.1
MS.4	Postflood......	100	100	100	99.6	98.4	97.4	97.0	96.9	92.5	85.1	53.8	33.9	27.0
	Preflood	100	100	98.6	92.1	70.9	56.3	53.3	51.2	48.6	44.0	34.3	23.1	15.6
MS.5	Postflood......	100	100	100	99.4	97.8	96.9	96.6	96.4	96.0	68.1	63.3	44.9	21.9
	Preflood	100	96.9	92.5	85.0	34.6	26.2	19.2	10.0	2.8	1.6	1.2	1.0	.9
MS.6	Postflood......	100	100	100	100	100	99.9	99.6	99.2	98.8	84.7	60.8	33.0	20.3
	Preflood	100	100	100	99.5	98.7	98.5	98.3	98.1	87.1	79.7	57.3	33.1	28.0

Table 5. Particle-size distribution of postflood sediment and preflood soil samples in the Missouri and the Mississippi River flood plains—Continued

[MO, Missouri; MS, Mississippi; —, no data. Analyzed at the U.S. Geological Survey sediment laboratory, Rolla, Missouri]

		Percentage of sample smaller than particle diameter Particle diameter, in millimeters												
		Gravel		Sand					Silt				Clay	
Site no. (fig. 1)	Sample type	8.0	4.0	2.0	1.0	0.50	0.25	0.125	0.062	0.031	0.016	0.008	0.004	0.002
						Mississippi River—Continued								
MS.7	Postflood......	100	100	100	100	100	99.9	99.5	97.5	87.0	52.8	35.5	23.6	17.8
	Replicate......	100	100	100	100	99.9	99.9	98.9	98.9	96.9	78.3	56.6	37.2	27.5
	Preflood........	100	100	99.0	96.0	83.6	72.4	69.3	68.5	66.7	58.3	45.7	31.1	23.1
MS.8	Postflood......	100	100	100	99.5	99.4	99.2	98.8	98.3	91.4	70.3	50.1	31.4	18.1
	Preflood........	100	100	100	99.7	98.9	98.7	98.1	97.0	76.5	55.7	33.8	18.1	11.1
MS.9	Postflood......	100	100	100	100	100	100	100	99.8	98.6	97.9	83.5	62.7	44.9
	Preflood........	100	10	100	100	100	100	99.0	92.5	83.4	73.1	61.7	51.8	34.7
MS.10	Postflood......	100	100	100	100	99.8	99.8	99.7	99.5	58.4	32.2	21.4	18.2	15.7
	Preflood........	100	98.7	98.5	98.5	98.5	97.9	95.8	83.4	71.5	53.3	35.5	26.2	16.6
MS.11	Postflood......	100	100	100	100	100	100	100	98.7	75.2	57.9	42.0	32.6	25.4
	Preflood........	100	100	100	100	100	100	100	99.9	94.6	84.0	70.7	58.6	45.6
MS.12	Postflood......	100	100	100	100	100	100	99.9	99.9	89.7	77.6	60.1	45.1	35.9
	Preflood........	100	100	100	99.9	99.9	98.9	87.8	51.6	31.3	25.7	22.9	12.1	10.1
MS.13	Postflood......	100	100	100	100	100	100	100	71.6	46.6	27.2	15.4	9.1	9.1
	Replicate......	100	100	100	100	100	100	100	78.2	66.8	43.2	32.7	20.5	16.0
	Preflood........	100	100	100	100	100	100	99.6	98.9	42.4	30.9	18.0	13.7	10.4

[1]Layer 1, 0 to 30 millimeters.
[2]Layer 2, 30 to 150 millimeters.

Table 6. Moisture content and volatile solids, nutrient, and carbon concentrations in the less than 2-millimeter size fraction of postflood sediment samples in the Missouri and the Mississippi River flood plains

[USGS, U.S. Geological Survey; mg/kg, milligrams per kilogram; N, nitrogen; g/kg, grams per kilogram; MO, Missouri; rep, replicate sample; MS, Mississippi; —, no data. All analyses by the USGS laboratory, Arvada, Colorado, except as indicated]

			Moisture content, in percent by weight							Carbon		
Site no. (fig. 1)	Date	Time	USGS laboratory	Enseco Analytical Laboratory	Solids, volatile (mg/kg)	Nitrite + nitrate as N (mg/kg)	Ammonia as N (mg/kg)	Ammonia + organic nitrogen as N (mg/kg)	Phosphorus, total (mg/kg)	Total (g/kg)	Organic (g/kg)	Inorganic (g/kg)
Missouri River												
MO.1	09–07–93	1040	26	29	28,700	9	3.9	800	440	11	8.4	2.6
MO.2	09–07–93	1636	27	36	9,110	8	7.2	710	390	11	9.0	2.0
MO.3	09–08–93	1125	30	36	74,600	20	5.2	2,300	760	23	22	.8
[1]MO.4	09–08–93	1605	37	28	68,400	18	6.3	1,900	760	21	20	1.0
[2]MO.4	09–08–93	1610	7	8.3	6,750	7	3.2	70	210	25	.8	1.7
MO.5	09–09–93	1315	35	23	46,000	41	7.5	1,100	620	51	50	1.5
MO.6	09–09–93	1820	37	26	73,800	33	6.8	2,100	750	21	20	1.3
MO.7	09–10–93	1000	26	24	34,500	16	7.6	1,200	560	13	12	1.1
MO.7 rep	09–10–93	1001	35	28	67,500	16	7.2	2,000	740	21	20	.9
MO.8	09–10–93	1415	38	32	65,000	23	4.2	2,100	740	18	16	1.9
MO.9	09–10–93	1745	35	30	63,200	13	7.3	1,900	810	19	18	.6
MO.10	09–11–93	1000	25	23	45,500	26	3.3	1,200	560	13	12	1.2
MO.11	09–11–93	1415	26	33	32,700	30	13	940	560	12	10	1.5
MO.12	09–11–93	1730	30	36	30,600	31	14	800	550	14	11	2.6
Mean			28	—	42,000	20	6.9	1,200	580	17	16	1.5
Standard deviation			8.2	—	22,000	10	3.5	670	180	12	12	.65
Mississippi River												
MS.1	09–18–93	1110	35	34	48,200	21	5.8	2,200	680	24	22	2.3
MS.1 rep	09–18–93	1111	35	35	52,300	21	5.3	2,000	660	22	20	2.3
MS.2	09–18–93	1720	51	50	85,300	15	13	3,200	990	32	31	.8

Table 6. Moisture content and volatile solids, nutrient, and carbon concentrations in the less than 2-millimeter size fraction of postflood sediment samples in the Missouri and the Mississippi River flood plains—Continued

[USGS, U.S. Geological Survey; mg/kg, milligrams per kilogram; N, nitrogen; g/kg, grams per kilogram; MO, Missouri; rep, replicate sample; MS, Mississippi; —, no data. All analyses by the USGS laboratory, Arvada, Colorado, except as indicated]

Site no. (fig. 1)	Date	Time	Moisture content, in percent by weight: USGS laboratory	Moisture content, in percent by weight: Enseco Analytical Laboratory	Solids, volatile (mg/kg)	Nitrite + nitrate as N (mg/kg)	Ammonia as N (mg/kg)	Ammonia + organic nitrogen as N (mg/kg)	Phosphorus, total (mg/kg)	Carbon: Total (g/kg)	Carbon: Organic (g/kg)	Carbon: Inorganic (g/kg)
Mississippi River—Continued												
MS.3	09–19–93	1440	34	33	35,400	10	7.1	1,400	640	22	17	4.6
MS.4	09–19–93	1845	50	48	91,500	19	8.0	3,300	920	38	34	3.6
MS.5	09–20–93	0920	27	35	50,900	29	5.6	1,600	690	18	16	1.9
MS.6	09–20–93	1730	48	51	64,900	15	60	2,600	790	25	25	.4
MS.7	09–21–93	0940	48	42	77,600	14	8.9	2,500	680	28	25	3.0
MS.7 rep	09–21–93	0941	48	51	71,500	11	24	2,400	680	29	26	2.6
MS.8	09–21–93	1545	26	28	43,000	47	9.7	1,400	310	15	14	1.3
MS.9	09–22–93	0830	32	33	50,900	44	6.2	1,300	610	14	12	2.4
MS.10	09–22–93	1420	26	25	51,300	42	7.4	1,400	270	15	15	.2
MS.11	09–24–93	0920	36	34	75,400	70	15	2,100	740	23	22	.9
MS.12	09–23–93	1120	31	33	71,700	140	24	1,900	850	21	20	.7
MS.13	09–23–93	1525	28	28	27,500	39	7.8	1,700	460	10	8.3	1.7
MS.13 rep	09–23–93	1526	27	28	23,900	12	6.1	1,700	390	10	8.0	2.0
Mean			36	—	60,000	39	14	2,000	660	22	20	1.8
Standard deviation			9.6	—	20,000	35	15	680	220	78	7.4	1.3
Missouri and Mississippi Rivers												
Mean			32	—	51,000	30	10	1,700	620	20	18	1.7
Standard deviation			9.6	—	22,000	28	11	770	200	10	10	1.0

[1]Layer 1, 0 to 30 millimeters.
[2]Layer 2, 30 to 150 millimeters.

Table 9. Measured and expected concentrations of elements in standard reference material

[GXR–2, U.S. Geological Survey (USGS) geochemical exploration sample; GSD–6, geochemical reference sample from China; STD, standard deviation; wt. %, percent by weight; mg/kg, milligrams per kilogram; —, no data; ( ), concentration does not meet criteria for recommended concentrations; L, detected at less than the lower reporting limit but not quantified; AAS, atomic absorption spectrometry. All elements analyzed by inductively coupled plasma–atomic emission spectrometry unless otherwise noted. Analyzed at the USGS laboratory, Lakewood, Colorado]

		GXR–2 concentrations				GSD–6 concentrations			
		Split sample				Split sample			
Element	Unit	Measured	Measured	Expected[1]	STD[1]	Measured	Measured	Expected[2]	STD[2]
Aluminum	wt. %	6.3	6.5	18.57	0.06	7.6	7.6	7.49	—
Calcium	wt. %	.91	.92	.88	.04	2.8	2.8	2.77	—
Iron	wt. %	1.9	1.9	1.84	.05	4.1	4.1	(4.12)	—
Magnesium	wt. %	.79	.80	.88	.02	1.8	1.8	1.81	—
Phosphorus	wt. %	.07	.07	.068	—	.11	.11	.10	0.07
Potassium	wt. %	1.4	1.4	1.36	.04	2.0	2.0	2.03	—
Sodium	wt. %	.59	.58	.54	.08	1.7	1.7	1.71	—
Sulfur, total	wt. %	.05L	.05L	.0315	—	.09	.10	(.08)	—
Titanium	wt. %	.25	.25	.29	.01	.40	.39	.46	.02
Antimony	mg/kg	40	38	47	4	1.6	1.8	1.25	.33
Arsenic	mg/kg	24	23	21	4	15	16	13.6	1.5
Arsenic, AAS	mg/kg	24	23	21	4	15	15	13.6	1.5
Barium	mg/kg	2,200	2,200	2,210	160	310	310	330	40
Beryllium	mg/kg	1.0	1.0	1.6	—	1.0	1.0	1.7	.4
Bismuth	mg/kg	10.0L	10.0L	.44	.1	10.0L	10.0L	5	.6
Cadmium	mg/kg	4.0	4.0	4.1	.04	2.0L	2.0L	.43	.04
Cadmium, AAS	mg/kg	4.5	4.2	4.1	.04	.35	.39	.43	.04
Cerium	mg/kg	50	50	50	—	70	67	68	8
Chromium	mg/kg	35	34	34	4	200	200	190	24
Cobalt	mg/kg	10	9.0	9.0	1.3	29	28	24.4	3
Copper	mg/kg	82	84	70	6	410	410	383	18
Europium	mg/kg	2.0L	2.0L	.77	—	2.0L	2.0L	1.5	.13
Gallium	mg/kg	19	18	37	—	18	16	16.7	.8
Gold	mg/kg	8.0L	8.0L	.046	1.019	8.0L	8.0L	—	—
Holmium	mg/kg	4.0L	4.0L	—	—	4.0L	4.0L	(.78)	.17
Lanthanum	mg/kg	27	29	25	3	38	37	39	8
Lead	mg/kg	590	590	670	50	24	25	27	5
Lithium	mg/kg	64	63	48	—	44	44	40	2
Manganese	mg/kg	1,000	1,000	980	40	970	970	970	60
Mercury	mg/kg	2.9	2.9	2.7	.6	.02	.02	.045	.008
Molybdenum	mg/kg	2.0L	2.0L	1.5	.2	5.0	6.0	7.7	1.2
Neodymium	mg/kg	21	22	—	—	32	30	33	6
Nickel	mg/kg	19	19	20	4	84	83	78	7
Niobium	mg/kg	10	11	9.0	—	12	11	12	4.6
Scandium	mg/kg	6.0	6.0	7.2	—	16	16	17	1.6
Selenium	mg/kg	.7	.7	.57	.17	.3	.3	(.3)	.13
Silver	mg/kg	17	16	18	3	2.0L	2.0L	.36	.04
Silver, AAS	mg/kg	19	19	18	3	.38	.36	.36	.04
Strontium	mg/kg	160	160	152	16	280	280	266	28
Tantalum	mg/kg	40.0L	40.0L	.78	—	40.0L	40.0L	.72	.07
Thorium	mg/kg	9.0	9.0	8.6	.2	9.0	8.0	9.0	2
Tin	mg/kg	5.0L	5.0L	1.2	.4	5.0L	5.0L	2.8	1
Uranium	mg/kg	100.0L	100.0L	1.98	1.25	100.0L	100.0L	2.4	.5
Vanadium	mg/kg	51	50	61	9	140	140	142	12
Ytterbium	mg/kg	1.0	1.0	2	—	2.0	2.0	2.1	.4
Yttrium	mg/kg	15	15	19	—	20	20	20.2	2.4
Zinc	mg/kg	550	550	460	30	140	140	144	10
Carbon, total	wt. %	2.9	2.8	2.5	.24	.93	.84	(1.17)	—
Carbon, organic	wt. %	2.9	2.8	—	—	.40	.33	(.62)	—
Carbon, carbonate	wt. %	.01L	.01	—	—	.53	.51	(.55)	—
Carbon dioxide	wt. %	.02	.04	—	—	1.9	1.9	—	—

[1]Gladney and others (1984).

[2]Xie and Yan (1985).

Table 10. Estimated pesticide concentrations in the less than 2-millimeter size fraction of postflood sediment samples in the Missouri and the Mississippi River flood plains

[Concentrations in micrograms per kilogram. DDE, dichlorodiphenyldichloroethylene; MO, Missouri; <, less than; —, no data; dup, laboratory duplicate sample; rep, field replicate sample; blank, blank sample; n.a., not applicable; MS, Mississippi. Analyzed at the U.S. Geological Survey laboratory, Arvada, Colorado]

Site no. (fig. 1)	Alachlor	Atrazine	4,4'-DDE	Desethyl-atrazine	Dieldrin	Metolachlor	Simazine	Trifluralin
Missouri River								
MO.1	2.0	4.2	<4.0	<1.2	6.2	3.2	—	5.1
MO.2	6.9	6.0	.65	<1.2	7.1	5.1	—	5.5
[1]MO.4	.80	7.8	.77	<1.2	4.4	3.3	—	4.8
[2]MO.4	<3.6	<6.8	<4.0	<1.2	<3.2	<3.6	—	<4.8
[2]MO.4 dup	<3.6	<6.8	<4.0	<1.2	<3.2	<3.6	—	<4.8
MO.5	3.6	6.0	1.6	<1.2	3.9	4.2	—	5.1
MO.7	4.6	6.0	2.5	<1.2	5.6	4.4	—	6.0
MO.7 rep	3.8	4.6	3.6	<1.2	5.2	3.5	—	7.6
MO.8	18	10	.64	2.9	3.6	9.9	—	4.8
MO.10	2.6	7.6	.36	<1.2	2.5	6.8	—	<4.8
MO.11	12	9.5	.87	<1.2	<3.2	5.6	—	5.4
MO blank	<3.6	<6.8	<4.0	<1.2	<3.2	<3.6	—	<4.8
Mean	6.3	7.1	1.2	n.a.	4.8	5.3	n.a.	4.9
Standard deviation	5.9	2.0	.76	n.a.	1.6	2.2	n.a.	1.1
Mississippi River								
MS.1	9.5	<6.8	0.93	<1.2	<3.2	3.4	6.4	<4.8
MS.1 rep	11	<6.8	<4.0	<1.2	<3.2	4.1	6.4	<4.8
MS.3	40	<6.8	1.1	<1.2	<3.2	6.1	<3.2	<4.8
MS.5	54	9.1	.96	<1.2	<3.2	7.5	<3.2	4.9
MS.7	27	6.7	.94	<1.2	<3.2	4.3	<3.2	<4.8
MS.7 rep	22	6.8	1.2	<1.2	<3.2	4.2	<3.2	<4.8

Table 10. Estimated pesticide concentrations in the less than 2-millimeter size fraction of postflood sediment samples in the Missouri and the Mississippi River flood plains—Continued

[Concentrations in micrograms per kilogram. DDE, dichlorodiphenyldichloroethylene; MO, Missouri; <, less than; —, no data; dup, laboratory duplicate sample; rep, field replicate sample; blank, blank sample; n.a., not applicable; MS, Mississippi. Analyzed at the U.S. Geological Survey laboratory, Arvada, Colorado]

Site no. (fig. 1)	Alachlor	Atrazine	4,4'-DDE	Desethyl-atrazine	Dieldrin	Metolachlor	Simazine	Trifluralin
Mississippi River—Continued								
MS.9	4.2	9.1	0.32	<1.2	<3.2	4.1	<3.2	5.9
MS.11	3.2	5.1	<4.0	<1.2	<3.2	2.9	<3.2	<4.8
MS.11 dup	2.9	4.6	.69	<1.2	<3.2	2.8	<3.2	4.9
MS.13	<3.6	4.2	.48	<1.2	<3.2	1.9	<3.2	18
MS.13 rep	<3.6	4.2	.47	<1.2	<3.2	1.9	<3.2	13
MS blank	<3.6	<6.8	<4.0	<1.2	<3.2	<3.6	<3.2	<4.8
Mean	20	5.8	.96	n.a.	n.a.	4.3	n.a.	n.a.
Standard deviation	21	2.5	.54	n.a.	n.a.	1.9	n.a.	n.a.
Missouri and Mississippi Rivers								
Mean	13	6.5	1.1	n.a.	n.a.	4.8	n.a.	n.a.
Standard deviation	16	2.2	.66	n.a.	n.a.	2.1	n.a.	n.a.
Standard reference material								
Measured	<3.6	<6.8	9.1	<1.2	<3.2	<3.6	<3.2	<4.8
Expected[3]	—	—	9.71	—	—	—	—	—

[1]Layer 1, 0 to 30 millimeters.
[2]Layer 2, 30 to 150 millimeters.
[3]Noncertified concentration.

Atrazine and DDE were detected in 13 samples. Desethylatrazine was detected only in one sample. Dieldrin was detected in seven samples, all of which were from the Missouri River flood-plain sites. Metolachlor was detected in 15 samples. The Missouri River flood-plain site samples were not analyzed for simazine, and only one Mississippi River site (MS.1) had a concentration that was larger than the detection or reporting limit. Trifluralin was detected in 10 samples.

Semivolatile Organic Compound Concentrations

Sediment samples were analyzed for semivolatile organic compounds by two laboratories. None of these compounds were detected by the Enseco Analytical Laboratory, which used USEPA analytical methods. However, the compounds were detected in the same samples by the USGS laboratory in Arvada, which used analytical methods that have lower detection limits than the methods used by Enseco. Eight semivolatile organic compounds were detected in sediment samples from eight sites in the Missouri River flood plain (table 11, which follows the "References Cited" section). Twenty-five semivolatile organic compounds were detected in samples from 7 sites in the Mississippi River flood plain (table 12, which follows the "References Cited" section); concentrations of the compounds detected in these samples ranged from 23 μg/kg of 2,6-dimethylnaphthalene at MS.5 and MS.11 and 2-ethylnaphthalene at MS.3 to 270 μg/kg of fluoranthene at MS.3. The number of compounds detected per site ranged from 5 to 24.

Identification of unknown organic compounds that were detected in the GC/MS analysis is presented in table 13, which follows the "References Cited" section. The siloxane compound group is present in silicon-based grease in the sampling or laboratory equipment, but is not present in the sediment. In the Missouri River flood-plain samples, 11 compounds and 4 compound groups were identified, and in the Mississippi River flood-plain samples, 29 compounds and 7 compound groups were identified.

SUMMARY AND CONCLUSIONS

Floodwaters inundated the Missouri and Mississippi River flood plains during July and August 1993 as a result of peak discharges that exceeded 100-year recurrence intervals at streamflow-gaging stations. Sediments transported by the floodwaters were deposited in varying thicknesses in the inundated areas. Because the sediments were thought to contain elevated concentrations of nutrients and trace elements, the U.S. Geological Survey collected sediment samples at 25 sites in the Missouri and the Mississippi River flood plains. The samples were analyzed for physical properties and chemical constituents that included particle-size distribution, water content, volatile solids, nutrients, carbon, selected trace elements, pesticides, and semivolatile organic compounds.

Postflood sediment samples consist primarily of silt and clay; sand ranged from 0 to 28.4 percent by weight in the samples. Moisture content ranged from 7 to 51 percent by weight. Volatile solids concentrations ranged from 6,750 to 91,500 milligrams per kilogram. Total carbon was present predominantly as organic carbon in postflood samples. Several pesticides commonly applied to cropland were detected in samples from several sites. Alachlor was detected in 14 samples; the largest concentration detected was 54 micrograms per kilogram. Atrazine and 4,4'-DDE were detected in 13 samples. Dieldrin was detected in seven samples, all from the Missouri River flood plain. Metolachlor was detected in 15 samples. Eight semivolatile organic compounds were detected in samples from 8 sites in the Missouri River flood plain; 25 semivolatile organic compounds were detected in samples from 7 sites in the Mississippi River flood plain.

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EXPLANATION OF TABLE 7

ABBREVIATIONS AND REPORTING UNITS FOR CHEMICAL CONSTITUENTS AND NOTATIONS USED IN TABLE

wt. %	Percent by weight
mg/kg	Milligrams per kilogram
4N HCl	4 normal hydrochloric acid (conditionally available fraction)
0.1N HCl	0.1 normal hydrochloric acid (available fraction)
AAS	Atomic absorption spectrometry
CVAAS	Cold-vapor atomic absorption spectrometry
DN	Delayed neutron activation
CO_2	Carbon dioxide
MO	Missouri
MS	Mississippi
rep	Replicate sample
dup	Duplicate sample
—	No data
N	Not detected at the lower reporting limit
L	Detected at less than the lower reporting limit but not quantified

All elements analyzed by inductively coupled plasma-atomic emission spectrometry except where noted. Analyzed at the U.S. Geological Survey laboratory, Lakewood, Colorado.

Table 7. Concentrations of elements and carbon in the less than 0.062-millimeter size fraction of postflood sediment samples in the Missouri and the Mississippi River flood plains

Site no. (fig. 1)	Aluminum Total (wt. %)	Aluminum 4N HCl (mg/kg)	Aluminum 0.1N HCl (mg/kg)	Calcium Total (wt. %)	Calcium 4N HCl (mg/kg)	Calcium 0.1N HCl (mg/kg)	Iron Total (wt. %)	Iron 4N HCl (mg/kg)	Iron 0.1N HCl (mg/kg)	Magnesium Total (wt. %)	Magnesium 4N HCl (mg/kg)	Magnesium 0.1N HCl (mg/kg)
Missouri River												
MO.1	5.1	4,300	360	1.4	1,000	8,000	1.8	8,600	620	0.65	1,900	1,900
MO.2	5.7	5,500	480	1.5	1,400	10,000	2.3	11,000	860	.77	2,300	2,100
MO.3	6.8	12,000	1,000	1.2	1,000	8,600	3.4	19,000	1,600	.84	3,000	1,600
[1]MO.4	4.9	3,900	350	1.2	760	7,000	1.6	7,800	660	.51	1,500	1,400
[2]MO.4	4.3	—	—	2.0	—	—	2.1	—	—	.79	—	—
MO.5	5.6	5,600	510	1.1	820	7,600	2.4	11,000	710	.57	1,700	1,200
MO.6	7.9	9,100	1,400	1.3	1,000	10,000	4.3	15,000	1,900	1.0	2,500	1,400
MO.7	5.3	5,600	430	1.3	960	8,400	2.0	9,900	850	.62	2,100	1,400
MO.7 rep	5.3	5,700	390	1.3	1,000	7,800	1.9	10,000	740	.59	2,200	1,300
MO.7 rep	5.3	4,900	400	1.3	100	8,100	1.9	9,100	730	.59	1,900	1,400
MO.8	7.4	15,000	1,400	1.1	1,100	8,700	3.9	22,000	1,400	.92	3,400	1,600
MO.9	7.9	19,000	1,300	1.1	1,200	8,700	4.3	29,000	1,700	1.0	4,200	1,700
MO.10	5.1	5,800	400	1.0	820	5,700	1.8	10,000	650	.54	2,000	1,200
MO.11	5.8	7,900	600	1.2	1,000	7,600	2.4	14,000	940	.69	2,700	1,500
MO.12	5.6	7,100	570	1.3	1,200	8,400	2.2	13,000	590	.71	2,700	1,700
Mississippi River												
MS.1	5.1	5,900	580	1.4	810	7,900	2.6	13,000	2,200	0.69	1,800	2,400
MS.1 rep	5.1	5,600	610	1.4	790	8,800	2.5	13,000	2,100	.70	1,700	2,600
MS.1 dup	5.1	5,600	560	1.4	850	8,100	2.5	13,000	1,900	.69	1,800	2,400
MS.2	6.6	10,000	980	1.0	740	6,800	3.7	20,000	2,100	.77	2,600	1,700
MS.3	4.7	4,600	450	1.7	1,200	10,000	2.0	10,000	1,400	.70	1,700	2,900
MS.4	5.8	8,500	780	2.0	1,300	15,000	3.1	17,000	1,600	.80	2,300	2,400
MS.5	6.1	9,000	710	1.0	680	7,000	3.0	16,000	1,700	.64	2,000	1,400
MS.6	5.2	6,000	440	.8	440	4,400	2.1	10,000	650	.38	1,200	450
MS.7	6.0	8,800	790	1.5	1,100	12,000	3.0	17,000	2,100	.70	2,200	2,000
MS.7 rep	5.9	8,000	740	1.6	1,000	12,000	3.0	15,000	2,000	.70	2,000	1,900
MS.7 dup	5.9	7,500	730	1.6	920	12,000	3.0	14,000	1,800	.70	1,800	2,000
MS.8	4.8	5,000	430	.9	430	5,300	1.6	7,700	440	.38	960	780
MS.9	5.9	8,100	480	1.3	1,100	8,300	2.4	15,000	700	.73	2,900	1,600
MS.10	4.6	4,300	320	.7	290	2,300	1.5	7,000	430	.34	1,100	340
MS.11	6.3	8,300	720	1.3	1,100	9,300	2.9	15,000	1,400	.77	2,500	1,700
MS.12	6.7	10,000	940	1.3	1,100	9,600	3.7	18,000	1,700	.88	2,800	1,800
MS.13	4.9	3,800	350	1.3	890	7,400	1.7	8,000	610	.57	1,600	1,800
MS.13 rep	4.8	4,100	390	1.3	950	8,100	1.7	8,500	620	.57	1,700	1,900
MS.13 dup	4.9	3,800	340	1.3	970	7,100	1.7	8,000	500	.58	1,600	1,700

Table 7. Concentrations of elements and carbon in the less than 0.062-millimeter size fraction of postflood sediment samples in the Missouri and the Mississippi River flood plains—Continued

Site no. (fig. 1)	Phosphorus Total (wt. %)	Phosphorus 4N HCl (mg/kg)	Phosphorus 0.1N HCl (mg/kg)	Potassium Total (wt. %)	Potassium 4N HCl (mg/kg)	Potassium 0.1N HCl (mg/kg)	Sodium Total (wt. %)	Sodium 4N HCl (mg/kg)	Sodium 0.1N HCl (mg/kg)	Sulfur, total, combustion (wt. %)	Titanium Total (wt. %)	Titanium 4N HCl (mg/kg)	Titanium 0.1N HCl (mg/kg)
						Missouri River							
MO.1	0.07	150	260	1.8	420	7.5N	1.1	42	25	0.05L	0.25	89	0.82
MO.2	.08	230	250	1.8	620	7.5N	.97	40	32	.05L	.27	74	.79
MO.3	.10	500	130	1.8	1,400	120	.74	54	51	.05L	.30	120	1.8
[1]MO.4	.06	150	260	1.7	290	7.5N	1.1	31	34	.05L	.24	69	.91
[2]MO.4	.09	—	—	1.6	—	—	1.2	—	—	.05L	.57	—	—
MO.5	.07	230	180	1.7	440	7.5N	.89	30	43	.05L	.26	61	.71
MO.6	.11	360	95	2.0	1,400	460	.47	35	61	.06	.31	64	2.0
MO.7	.07	200	280	1.9	700	7.5N	1.1	35	26	.05L	.24	90	.85
MO.7 rep	.07	160	300	1.8	750	7.5N	1.1	38	24	.05L	.24	110	1.4
MO.7 dup	.07	190	300	1.9	580	7.5N	1.1	34	21	.05L	.24	78	1.1
MO.8	.10	450	120	1.9	1,800	290	.61	49	60	.05L	.31	140	2.2
MO.9	.11	490	120	1.9	2,400	300	.52	46	73	.05	.32	170	2.5
MO.10	.06	170	260	1.8	680	7.5N	1.1	38	25	.05L	.24	89	1.6
MO.11	.08	320	260	1.9	1,100	7.5N	.99	41	32	.05L	.25	120	1.7
MO.12	.08	210	280	1.9	1,100	7.5N	1.1	58	54	.05L	.23	120	1.4
						Mississippi River							
MS.1	0.10	450	180	1.8	94	7.5N	1.0	28	28	0.05L	0.25	150	5.2
MS.1 rep	.09	430	190	1.8	68	7.5N	1.0	25	35	.05	.25	140	4.9
MS.1 dup	.09	480	200	1.7	64	7.5N	.98	22	33	.05	.24	120	3.8
MS.2	.14	750	140	1.8	670	7.5N	.70	27	33	.06	.30	190	6.5
MS.3	.08	360	190	1.6	43	7.5N	1.0	16	16	.05L	.25	110	3.8
MS.4	.12	620	130	1.7	430	7.5N	.74	22	30	.08	.28	170	4.0
MS.5	.11	550	150	1.6	550	7.5N	.69	17	13	.05	.28	1,100	2.9
MS.6	.08	250	240	1.6	390	7.5N	.80	9.5	6.7	.05L	.28	57	1.2
MS.7	.09	480	96	1.7	490	7.5N	.74	20	33	.08	.29	150	5.1
MS.7 rep	.09	410	87	1.7	400	7.5N	.76	20	32	.09	.26	130	5.4
MS.7 dup	.09	430	86	1.7	340	7.5N	.76	21	43	.09	.25	120	3.8
MS.8	.04	170	60	1.8	170	7.5N	.80	13	23	.05L	.25	58	1.7
MS.9	.07	290	210	1.9	1,100	7.5N	.94	49	33	.05L	.27	120	1.5
MS.10	.04	150	77	1.8	430	7.5N	.96	19	20	.05L	.26	89	2.6
MS.11	.09	410	170	1.8	940	7.5N	.81	32	32	.05	.27	110	2.0
MS.12	.11	530	130	1.8	1,100	33	.66	37	44	.05	.32	120	2.5
MS.13	.07	180	290	1.7	220	7.5N	1.1	28	21	.05L	.25	74	1.3
MS.13 rep	.07	180	310	1.7	270	7.5N	1.1	30	21	.05L	.29	84	1.4
MS.13 dup	.07	200	310	1.7	210	7.5N	1.1	27	33	.05L	.27	73	1.3

Table 7. Concentrations of elements and carbon in the less than 0.062-millimeter size fraction of postflood sediment samples in the Missouri and the Mississippi River flood plains—Continued

	Antimony			Arsenic						Barium		
Site no. (fig. 1)	Total, AAS (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	Total (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	Total, AAS (mg/kg)	4N HCl, AAS (mg/kg)	0.1N HCl, AAS (mg/kg)	Total (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)
Missouri River												
MO.1	0.8	6.3N	6.3N	10L	3.8N	3.8N	7.2	3.6	1.2	760	69	62
MO.2	.8	6.3N	6.3N	10	3.8N	3.8N	10	4.3	1.9	770	83	93
MO.3	.9	6.3N	6.3N	14	3.8N	3.8N	14	8.8	1.5	760	100	140
[1]MO.4	.5	6.3N	6.3N	10L	3.8N	3.8N	6.4	2.9	1.3	700	53	62
[2]MO.4	.6	—	—	10L	—	—	4.9	—	—	1,100	—	—
MO.5	.7	6.3N	6.3N	10L	3.8N	3.8N	9.0	4.6	.9	670	61	94
MO.6	1.1	6.3N	6.3N	18	6.9	3.8N	19	6.9	2.0	770	84	190
MO.7	.9	6.3N	6.3N	10L	3.8N	3.8	8.2	3.3	1.9	740	67	80
MO.7 rep	.6	6.3N	6.3N	10L	3.8N	3.8N	8.0	3.5	1.6	730	69	70
MO.7 dup	.8	6.3N	6.3N	10L	3.8N	3.8N	8.1	3.2	2.1	730	65	72
MO.8	1.4	6.3N	6.3N	17	4.2	3.8N	16	9.4	1.6	760	110	180
MO.9	1.2	6.3N	6.3N	22	3.9	3.8N	18	11	1.8	750	120	190
MO.10	.5	6.3N	6.3N	10L	3.8N	3.8	7.0	3	1.7	710	70	72
MO.11	.8	6.3N	6.3N	10	4.0	3.8N	9.8	5.0	2.0	770	83	110
MO.12	.7	6.3N	6.3N	10L	3.8N	3.8N	9.0	4.7	1.6	790	81	88
Mississippi River												
MS.1	0.4	6.3N	6.3N	10L	3.8N	3.8N	6.4	3.1	1.1	580	31	67
MS.1 rep	.5	6.3N	6.3N	10L	3.8N	3.8N	6.0	2.9	1.0	580	30	70
MS.1 dup	.5	6.3N	6.3N	10L	3.8N	3.8N	6.2	2.4	1.0	570	30	64
MS.2	.7	6.3N	6.3N	11	3.8N	3.8N	11	2.7	1.0	670	57	130
MS.3	1.0	6.3N	6.3N	10L	3.8N	3.8N	4.9	2.1	.7	550	24	51
MS.4	1.0	6.3N	6.3N	10L	3.8N	3.8N	7.6	2.0	.7	600	44	98
MS.5	.9	6.3N	6.3N	10	3.8N	3.8N	9.4	4.3	1.0	650	63	130
MS.6	.6	6.3N	6.3N	10L	3.8N	3.8N	5.0	1.8	.6	590	39	110
MS.7	1.0	6.3N	6.3N	10L	3.8N	3.8N	6.8	2.8	.6	610	58	110
MS.7 rep	.8	6.3N	6.3N	10L	3.8N	3.9	6.8	2.7	.7	610	60	92
MS.7 dup	.9	6.3N	6.3N	10L	3.8N	3.8N	6.5	1.9	.6	610	63	90
MS.8	.7	6.3N	6.3N	10L	3.8N	4.0	4.5	1.6	.4	580	32	75
MS.9	1.0	6.3N	6.3N	11	4.8	4.8	9.5	5.7	1.3	770	91	93
MS.10	.5	6.3N	6.3N	10L	3.8N	3.8N	4.3	1.7	.3	650	37	77
MS.11	1.1	6.3N	6.3N	13	3.8N	3.8N	11	4.0	1.7	720	85	120
MS.12	1.3	6.3N	6.3N	15	3.8N	3.8N	14	6.3	1.4	720	91	140
MS.13	.7	6.3N	6.3N	10L	3.8N	3.8N	5.6	2.2	1.0	710	59	56
MS.13 rep	.8	6.3N	6.3N	10L	3.8N	3.8N	5.9	2.6	1.1	700	69	61
MS.13 dup	.7	6.3N	6.3N	10L	3.8N	3.8N	5.9	1.4	1.0	710	62	54

Table 7. Concentrations of elements and carbon in the less than 0.062-millimeter size fraction of postflood sediment samples in the Missouri and the Mississippi River flood plains—Continued

Site no. (fig. 1)	Beryllium Total (mg/kg)	Beryllium 4N HCl (mg/kg)	Beryllium 0.1N HCl (mg/kg)	Bismuth Total (mg/kg)	Bismuth 4N HCl (mg/kg)	Bismuth 0.1N HCl (mg/kg)	Cadmium Total (mg/kg)	Cadmium 4N HCl (mg/kg)	Cadmium 0.1N HCl (mg/kg)	Cadmium Total, AAS (mg/kg)	Cerium Total (mg/kg)	Cerium 4N HCl (mg/kg)	Cerium 0.1N HCl (mg/kg)
Missouri River													
MO.1	1.0	0.056	0.16	10L	7.5N	7.5N	2L	0.5N	0.5N	0.56	59	5.0N	5.0N
MO.2	1.0	.084	.24	10L	7.5N	7.5N	2L	.5N	.5N	.37	70	5.0N	5.0N
MO.3	2.0	.17	.45	10L	7.5N	7.5N	2L	.5N	.5N	.48	75	5.0N	10
[1]MO.4	1.0	.048	.15	10L	7.5N	7.5N	2L	.5N	.5N	.22	59	5.2	5.0N
[2]MO.4	1.0L	—	—	10L	—	—	2L	—	—	.14	140	—	—
MO.5	1.0	.12	.28	10L	7.5N	7.5N	2L	.5N	.5N	.35	69	5.4	5.0N
MO.6	2.0	.20	.61	10L	7.5N	7.5N	2L	.5N	.5N	.56	70	5.0N	6.0
MO.7	1.0	.084	.21	10L	7.5N	7.5N	2L	.5N	.5N	.32	59	5.0N	5.0N
MO.7 rep	1.0	.083	.19	10L	7.5N	7.5N	2L	.5N	.5N	.27	57	5.0N	5.9
MO.7 dup	1.0	.060	.20	10L	7.5N	7.5N	2L	.5N	.5N	.29	54	5.0N	5.0N
MO.8	2.0	.25	.53	10L	7.5N	7.5N	2L	.5N	.5N	.51	74	5.0N	6.3
MO.9	2.0	.25	.59	10L	7.5N	7.5N	2L	.5N	.5N	.50	79	5.0N	5.8
MO.10	1.0	.089	.20	10L	7.5N	7.5N	2L	.5N	.5N	.25	60	5.0N	5.0N
MO.11	1.0	.084	.27	10L	7.5N	7.5N	2L	.5N	.5N	.37	62	5.0N	5.0N
MO.12	1.0	.099	.24	10L	7.5N	7.5N	2L	.5N	.5N	.34	55	5.0N	5.0N
Mississippi River													
MS.1	1.0	0.025N	0.22	10L	7.5N	7.5N	2L	0.5N	0.5N	0.37	54	5.0N	7.5
MS.1 rep	1.0	.025N	.24	10L	7.5N	7.5N	2L	.5N	.5N	.40	53	5.0N	7.3
MS.1 dup	1.0	.025N	.23	10L	7.5N	7.5N	2L	.5N	.5N	.37	51	5.0N	5.0N
MS.2	1.0	.064	.43	10L	7.5N	7.5N	2L	.5N	.5N	.40	73	5.0N	12
MS.3	1.0L	.025N	.17	10L	7.5N	7.5N	2L	.5N	.5N	.35	58	5.0N	5.0N
MS.4	1.0	.025N	.33	10L	7.5N	7.5N	2L	.5N	.5N	.66	62	5.0N	5.0N
MS.5	1.0	.063	.39	10L	7.5N	7.5N	2L	.5N	.5N	.27	67	5.0N	5.0N
MS.6	1.0	.092	.34	10L	7.5N	7.5N	2L	.5N	.5N	.25	67	6.7N	5.0N
MS.7	1.0	.059	.39	10L	7.5N	7.5N	2L	.5N	.5N	.49	64	5.0N	5.0N
MS.7 rep	1.0	.053	.36	10L	7.5N	7.5N	2L	.5N	.5N	.52	61	5.0N	6.7
MS.7 dup	1.0	.030	.37	10L	7.5N	7.5N	2L	.5N	.5N	.51	65	5.0N	5.0N
MS.8	1.0	.082	.31	10L	7.5N	7.5N	2L	.5N	.5N	.18	60	5.4	12
MS.9	1.0	.11	.26	10L	7.5N	7.5N	2L	.5N	.5N	.35	63	5.0N	7.5
MS.10	1.0L	.061	.20	10L	7.5N	7.5N	2L	.5N	.55	.36	57	5.0N	12
MS.11	1.0	.11	.37	10L	7.5N	7.5N	2L	.5N	.5N	.50	69	5.0N	5.0N
MS.12	2.0	.14	.46	10L	7.5N	7.5N	2L	.5N	.5N	.61	71	5.0N	10
MS.13	1.0	.027	.16	10L	7.5N	7.5N	2L	.5N	.5N	.24	73	5.0N	5.0N
MS.13 rep	1.0	.026	.16	10L	7.5N	7.5N	2L	.5N	.5N	.26	73	5.0N	5.0N
MS.13 dup	1.0	.040	.16	10L	7.5N	7.5N	2L	.5N	.5N	.25	76	5.0N	5.3

Table 7. Concentrations of elements and carbon in the less than 0.062-millimeter size fraction of postflood sediment samples in the Missouri and the Mississippi River flood plains—Continued

Site no. (fig. 1)	Chromium			Cobalt			Copper			Europium, total (mg/kg)	Gal-lium, total (mg/kg)	Gold, total (mg/kg)	Holmium, total (mg/kg)
	Total (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	Total (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	Total (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)				
Missouri River													
MO.1	40	5.2	1.5N	8	1.3	1.7	11	3.1	3.5	2.0L	11	8.0L	4.0L
MO.2	50	4.8	1.5N	10	2.6	1.3N	17	4.4	5.7	2.0L	12	8.0L	4.0L
MO.3	65	9.6	1.5N	15	3.4	2.2	25	8.3	8.6	2.0L	16	8.0L	4.0L
[1]MO.4	35	4.1	1.5N	8	2.0	1.6	10	2.5	2.7	2.0L	10	8.0L	4.0L
[2]MO.4	55	—	—	7	—	—	7	—	—	2.0L	10	8.0L	4.0L
MO.5	51	5.1	1.5N	11	2.3	1.8	15	4.8	4.4	2.0L	14	8.0L	4.0L
MO.6	82	7.1	1.5N	16	2.3	3.2	31	8.2	10	2.0L	21	8.0L	4.0L
MO.7	41	4.9	1.5N	9	1.7	1.4	14	3.7	4.7	2.0L	12	8.0L	4.0L
MO.7 rep	42	5.8	1.5N	9	1.8	1.8	14	3.6	4.1	2.0L	12	8.0L	4.0L
MO.7 dup	40	5.6	1.5N	8	1.5	1.4	14	3.7	4.2	2.0L	11	8.0L	4.0L
MO.8	73	12	1.5N	16	3.6	2.7	29	11	8.6	2.0L	19	8.0L	4.0L
MO.9	81	13	1.5N	17	3.9	2.3	31	13	9.4	2.0L	19	8.0L	4.0L
MO.10	40	6.5	1.5N	9	1.7	1.4	12	4.1	3.6	2.0L	11	8.0L	4.0L
MO.11	47	6.7	1.5N	11	3.2	1.3	17	6.2	4.9	2.0L	13	8.0L	4.0L
MO.12	43	6.9	1.5N	10	2.9	2.0	16	6.2	4.2	2.0L	13	8.0L	4.0L
Mississippi River													
MS.1	50	9.3	1.5N	11	2.0	1.3N	16	3.2	4.8	2.0L	11	8.0L	4.0L
MS.1 rep	49	8.4	1.5N	11	2.2	1.3N	16	3.2	5.3	2.0L	11	8.0L	4.0L
MS.1 dup	48	9.3	1.5N	11	1.9	1.3N	16	3.4	4.6	2.0L	11	8.0L	4.0L
MS.2	67	11	1.5N	15	2.1	3.0	25	7.6	8.4	2.0L	16	8.0L	4.0L
MS.3	43	6.8	1.5N	8	N1.3	1.3	14	3.9	5.2	2.0L	10	8.0L	4.0L
MS.4	62	11	1.5N	12	2.2	1.8	21	6.1	6.4	2.0L	14	8.0L	4.0L
MS.5	60	8.6	1.5N	12	2.5	1.6	22	6.5	6.6	2.0L	13	8.0L	4.0L
MS.6	47	6.6	1.5N	8	1.7	1.3N	17	4.8	5.1	2.0L	12	8.0L	4.0L
MS.7	59	9.5	1.5N	12	2.1	2.2	21	5.6	8.1	2.0L	13	8.0L	4.0L
MS.7 rep	57	9.5	1.7	12	2.5	2.8	20	5.5	7.5	2.0L	13	8.0L	4.0L
MS.7 dup	59	9.2	1.6	12	2.5	2.8	21	5.2	7.2	2.0L	13	8.0L	4.0L
MS.8	40	6.3	1.5N	6	1.4	1.3N	15	4.0	4.5	2.0L	11	8.0L	4.0L
MS.9	52	8.5	1.5N	11	2.9	2.2	18	6.6	5.4	2.0L	14	8.0L	4.0L
MS.10	38	4.2	1.6	7	2.1	1.7	14	3.3	3.6	2.0L	9	8.0L	4.0L
MS.11	59	8.2	1.5N	12	3.1	2.5	21	6.5	7.6	2.0L	15	8.0L	4.0L
MS.12	74	9.6	1.6	15	3.3	3.4	26	7.7	9.2	2.0L	19	8.0L	4.0L
MS.13	43	4.6	1.5N	7	1.7	1.3	12	2.4	2.6	2.0L	11	8.0L	4.0L
MS.13 rep	40	5.2	1.5N	8	1.6	1.3N	11	2.5	2.6	2.0L	11	8.0L	4.0L
MS.13 dup	40	4.8	1.7	8	1.6	1.7	11	2.6	2.8	2.0L	11	8.0L	4.0L

Table 7. Concentrations of elements and carbon in the less than 0.062-millimeter size fraction of postflood sediment samples in the Missouri and the Mississippi River flood plains—Continued

	Lanthanum			Lead			Lithium			Manganese		
Site no. (fig.1)	**Total (mg/kg)**	**4N HCl (mg/kg)**	**0.1N HCl (mg/kg)**	**Total (mg/kg)**	**4N HCl (mg/kg)**	**0.1N HCl (mg/kg)**	**Total (mg/kg)**	**4N HCl (mg/kg)**	**0.1N HCl (mg/kg)**	**Total (mg/kg)**	**4N HCl (mg/kg)**	**0.1N HCl (mg/kg)**
Missouri River												
MO.1	35	7.7	2.6	15	6.3N	6.3N	21	5.0	0.38N	430	84	210
MO.2	39	8.8	3.2	17	6.3N	9.2	26	6.1	.38N	650	120	380
MO.3	43	13	5.7	22	7.0	8.6	37	9.9	.38N	1,100	370	560
[1]MO.4	35	7.4	2.6	16	6.3N	6.3N	19	4.4	.38N	450	93	240
[2]MO.4	78	—	—	13	—	—	14	—	—	500	—	—
MO.5	37	9.6	3.6	16	11	6.7	28	5.6	.38N	760	280	320
MO.6	40	10	6.2	24	12	10	46	9.0	.38N	1,300	330	720
MO.7	35	8.4	3.0	18	7.0	6.3N	22	5.6	.38N	490	89	280
MO.7 rep	34	8.9	3.0	17	6.3N	6.4	22	5.4	.38N	460	94	240
MO.7 dup	33	8.1	3.3	16	6.3N	6.3N	22	4.9	.38N	450	87	250
MO.8	44	16	6.1	24	9.8	9.5	41	11	.38N	1,300	470	640
MO.9	45	18	6.6	23	12	8.1	45	14	.38N	1,200	490	610
MO.10	36	9.7	3.2	15	7.4	6.9	21	5.0	.38N	450	180	180
MO.11	36	11	3.9	15	7.3	6.8	25	6.7	.38N	820	380	320
MO.12	32	10	3.4	17	12	6.3N	23	6.5	.38N	770	330	320
Mississippi River												
MS.1	30	6.5	4.0	19	9.1	9.4	20	4.1	0.38N	1,100	400	510
MS.1 rep	30	6.4	4.1	21	12	8.5	20	3.8	.38N	1,100	340	550
MS.1 dup	29	6.7	3.9	21	6.3N	6.3N	20	4.3	.38N	1,100	360	510
MS.2	40	11	6.7	22	11	14	31	7.2	.38N	1,400	280	870
MS.3	33	5.6	2.8	23	6.7	13	17	3.4	.38N	660	110	330
MS.4	35	8.0	4.6	23	15	11	29	6.5	.38N	1,200	230	730
MS.5	39	11	5.5	18	12	6.3N	30	6.2	.38N	970	380	420
MS.6	38	9.9	4.4	16	7.9	6.3N	24	3.8	.38N	570	270	170
MS.7	36	9.4	6.0	24	11	10	29	6.4	.38N	1,100	170	720
MS.7 rep	34	8.8	5.7	21	13	9.9	29	6.1	.38N	1,000	150	660
MS.7 dup	35	8.3	5.6	22	6.3N	6.3N	29	5.6	.38N	1,000	140	670
MS.8	35	8.1	4.8	19	17	6.3N	22	3.4	.38N	830	420	220
MS.9	36	12	3.8	18	12	6.3N	28	8.7	.38N	750	270	350
MS.10	33	5.8	3.3	21	17	6.3N	17	3.5	.38N	610	320	140
MS.11	40	11	5.3	22	6.3N	6.3N	31	7.6	.38N	970	280	530
MS.12	39	12	6.4	25	6.3N	6.3N	40	9.0	.38N	1,300	300	780
MS.13	41	7.0	2.9	16	6.3N	6.3N	19	3.9	.38N	640	220	260
MS.13 rep	41	7.8	3.0	16	6.3N	6.3N	19	4.2	.38N	670	230	300
MS.13 dup	43	7.2	3.1	15	6.3N	6.3N	19	4.0	.38N	670	220	260

Table 7. Concentrations of elements and carbon in the less than 0.062-millimeter size fraction of postflood sediment samples in the Missouri and the Mississippi River flood plains—Continued

Site no. (fig.1)	Mercury (CVAAS) Total (mg/kg)	Mercury (CVAAS) 0.1N HCl (mg/kg)	Molybdenum Total (mg/kg)	Molybdenum 4N HCl (mg/kg)	Molybdenum 0.1N HCl (mg/kg)	Neodymium, total (mg/kg)	Nickel Total (mg/kg)	Nickel 4N HCl (mg/kg)	Nickel 0.1N HCl (mg/kg)	Niobium, total (mg/kg)	Scandium, total (mg/kg)
Missouri River											
MO.1	0.02L	0.008	2.0L	1.0N	1.0N	26	18	6.0	4.0	10	6.0
MO.2	.02L	.006	2.0L	1.0N	1.0N	31	24	7.7	3.5	11	7.0
MO.3	.02	.010	2.0L	1.5	1.0N	34	33	11	6.1	12	10
[1]MO.4	.02L	.006L	2.0L	1.0N	1.0N	27	16	5.4	3.0	10	5.0
[2]MO.4	.02L	—	2.0L	—	—	60	14	—	—	16	6.0
MO.5	.02L	.006	2.0L	1.1	1.0N	30	24	6.8	4.1	10	8.0
MO.6	.03	.010	2.0L	1.0N	1.0N	34	40	8.3	7.3	13	13
MO.7	.02L	.006L	2.0L	1.0N	1.0N	30	20	6.4	3.6	10	6.0
MO.7 rep	.02L	.006	2.0L	1.0N	1.0N	27	19	7.4	3.5	10	6.0
MO.7 dup	.02L	.006L	2.0L	1.1	1.0N	26	19	8.3	1.6	10	6.0
MO.8	.02	.006	2.0L	1.0N	1.0N	37	37	14	6.5	13	12
MO.9	.02L	.006	2.0L	1.0N	1.0N	36	42	16	6.4	15	13
MO.10	.02L	.006L	2.0L	1.0N	1.0N	28	18	9.2	3.4	11	6.0
MO.11	.02L	.020L	2.0L	1.0N	1.0N	29	25	11	3.8	10	7.0
MO.12	.02L	.060L	2.0L	1.0N	1.0N	25	22	11	4.3	10	7.0
Mississippi River											
MS.1	0.03	0.008	2.0L	1.0N	1.0N	24	21	5.9	2.7	8.0	7.0
MS.1 rep	.03	.008	2.0L	1.0N	1.0N	24	21	6.5	2.8	9.0	7.0
MS.1 dup	.03	.01	2.0L	1.0N	1.0N	23	22	5.5	1.3N	8.0	7.0
MS.2	.04	.006	2.0L	1.0N	1.0N	31	33	11	5.6	12	10
MS.3	.02L	.006L	2.0L	1.0N	1.0N	28	20	7.8	1.3N	8.0	6.0
MS.4	.04	.006	2.0L	1.5	1.0N	28	28	8.6	1.6	10	9.0
MS.5	.02	.006L	2.0L	1.7	1.0N	31	27	8.4	2.0	11	9.0
MS.6	.02L	.006L	2.0L	1.4	1.0N	32	21	6.1	2.8	10	8.0
MS.7	.02L	.006	2.0L	1.0N	1.0N	29	27	8.9	2.1	11	9.0
MS.7 rep	.03	.006L	2.0L	1.4	1.0N	28	27	8.0	2.9	10	9.0
MS.7 dup	.04	.01	2.0L	1.7	1.0N	29	28	7.2	2.7	10	9.0
MS.8	.02L	.006L	2.0L	1.1	1.0N	30	18	4.7	2.5	10	7.0
MS.9	.02L	.006L	2.0L	1.5	1.0N	30	25	11	2.8	11	8.0
MS.10	.02L	.006L	2.0L	1.0N	1.0N	26	15	5.9	1.5	10	6.0
MS.11	.02	.006L	2.0L	1.1	1.0N	31	28	10	3.3	11	9.0
MS.12	.03	.006	2.0L	1.0	1.0N	34	36	12	5.1	14	11
MS.13	.02L	.006L	2.0L	1.0N	1.0N	32	17	4.7	1.3N	10	6.0
MS.13 rep	.02L	.006L	2.0L	1.1	1.0N	33	17	6.9	1.3N	11	6.0
MS.13 dup	.02L	.006L	2.0L	1.0N	1.0N	26	16	4.8	1.3N	10	6.0

Table 7. Concentrations of elements and carbon in the less than 0.062-millimeter size fraction of postflood sediment samples in the Missouri and the Mississippi River flood plains—Continued

	Selenium (AAS)			Silver				Strontium			Tantalum, total	Thorium	
Site no. (fig.1)	Total (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	Total (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	Total, AAS (mg/kg)	Total (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	(mg/kg)	Total (mg/kg)	Total, DN (mg/kg)
Missouri River													
MO.1	0.3	0.05L	0.05L	2.0L	0.50N	0.50N	0.15	190	9.7	17	40L	8	8.9
MO.2	.5	.05L	.05L	2.0L	.50N	.50N	.17	180	11	24	40L	10	10
MO.3	.8	.05L	.05L	2.0L	.50N	.50N	.20	150	14	30	40L	11	14
[1]MO.4	.2	.05L	.05L	2.0L	.50N	.50N	.14	180	8.1	18	40L	9	8.0
[2]MO.4	.1	—	—	2.0L	—	—	.11	220	—	—	40L	25	—
MO.5	.5	.06	.05L	2.0L	.50N	.50N	.16	160	8.7	25	40L	10	9.1
MO.6	1.0	.05L	.05L	2.0L	.50N	.50N	.17	140	12	46	40L	13	13
MO.7	.4	.05L	.05L	2.0L	.50N	.50N	.17	180	10	23	40L	11	7.8
MO.7 rep	.3	.05L	.05L	2.0L	.50N	.50N	.16	180	11	21	40L	9	9.6
MO.7 dup	.3	.05L	.05L	2.0L	.50N	.50N	.16	180	10	22	40L	9	12
MO.8	.8	.05L	.05L	2.0L	.50N	.50N	.17	140	15	35	40L	13	12
MO.9	1.0	.05L	.05L	2.0L	.50N	.50N	.16	140	17	39	40L	13	11
MO.10	.3	.05L	.05L	2.0L	.50N	.50N	.15	170	9.4	17	40L	9	8.1
MO.11	.6	.05L	.05L	2.0L	.50N	.50N	.15	170	11	23	40L	9	10
MO.12	.5	.05L	.05L	2.0L	.50N	.50N	.16	190	13	24	40L	8	7.3
Mississippi River													
MS.1	0.5	0.05L	0.05L	2.0L	0.50N	0.50N	0.16	150	4.5	10	40L	8	7.2
MS.1 rep	.5	.05L	.05L	2.0L	.50N	.50N	.16	150	4.3	11	40L	8	7.8
MS.1 dup	.5	.05L	.05L	2.0L	.50N	.50N	.19	150	4.3	10	40L	8	7.9
MS.2	.8	.05L	.05L	2.0L	.50N	.50N	.16	120	6.3	13	40L	11	10
MS.3	.3	.05L	.05L	2.0L	.50N	.50N	.13	150	4.0	8.8	40L	9	6.9
MS.4	.8	.05L	.05L	2.0L	.50N	.50N	.21	120	5.6	15	40L	9	8.7
MS.5	.6	.05L	.05L	2.0L	.50N	.50N	.16	110	6.2	13	40L	10	11
MS.6	.4	.05L	.05L	2.0L	.50N	.50N	.15	120	4.2	9.2	40L	9	12
MS.7	.7	.05L	.05L	2.0L	.50N	.50N	.22	120	6.3	15	40L	11	10
MS.7 rep	.7	.05L	.05L	2.0L	.50N	.50N	.20	120	5.9	14	40L	10	11
MS.7 dup	.7	.05L	.05L	2.0L	.50N	.50N	.20	120	5.7	14	40L	9	11
MS.8	.3	.05L	.05L	2.0L	.50N	.50N	.15	120	3.4	8.8	40L	10	9.6
MS.9	.4	.05L	.05L	2.0L	.50N	.50N	.17	170	14	23	40L	9	11
MS.10	.3	.05L	.05L	2.0L	.50N	.50N	.13	140	4.5	7.5	40L	9	9.2
MS.11	.6	.05L	.05L	2.0L	.50N	.50N	.20	150	11	23	40L	12	12
MS.12	.8	.05L	.05L	2.0L	.50N	.50N	.23	140	11	24	40L	12	13
MS.13	.2	.05L	.05L	2.0L	.50N	.50N	.15	180	7.3	13	40L	10	10
MS.13 rep	.2	.05L	.05L	2.0L	.50N	.50N	.13	170	7.7	14	40L	11	13
MS.13 dup	.2	.05L	.05L	2.0L	.50N	.50N	.15	180	7.1	13	40L	10	13

Table 7. Concentrations of elements and carbon in the less than 0.062-millimeter size fraction of postflood sediment samples in the Missouri and the Mississippi River flood plains—Continued

Site no. (fig.1)	Tin			Tungsten		Uranium		Vanadium			Ytter-bium, total (mg/kg)
	Total (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	Total (mg/kg)	Total, DN (mg/kg)	Total (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	
Missouri River											
MO.1	5.0L	10N	10N	7.5N	7.5N	100L	3.1	63	12	3.2	2.0
MO.2	5.0L	10N	10N	7.5N	7.5N	100L	3.3	79	14	5.1	2.0
MO.3	5.0L	10N	10N	7.5N	7.5N	100L	3.7	110	26	8.4	2.0
[1]MO.4	5.0L	10N	10N	7.5N	7.5N	100L	3.2	56	11	3.0	2.0
[2]MO.4	5.0L	—	—	—	—	100L	—	75	—	—	3.0
MO.5	5.0L	10N	10N	7.5N	7.5N	100L	3.6	81	17	4.3	2.0
MO.6	5.0L	10N	10N	7.5N	7.5N	100L	3.5	140	20	10	3.0
MO.7	5.0L	10N	10N	7.5N	7.5N	100L	3.3	68	13	4.6	2.0
MO.7 rep	5.0L	10N	10N	7.5N	7.5N	100L	3.0	65	14	4.0	2.0
MO.7 dup	5.0L	10N	10N	7.5N	7.5N	100L	2.9	64	12	3.7	2.0
MO.8	5.0L	10N	10N	7.5N	7.5N	100L	3.7	130	33	8.6	2.0
MO.9	5.0L	10N	10N	7.5N	7.5N	100L	3.6	140	38	11	2.0
MO.10	5.0L	10N	10N	7.5N	7.5N	100L	3.3	64	14	4.7	2.0
MO.11	5.0L	10N	10N	7.5N	7.5N	100L	3.3	83	19	5.1	2.0
MO.12	5.0L	10N	10N	7.5N	7.5N	100L	2.8	75	18	3.7	2.0
Mississippi River											
MS.1	5.0L	10N	10N	7.5N	7.5N	100L	2.6	63	13	4.3	1.0
MS.1 rep	5.0L	10N	10N	7.5N	7.5N	100L	2.5	63	13	4.5	2.0
MS.1 dup	5.0L	10N	10N	7.5N	7.5N	100L	2.6	62	13	3.7	2.0
MS.2	5.0L	10N	10N	7.5N	7.5N	100L	3.2	100	23	9.5	2.0
MS.3	5.0L	10N	10N	7.5N	7.5N	100L	2.9	54	11	3.6	1.0
MS.4	5.0L	10N	10N	7.5N	7.5N	100L	2.8	83	17	6.4	2.0
MS.5	5.0L	10N	10N	7.5N	7.5N	100L	3.3	88	20	6.7	2.0
MS.6	5.0L	10N	10N	7.5N	7.5N	100L	3.1	65	12	6.5	2.0
MS.7	5.0L	10N	10N	7.5N	7.5N	100L	3.1	86	17	8.6	2.0
MS.7 rep	5.0L	10N	10N	7.5N	7.5N	100L	2.9	83	16	8.1	2.0
MS.7 dup	5.0L	10N	10N	7.5N	7.5N	100L	3.0	83	15	7.5	2.0
MS.8	5.0L	10N	10N	7.5N	7.5N	100L	2.9	57	12	3.9	2.0
MS.9	5.0L	10N	10N	7.5N	7.5N	100L	3.0	84	21	4.5	2.0
MS.10	5.0L	10N	10N	7.5N	7.5N	100L	3.3	56	12	4.4	2.0
MS.11	5.0L	10N	10N	7.5N	7.5N	100L	3.3	93	18	7.3	2.0
MS.12	5.0L	10N	10N	7.5N	7.5N	100L	3.4	110	22	9.2	2.0
MS.13	5.0L	10N	10N	7.5N	7.5N	100L	3.7	57	11	2.2	2.0
MS.13 rep	5.0L	10N	10N	7.5N	7.5N	100L	4.0	60	12	2.1	2.0
MS.13 dup	5.0L	10N	10N	7.5N	7.5N	100L	3.9	59	11	2.2	2.0

Table 7. Concentrations of elements and carbon in the less than 0.062-millimeter size fraction of postflood sediment samples in the Missouri and the Mississippi River flood plains—Continued

	Yttrium			Zinc			Zirconium		Carbon (wt. %)			
Site no. (fig.1)	Total (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	Total (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	Total, combus-tion	Organic, diff-erence	Car-bonate, titration	[3]CO_2
Missouri River												
MO.1	19	4.2	3.6	51	32	6.4	0.63N	0.63N	0.80	0.51	0.29	1.1
MO.2	21	5.8	4.6	66	40	9.1	.63N	.63N	1.24	.91	.33	1.2
MO.3	24	8.5	6.7	96	64	15	.63N	.63N	1.53	1.37	.16	.57
[1]MO.4	17	3.8	3.3	44	28	6.5	.63N	.63N	.56	.35	.21	.77
[2]MO.4	28	—	—	42	—	—	—	—	.61	.12	.49	1.8
MO.5	19	5.7	4.3	64	35	10	.63N	.63N	.98	.81	.17	.63
MO.6	25	7.6	7.5	130	53	18	.63N	.63N	2.38	2.27	.11	.39
MO.7	18	4.8	4.0	63	37	10	.63N	.63N	.92	.68	.24	.88
MO.7 rep	18	5.1	3.6	57	37	9.7	.63N	.63N	.84	.60	.24	.87
MO.7 dup	17	4.8	3.7	56	37	8.5	.63N	.63N	.90	.67	.23	.86
MO.8	26	1.0	7.4	110	73	14	.63N	.63N	1.85	1.73	.12	.43
MO.9	27	13	7.9	120	86	13	.63N	.63N	1.90	1.81	.09	.35
MO.10	19	5.5	3.7	50	36	5.7	.63N	.63N	.78	.64	.14	.53
MO.11	19	6.9	4.7	70	54	8.8	.63N	.63N	1.19	1.02	.17	.62
MO.12	18	6.5	4.3	64	46	8	.63N	.63N	1.19	.97	.22	.81
Mississippi River												
MS.1	16	3.7	4.3	89	52	22	0.63N	0.63N	1.92	1.65	0.27	0.97
MS.1 rep	16	3.6	4.6	93	52	25	.63N	.63N	2.00	1.73	.27	.98
MS.1 dup	16	3.8	4.2	91	53	24	.63N	.63N	1.95	1.68	.27	.99
MS.2	22	7.0	6.4	100	62	18	.63N	.76	3.10	2.98	.12	.45
MS.3	16	3.0	3.5	67	38	17	.63N	.66	1.54	1.09	.45	1.6
MS.4	20	5.2	5.2	120	66	30	.63N	.63N	3.30	2.86	.44	1.6
MS.5	21	6.3	5.6	83	51	12	.63N	.63N	2.13	2.01	.12	.42
MS.6	21	5.9	4.3	65	39	7.1	.90	.76	1.29	1.26	.03	.10
MS.7	21	5.8	6.2	100	59	24	.63N	.70	2.39	2.08	.31	1.1
MS.7 rep	20	5.4	5.9	98	55	23	.63N	1.1	2.37	2.06	.31	1.1
MS.7 dup	20	5.1	5.7	99	53	25	.63N	.63N	2.54	2.23	.31	1.1
MS.8	18	4.5	4.3	50	29	4.7	.63N	1.8	1.34	1.23	.11	.42
MS.9	20	7.2	4.3	72	54	8.7	.63N	1.4	1.07	.84	.23	.86
MS.10	15	3.0	2.5	44	32	4.4	.63N	2.4	1.19	1.18	.01	.05
MS.11	21	7.0	5.8	88	52	16	.63N	.63N	1.52	1.31	.21	.79
MS.12	23	8.0	6.8	110	62	19	.63N	.80	1.96	1.76	.20	.72
MS.13	17	3.7	3.5	48	28	7.1	.63N	.63N	.70	.46	.24	.89
MS.13 rep	19	3.9	3.7	49	31	8.6	.63N	.63N	.64	.38	.26	.94
MS.13 dup	19	3.9	3.3	49	29	7.7	.63N	4.5	.70	.44	.26	.94

[1]Layer 1, 0 to 3 centimeters.

[2]Layer 2, 3 to 15 centimeters.

[3]Coulometrically titrated to compute carbonate carbon.

EXPLANATION OF TABLE 8

ABBREVIATIONS AND REPORTING UNITS FOR CHEMICAL CONSTITUENTS AND NOTATIONS USED IN TABLE

wt. %	Percent by weight
mg/kg	Milligrams per kilogram
4N HCl	4 normal hydrochloric acid (conditionally available fraction)
0.1N HCl	0.1 normal hydrochloric acid (available fraction)
AAS	Atomic absorption spectrometry
CVAAS	Cold-vapor atomic absorption spectrometry
DN	Delayed neutron activation
MO	Missouri
MS	Mississippi
N	Not detected at the lower reporting limit
L	Detected at less than the lower reporting limit but not quantified
n.a.	Not applicable

All elements analyzed by inductively coupled plasma-atomic emission spectrometry except where noted. Analyzed at the U.S. Geological Survey laboratory, Lakewood, Colorado.

Table 8. Descriptive statistics of selected element and carbon concentrations in less than 0.062-millimeter size fraction of postflood sediment samples in the Missouri and the Mississippi River flood plains

Descriptive statistics	Aluminum			Calcium			Iron			Magnesium		
	Total (wt. %)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	Total (wt. %)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	Total (wt. %)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	Total (wt. %)	4N HCl (mg/kg)	0.1N HCl (mg/kg)
Missouri River flood-plain samples (12)												
Minimum	4.9	3,900	350	1.0	760	5,700	1.6	7,800	590	0.51	1,500	1,200
Maximum	7.9	19,000	1,400	1.5	1,400	10,000	4.3	29,000	1,900	1.0	4,200	2,100
Mean	6.1	8,400	730	1.2	1,000	8,200	2.7	14,000	1,000	.74	2,500	1,600
Standard deviation	1.1	4,700	420	.14	180	1,200	1.0	6,300	470	.17	770	270
Number of samples above detection limit	12	12	12	12	12	12	12	12	12	12	12	12
Mississippi River flood-plain samples (13)												
Minimum	4.6	3,800	320	0.7	290	2,300	1.5	7,000	430	0.34	960	340
Maximum	6.7	10,000	980	2.0	1,300	15,000	3.7	20,000	2,200	.88	2,900	2,900
Mean	5.6	7,100	610	1.2	860	8,100	2.6	13,000	1,300	.64	2,000	1,600
Standard deviation	.74	2,200	220	.37	330	3,300	.75	4,400	660	.17	640	750
Number of samples above detection limit	13	13	13	13	13	13	13	13	13	13	13	13
Missouri and Mississippi River flood-plain samples (25)												
Minimum	4.6	3,800	320	0.7	290	2,300	1.5	7,000	430	0.34	960	340
Maximum	7.9	19,000	1,400	2.0	1,400	15,000	4.3	29,000	2,200	1.0	4,200	2,900
Mean	5.8	7,800	670	1.2	940	8,200	2.6	14,000	1,200	.69	2,200	1,600
Standard deviation	.95	3,600	330	.28	270	2,400	.86	5,300	580	.18	740	560
Number of samples above detection limit	25	25	25	25	25	25	25	25	25	25	25	25

Table 8. Descriptive statistics of selected element and carbon concentrations in less than 0.062-millimeter size fraction of postflood sediment samples in the Missouri and the Mississippi River flood plains—Continued

Descriptive statistics	Phosphorus			Potassium			Sodium			Sulfur, total, com-bustion (wt. %)	Titanium		
	Total (wt. %)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	Total (wt. %)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	Total (wt. %)	4N HCl (mg/kg)	0.1N HCl (mg/kg)		Total (wt. %)	4N HCl (mg/kg)	0.1N HCl (mg/kg)
Missouri River flood-plain samples (12)													
Minimum	0.06	150	95	1.7	290	7.5N	0.47	30	25	0.05L	0.23	61	0.71
Maximum	.11	500	280	2.0	2,400	460	1.1	58	73	.06	.32	170	2.5
Mean	.08	290	210	1.8	1,000	n.a.	.89	42	43	n.a.	.27	100	1.4
Standard deviation	.018	130	73	.09	630	n.a.	.24	8.8	16	n.a.	.032	34	.62
Number of samples above detection limit	12	12	12	12	12	4	12	12	12	2	12	12	12
Mississippi River flood-plain samples (13)													
Minimum	0.04	150	60	1.6	43	7.5N	0.66	9.5	6.7	0.05L	0.25	57	1.2
Maximum	.14	750	290	1.9	1,100	33	1.1	49	44	.08	.32	190	6.5
Mean	.087	400	160	1.7	510	n.a.	.84	24	26	n.a.	.27	120	3.1
Standard deviation	.029	190	65	.10	360	n.a.	.14	11	10	n.a.	.022	41	1.7
Number of samples above detection limit	13	13	13	13	13	1	13	13	13	6	13	13	13
Missouri and Mississippi River flood-plain samples (25)													
Minimum	0.04	150	60	1.6	43	7.5N	0.47	9.5	6.7	0.05L	0.23	57	0.71
Maximum	.14	750	290	2.0	2,400	460	1.1	58	73	.08	.32	190	6.5
Mean	.085	340	180	1.8	790	n.a.	.86	33	34	n.a.	.27	110	2.3
Standard deviation	.024	170	72	.10	560	n.a.	.19	13	16	n.a.	.027	38	1.5
Number of samples above detection limit	25	25	25	25	25	5	25	25	25	8	25	25	25

Table 8. Descriptive statistics of selected element and carbon concentrations in less than 0.062-millimeter size fraction of postflood sediment samples in the Missouri and the Mississippi River flood plains—Continued

Descriptive statistics	Antimony			Arsenic						Barium		
	Total, AAS (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	Total (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	Total, AAS (mg/kg)	4N HCl, AAS (mg/kg)	0.1N HCl, AAS (mg/kg)	Total (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)
Missouri River flood-plain samples (12)												
Minimum	0.5	6.3N	6.3N	10L	3.8N	3.8N	6.4	2.9	0.9	670	53	62
Maximum	1.4	6.3N	6.3N	22	6.9	3.8	19	11	2.0	790	120	190
Mean	.9	n.a.	n.a.	n.a.	n.a.	n.a.	11	5.6	1.6	740	82	110
Standard deviation	.27	n.a.	n.a.	n.a.	n.a.	n.a.	4.4	2.7	.34	35	20	49
Number of samples above detection limit	12	0	0	6	4	2	12	12	12	12	12	12
Mississippi River flood-plain samples (13)												
Minimum	0.4	6.3N	6.3N	10L	3.8N	3.8N	4.3	1.6	0.3	550	24	51
Maximum	1.3	6.3N	6.3N	15	4.8	4.8	14	6.3	1.7	770	91	140
Mean	.84	n.a.	n.a.	n.a.	n.a.	n.a.	7.7	3.1	.91	650	55	97
Standard deviation	.26	n.a.	n.a.	n.a.	n.a.	n.a.	3.0	1.5	.41	68	23	30
Number of samples above detection limit	13	0	0	5	1	2	13	13	13	13	13	13
Missouri and Mississippi River flood-plain samples (25)												
Minimum	0.4	6.3N	6.3N	10L	3.8N	3.8N	4.3	1.6	0.3	550	24	51
Maximum	1.4	6.3N	6.3N	22	6.9	4.8	19	11	2.0	790	120	190
Mean	.8	n.a.	n.a.	n.a.	n.a.	n.a.	9.3	4.4	1.2	690	69	100
Standard deviation	.26	n.a.	n.a.	n.a.	n.a.	n.a.	4.1	2.5	.52	74	25	40
Number of samples above detection limit	25	0	0	11	5	4	25	25	25	25	25	25

Table 8. Descriptive statistics of selected element and carbon concentrations in less than 0.062-millimeter size fraction of postflood sediment samples in the Missouri and the Mississippi River flood plains—Continued

Descriptive statistics	Beryllium Total (mg/kg)	Beryllium 4N HCl (mg/kg)	Beryllium 0.1N HCl (mg/kg)	Bismuth Total (mg/kg)	Bismuth 4N HCl (mg/kg)	Bismuth 0.1N HCl (mg/kg)	Cadmium Total (mg/kg)	Cadmium 4N HCl (mg/kg)	Cadmium 0.1N HCl (mg/kg)	Cadmium Total, AAS (mg/kg)	Cerium Total (mg/kg)	Cerium 4N HCl (mg/kg)	Cerium 0.1N HCl (mg/kg)
Missouri River flood-plain samples (12)													
Minimum	1	0.048	0.15	10L	7.5N	7.5N	2.0L	0.5N	0.5N	0.22	55	5.0N	5.0N
Maximum	2	.25	.61	10L	7.5N	7.5N	2.0L	.5N	.5N	.56	79	5.4	10
Mean	1.3	.13	.33	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	.40	66	n.a.	n.a.
Standard deviation	.5	.072	.17	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	.12	7.8	n.a.	n.a.
Number of samples above detection limit	12	12	12	0	0	0	0	0	0	12	12	2	4
Mississippi River flood-plain samples (13)													
Minimum	1.0L	0.025N	0.16	10L	7.5N	7.5N	2.0L	0.5N	0.5N	0.18	54	5.0N	5.0N
Maximum	2	.14	.46	10L	7.5N	7.5N	2.0L	.5N	.55	.66	73	6.7	12
Mean	1	.065	.31	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	.39	64	n.a.	n.a.
Standard deviation	.4	.041	.10	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	.14	6.2	n.a.	n.a.
Number of samples above detection limit	11	10	13	0	0	0	0	0	1	13	13	2	6
Missouri and Mississippi River flood-plain samples (25)													
Minimum	1.0L	0.025N	0.15	10L	7.5N	7.5N	2.0L	0.5N	0.5N	0.18	54	5.0N	5.0N
Maximum	2	.25	.61	10L	7.5N	7.5N	2.0L	.5N	.55	.66	79	6.7	12
Mean	1.2	.099	.32	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	.39	65	n.a.	n.a.
Standard deviation	.45	.065	.13	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	.13	6.9	n.a.	n.a.
Number of samples above detection limit	23	22	25	0	0	0	0	0	1	25	25	4	10

Table 8. Descriptive statistics of selected element and carbon concentrations in less than 0.062-millimeter size fraction of postflood sediment samples in the Missouri and the Mississippi River flood plains—Continued

Descriptive statistics	Chromium			Cobalt			Copper			Europium, total (mg/kg)	Gallium, total (mg/kg)	Gold, total (mg/kg)	Holmium, total (mg/kg)
	Total (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	Total (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	Total (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)				
Missouri River flood-plain samples (12)													
Minimum	35	4.1	1.5N	8	1.3	1.3N	10	2.5	2.7	2.0L	10	8.0L	4.0L
Maximum	82	13	1.5N	17	3.9	3.2	31	13	10	2.0L	21	8.0L	4.0L
Mean	54	7.2	n.a.	12	2.6	1.8	19	6.3	5.8	n.a.	14	n.a.	n.a.
Standard deviation	17	2.9	n.a.	3.4	.83	.68	7.8	3.2	2.6	n.a.	3.6	n.a.	n.a.
Number of samples above detection limit	12	12	0	12	12	11	12	12	12	0	12	0	0
Mississippi River flood-plain samples (13)													
Minimum	38	4.2	1.5N	6	1.3N	1.3N	12	2.4	2.6	2.0L	9	8.0L	4.0L
Maximum	74	11	1.6	15	3.3	3.4	26	7.7	9.2	2.0L	19	8.0L	4.0L
Mean	53	8.0	n.a.	10	2.1	1.8	19	5.2	6.0	n.a.	13	n.a.	n.a.
Standard deviation	11	2.2	n.a.	3.0	.72	.88	4.4	1.8	2.0	n.a.	2.7	n.a.	n.a.
Number of samples above detection limit	13	13	2	13	12	10	13	13	13	0	13	0	0
Missouri and Mississippi River flood-plain samples (25)													
Minimum	35	4.1	1.5N	6	1.3N	1.3N	10	2.4	2.6	2.0L	9	8.0L	4.0L
Maximum	82	13	1.6	17	3.9	3.4	31	13	10	2.0L	21	8.0L	4.0L
Mean	54	7.5	n.a.	11	2.4	1.8	19	5.8	5.9	n.a.	14	n.a.	n.a.
Standard deviation	14	2.5	n.a.	3.2	.79	.78	6.2	2.6	2.2	n.a.	3.2	n.a.	n.a.
Number of samples above detection limit	25	25	2	25	24	21	25	25	25	0	25	0	0

Table 8. Descriptive statistics of selected element and carbon concentrations in less than 0.062-millimeter size fraction of postflood sediment samples in the Missouri and the Mississippi River flood plains—Continued

Descriptive statistics	Lanthanum			Lead			Lithium			Manganese		
	Total (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	Total (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	Total (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	Total (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)
Missouri River flood-plain samples (12)												
Minimum	32	7.4	2.6	15	6.3N	6.3N	19	4.4	0.38N	430	84	180
Maximum	45	18	6.6	24	12	10	46	14	.38N	1,300	490	720
Mean	38	11	4.2	18	7.9	6.6	30	7.4	n.a.	810	270	400
Standard deviation	4.1	3.3	1.5	3.6	3.5	2.7	9.9	2.9	n.a.	340	150	180
Number of samples above detection limit	12	12	12	12	9	8	12	12	0	12	12	12
Mississippi River flood-plain samples (13)												
Minimum	30	5.6	2.8	16	6.3N	6.3N	17	3.4	0.38N	570	110	140
Maximum	41	12	6.7	25	17	14	40	9	.38N	1,400	420	870
Mean	36	9.0	4.6	20	9.9	n.a.	26	5.7	n.a.	930	280	460
Standard deviation	3.3	2.3	1.3	3.0	4.9	n.a.	6.8	2.1	n.a.	280	88	250
Number of samples above detection limit	13	13	13	13	10	5	13	13	0	13	13	13
Missouri and Mississippi River flood-plain samples (25)												
Minimum	30	5.6	2.6	15	6.3N	6.3N	17	3.4	0.38N	430	84	140
Maximum	45	18	6.7	25	17	14	46	14	.38N	1,400	490	870
Mean	37	10	4.4	20	8.9	n.a.	28	6.6	n.a.	870	270	430
Standard deviation	3.7	2.9	1.4	3.4	4.3	n.a.	8.5	2.6	n.a.	310	120	220
Number of samples above detection limit	25	25	25	25	19	13	25	25	0	25	25	25

Table 8. Descriptive statistics of selected element and carbon concentrations in less than 0.062-millimeter size fraction of postflood sediment samples in the Missouri and the Mississippi River flood plains—Continued

Descriptive statistics	Mercury (CVAAS)		Molybdenum			Neodymium, total (mg/kg)	Nickel			Niobium, total (mg/kg)	Scandium, total (mg/kg)
	Total (mg/kg)	0.1N HCl (mg/kg)	Total (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)		Total (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)		
Missouri River flood-plain samples (12)											
Minimum	0.02L	0.006L	2.0L	1.0N	1.0N	25	16	5.4	3.0	10	5
Maximum	.03	.01	2.0L	1.5	1.0N	37	42	16	7.3	15	13
Mean	n.a.	.008	n.a.	n.a.	n.a.	30	26	9.4	4.7	11	8.3
Standard deviation	n.a.	.007	n.a.	n.a.	n.a.	3.9	9.1	3.3	1.5	1.6	2.9
Number of samples above detection limit	3	7	0	2	0	12	12	12	12	12	12
Mississippi River flood-plain samples (13)											
Minimum	0.02L	0.006L	2.0L	1.0N	1.0N	24	15	4.7	1.3N	8	6
Maximum	.04	.008	2.0L	1.7	1.0N	34	36	12	5.6	14	11
Mean	n.a.	n.a.	n.a.	.95	n.a.	30	24	8.1	2.6	10	8.1
Standard deviation	n.a.	n.a.	n.a.	.47	n.a.	2.7	6.3	2.5	1.5	1.6	1.6
Number of samples above detection limit	6	5	0	7	0	13	13	13	11	13	13
Missouri and Mississippi River flood-plain samples (25)											
Minimum	0.02L	0.006L	2.0L	1.0N	1.0N	24	15	4.7	1.3N	8	5
Maximum	.04	.01	2.0L	1.7	1.0N	37	42	16	7.3	15	13
Mean	n.a.	n.a.	n.a.	n.a.	n.a.	30	25	8.8	3.6	11	8.2
Standard deviation	n.a.	n.a.	n.a.	n.a.	n.a.	3.3	7.7	2.9	1.8	1.6	2.3
Number of samples above detection limit	9	12	0	9	0	25	25	25	23	25	25

Table 8. Descriptive statistics of selected element and carbon concentrations in less than 0.062-millimeter size fraction of postflood sediment samples in the Missouri and the Mississippi River flood plains—Continued

Descriptive statistics	Selenium (AAS)			Silver				Strontium			Tantalum, total (mg/kg)	Thorium	
	Total (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	Total (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	Total, AAS (mg/kg)	Total (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)		Total (mg/kg)	Total, DN (mg/kg)
Missouri River flood-plain samples (12)													
Minimum	0.2	0.05L	0.05L	2.0L	0.5N	0.5N	0.14	140	8.1	17	40L	8	7.3
Maximum	1.0	.06	.05L	2.0L	.5N	.5N	.20	190	17	46	40L	13	14
Mean	.6	n.a.	n.a.	n.a.	n.a.	n.a.	.16	160	12	27	n.a.	10	9.9
Standard deviation	.3	n.a.	n.a.	n.a.	n.a.	n.a.	.015	19	2.7	9.1	n.a.	1.9	2.2
Number of samples above detection limit	12	1	0	0	0	0	12	12	12	12	0	12	12
Mississippi River flood-plain samples (13)													
Minimum	0.2	0.05L	0.05L	2.0L	0.5N	0.5N	0.13	110	3.4	7.5	40L	8	6.9
Maximum	.8	.05L	.05L	2.0L	.5N	.5N	.23	180	14	24	40L	12	13
Mean	.5	n.a.	n.a.	n.a.	n.a.	n.a.	.17	140	6.8	14	n.a.	9.9	10
Standard deviation	.2	n.a.	n.a.	n.a.	n.a.	n.a.	.033	22	3.2	5.8	n.a.	1.2	1.8
Number of samples above detection limit	13	0	0	0	0	0	13	13	13	13	0	13	13
Missouri and Mississippi River flood-plain samples (25)													
Minimum	0.2	0.05L	0.05L	2.0L	0.5N	0.5N	0.13	110	3.4	7.5	40L	8	6.9
Maximum	1.0	.06	.05L	2.0L	.5N	.5N	.23	190	17	46	40L	13	14
Mean	.5	n.a.	n.a.	n.a.	n.a.	n.a.	.17	150	9.3	20	n.a.	10	10
Standard deviation	.2	n.a.	n.a.	n.a.	n.a.	n.a.	.026	25	3.8	9.8	n.a.	1.6	1.9
Number of samples above detection limit	25	1	0	0	0	0	25	25	25	25	0	25	25

Table 8. Descriptive statistics of selected element and carbon concentrations in less than 0.062-millimeter size fraction of postflood sediment samples in the Missouri and the Mississippi River flood plains—Continued

Descriptive statistics	Tin			Tungsten		Uranium		Vanadium			Ytterbium, total (mg/kg)
	Total (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	Total (mg/kg)	Total, DN (mg/kg)	Total (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	
Missouri River flood-plain samples (12)											
Minimum	5.0L	10N	10N	7.5N	7.5N	100L	2.8	56	11	3.0	2
Maximum	5.0L	10N	10N	7.5N	7.5N	100L	3.7	140	38	11	3
Mean	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	3.4	91	20	6.0	2.1
Standard deviation	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	.27	31	8.6	2.8	.29
Number of samples above detection limit	0	0	0	0	0	0	12	12	12	12	12
Mississippi River flood-plain samples (13)											
Minimum	5.0L	10N	10N	7.5N	7.5N	100L	2.6	54	11	2.2	1
Maximum	5.0L	10N	10N	7.5N	7.5N	100L	3.7	110	23	9.5	2
Mean	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	3.1	77	16	5.9	1.8
Standard deviation	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	.29	19	4.5	2.3	.37
Number of samples above detection limit	0	0	0	0	0	0	13	13	13	13	13
Missouri and Mississippi River flood-plain samples (25)											
Minimum	5.0L	10N	10N	7.5N	7.5N	100L	2.6	54	11	2.2	1
Maximum	5.0L	10N	10N	7.5N	7.5N	100L	3.7	140	38	11	3
Mean	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	3.2	83	18	6.0	2.0
Standard deviation	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	.30	26	6.8	2.5	.35
Number of samples above detection limit	0	0	0	0	0	0	25	25	25	25	25

Table 8. Descriptive statistics of selected element and carbon concentrations in less than 0.062-millimeter size fraction of postflood sediment samples in the Missouri and the Mississippi River flood plains—Continued

Descriptive statistics	Yttrium			Zinc			Zirconium		Carbon (wt. %)			
	Total (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	Total (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	4N HCl (mg/kg)	0.1N HCl (mg/kg)	Total, combus-tion	Organic, diff-erence	Car-bonate, titration	[1]CO_2
Missouri River flood-plain samples (12)												
Minimum	17	3.8	3.3	44	28	5.7	0.63N	0.63N	0.56	0.35	0.09	0.35
Maximum	27	13	7.9	130	86	18	.63N	.63N	2.38	2.27	.33	1.2
Mean	21	6.9	5.2	77	49	10	n.a.	n.a.	1.28	1.09	.19	.69
Standard deviation	3.5	2.6	1.7	29	18	3.8	n.a.	n.a.	.54	.59	.073	.27
Number of samples above detection limit	12	12	12	12	12	12	0	0	12	12	12	12
Mississippi River flood-plain samples (13)												
Minimum	15	3.0	2.5	44	28	4.4	0.63N	0.63N	0.70	0.46	0.01	0.05
Maximum	23	8.0	6.8	120	66	30	.9	2.4	3.30	3.00	.45	1.64
Mean	19	5.4	4.8	80	48	15	n.a.	.84	1.8	1.59	.21	.77
Standard deviation	2.6	1.7	1.3	24	13	8.0	n.a.	.65	.77	.74	.14	.50
Number of samples above detection limit	13	13	13	13	13	13	1	8	13	13	13	13
Missouri and Mississippi River flood-plain samples (25)												
Minimum	15	3.0	2.5	44	28	4.4	0.63N	0.63N	0.56	0.35	0.01	0.05
Maximum	27	13	7.9	130	86	30	.9	2.4	3.3	2.98	.45	1.64
Mean	20	6.2	5.0	78	48	12	n.a.	n.a.	1.6	1.35	.20	.73
Standard deviation	3.1	2.3	1.5	26	15	6.6	n.a.	n.a.	.71	.70	.11	.40
Number of samples above detection limit	25	25	25	25	25	25	1	8	25	25	25	25

[1]Coulometrically titrated to compute carbonate carbon.

EXPLANATION OF TABLE 11

ABBREVIATIONS AND REPORTING UNITS FOR CHEMICAL CONSTITUENTS AND NOTATIONS USED IN TABLE

MO	Missouri
SRM	Standard reference material
dup	Duplicate sample split in laboratory
rep	Replicate sample
RS	Reagent spiked sample, in percent recovery
MC	Measured concentration
EC	Expected concentration
STD	Standard deviation
<	Less than
—	No data

Detections shown in bold. Analyzed at the U.S. Geological Survey laboratory, Arvada, Colorado.

Table 11. Concentrations of semivolatile organic compounds in the less than 2-millimeter size fraction of postflood sediment samples in the Missouri River flood plain, sample set reagent spike, standard reference material, and surrogate samples

Compound	Site number (fig. 1)												SRM 1941		
			MO.4				MO.7								
				Layer 2											
	MO.1	MO.2	Layer 1	Sample	Dup	MO.5	Sample	Rep	MO.8	MO.10	MO.11	RS	MC	[1]EC	[1]STD
	Concentration, in micrograms per kilogram														
Acenaphthene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	62	<10	52	2
Acenaphthylene	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	58	**260**	115	10
Acridine	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	69	<10	—	—
Anthracene	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	70	**370**	202	42
Anthraquinone	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	80	**390**	—	—
Azo-benzene	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	66	<20	—	—
Benzo[*a*]anthracene	<10	<10	<10	<10	<10	<10	<10	**49**	<10	<10	<10	70	**580**	[2]550	79
Benzo[*b*]fluoranthene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	68	**720**	[2]780	190
Benzo[*k*]fluoranthene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	74	**520**	[2]444	49
Benzo[*g,h,i*]perylene	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	66	**360**	[2]516	83
Benzo[*a*]pyrene	**110**	**120**	**100**	<10	<10	<10	<10	<10	<10	**100**	<10	68	**780**	[2]670	130
Benzo[*c*]quinoline	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	75	<10	—	—
2,2'-Biquinoline	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	54	<20	—	—
4-Bromophenyl phenyl ether	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	68	<10	—	—
Butylbenzylphthalate	<10	<10	<10	<10	<10	<10	**78**	<10	<10	<10	<10	63	<10	—	—
C_8-Alkyl-phenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	56	<10	—	—
9H-Carbazole	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	75	<10	—	—
bis(2-Chloroethoxy)methane	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	52	<10	—	—
bis(2-Chloroethyl)ether	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	55	<10	—	—
bis(2-Chloroisopropyl)ether	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	51	<20	—	—
4-Chloro-3-methylphenol	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	47	<30	—	—
2-Chloronaphthalene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	60	<10	—	—
2-Chlorophenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	55	<10	—	—
4-Chlorophenyl phenyl ether	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	67	<10	—	—
Chrysene	<10	<10	<10	<10	<10	<10	**53**	**50**	<10	<10	<10	72	**660**	449	—
p-Cresol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	52	<10	—	—
Dibenzo[*a,h*]anthracene	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	107	<20	—	—
Dibenzothiphene	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	69	**190**	—	—
Di-*n*-butylphthalate	**54**	**53**	**59**	<10	<10	**60**	**62**	**60**	**60**	<10	<10	74	**380**	—	—
1,2-Dichlorobenzene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	61	<10	—	—

Table 11. Concentrations of semivolatile organic compounds in the less than 2-millimeter size fraction of postflood sediment samples in the Missouri River flood plain, sample set reagent spike, standard reference material, and surrogate samples—Continued

Compound	Site number (fig. 1)												SRM 1941		
			MO.4				MO.7								
				Layer 2											
	MO.1	MO.2	Layer 1	Sample	Dup	MO.5	Sample	Rep	MO.8	MO.10	MO.11	RS	MC	[1]EC	[1]STD
Concentration, in micrograms per kilogram—Continued															
1,3-Dichlorobenzene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	58	<10	—	—
1,4-Dichlorobenzene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	49	<10	—	—
2,4-Dichlorophenol	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	56	<20	—	—
Diethyl phthalate	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	70	<10	—	—
1,2-Dimethylnaphthalene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	61	**110**	—	—
1,6-Dimethylnaphthalene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	61	**280**	—	—
2,6-Dimethylnaphthalene	<10	<10	<10	<10	<10	<10	<10	**28**	<10	<10	**22**	60	**240**	198	23
3,5-Dimethylphenol	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	56	<20	—	—
Dimethyl phthalate	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	66	<10	—	—
4,6-Dinitro-2-methylphenol	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	0	<200	—	—
2,4-Dinitrophenol	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	0	<300	—	—
2,4-Dinitrotoluene	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	59	<20	—	—
2,6-Dinitrotoluene	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	58	<50	—	—
di-*n*-Octyl phthalate	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	65	<20	—	—
bis(2-Ethylhexyl)phthalate	**60**	**79**	**94**	<10	<10	**96**	**91**	**81**	**66**	<10	**79**	64	**1,900**	—	—
2-Ethylnapthalene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	58	**110**	—	—
Fluoranthene	**36**	**39**	**47**	<5	<5	**44**	**58**	**50**	**38**	<5	**42**	77	**950**	[2]1,220	240
9H-Fluorene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	64	**210**	104	5
Hexachlorobenzene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	68	<10	—	—
Hexachlorobutadiene	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	61	<20	—	—
Hexachlorocyclopentadiene	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	34	<20	—	—
Hexachloroethane	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	51	<20	—	—
Indeno[*1,2,3-cd*]pyrene	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	52	560	[2]569	40
Isophorone	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	76	<10	—	—
Isoquinoline	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	54	<10	—	—
1-Methyl-9H-fluorene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	68	<10	—	—
2-Methylanthracene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	72	**320**	66	7
4,5-Methylenephenanthrene	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	73	**260**	—	—
1-Methylphenanthrene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	73	**260**	109	6
1-Methylpyrene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	74	**340**	—	—

Table 11. Concentrations of semivolatile organic compounds in the less than 2-millimeter size fraction of postflood sediment samples in the Missouri River flood plain, sample set reagent spike, standard reference material, and surrogate samples—Continued

Compound	Site number (fig. 1)												SRM 1941		
			MO.4				MO.7								
				Layer 2											
	MO.1	MO.2	Layer 1	Sample	Dup	MO.5	Sample	Rep	MO.8	MO.10	MO.11	RS	MC	[1]EC	[1]STD
Concentration, in micrograms per kilogram—Continued															
Naphthalene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	58	**780**	1,322	14
Nitrobenzene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	52	<10	—	—
2-Nitrophenol	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	52	<100	—	—
4-Nitrophenol	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	0	<40	—	—
n-Nitroso di-*n*-propylamine	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	53	<10	—	—
n-Nitrosodiphenylamine	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	68	<10	—	—
Pentachloroanisol	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	73	<20	—	—
Pentachloronitrobenzene	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	88	<30	—	—
Pentachlorophenol	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	0	<100	—	—
Phenanthrene	<5	<5	**31**	<5	<5	<5	**43**	**36**	<5	<5	<5	71	**530**	[2]577	59
Phenanthridine	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	74	<10	—	—
Phenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	55	**200**	—	—
Pyrene	**46**	**49**	**56**	<5	<5	**53**	**63**	**57**	**44**	<5	**50**	76	**890**	[2]1,080	200
Quinoline	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	58	<10	—	—
2,3,5,6-Tetramethylphenol	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	56	<30	—	—
1,2,4-Trichlorobenzene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	60	<10	—	—
2,4,6-Trichlorophenol	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	15	<20	—	—
2,3,6-Trimethylnaphthalene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	62	**230**	—	—
2,4,6-Trimethylphenol	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	53	<30	—	—
Surrogate samples, in percent recovery															
Nitrobenzene-d5	33	55	20	29	39	48	54	40	60	14	73	31	32	—	—
2-Fluorobiphenyl	49	62	52	57	53	68	58	55	64	68	61	49	55	—	—
Terphenyl-d14	52	69	65	62	53	77	60	61	66	68	64	52	59	—	—
[3]Benzo-E-pyrene-d12	87	97	75	70	64	114	95	92	108	87	102	74	71	—	—

[1]National Institute of Standards and Technology (1990).

[2]Certified concentrations.

[3]This surrogate compound is added just before the gel permeation chromatography (GPC) step to monitor for GPC-specific losses (E.T. Furlong, U.S. Geological Survey, written commun., 1993).

EXPLANATION OF TABLE 12

ABBREVIATIONS AND REPORTING UNITS FOR CHEMICAL CONSTITUENTS AND NOTATIONS USED IN TABLE

MS	Mississippi
SRM	Standard reference material
rep	Replicate sample
dup	Duplicate sample split in laboratory
RS	Reagent spike sample, in percent recovery
MC	Measured concentration
EC	Expected concentration
STD	Standard deviation
<	Less than
—	No data

Detections shown in bold. Analyzed at the U.S. Geological Survey laboratory, Arvada, Colorado.

Table 12. Concentrations of semivolatile organic compounds in the less than 2-millimeter size fraction of postflood sediment samples in the Mississippi River flood plain, sample set reagent spike, standard reference material, and surrogate samples

Compound	Site number (fig. 1) MS.1 Sample	MS.1 Rep	MS.3	MS.5	MS.7 Sample	MS.7 Rep	MS.9	MS.11 Sample	MS.11 Dup	MS.13 Sample	MS.13 Rep	RS	SRM MC	SRM [1]EC	SRM [1]STD
	Concentration, in micrograms per kilogram														
Acenaphthene	<10	<10	**34**	<10	<10	<10	<10	<10	<10	<10	<10	67	<10	52	2
Acenaphthylene	<5	<5	**48**	<5	<5	<5	<5	<5	<5	<5	<5	65	**280**	115	10
Acridine	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	65	<10	—	—
Anthracene	<5	<5	**74**	<5	<5	**46**	<5	<5	<5	<5	<5	69	**410**	[2]202	42
Anthraquinone	<20	<20	**89**	<20	<20	<20	<20	<20	<20	<20	<20	76	**400**	—	—
Azo-benzene	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	66	<20	—	—
Benzo[*a*]anthracene	<10	<10	**140**	<10	**67**	**63**	<10	**62**	**60**	<10	<10	78	**670**	[2]550	79
Benzo[*b*]fluoranthene	<10	<10	**130**	<10	**84**	<10	<10	**76**	**75**	<10	<10	56	**760**	[2]780	190
Benzo[*k*]fluoranthene	<10	<10	**100**	<10	**70**	<10	<10	**62**	**62**	<10	<10	58	**700**	[2]444	49
Benzo[*g,h,i*]perylene	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	20	**260**	[2]516	83
Benzo[*a*]pyrene	<10	<10	**160**	<10	<10	<10	<10	**100**	**100**	<10	<10	60	**860**	670	130
Benzo[*c*]quinoline	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	72	<10	—	—
2,2'-Biquinoline	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	63	<20	—	—
4-Bromophenyl phenyl ether	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	68	<10	—	—
Butylbenzylphthalate	<10	<10	<10	<10	<10	<10	**85**	**88**	<10	<10	<10	76	<10	—	—
C_8-Alkyl-phenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	72	<10	—	—
9H-Carbazole	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	72	**190**	—	—
bis(2-Chloroethoxy)methane	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	71	<10	—	—
bis(2-Chloroethyl)ether	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	66	<10	—	—
bis(2-Chloroisopropyl)ether	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	73	<20	—	—
4-Chloro-3-methylphenol	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	52	<30	—	—
2-Chloronaphthalene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	65	<10	—	—
2-Chlorophenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	62	<10	—	—
4-Chlorophenyl phenyl ether	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	67	<10	—	—
Chrysene	<10	<10	**180**	<10	**75**	**76**	<10	**69**	**68**	<10	**54**	80	**760**	449	—
p-Cresol	<10	<10	**64**	<10	<10	<10	<10	<10	<10	<10	<10	66	<10	—	—
Dibenzo[*a,h*]anthracene	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	29	<20	—	—
Dibenzothiphene	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	69	**210**	—	—
Di-*n*-butylphthalate	**60**	**71**	**87**	**65**	**77**	**69**	**65**	**72**	**64**	**68**	**77**	76	**460**	—	—
1,2-Dichlorobenzene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	74	<10	—	—

Table 12. Concentrations of semivolatile organic compounds in the less than 2-millimeter size fraction of postflood sediment samples in the Mississippi River flood plain, sample set reagent spike, standard reference material, and surrogate samples—Continued

Compound	Site number (fig. 1) MS.1 Sample	MS.1 Rep	MS.3	MS.5	MS.7 Sample	MS.7 Rep	MS.9	MS.11 Sample	MS.11 Dup	MS.13 Sample	MS.13 Rep	RS	SRM MC	SRM [1]EC	SRM [1]STD
Concentration, in micrograms per kilogram–Continued															
1,3-Dichlorobenzene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	66	<10	—	—
1,4-Dichlorobenzene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	68	<10	—	—
2,4-Dichlorophenol	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	62	<20	—	—
Diethyl phthalate	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	72	<10	—	—
1,2-Dimethylnaphthalene	<10	<10	**19**	<10	<10	<10	<10	<10	<10	<10	<10	66	**130**	—	—
1,6-Dimethylnaphthalene	<10	<10	**39**	<10	<10	<10	<10	<10	<10	<10	<10	66	**310**	—	—
2,6-Dimethylnaphthalene	**42**	**39**	**58**	**23**	**50**	**52**	**29**	**23**	**25**	**30**	**24**	66	**270**	198	23
3,5-Dimethylphenol	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	60	<20	—	—
Dimethyl phthalate	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	66	<10	—	—
4,6-Dinitro-2-methylphenol	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	<200	0	<200	—	—
2,4-Dinitrophenol	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	0	<300	—	—
2,4-Dinitrotoluene	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	62	<20	—	—
2,6-Dinitrotoluene	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	66	<50	—	—
Di-*n*-octyl phthalate	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	61	<20	—	—
bis(2-Ethylhexyl)phthalate	**75**	**86**	**220**	**70**	**91**	**91**	**80**	**130**	**140**	**74**	**73**	81	**2,300**	—	—
2-Ethylnaphthalene	<10	<10	**23**	<10	<10	<10	<10	<10	<10	<10	<10	65	**120**	—	—
Fluoranthene	**54**	**57**	**270**	**45**	**78**	**85**	**43**	**67**	**67**	**49**	**53**	73	**1,000**	[2]1,220	240
9H-Fluorene	<10	<10	**47**	<10	<10	**35**	<10	<10	<10	<10	<10	66	**240**	104	5
Hexachlorobenzene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	70	<10	—	—
Hexachlorobutadiene	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	65	<20	—	—
Hexachlorocyclopentadiene	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	63	<20	—	—
Hexachloroethane	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	64	<20	—	—
Indeno[*1,2,3-cd*]pyrene	<20	<20	**69**	<20	<20	<20	<20	<20	<20	<20	<20	28	**440**	[2]569	40
Isophorone	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	66	<10	—	—
Isoquinoline	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	59	<10	—	—
1-Methyl-9H-fluorene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	68	<10	—	—
2-Methylanthracene	<10	<10	**83**	<10	<10	<10	<10	<10	<10	<10	<10	70	**360**	66	7
4,5-Methylenephenanthrene	<20	<20	**60**	<20	**40**	**41**	<20	<20	<20	<20	<20	69	**270**	—	—
1-Methylphenanthrene	<10	<10	**53**	<10	<10	<10	<10	<10	<10	<10	<10	70	**280**	109	6
1-Methylpyrene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	72	**390**	—	—
Naphthalene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	66	**740**	1,322	14
Nitrobenzene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	68	<10	—	—
2-Nitrophenol	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	66	<100	—	—
4-Nitrophenol	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	0	<40	—	—
n-Nitrosodi-*n*-propylamine	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	64	<10	—	—

Table 12. Concentrations of semivolatile organic compounds in the less than 2-millimeter size fraction of postflood sediment samples in the Mississippi River flood plain, sample set reagent spike, standard reference material, and surrogate samples—Continued

Compound	Site number (fig. 1)												SRM		
	MS.1				MS.7			MS.11		MS.13					
	Sample	Rep	MS.3	MS.5	Sample	Rep	MS.9	Sample	Dup	Sample	Rep	RS	MC	[1]EC	[1]STD
Concentration, in micrograms per kilogram–Continued															
n-Nitrosodiphenylamine	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	73	<10	—	—
Pentachloroanisol	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	68	<20	—	—
Pentachloronitrobenzene	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	78	<30	—	—
Pentachlorophenol	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	0	<100	—	—
Phenanthrene	**32**	<5	**160**	<5	**46**	**46**	<5	**45**	**44**	<5	<5	70	**560**	[2]577	59
Phenanthridine	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	71	<10	—	—
Phenol	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	65	**210**	—	—
Pyrene	**57**	**60**	**220**	**52**	**84**	**87**	**55**	**75**	**71**	**58**	**61**	74	**960**	[2]1,080	200
Quinoline	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	67	<10	—	—
2,3,5,6-Tetramethylphenol	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	60	<30	—	—
1,2,4-Trichlorobenzene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	60	<10	—	—
2,4,6-Trichlorophenol	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	60	<20	—	—
2,3,6-Trimethylnaphthalene	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	16	<10	—	—
2,4,6-Trimethylphenol	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	63	<30	—	—
Surrogate samples, percent recovery															
Nitrobenzene-d5	9.3	14	23	19	9.9	16	12	20	25	22	10	45	30	—	—
2-Fluorobiphenyl	55	51	52	38	54	55	45	48	46	53	54	54	55	—	—
Terphenyl-d14	60	62	63	45	59	67	64	64	60	64	71	58	64	—	—
[3]Benzo-E-pyrene-d12	87	84	93	66	92	96	82	90	91	89	92	65	67	—	—

[1]National Institute of Standards and Technology (1990).

[2]Certified concentrations.

[3]This surrogate compound is added just before the gel permeation chromatography (GPC) step to monitor for GPC-specific losses (E.T. Furlong, U.S. Geological Survey, written commun., 1993).

Table 13. Tentatively identified compounds that were detected in the gas chromatography/mass spectrometry analysis

[MO, Missouri; MS, Mississippi; —, no established confidence level; $>C_{20}$, more than 20 carbon molecular chain; 1 (in "Confidence level" column), tentative identification based on an indication of a specific library spectrum; 2 (in "Confidence level" column), confident identification, which means good agreement was observed between the unknown compound and a specific library spectrum. Analyzed at the Enseco Analytical Laboratory, Arvada, Colorado]

Compound	Confidence level	Estimated concentration, in milligrams per kilogram
Missouri River		
MO.1		
Oxygenated hydrocarbon	—	0.15
Saturated hydrocarbon: $>C_{10}$-C_{20}	—	.16
—do—	—	.24
Saturated hydrocarbon: $>C_{20}$	—	.26
—do—	—	.31
Saturated hydrocarbon: $>C_{20}$	—	.38
—do—	—	.46
—do—	—	.54
—do—	—	.20
Siloxane	—	.29
Saturated hydrocarbon: $>C_{20}$	—	.25
—do—	—	.17
Siloxane	—	.40
MO.2		
Saturated hydrocarbon: $>C_{20}$	—	0.15
MO.3		
Saturated hydrocarbon: C_{10}-C_{20}	—	0.16
(4aS-cis)-2,3,4,4a,5,6,7,8-octahydro-1,1,4a,7-tetramethyl-1H-benzocyclo-hepten-7-ol	1	.15
Siloxane	—	.19
Saturated hydrocarbon: $>C_{20}$	—	.16
MO.4 (layer 1)		
No compounds detected		
MO.4 (layer 2)		
No compounds detected		
MO.5		
Saturated hydrocarbon: $>C_{20}$	—	0.14
Siloxane	—	.24
—do—	—	.62
—do—	—	2.1
—do—	—	4.1

Table 13. Tentatively identified compounds that were detected in the gas chromatography/mass spectrometry analysis—Continued

[MO, Missouri; MS, Mississippi; —, no established confidence level; >C_{20}, more than 20 carbon molecular chain; 1 (in "Confidence level" column), tentative identification based on an indication of a specific library spectrum; 2 (in "Confidence level" column), confident identification, which means good agreement was observed between the unknown compound and a specific library spectrum. Analyzed at the Enseco Analytical Laboratory, Arvada, Colorado]

Compound	Confidence level	Estimated concentration, in milligrams per kilogram
MO.6		
Saturated hydrocarbon: C_{10}-C_{20}	—	0.15
(Z)-14-Methyl-8-hexadecen-1-ol	1	.16
Cyclododecanol	1	.19
9-Hexadecenoic acid	—	.19
Hexadecanoic acid	—	.65
Siloxane	—	.37
—do—	—	.87
—do—	—	.89
4,8,1,2-Trimethyl-3,7, 11-tridecatrienenitrile	1	.18
Saturated hydrocarbon: >C_{20}	—	.23
Siloxane	—	9.1
2-Methyl-1-hexadecanol	1	.22
Saturated hydrocarbon: >C_{20}	—	.20
Hexadecyl ester tetradecanoic acid	1	.68
Saturated hydrocarbon: >C_{20}	—	.20
Siloxane	—	.20
Hexadecyl ester hexadecanoic acid	1	.65
MO.7		
Siloxane	—	0.51
3-Ethyl-5-(2-ethylbutyl)-octadecane	1	.14
Siloxane	—	.69
MO.7 (replicate)		
Unknown	—	0.39
Siloxane	—	.32
MO.8		
Saturated hydrocarbon: >C_{20}	—	0.26
—do—	—	.21
Hexadecanoic acid	1	.34
MO.9		
No compounds detected		
MO.10		
No compounds detected		

Table 13. Tentatively identified compounds that were detected in the gas chromatography/mass spectrometry analysis—Continued

[MO, Missouri; MS, Mississippi; —, no established confidence level; >C_{20}, more than 20 carbon molecular chain; 1 (in "Confidence level" column), tentative identification based on an indication of a specific library spectrum; 2 (in "Confidence level" column), confident identification, which means good agreement was observed between the unknown compound and a specific library spectrum. Analyzed at the Enseco Analytical Laboratory, Arvada, Colorado]

Compound	Confidence level	Estimated concentration, in milligrams per kilogram
MO.11		
Saturated hydrocarbon: >C_{20}	—	0.14
—do—	—	.14
11-Diene selina-4(14)	1	.22
MO.12		
No compounds detected		
Mississippi River		
MS.1		
2-Methyl-1,3-dioxolane-2-propanol	1	6.0
2,4-Dimethyl-2-pentanol	1	.21
Oxygenated hydrocarbon	—	.60
Saturated hydrocarbon: >C_{20}	—	.28
1,2-Dibromo-2-methyl-propane	1	.18
Saturated hydrocarbon: >C_{20}	—	.40
Oxygenated hydrocarbon	—	.32
Saturated hydrocarbon: >C_{20}	—	.82
—do—	—	.37
Oxygenated hydrocarbon	—	.24
MS.1 (replicate)		
2-Methyl-1,3-dioxolane-2-propanol	1	6.1
2,4-Dimethyl-2-pentanol	1	.14
Oxygenated hydrocarbon	—	.54
—do—	—	.26
—do—	—	.28
Oxygenated hydrocarbon	—	.20
Saturated hydrocarbon: >C_{20}	—	.34
Unsaturated hydrocarbon	—	.47
Saturated hydrocarbon: >C_{20}	—	.59
Oxygenated hydrocarbon	—	.26
Saturated hydrocarbon: >C_{20}	—	.35
MS.2		
2-Methyl-1,3-dioxolane-2-propanol	1	5.1
2,4-Dimethyl-2-pentanol	1	.17
Oxygenated hydrocarbon	—	.49
—do—	—	.44
Saturated hydrocarbon: >C_{20}	—	.16

Table 13. Tentatively identified compounds that were detected in the gas chromatography/mass spectrometry analysis—Continued

[MO, Missouri; MS, Mississippi; —, no established confidence level; $>C_{20}$, more than 20 carbon molecular chain; 1 (in "Confidence level" column), tentative identification based on an indication of a specific library spectrum; 2 (in "Confidence level" column), confident identification, which means good agreement was observed between the unknown compound and a specific library spectrum. Analyzed at the Enseco Analytical Laboratory, Arvada, Colorado]

Compound	Confidence level	Estimated concentration, in milligrams per kilogram
MS.2—Continued		
1,2-Dibromo-2-methyl-propane	1	0.16
Saturated hydrocarbon: $>C_{20}$	—	.14
—do—	—	.68
Oxygenated hydrocarbon	—	.26
Saturated hydrocarbon: $>C_{20}$	—	.22
Oxygenated hydrocarbon	—	.34
Saturated hydrocarbon: $>C_{20}$	—	1.3
Oxygenated hydrocarbon	—	.83
Saturated hydrocarbon: $>C_{20}$	—	.86
Oxygenated hydrocarbon	—	.64
Unsaturated hydrocarbon	—	.88
Oxygenated hydrocarbon	—	.85
—do—	—	.71
MS.3		
2-Methyl-1,3-dioxolane-2-propanol	1	5.1
Oxygenated hydrocarbon	—	.58
—do—	—	.69
Saturated hydrocarbon: $>C_{20}$	—	.84
—do—	—	1.1
Unsaturated hydrocarbon	—	.56
Saturated hydrocarbon: $>C_{20}$	—	1.5
Unsaturated hydrocarbon	—	1.4
Saturated hydrocarbon: $>C_{20}$	—	1.1
Oxygenated hydrocarbon	—	.34
Oxygenated hydrocarbon	—	.34
—do—	—	.43
—do—	—	.34
—do—	—	.40
—do—	—	.49
Saturated hydrocarbon: $>C_{20}$	—	.85
Oxygenated hydrocarbon	—	.73
Unsaturated hydrocarbon	—	.39
Oxygenated hydrocarbon	—	1.3

Table 13. Tentatively identified compounds that were detected in the gas chromatography/mass spectrometry analysis—Continued

[MO, Missouri; MS, Mississippi; —, no established confidence level; $>C_{20}$, more than 20 carbon molecular chain; 1 (in "Confidence level" column), tentative identification based on an indication of a specific library spectrum; 2 (in "Confidence level" column), confident identification, which means good agreement was observed between the unknown compound and a specific library spectrum. Analyzed at the Enseco Analytical Laboratory, Arvada, Colorado]

Compound	Confidence level	Estimated concentration, in milligrams per kilogram
MS.4		
Oxygenated hydrocarbon	—	1.2
—do—	—	.61
—do—	—	.18
—do—	—	1.4
Saturated hydrocarbon: $>C_{20}$	—	.49
Saturated hydrocarbon: $>C_{20}$	—	.86
—do—	—	.68
—do—	—	1.7
Unsaturated hydrocarbon	—	.58
Oxygenated hydrocarbon	—	.57
Saturated hydrocarbon: $>C_{20}$	—	1.1
Oxygenated hydrocarbon	—	.53
—do—	—	.70
—do—	—	1.1
—do—	—	.40
Oxygenated hydrocarbon	—	1.1
—do—	—	1.2
—do—	—	.38
—do—	—	1.5
—do—	—	.40
MS.5		
2-Methyl-1,3-dioxolane-2-propanol	1	5.0
Oxygenated hydrocarbon	—	1.3
—do—	—	.64
—do—	—	1.6
Saturated hydrocarbon: $>C_{20}$	—	.52
Diisooctyl ester-1,2-benzenedicarboxlic acid	1	.41
Saturated hydrocarbon: $>C_{20}$	—	.41
—do—	—	.75
Oxygenated hydrocarbon	—	.46
Saturated hydrocarbon: $>C_{20}$	—	.56
Unsaturated hydrocarbon	—	1.8
Saturated hydrocarbon: $>C_{20}$	—	1.1
Saturated hydrocarbon: $>C_{20}$	—	.82
Oxygenated hydrocarbon	—	.75
—do—	—	.53
Saturated hydrocarbon: $>C_{20}$	—	.49
Oxygenated hydrocarbon	—	.88

Table 13. Tentatively identified compounds that were detected in the gas chromatography/mass spectrometry analysis—Continued

[MO, Missouri; MS, Mississippi; —, no established confidence level; $>C_{20}$, more than 20 carbon molecular chain; 1 (in "Confidence level" column), tentative identification based on an indication of a specific library spectrum; 2 (in "Confidence level" column), confident identification, which means good agreement was observed between the unknown compound and a specific library spectrum. Analyzed at the Enseco Analytical Laboratory, Arvada, Colorado]

Compound	Confidence level	Estimated concentration, in milligrams per kilogram
	MS.6	
2-Methyl-1,3-dioxolane-2-propanol	1	3.9
Saturated hydrocarbon: C_{10}-C_{20}	—	.68
Oxygenated hydrocarbon	—	.77
—do—	—	1.6
—do—	—	1.5
Oxygenated hydrocarbon	—	.65
—do—	—	1.7
—do—	—	.75
—do—	—	1.2
—do—	—	1.1
Oxygenated hydrocarbon	—	2.8
—do—	—	1.1
—do—	—	1.1
—do—	—	.75
—do—	—	1.0
Oxygenated hydrocarbon	—	1.2
—do—	—	.88
—do—	—	.65
—do—	—	1.8
—do—	—	.97
	MS.7	
5-(Acetyloxy)-2-pentanone	1	4.1
Oxygenated hydrocarbon	—	.39
Saturated hydrocarbon: $>C_{20}$	2	.64
Oxygenated hydrocarbon	—	.56
Saturated hydrocarbon: $>C_{20}$	—	.93
Oxygenated hydrocarbon	—	.22
Saturated hydrocarbon: $>C_{20}$	—	.27
1,1'-Thiobis-dodecane	1	.27
Saturated hydrocarbon: $>C_{20}$	—	.92
Cyclic hydrocarbon	—	.21
Unsaturated hydrocarbon	—	.46
Saturated hydrocarbon: $>C_{20}$	—	.71
Oxygenated hydrocarbon	—	.25
—do—	—	.61
Saturated hydrocarbon: $>C_{20}$	—	.52

Table 13. Tentatively identified compounds that were detected in the gas chromatography/mass spectrometry analysis—Continued

[MO, Missouri; MS, Mississippi; —, no established confidence level; $>C_{20}$, more than 20 carbon molecular chain; 1 (in "Confidence level" column), tentative identification based on an indication of a specific library spectrum; 2 (in "Confidence level" column), confident identification, which means good agreement was observed between the unknown compound and a specific library spectrum. Analyzed at the Enseco Analytical Laboratory, Arvada, Colorado]

Compound	Confidence level	Estimated concentration, in milligrams per kilogram
MS.7—Continued		
Unsaturated hydrocarbon	—	0.67
Oxygenated hydrocarbon	—	.25
—do—	—	.64
—do—	—	.28
MS.7 (replicate)		
2-Methyl-1,3-dioxolane-2-propanol	1	3.5
Oxygenated hydrocarbon	—	.20
—do—	—	.27
—do—	—	.34
—do—	—	1.3
Saturated hydrocarbon: $>C_{20}$	—	.32
—do—	—	.53
—do—	—	.21
Oxygenated hydrocarbon	—	.21
Saturated hydrocarbon: $>C_{20}$	—	.84
Oxygenated hydrocarbon	—	.23
Saturated hydrocarbon: $>C_{20}$	—	.81
Oxygenated hydrocarbon	—	.41
—do—	—	.59
Saturated hydrocarbon: $>C_{20}$	—	.33
Oxygenated hydrocarbon	—	.68
—do—	—	.28
—do—	—	.66
—do—	—	.21
MS.8		
2-Methyl-1,3-dioxolane-2-propanol	1	6.2
Saturated hydrocarbon: C_{10}-C_{20}	—	.48
Oxygenated hydrocarbon	—	.57
Unsaturated hydrocarbon	—	.25
Oxygenated hydrocarbon	—	.31
Oxygenated hydrocarbon	—	1.6
—do—	—	1.1
—do—	—	.59
—do—	—	1.5
—do—	—	.33

Table 13. Tentatively identified compounds that were detected in the gas chromatography/mass spectrometry analysis—Continued

[MO, Missouri; MS, Mississippi; —, no established confidence level; >C_{20}, more than 20 carbon molecular chain; 1 (in "Confidence level" column), tentative identification based on an indication of a specific library spectrum; 2 (in "Confidence level" column), confident identification, which means good agreement was observed between the unknown compound and a specific library spectrum. Analyzed at the Enseco Analytical Laboratory, Arvada, Colorado]

Compound	Confidence level	Estimated concentration, in milligrams per kilogram
MS.8—Continued		
Saturated hydrocarbon: >C_{20}	—	0.27
Oxygenated hydrocarbon	—	.35
—do—	—	.36
—do—	—	.64
—do—	—	.53
Unsaturated hydrocarbon	—	.33
Oxygenated hydrocarbon	—	.88
—do—	—	.78
—do—	—	.32
MS.9		
Ethyl ester, acetic acid	1	0.14
2-Methyl-1,3-dioxolane-2-propanol	1	4.4
2,4-Dimethyl-2-pentanol	1	.16
Saturated hydrocarbon: C_{10}-C_{20}	—	.20
Oxygenated hydrocarbon	—	.20
Oxygenated hydrocarbon	—	.51
—do—	—	.18
Saturated hydrocarbon: >C_{20}	—	.15
—do—	—	.22
Oxygenated hydrocarbon	—	.24
Saturated hydrocarbon: >C_{20}	—	.59
—do—	—	.34
Aromatic hydrocarbon	—	.60
MS.10		
4-(Acetyloxy)-2-butanone	1	0.16
2-Methyl-1,3-dioxolane-2-propanol	1	5.5
2,4-Dimethyl-2-pentanol	1	.20
Saturated hydrocarbon: C_{10}-C_{20}	—	.32
Oxygenated hydrocarbon	—	.24
Oxygenated hydrocarbon	—	.32
Saturated hydrocarbon: >C_{20}	—	.16
Unsaturated hydrocarbon	—	.43
Saturated hydrocarbon: >C_{20}	—	.32
—do—	—	.19
Saturated hydrocarbon: >C_{20}	—	.45
Oxygenated hydrocarbon	—	.24

Table 13. Tentatively identified compounds that were detected in the gas chromatography/mass spectrometry analysis—Continued

[MO, Missouri; MS, Mississippi; —, no established confidence level; $>C_{20}$, more than 20 carbon molecular chain; 1 (in "Confidence level" column), tentative identification based on an indication of a specific library spectrum; 2 (in "Confidence level" column), confident identification, which means good agreement was observed between the unknown compound and a specific library spectrum. Analyzed at the Enseco Analytical Laboratory, Arvada, Colorado]

Compound	Confidence level	Estimated concentration, in milligrams per kilogram
MS.11		
Saturated hydrocarbon: $>C_{20}$	—	0.16
(Z,E)-3,7,11-trimethyl-2,6,10-dodecatrien-1-ol	1	.18
Saturated hydrocarbon: $>C_{20}$	—	.33
—do—	—	.24
Siloxane	—	.17
Siloxane	—	.34
MS.12		
4-Methyl-, (Z)-2-pentene	1	0.19
Saturated hydrocarbon: C_{10}-C_{20}	—	.23
Siloxane	—	.33
9-Hexadecenoic acid	1	1.3
Hexadecanoic acid	1	1.7
1-Methyl-4-(1-methylethyl)-cyclohexanol	1	.14
5-Bromo-2,3-dimethyl-2-pentene	1	.16
[R- [(E,E)]-3,7,11,15-tetramethyl-6,10,14-hexadecatrien-1-ol	1	.23
Saturated hydrocarbon: $>C_{20}$	—	.25
1-(Ethenyloxy)-octadecane	1	.17
Saturated hydrocarbon: $>C_{20}$	—	.28
Siloxane	—	.26
1,2-Dimethyl ester 1,2,4-benzenetricarboxylic acid	1	.30
Alloaromadendrene	1	.26
MS.13		
2,4-Dimethyl-3-pentanone	1	0.13
Saturated hydrocarbon: C_{10}-C_{20}	—	.16
Siloxane	—	.34
9-Hexadecenoic acid	1	1.4
Hexadecanoic acid	1	1.5
[R- [R,R-(E)]]-3,7,11,15-tetramethyl-2-hexadecen-1-ol	1	.14
3,7,11-Trimethyl-2,6,10-dodecatrien-1-ol	1	.22
Saturated hydrocarbon: $>C_{20}$	—	.27
—do—	—	.20
[S-(Z)]-3,7,11-trimethyl-1,6,10-dodecatrien-3-ol	1	.38
Saturated hydrocarbon: $>C_{20}$	—	.28
(+)-6-methyl-2-(4-methyl-3-cyclohexen-1-yl)-5-hepten-2-ol	1	.30

Table 13. Tentatively identified compounds that were detected in the gas chromatography/mass spectrometry analysis—Continued

[MO, Missouri; MS, Mississippi; —, no established confidence level; $>C_{20}$, more than 20 carbon molecular chain; 1 (in "Confidence level" column), tentative identification based on an indication of a specific library spectrum; 2 (in "Confidence level" column), confident identification, which means good agreement was observed between the unknown compound and a specific library spectrum. Analyzed at the Enseco Analytical Laboratory, Arvada, Colorado]

Compound	Confidence level	Estimated concentration, in milligrams per kilogram
MS.13 (replicate)		
Saturated hydrocarbon: $>C_{20}$	—	0.19
Octadecanal	1	.16
3,7,11-Trimethyl-2,6,10-dodecatrien-1-ol	1	.21
Saturated hydrocarbon: $>C_{20}$	—	.39
—do—	—	.35
1,1'-ethylidenebis-cyclohexane	1	.19
5,6-dihydro-5,6-dihydroxy-.beta.-carotene. beta	1	.31
Sclareol	1	.51