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Reconnaissance Data for Selected Herbicides, Two Atrazine Metabolites, and Nitrate in Surface Water of the Midwestern United States, 1989-90

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CONVERSION FACTORS AND ABBREVIATED WATER-QUALITY UNITS

Multiply	*By*	*To Obtain*
cubic foot per second (ft^3/s)	0.02832	cubic meter per second
mile (mi)	1.609	kilometer
pound (lb)	453.6	gram
square mile (mi^2)	2.590	square kilometer

Temperature can be converted to degrees Celsius (°C) or degrees Fahrenheit (°F) by the equations:

°C=5/9 (°F-32)
°F-9/5 (°C) + 32.

Abbreviated Water-Quality Units

microgram per liter (µg/L)
microsiemens per centimeter at 25 degrees Celsius (µS/cm)
milligram (mg)
milligram per liter (mg/L)
milliliter (mL)
milliliter per minute (mL/min)
nanogram per microliter (ng/µL)

RECONNAISSANCE DATA FOR SELECTED HERBICIDES, TWO ATRAZINE METABOLITES, AND NITRATE IN SURFACE WATER OF THE MIDWESTERN UNITED STATES, 1989-90

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ABSTRACT

Water-quality data were collected from 147 rivers and streams during 1989-90 to determine the temporal and geographic distribution of selected preemergent herbicides, two atrazine metabolites, and nitrate in 10 Midwestern States. This report includes a description of the sampling design, data-collection techniques, laboratory and analytical methods, and a compilation of constituent concentrations and quality-assurance data. All water samples were collected by depth-integrating techniques at three to five locations across the wetted perimeter of each stream. Sites were sampled three times in 1989--before application of herbicides, during the first major runoff after application of herbicides, and in the fall during a low-flow period when most of the streamflow was derived from ground water. About 50 sites were selected by a stratified random procedure and resampled for both pre- and post-application herbicide concentrations in 1990 to verify the 1989 results. Laboratory analyses consisted of both enzyme-linked immunosorbent assay (ELISA) and confirmation by gas chromatography/mass spectrometry (GC/MS). The data have been useful in studying herbicide transport, in comparison of the spatial distribution of the post-application concentrations of 11 herbicides and 2 atrazine metabolites (deethylatrazine and deisopropylatrazine) in streams and rivers at a regional scale, in examination of the annual persistence of herbicides and two atrazine metabolites in surface water, and in assessment of atrazine metabolites as indicators of surface- and ground-water interaction.

INTRODUCTION

This is one of several water-quality reports intended to present the results of a reconnaissance study of preemergent herbicides, two atrazine metabolites, and nitrite plus nitrate in surface water of a 10-state region in the midwestern United States (fig. 1). The reconnaissance study was conducted during 1989-90 by the U.S. Geological Survey as part of the Toxic Substances Hydrology Program.

During 1987-89, about 136 million pounds per year of four major herbicides were applied in the 10-state region (table 1). The herbicides alachlor, atrazine, cyanazine, and metolachlor accounted for about 73 percent of the pesticides applied (Gianessi and Puffer, 1990). The intense use of herbicides, their moderate water solubility, and mobility can cause them to leach into ground water, to run off in surface water, as well as to be transported in air and in precipitation (Goolsby and others, 1990). Goolsby and others (1991a) identified substantial increases in herbicide concentrations in streams and rivers and in runoff from fields immediately after herbicide application. Nonpoint-source contamination of surface- and ground-water supplies may be associated with the intense use of agricultural chemicals. Drinking-water quality also may be affected because conventional water-treatment practices do not remove these moderately soluble herbicides (Goolsby and others, 1990).

This report presents the water-quality data collected during a reconnaissance study of surface water in the midwestern United States. The data are being used in subsequent reports to document the occurrence, distribution, and concentrations of selected preemergent herbicides, two atrazine metabolites, and nitrite plus nitrate, to understand the geographic and seasonal distribution of nitrite plus nitrate and commonly used herbicides in streams of different size throughout the 10-state area, and to examine the usefulness of a low-cost immunoassay analysis technique for determining atrazine concentrations in a regional-scale reconnaissance (Goolsby and others, 1990). The scope of this report includes a discussion of the sampling design, data-collection techniques, analytical procedures, and a compilation of surface-water quality and quality-assurance data.

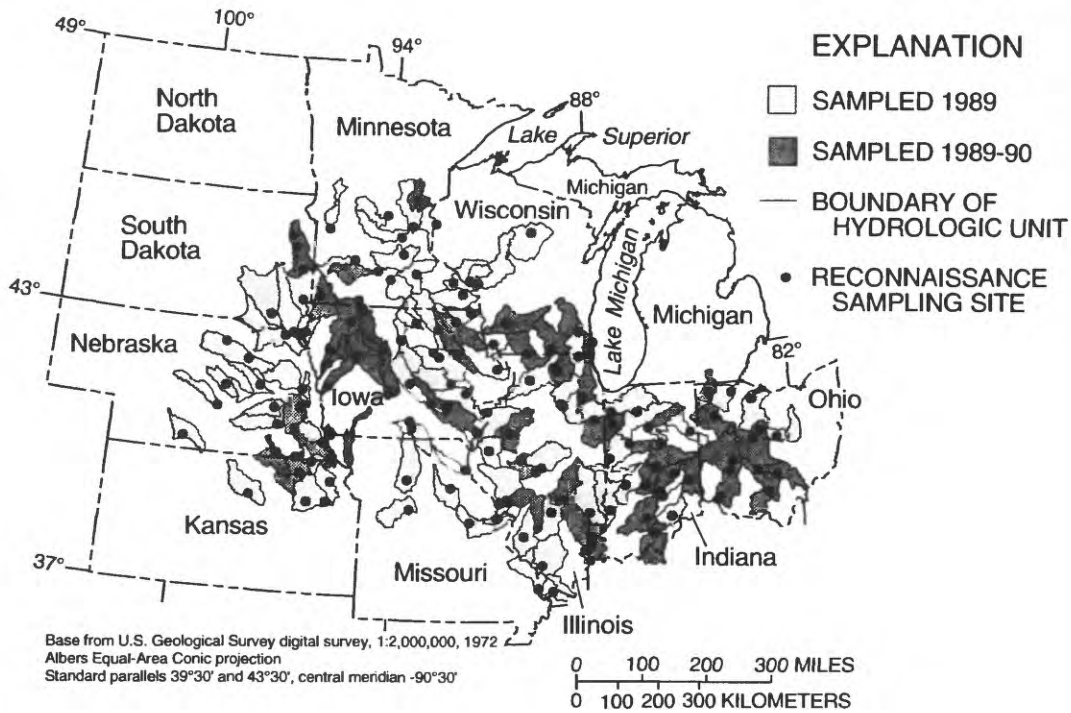

Figure 1. Location of study area, hydrologic units, and sites sampled during 1989 and 1990 in the midwestern United States.

Table 1. *Quantities of four major herbicides applied in 10 agricultural Midwestern States, 1987-89*

[From Gianessi and Puffer, 1990; values shown are in millions of pounds of active ingredient per year]

State	Alachlor	Atrazine	Cyanazine	Metolachlor
Illinois	8.0	8.5	3.1	8.1
Indiana	6.9	5.7	1.7	3.5
Iowa	6.4	5.6	3.7	8.5
Kansas	1.9	4.7	.2	2.2
Minnesota	4.0	1.5	2.8	2.4
Missouri	1.8	3.1	1.2	1.6
Nebraska	3.8	7.1	1.8	1.9
Ohio	3.7	3.8	1.6	4.0
South Dakota	1.9	.5	.3	1.0
Wisconsin	1.3	2.7	1.7	1.4
Total	**39.7**	**43.2**	**18.1**	**34.6**

Total of four major herbicides: 135.6

The study area includes the following states: Illinois, Indiana, Iowa, Kansas, Minnesota, Missouri, Nebraska, Ohio, South Dakota, and Wisconsin. Sampling-site names and locations are given in table 2, and the corresponding map locations are shown in figures 2 through 5. Also, included in table 2 is the drainage area of each sampling site.

METHODS

Sampling sites were geographically distributed throughout the study area and represented streams and rivers of all sizes. A sampling schedule was established for each calendar year. Sampling techniques, including data-collection methods, processing, packaging, and shipping, were established. Laboratory methods were developed for enzyme-linked immunosorbent assay (ELISA) and gas chromatography/mass spectrometry (GC/MS).

Sampling Design

Sampling sites were selected at 147 U.S. Geological Survey streamflow-gaging stations by a stratified random-sampling procedure designed to ensure geographic distribution and regional-scale interpretation of the data. The number of sites per state was proportional to the amount of corn and soybean production in each state, and sites were chosen randomly by county. The drainage area of the basins sampled ranged from 66 to more than 700,000 mi^2, with a median drainage area of 770 mi^2. Most of the sites were sampled three times in 1989--(1) before application of herbicides (March or April); (2) after application and during the first major runoff (May or June); and (3) in the fall during a low-flow period (October or November) when most of the streamflow was derived from ground water. A few sites were not sampled after herbicide application because of drought conditions or no runoff.

About one-third of the sites sampled in 1989 were resampled during 1990 before (March or April) and after (May or June) herbicide application. Based on a ranking of 1989 herbicide concentrations from highest to lowest values, sampling sites in 1990 were selected as follows: 50 percent of the sites to be sampled in 1990 were randomly selected from the upper one-third of 1989 herbicide concentrations, 25 percent from the middle one-third, and 25 percent from the lower one-third.

Data-Collection Techniques

All water samples were collected by depth-integrating techniques at three to five locations across each stream (Thurman and others, 1992). The herbicide samples were collected in glass or Teflon[1] containers, composited in large glass containers, and filtered through 1-μm (micrometer) pore diameter, glass-fiber filters into baked glass bottles prior to shipment to the laboratory.

Analytical Procedures

Specific conductance and pH measurements were made onsite. Samples, preserved with mercuric chloride, were analyzed for nitrate plus nitrite at the National Water Quality Laboratory, Arvada, Colorado (Fishman and Friedman, 1989). Herbicides were analyzed by enzyme-linked immunosorbent assay at the U.S. Geological Survey laboratory in Iowa City, Iowa (Goolsby and others, 1991b; table 6 at the end of this report). Most samples were also analyzed by gas chromatography/mass spectrometry (Thurman and others, 1990) at the U.S. Geological Survey laboratory in Lawrence, Kansas (table 7 at the end of this report). A comparison of the immunoassay method to the GC/MS analysis is presented in Goolsby and others (1991b).

Solvents used for analyzing samples included pesticide-grade methanol, ethyl acetate, and isooctane. Deionized water was charcoal filtered and glass distilled prior to use. Internal quantitative standard solutions were prepared in methanol and phenanthrene-d_{10}. Assay kits were used for the immunoassay analysis. The kits used polyclonal antibodies coated on the walls of polystyrene test tubes and an atrazine-enzyme conjugate prepared by covalently binding atrazine to horseradish peroxidase by a modified carbodiamide technique (Bushway and others, 1988). The immunoassay procedure is described by Goolsby and others (1991b).

An automated workstation was used for solid-phase extraction of the herbicide compounds. Cartridges were preconditioned

[1]The use of brand names in this report is for identification purposes only and does not constitute endorsement by the U.S. Geological Survey.

Table 2. *Sampling-site names, locations, and drainage areas*

Map no. (figs. 2-5)	State	Site identifier	Site name	Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Drainage area (square miles)
1	S. Dak.	06479438	Big Sioux River near Watertown	45°00'22"	97°09'53"	1,007
2		06479525	Big Sioux River near Castlewood	44°43'54"	97°02'39"	1,997
3		06480000	Big Sioux River near Brookings	44°13'27"	96°46'06"	3,898
4		06482020	Big Sioux River at N. Cliff Avenue	43°34'01"	96°42'39"	5,216
5		06478500	James River near Scotland	43°11'09"	97°38'07"	20,653
6		06479010	Vermillion River near Vermillion	42°49'02"	96°55'26"	1,779
7		06485696	Brule Creek near Elk Point	42°48'32"	96°41'11"	204
8		06485500	Big Sioux River at Akron	42°50'14"	96°33'41"	8,424
9	Nebr.	06478518	Bow Creek near St. James	42°43'48"	97°08'53"	304
10		06796973	Elkhorn River near Atkinson	42°29'12"	98°54'42"	586
11		06798300	Clearwater Creek near Clearwater	42°08'20"	98°12'10"	210
12		06788988	Mira Creek near Northloup	41°30'09"	98°47'47"	66
13		06795500	Shell Creek near Columbus	41°34'33"	97°46'55"	270
14		06800000	Maple Creek near Nickerson	41°32'44"	96°30'09"	450
15		06783500	Mud Creek at Sweetwater	41°02'15"	98°59'35"	707
16		06879900	Big Blue River at Surprise	41°06'05"	97°18'35"	345
17		06804000	Wahoo Creek at Itica	41°08'40"	96°32'10"	271
18		06880800	W. Fork Big Blue River near Dorchester	40°43'52"	97°10'38"	1,206
19		06803000	Salt Creek at Roca	40°39'29"	96°39'55"	167
20		06844000	Muddy Creek near Arapahoe	40°18'20"	99°54'40"	246
21		06884000	Little Blue River near Fairbury	40°06'54"	97°10'13"	2,350
22		06811500	Little Nemaha River at Auburn	40°23'33"	95°48'46"	793
23		06882000	Big Blue River at Barneston	40°02'40"	96°35'12"	4,447
24		06815000	Big Nemaha River at Fall City	40°02'08"	95°35'45"	1,340
25	Kans.	06814000	Turkey Creek near Seneca	39°56'52"	96°06'30"	276
26		06885500	Black Vermillion River near Frankfort	39°41'03"	96°26'15"	410
27		06890100	Delaware River near Muscotah	39°31'17"	95°31'57"	431
28		06876700	Salt Creek near Ada	39°08'30"	97°50'10"	384
29		06888500	Mill Creek near Paxico	39°03'44"	96°10'52"	316
30		06889000	Kansas River at Topeka	39°04'00"	95°38'58"	56,720
31	Minn.	05337400	Knife River near Mora	45°55'12"	93°18'26"	102
32		05270500	Sauk River near St. Cloud	45°33'35"	94°14'00"	925
33		05294000	Pomme de Terre River at Appleton	45°12'10"	96°01'20"	905
34		05286000	Rum River near St. Francis	45°19'40"	93°22'20"	1,360
35	Wisc.	05340500	St. Croix River at St. Croix Falls	45°24'25"	92°38'49"	6,240

Table 2. *Sampling-site names, locations, and drainage areas*--Continued

Map no. (figs. 2-5)	State	Site identifier	Site name	Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Drainage area (square miles)
36	Minn.	05280000	Crow River at Rockford	45°05'12"	93°44'02"	2,520
37		05330000	Minnesota River near Jordan	44°41'35"	93°38'30"	16,200
38		05316500	Redwood River near Redwood Falls	44°31'25"	95°10'20"	697
39		05317000	Cottonwood River near New Ulm	44°17'29"	94°26'24"	1,280
40		05320500	Le Sueur River near Rapidan	44°06'40"	94°02'28"	1,100
41		05353800	Straight River near Faribault	44°15'29"	93°13'51"	442
42		05376000	N. Fork Whitewater River near Elba	44°05'30"	92°03'57"	101
43		06483000	Rock River at Luverne	43°39'15"	96°12'03"	425
44		05476000	Des Moines River at Jackson	43°37'10"	94°59'10"	1,220
45		05384500	Rush Creek near Rushford	43°50'00"	91°46'40"	129
46	Iowa	06605000	Ocheyedan River near Spencer	43°07'44"	95°12'37"	426
47		05476500	Des Moines River at Estherville	43°23'51"	94°50'38"	1,372
48		05459500	Winnebago River at Mason City	43°09'54"	93°11'33"	526
49		05458000	Little Cedar River near Ionia	43°02'05"	92°30'05"	306
50		05411600	Turkey River at Spillville	43°12'28"	91°56'56"	177
51		05388250	Upper Iowa River near Dorchester	43°25'16"	91°30'31"	770
52		06606600	Little Sioux River at Correctionville	42°28'20"	95°47'49"	2,500
53		05482300	North Racoon River near Sac City	42°20'28"	94°59'05"	713
54		05480500	Des Moines River at Fort Dodge	42°30'22"	94°12'04"	4,190
55		05449500	Iowa River near Rowan	42°45'36"	93°37'23"	429
56		05463050	Cedar River at Cedar Falls	42°30'50"	92°37'55"	4,734
57		05463500	Black Hawk Creek at Hudson	42°24'28"	92°27'47"	303
58		05421000	Wapsipinicon River at Independence	42°27'49"	91°53'42"	1,048
59		06607200	Maple River at Mapleton	42°09'28"	95°48'27"	669
60		06609500	Boyer River at Logan	41°38'33"	95°46'57"	871
61		05484500	Raccoon River at Van Meter	41°32'02"	93°56'59"	3,441
62		05471200	Indian Creek near Mingo	41°48'17"	93°18'26"	276
63		05453100	Iowa River near Marengo	41°48'41"	92°03'42"	2,794
64		05455100	Old Mans Creek near Iowa City	41°36'25"	91°36'40"	201
65		05418450	N. Fork Maquoketa River at Fulton	42°08'42"	90°40'55"	516
66		05471500	S. Skunk River near Oskaloosa	41°21'19"	92°39'31"	1,635
67		05472500	N. Skunk River near Sigourney	41°18'03"	92°12'16"	730
68		06810000	Nishnabotna River above Hamburg	40°37'57"	95°37'32"	2,806
69		06903400	Chariton River near Chariton	40°57'12"	93°15'37"	182
70		06903700	S. Fork Chariton River near Promise City	40°48'02"	93°11'32"	168
71		05474000	Skunk River at Augusta	40°45'13"	91°16'40"	4,303
72	Mo.	06817700	Nodaway River near Graham	40°12'08"	95°04'07"	1,320
73		05500000	South Fabius River near Taylor	39°53'49"	91°34'49"	620

Table 2. *Sampling-site names, locations, and drainage areas*--Continued

Map no. (figs. 2-5)	State	Site identifier	Site name	Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Drainage area (square miles)
74	Mo.	06902000	Grand River near Sumner	39°38'25"	93°16'25"	6,880
75		05506500	Middle Fork Salr River at Paris	39°29'05"	91°59'50"	356
76		06908000	Blackwater River at Blue Lick	38°59'32"	93°11'48"	1,120
77		06934500	Missouri River at Hermann	38°42'36"	91°26'21"	524,200
78		05587450	Mississippi River at Grafton	38°48'46"	90°40'38"	141,000
79	Wisc.	05394500	Prairie River near Merrill	45°14'09"	89°38'59"	184
80		05379500	Trempealeau River at Dodge	44°07'55"	91°33'14"	643
81		05382000	Black River near Galesville	44°04'22"	91°17'41"	2,080
82		05407000	Wisconsin River at Muscada	43°11'54"	90°26'26"	10,400
83		05413500	Grant River near Burton	42°43'13"	90°49'09"	269
84		05434500	Pecatonic River at Martintown	42°30'34"	89°47'58"	1,034
85		05430500	Rock River at Afton	42°36'33"	89°04'14"	3,340
86		05543830	Fox River at Wakesha	43°00'17"	88°14'37"	126
87		04087240	Root River at Racine	42°45'05"	87°49'25"	190
88	Ill.	05527800	Des Plains River at Russell	42°29'22"	87°55'32"	123
89		05548280	Nippersink Creek at Spring Cove	42°26'37"	88°14'51"	192
90		05439500	S. Br. Kishwaukee River at Fairdale	42°06'40"	88°54'00"	387
91		05440000	Kishwaukee River near Perryville	42°11'45"	88°59'55"	1,099
92		05444000	Elkhorn Creek near Penrose	41°54'10"	89°41'40"	146
93		05543500	Illinois River near Marseilles	41°19'40"	88°43'10"	8,259
94		05552500	Fox River near Dayton	41°23'12"	88°47'26"	2,642
95		05540500	Dupage River near Shorwood	41°31'20"	88°11'35"	324
96		05526000	Iroquois River near Chebanse	41°00'32"	87°49'27"	2,091
97		05466500	Edwards River near New Boston	41°11'15"	90°58'05"	445
98		05569500	Spoon River at London Mills	40°42'32"	90°16'53"	1,072
99		05584500	La Moine River at Colmar	40°19'45"	90°53'55"	655
100		05583000	Sangamon River at Oaksford	40°07'25"	89°59'05"	5,093
101		05579500	Lake Fork near Cornland	39°57'00"	89°23'10"	214
102		05576500	Sangamon River at Riverton	39°50'34"	89°32'52"	2,618
103		05587060	Illinois River at Hardin	39°09'37"	90°36'55"	28,690
104		05587000	Macoupin Creek near Kane	39°14'03"	90°23'40"	868
105		05592100	Kaskaskia River near Cowden	39°13'50"	88°50'33"	1,330
106		05592500	Kaskaskia River at Vandalia	38°57'35"	89°05'20"	1,940
107		03345500	Embarras River at Ste. Marie	38°56'10"	88°01'10"	1,516
108		05594000	Shoal Creek near Breese	38°36'35"	89°29'40"	735
109		05594800	Silver Creek near Freeburg	38°24'22"	89°52'26"	464
110		03378000	Bonpas Creek at Browns	38°23'11"	87°58'32"	228

Table 2. *Sampling-site names, locations, and drainage areas*--Continued

Map no. (figs. 2-5)	State	Site identifier	Site name	Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Drainage area (square miles)
111	Ind.	03378500	Wabash River near New Harmony	38°13'42"	87°59'04"	29,080
112	Ill.	03381495	Little Wabash River at Carmi	38°05'32"	88°09'22"	3,088
113		05599500	Big Muddy River near Murphysboro	37°44'55"	89°20'45"	2,169
114	Mo.	07022000	Mississippi River at Thebes	37°13'00"	89°27'50"	713,200
115	Ill.	03612500	Ohio River near Grand Chain	37°10'34"	89°04'02"	203,100
116	Ind.	05518000	Kankakee River at Shelby	41°10'58"	87°20'33"	1,779
117		03331500	Tippecanoe River near Ora	41°09'26"	86°33'49"	856
118		05524500	Iroquois River near Foresman	40°52'14"	87°18'24"	449
119		03328500	Eel River near Logansport	40°46'55"	86°15'50"	789
120		03322900	Wabash River at Linn Grove	40°39'22"	85°01'58"	453
121		03335000	Wildcat Creek near Lafayette	40°26'26"	86°49'45"	794
122		03333450	Wildcat Creek near Jerome	40°26'29"	85°55'08"	146
123		03336000	Wabash River at Covington	40°08'24"	87°24'24"	8,218
124		03351000	White River near Nora	39°54'35"	86°06'20"	1,219
125		03361000	Big Blue River at Carthage	39°44'38"	85°34'33"	184
126		03275000	Whitewater River near Alpine	39°34'46"	85°09'29"	522
127		03357500	Big Walnut Creek near Reelsville	39°32'11"	86°58'35"	326
128		03354000	White River near Centerton	39°29'51"	86°24'02"	2,444
129		03362500	Sugar Creek near Edinburgh	39°21'39"	85°59'51"	474
130		03363900	Flatrock River at Columbus	39°14'06"	85°55'36"	534
131		03342500	Busseron Creek near Carlisle	38°58'26"	87°25'33"	228
133		03366500	Muscatatuck River near Deputy	38°48'15"	85°40'26"	293
134		03302800	Blue River at Fredricksburg	38°26'02"	86°11'31"	283
135	Ohio	04185000	Tiffin River at Stryker	41°30'16"	84°25'47"	410
136		04193500	Maumee River at Waterville	41°28'34"	83°44'20"	6,330
137		04198000	Sandusky River near Fremont	41°18'28"	83°09'32"	1,251
138		04186500	Auglaize River near Fort Jennings	40°56'55"	84°15'58"	332
139		03223000	Olentangy River at Claridon	40°34'58"	82°59'20"	157
140		03219500	Scioto River near Prospect	40°25'10"	83°11'50"	567
141		03136500	Kokosing River at Mount Vernon	40°24'20"	82°30'00"	202
142		03267900	Mad River at Eagle City	39°57'51"	83°49'54"	310
143		03240000	Little Miami River near Oldtown	39°44'54"	83°55'53"	129
144		03230500	Big Darby Creek at Darbyville	39°42'02"	83°06'37"	534
145		03157000	Clear Creek near Rockbridge	39°35'18"	82°34'43"	89
146		03234500	Scioto River at Higby	39°12'44"	82°51'50"	5,131
147		03245500	Little Miami River at Milford	39°10'17"	84°17'53"	1,203

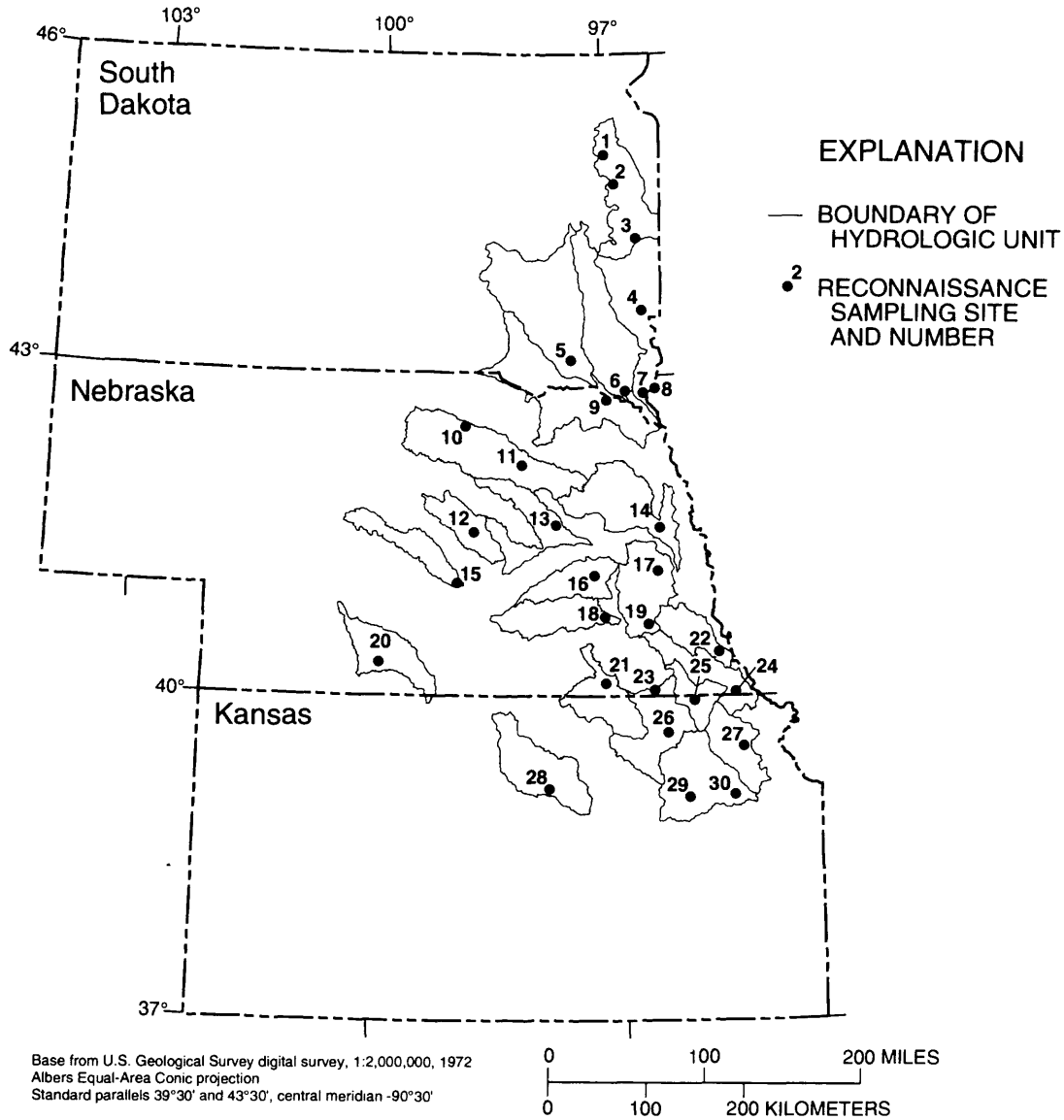

Figure 2. Location of sites sampled in South Dakota, Nebraska, and Kansas, map numbers 1 through 30.

sequentially with 2 mL methanol, 6 mL ethyl acetate, 2 mL methanol, and 2 mL distilled water. Each 123-mL water sample was spiked with a surrogate standard, 2.4 ng/μL terbutylazine, and pumped through the cartridge at a rate of 20 mL/min by the robotic probe. Herbicide compounds were eluted with ethyl acetate and spiked robotically with phenanthrene-d_{10}. The ethyl-acetate layer was transferred by probe to a clean test tube. Finally, the extract was evaporated automatically by a turbovap at 45° C under a nitrogen stream to approximately 100 μL. The robotic probe was washed between samples by immersing in 4 mL of ethyl acetate and bubbling filtered compressed air through the probe to ensure thorough removal of any herbicide or spike residues adhering to the outside of the probe.

Automated GC/MS analyses of the eluates were performed on a mass selective detector. Operating conditions were as follows: ionization voltage, 70 electronvolts; ion source temperature, 250 °C; electron multiplier, 2,200 volts; direct capillary interface at 280 °C, tuned daily with perfluorotributylamine; dwell time, 50 milliseconds. Separation of the herbicides was carried out using a 12-meter fused-silica capillary column, 0.2 millimeter in diameter with a methyl silicone stationary phase,

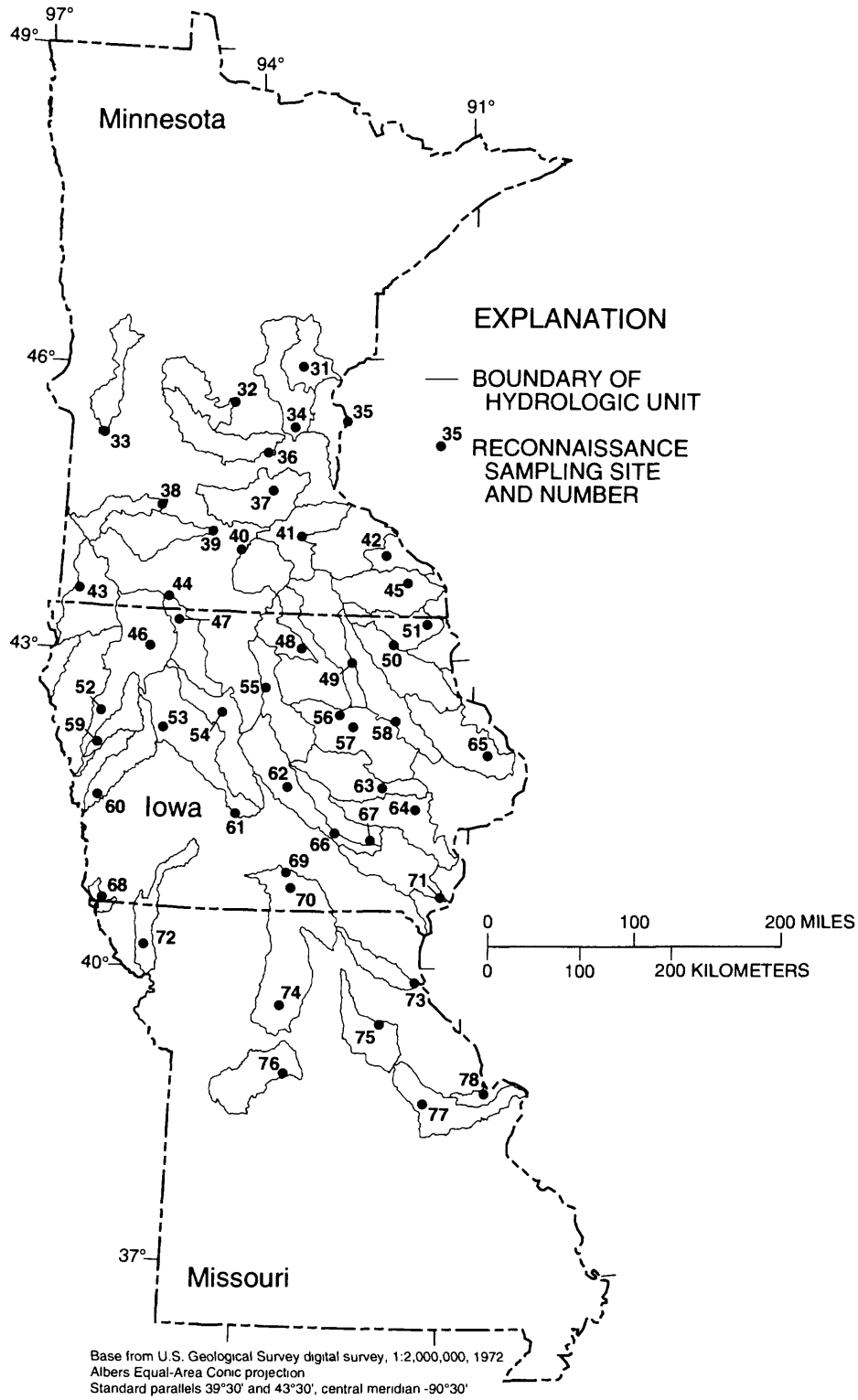

Figure 3. Location of sites sampled in Minnesota, Iowa, and Missouri, map numbers 31 through 78 (site 35 sampled in Wisconsin).

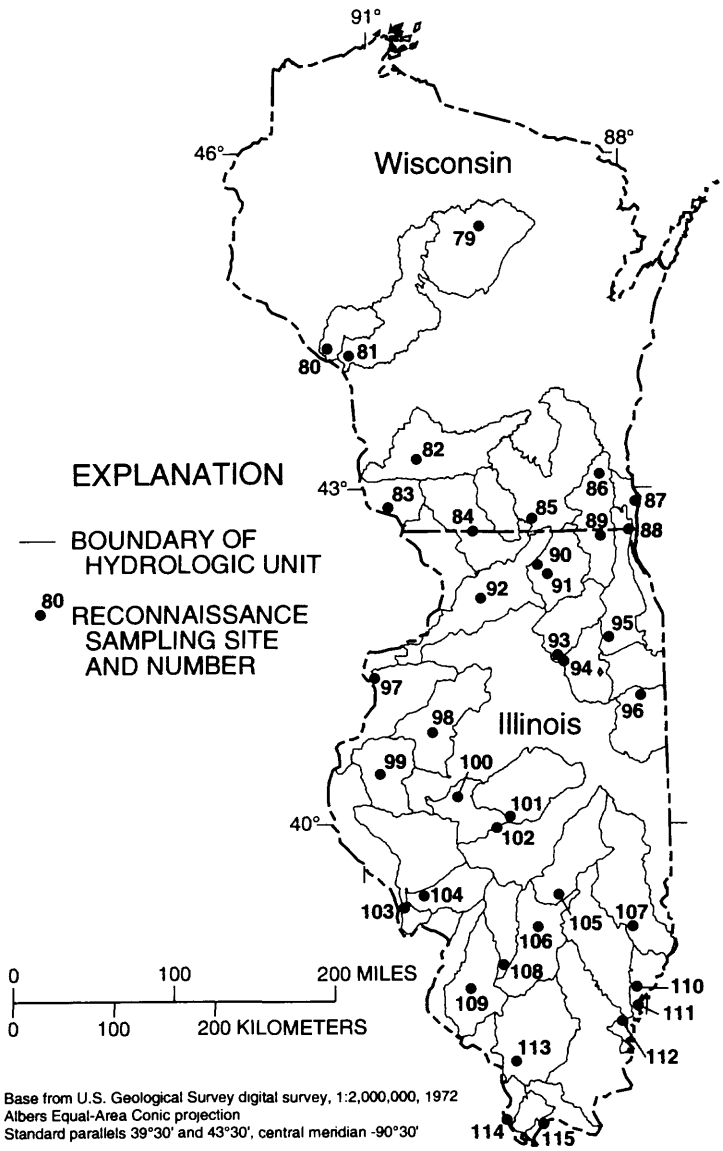

Figure 4. Location of sites sampled in Wisconsin and Illinois, map numbers 79 through 115 (site 111 sampled in Indiana and site 114 sampled in Missouri).

0.33 µm thick. Helium was used as the carrier gas at a flow rate of 1 mL/min and a head pressure of 35 kilopascals. The column temperature was held at 50 °C for 1 minute, then ramped at 6 °C per minute to 250 °C. Injector temperature was 280 °C. The filament and multiplier were not turned on until 5 minutes into the analysis. Quantification of the base peak of each compound was based on the response of the 188 ion of the internal standard, phenanthrene-d_{10}. Confirmation of the compound was based on the presence of the molecular ion and one to two confirming ions with a retention-time match of + 0.2 percent relative to phenanthrene-d_{10}. This procedure is described by Thurman and others (1990) and Meyer and others (1993).

Quality Assurance

All water-quality measurements and water samples for this study were collected by U.S. Geological Survey personnel. All samples for GC/MS analysis were collected in duplicate to

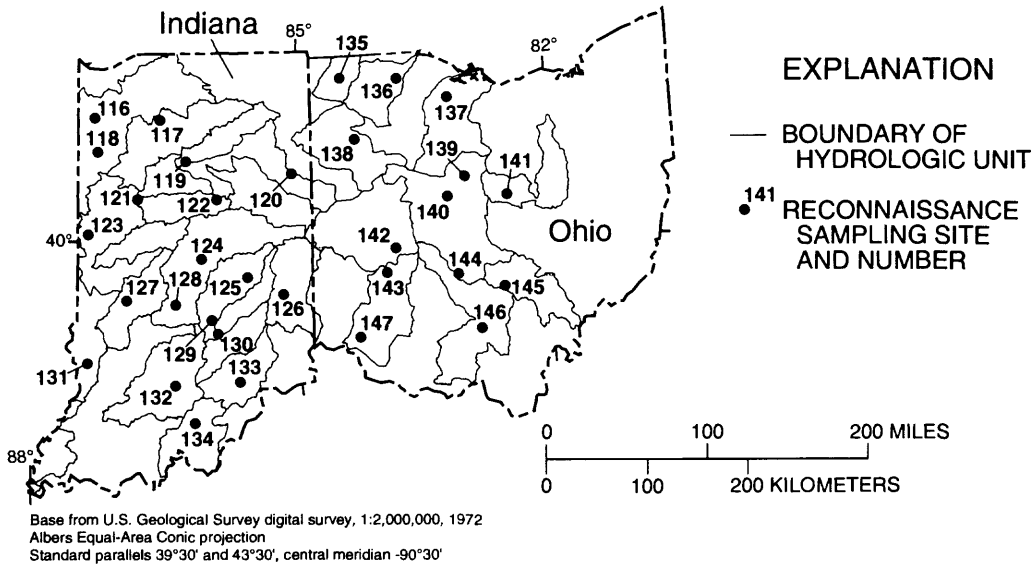

Figure 5. Location of sites sampled in Indiana and Ohio, map numbers 116 through 147.

provide a backup sample in case reanalysis was needed. Ten percent of the duplicates were analyzed by GC/MS for quality-assurance purposes. These analyses are identified in table 7 at the end of this report by a sample-type code of "L." In addition, blind duplicates were collected and analyzed by both GC/MS and immunoassay for about 5 percent of the samples. These samples were disguised in such a way that laboratories doing the analyses were not aware they were duplicates. Analyses of these samples are identified in table 7 by a sample-type code of "B." About 2 percent of the samples analyzed by GC/MS were spikes prepared in organic-free distilled water by the U.S. Geological Survey's National Water Quality Laboratory (NWQL) in Arvada, Colorado. Analyses of these spikes are given in table 3. Also, included in the table are the herbicide concentrations added to the samples and an analysis of spikes by the NWQL. Analyses in table 3 identified by a sample-type code of "S" were known to be spikes by the analyzing laboratory. Some spikes were disguised as water samples. Results for these samples are identified in table 3 by a sample-type code of "BS."

DISCUSSION

Analytical results are presented in tables 6 and 7 at the end of this report. These results indicate that large concentrations of herbicides were flushed from cropland and transported through the surface-water system in response to late spring and early summer rainfall (Thurman and others, 1992). Of the 11 herbicides and 2 atrazine metabolites analyzed, atrazine, alachlor, cyanazine, and metolachlor, were present in the largest percentage of samples, as shown in table 4. During the 1989 post-application sampling, atrazine was detected (greater than 0.05 µg/L) in 98 percent of the samples. Alachlor, metolachlor, and deethylatrazine, an atrazine metabolite, were detected (greater than 0.05 µg/L) in water in more than 80 percent of the samples, and cyanazine was detected (greater than 0.20 µg/L) in more than 60 percent of the samples. Similar seasonal distributions were observed for the other major herbicides. It should be noted that the two atrazine metabolites (deethylatrazine and deisopropylatrazine) also can be produced by simazine and propazine. However, because these two herbicides are generally present in low concentrations relative to atrazine, their contribution to the formation of these two metabolites should be minimal.

During the late spring and summer (May or June, 1989-90), concentrations of one or more herbicides exceeded U.S. Environmental Protection Agency (USEPA) Maximum Contaminant Levels (MCL) or lifetime Health Advisories

Table 3. *Concentrations of selected herbicides and two atrazine metabolites in quality-assurance samples, 1989-90*

[DEA, deethylatrazine; DIA, deisopropylatrazine; ametryn, prometryn, terbutryn were not detected; S, spike sample; BS, blind spiked sample; spike, spiked concentration; NWQL, analysis by U.S. Geological Survey National Water Quality Laboratory, Arvada, Colo.; --, no data; <, less than]

Laboratory identification number	Quality assurance identification	Round[1]	Sample type	Concentrations, in micrograms per liter									
				Alachlor	Atrazine	Cyanazine	DEA	DIA	Metolachlor	Metribuzin	Prometon	Propazine	Simazine
				Organic-free water									
MT-101A	0DG0	1	BS	<0.05	<0.05	<0.20	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
MT-102	0DG0	1	BS	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
MT-1217A	0DG0	3	BS	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
MT-2077	0DG0	4	S	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
Mean				<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
Theoretical	1DG1	--	--	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05	<.05
MT-35A	1DG1	1	BS	.14	.07	<.20	<.05	<.05	<.05	.40	<.05	.32	.10
MT-67	1DG1	1	S	.25	.13	.24	<.05	<.05	.14	.43	<.05	.46	.14
MT-7	1DG1	1	S	.22	.14	<.20	<.05	<.05	.10	.61	<.05	.46	.13
MT-8	1DG1	1	S	.20	.13	<.20	<.05	<.05	.11	.47	<.05	.38	.15
Mean				.20	.12	<.20	<.05	<.05	.09	.48	<.05	.41	.13
Theoretical	1DG1	--	--	.26	.11	.19	<.05	<.05	.14	.30	.05	.34	.14
NWQL	1DG1	--	--	.26	.11	.19	--	--	<.10	.30	--	.33	.14
MT-3	1DG2	1	S	.54	.38	<.20	<.05	<.05	.22	.83	<.05	.74	.28
MT-4	1DG2	1	S	.59	.46	<.20	<.05	<.05	.25	.90	<.05	.83	.33
MT-69	1DG2	1	S	.56	.33	.46	<.05	<.05	.23	.71	<.05	.71	.27
Mean				.56	.39	.22	<.05	<.05	.23	.81	<.05	.76	.29
Theoretical	1DG2	--	--	.66	.32	.57	<.05	<.05	.27	.75	<.05	.51	.28
NWQL	1DG2	--	--	--	--	--	--	--	--	--	--	--	--
MT-5	1DG3	1	S	1.1	1.4	<.20	<.05	<.05	.58	1.4	<.05	1.3	.58
MT-6	1DG3	1	S	1.1	1.3	<.20	<.05	<.05	.58	1.3	<.05	1.3	.58
MT-65	1DG3	1	S	1.3	1.4	<.20	<.05	<.05	.64	1.5	<.05	1.3	.61
MT-97A	1DG3	1	BS	.93	1.4	<.20	<.05	<.05	.60	1.7	<.05	1.2	.69
MT-97B	1DG3	1	BS	.97	1.3	<.20	<.05	<.05	.54	1.4	<.05	1.2	.58
Mean				1.1	1.4	<.20	<.05	<.05	.59	1.5	<.05	1.3	.61
Theoretical	1DG3	--	--	1.3	1.1	.95	<.05	<.05	.68	1.5	<.05	.85	.57
NWQL	1DG3	--	--	1.2	1.0	1.1	--	--	.70	1.2	--	.70	.57

Table 3. *Concentrations of selected herbicides and two atrazine metabolites in quality-assurance samples, 1989-90*--Continued

Laboratory identification number	Quality assurance identification	Round[1]	Sample type	Concentrations, in micrograms per liter									
				Alachlor	Atrazine	Cyanazine	DEA	DIA	Metolachlor	Metribuzin	Prometon	Propazine	Simazine
				Organic-free water--Continued									
MT-2	1DG4	1	S	3.0	<0.05	2.1	<0.05	<0.05	2.3	2.6	<0.05	2.3	0.68
MT-6B	1DG4	1	S	3.9	<.05	1.8	<.05	<.05	2.9	3.2	<.05	2.7	.75
Mean				3.5	<.05	2.0	<.05	<.05	2.6	2.9	<.05	2.5	.72
Theoretical	1DG4	--	--	3.9	3.8	1.9	<.05	<.05	2.7	3.0	<.05	1.7	.71
NWQL	1DG4	--	--	--	--	--	--	--	--	--	--	--	--
MT-10	1DG5	1	S	4.8	5.1	5.7	<.05	<.05	4.4	4.8	<.05	4.6	1.4
MT-66	1DG5	1	S	6.0	5.7	5.5	<.05	<.05	5.2	6.5	<.05	5.3	1.6
MT-9	1DG5	1	S	4.7	4.9	5.5	<.05	<.05	4.3	4.8	<.05	4.5	1.3
Mean				5.2	5.2	5.6	<.05	<.05	4.6	5.4	<.05	4.8	1.4
Theoretical	1DG5	--	--	6.5	4.3	5.7	<.05	<.05	5.4	6.0	<.05	3.4	1.4
NWQL	1DG5	--	--	--	--	--	--	--	--	--	--	--	--
MT-275A	2DG1	2	S	.44	.40	<.20	<.05	<.05	5.6	1.5	<.05	1.5	2.3
Mean				.44	.40	<.20	<.05	<.05	5.6	1.5	<.05	1.5	2.3
Theoretical	2DG1	--	--	.40	.27	<.20	<.05	<.05	5.5	1.5	<.05	1.4	2.1
NWQL	2DG1	--	--	.30	.22	--	--	--	6.1	1.4	--	1.3	2.0
MT-276A	2DG2	2	S	1.3	1.1	.80	<.05	<.05	1.7	<.05	<.05	5.3	5.9
MT-612A	2DG2	2	BS	1.1	1.1	.58	<.05	<.05	1.5	<.05	<.05	5.0	5.4
MT-612B	2DG2	2	BS	1.1	1.1	.70	<.05	<.05	1.5	<.05	<.05	5.0	5.4
Mean				1.2	1.1	.69	<.05	<.05	1.6	<.05	<.05	5.1	5.6
Theoretical	2DG2	--	--	1.3	.90	1.0	<.05	<.05	2.0	--	--	5.1	5.7
NWQL	2DG2	--	--	1.0	.90	1.5	--	--	1.5	--	--	5.2	6.2
MT-277A	2DG3	2	S	5.4	4.9	6.4	<.05	<.05	.26	.37	<.05	.54	.51
MT-506A	2DG3	2	BS	1.7	3.5	<.20	<.05	<.05	.07	<.05	<.05	.38	.26
Mean				3.6	4.2	3.3	<.05	<.05	.17	.20	<.05	.46	.39
Theoretical	3DG3	--	--	5.2	3.8	5.7	<.05	<.05	.30	.30	<.05	.42	.40
NWQL	3DG3	--	--	4.6	3.8	4.8	--	--	.30	.30	--	.50	.40

Table 3. *Concentrations of selected herbicides and two atrazine metabolites in quality-assurance samples, 1989-90*--Continued

Laboratory identification number	Quality assurance identification	Round[1]	Sample type	Concentrations, in micrograms per liter									
				Alachlor	Atrazine	Cyanazine	DEA	DIA	Metolachlor	Metribuzin	Prometon	Propazine	Simazine
				Organic-free water--Continued									
MT-1203A	3DG1	3	S	0.33	0.53	1.6	0.13	<0.05	3.7	3.8	<0.05	0.61	4.4
MT-1219B	3DG1	3	BS	.34	.56	1.6	.11	<.05	4.7	3.7	<.05	.66	5.3
MT-1221A	3DG1	3	BS	.33	.51	1.9	.10	<.05	3.3	4.0	<.05	.62	4.2
MT-1221B	3DG1	3	BS	.30	.73	2.1	.11	<.05	3.6	7.3	<.05	.66	4.9
MT-1225A	3DG1	3	BS	.37	.56	1.7	.11	<.05	3.3	3.9	<.05	.63	4.4
MT-1294	3DG1	3	S	.30	.69	3.0	<.05	<.05	4.5	4.0	<.05	.64	4.6
Mean				.33	.60	2.0	.11	<.05	3.9	4.5	<.05	.64	4.6
Theoretical	3DG1	--	--	.30	.50	4.0	.10	<.05	3.5	3.0	<.05	.50	4.5
NWQL	3DG1	--	--	.27	.44	2.4	.19	--	2.3	2.7	--	.45	3.3
MT-1204A	3DG2	3	S	3.3	3.8	.70	.38	<.05	1.3	.57	<.05	1.8	1.5
MT-1218B	3DG2	3	BS	3.1	5.4	1.1	.39	<.05	1.2	.70	<.05	1.9	1.5
MT-1220B	3DG2	3	BS	3.2	5.1	.71	.32	<.05	1.1	.56	<.05	1.8	1.3
MT-1224A	3DG2	3	BS	3.1	3.8	1.0	.37	<.05	1.2	.73	<.05	1.8	1.7
MT-1293	3DG2	3	S	4.2	5.1	1.8	.36	<.05	1.5	.65	<.05	1.9	1.5
Mean				3.4	4.6	1.1	.36	<.05	1.3	.64	<.05	1.8	1.5
Theoretical	4DG2	--	--	3.0	4.0	1.5	.40	<.05	1.1	.50	<.05	1.5	1.5
NWQL	4DG2	--	--	2.7	3.8	.94	.49	--	1.0	.41	--	1.4	1.1
MT-1964	4DG1	4	S	.34	.25	.38	<.05	<.05	.21	<.05	<.05	<.05	<.05
MT-2155	4DG1	4	S	.33	.27	<.20	<.05	<.05	.19	<.05	<.05	<.05	<.05
MT-3138	4DG1	4	S	.35	.26	<.20	<.05	<.05	.19	<.05	<.05	<.05	<.05
Mean				.34	.26	<.20	<.05	<.05	.20	<.05	<.05	<.05	<.05
Theoretical	4DG1	--	--	.30	.20	.05	<.05	<.05	.20	<.05	<.05	<.05	<.05
NWQL	4DG1	--	--	.30	.20	--	--	--	.20	.--	--	--	--

Table 3. *Concentrations of selected herbicides and two atrazine metabolites in quality-assurance samples, 1989-90*--Continued

Laboratory identification number	Quality assurance identification	Round[1]	Sample type	Concentrations, in micrograms per liter									
				Alachlor	Atrazine	Cyanazine	DEA	DIA	Metolachlor	Metribuzin	Prometon	Propazine	Simazine
				Organic-free water--Continued									
MT-1963	4DG2	4	S	0.78	1.4	<0.20	<0.05	<0.05	0.48	0.23	<0.05	<0.05	0.55
MT-2156	4DG2	4	S	.86	1.5	.20	<.05	<.05	.50	.17	<.05	<.05	.50
MT-3139	4DG2	4	S	.99	1.5	.50	<.05	<.05	.51	.28	<.05	<.05	.59
Mean				.88	1.5	.27	<.05	<.05	.50	.23	<.05	<.05	.55
Theoretical	4DG2	--	--	.80	1.2	.50	<.05	<.05	.50	.20	<.05	<.05	.50
NWQL	4DG2	--	--	.60	1.0	.50	--	--	.40	.20	--	--	.40

[1]Round--1, 1989 pre-application (March or April);
2, 1989 post-application (May or June);
3, 1989 fall low flow (October or November); and
4, 1990 pre-application (March or April).

Table 4. *Herbicide compounds analyzed and percentage of detections in pre-application, post-application, and fall low-flow samples during 1989-90*

[µg/L, micrograms per liter; N, number of samples analyzed; <, less than. 1990 samples are from a stratified random subset of sites sampled in 1989 and are biased toward a slightly higher detection rate; ametryn, prometryn, terbutryn were not detected]

Herbicide or metabolite	Reporting limit (µg/L)	Percentage of detections				
		1989 pre-application (N=55)	1989 post-application (N=132)	1989 fall low flow (N=145)	1990 pre-application (N=52)	1990 post-application (N=52)
Alachlor	0.05	18	86	12	50	92
Atrazine	.05	91	98	76	96	100
Cyanazine	.20	5	63	0	8	81
Deethylatrazine	.05	54	86	47	86	98
Deisopropylatrazine	.05	9	54	0	44	90
Metolachlor	.05	34	83	44	67	96
Metribuzin	.05	2	53	0	0	58
Prometon	.05	0	23	6	10	17
Propazine	.05	0	40	<1	0	65
Simazine	.05	7	55	3	15	67

Levels (HAL) for drinking water (U.S. Environmental Protection Agency, 1988; Federal Register, 1989, 1990) in more than one-half of the samples (table 5). The majority of exceedences occurred during the post-application samplings (table 5). However, in order for these concentrations to be in violation of the Safe Drinking Water Act, the average annual concentrations must exceed the MCLs.

Analytical results indicate that atrazine was the most frequently detected and the most persistent of the major herbicides followed by deethylatrazine and metolachlor (Goolsby and others, 1990). Alachlor and cyanazine were detected primarily during the late spring and summer (table 7 at the end of this report). Atrazine was detected in three-fourths of the streams sampled during the fall. Resampling of about 50 streams in 1990 before and after herbicide application produced results similar to those obtained in 1989.

Concentrations of alachlor, atrazine, cyanazine, and metolachlor for the five sampling periods (data from table 7) are shown in figures 6-9. These figures also show that atrazine had the largest concentration, followed by alachlor, metolachlor, and cyanazine.

ELISA proved to be a rapid, reliable, and inexpensive method for analysis of herbicides in surface water. The presence or absence of triazine herbicides at concentrations of about 0.5 µg/L can be determined by visually comparing water samples with standard solutions containing atrazine. When a spectrophotometer is used to quantify immunoassay results, triazine concentrations as small as 0.2 µg/L can be detected. No false-positive identifications of atrazine were made by immunoassay, and no false-negative detections resulted from samples containing 0.5 µg/L or more of atrazine concentrations. The immunoassay results were useful in determining the occurrence and seasonal distribution of atrazine in the corn and soybean belt of the midwestern United States (Goolsby and others, 1991b).

Table 5. *Comparison of herbicide samples collected during 1989-90 with Maximum Contaminant Levels and Health Advisory Levels for drinking water in effect at the time of this study*

[MCL, U.S. Environmental Protection Agency Maximum Contaminant Level; HAL, Health Advisory Levels; µg/L, micrograms per liter; --, no data. 1990 samples are from a stratified random subset of sites sampled in 1989 and are biased toward slightly higher concentrations. HAL for cyanazine was 10 µg/L in 1989-90; current (1993) HAL is 1 µg/L; MCL for simazine was 1 µg/L in 1989-90; current (1993) MCL is 4 mg/L]

Herbicide	1990 MCL (µg/L)	1990 Lifetime HAL (µg/L)	Percentage of samples above MCL or HAL				
			1989 pre-application (March or April)	1989 post-application (May or June)	1989 fall low flow (October or November)	1990 pre-application (March or April)	1990 post-application (May or June)
Alachlor	2.0	--	0	36	0	0	40
Atrazine	3.0	3.0	0	52	.60	1.6	74
Cyanazine	--	10	0	48	0	0	63
Simazine	1.0	4.0	5.6	8.8	0	3.1	12

REFERENCES CITED

Bushway, R.J., Perkins, Bill, Savage, S.A., Lekousi, S.L., and Ferguson, B.S., 1988, Determination of atrazine residues in water and soil by enzyme immunoassay: Bulletin of Environmental Contamination Toxicology, v. 40, p. 647-654.

Federal Register, 1989, National Primary and Secondary Drinking Water Regulations: Washington, D.C., v. 54, no. 97, May 22, 1989, p. 22062-22160.

_____1990, National Primary and Secondary Drinking Water Regulations: Washington, D.C., v. 55, no. 143, July 25, 1990, p. 30370-30447.

Fishman, M.J., and Friedman, L.C., 1989, Methods for the determination of inorganic substances in water and fluvial sediments: U.S. Geological Survey Techniques of Water-Resources Investigations, book 5, chap. A1, 545 p.

Gianessi, L.P., and Puffer, C.M., 1990, Herbicide use in the United States--National Summary Report, revised April 1991: Washington, D.C., Resources for the Future, 128 p.

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

Goolsby, D. A., Thurman, E. M., Clark, M.L., and Pomes, M.L., 1991b, Immunoassay as a screening tool for atrazine herbicides in streams--Comparison with gas chromatographic/mass spectrometric methods, *in* Vanderlaan, Martin, Stanker, L.H., Watkins, B.E., and Roberts, D.W., eds., Immunoassays for trace chemical analysis: American Chemical Society, ACS Symposium Series 451, chap. 8, p. 86-99.

Goolsby, D. A., Thurman, E. M., and Kolpin, D. W., 1990, Geographic and temporal distribution of herbicides in surface waters of the upper midwestern United States, 1989-90: U.S. Geological Survey Water-Resources Investigations Report 91-4034, p. 86-99.

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

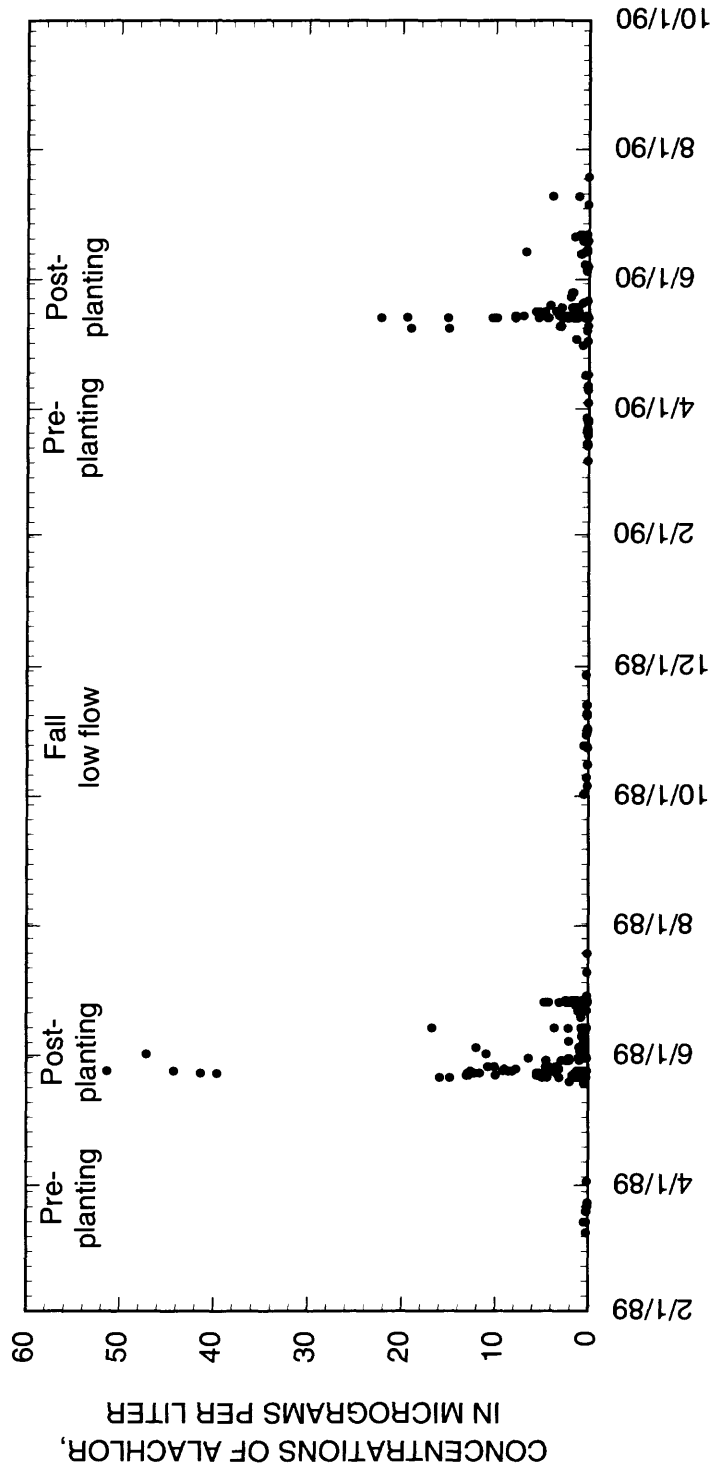

Figure 6. Concentrations of alachlor during 1989-90 reconnaissance study.

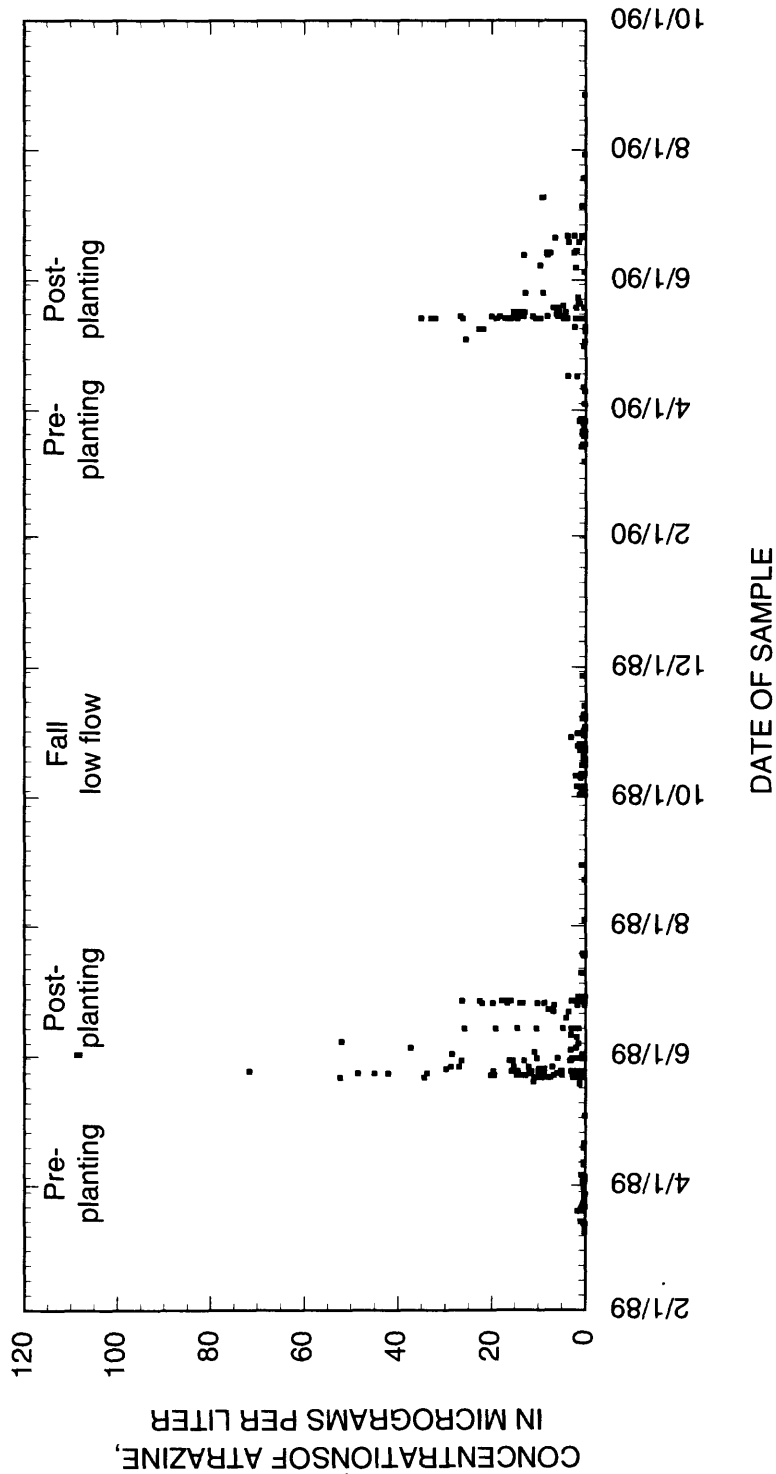

Figure 7. Concentrations of atrazine during 1989-90 reconnaissance study.

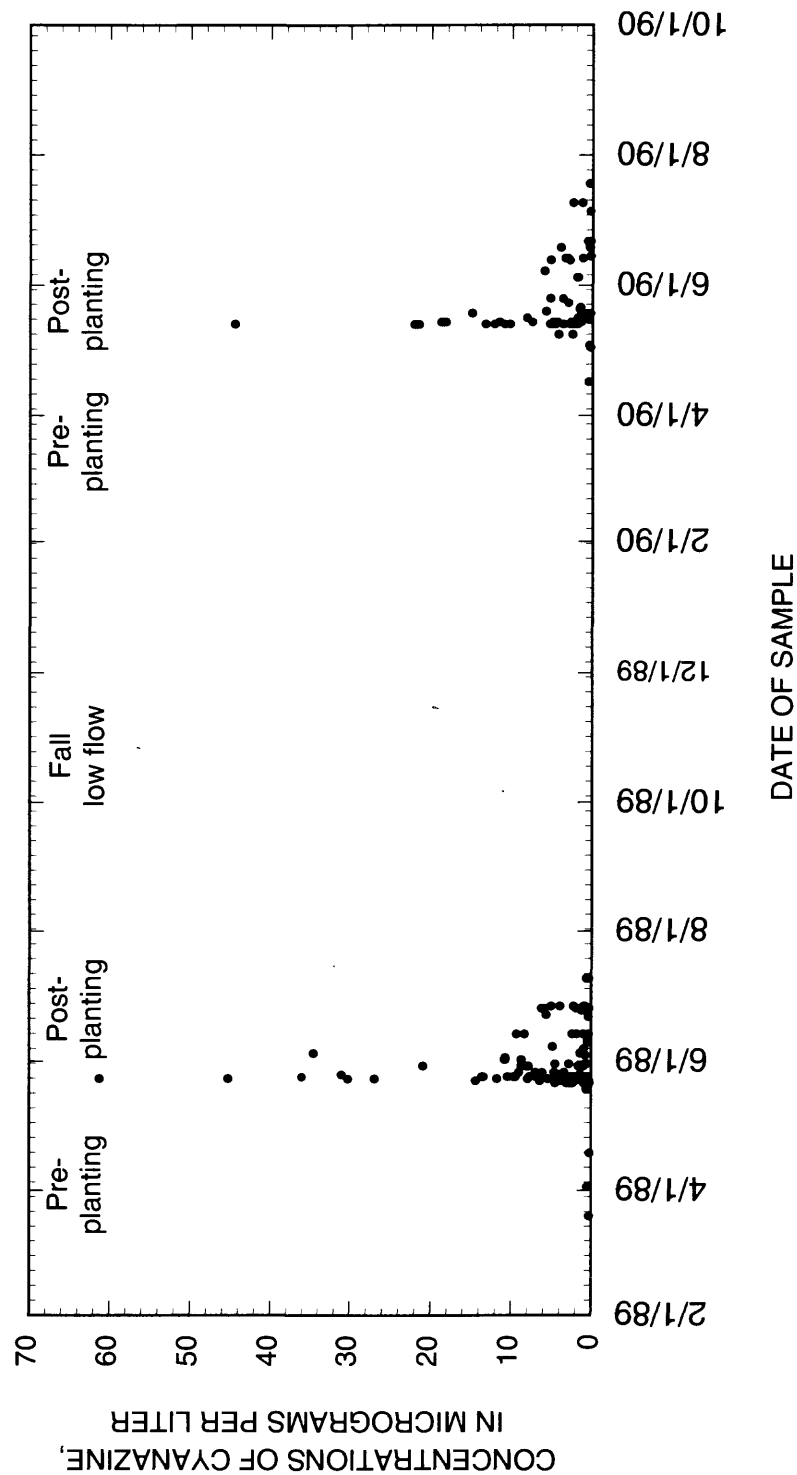

Figure 8. Concentrations of cyanazine during 1989-90 reconnaissance study.

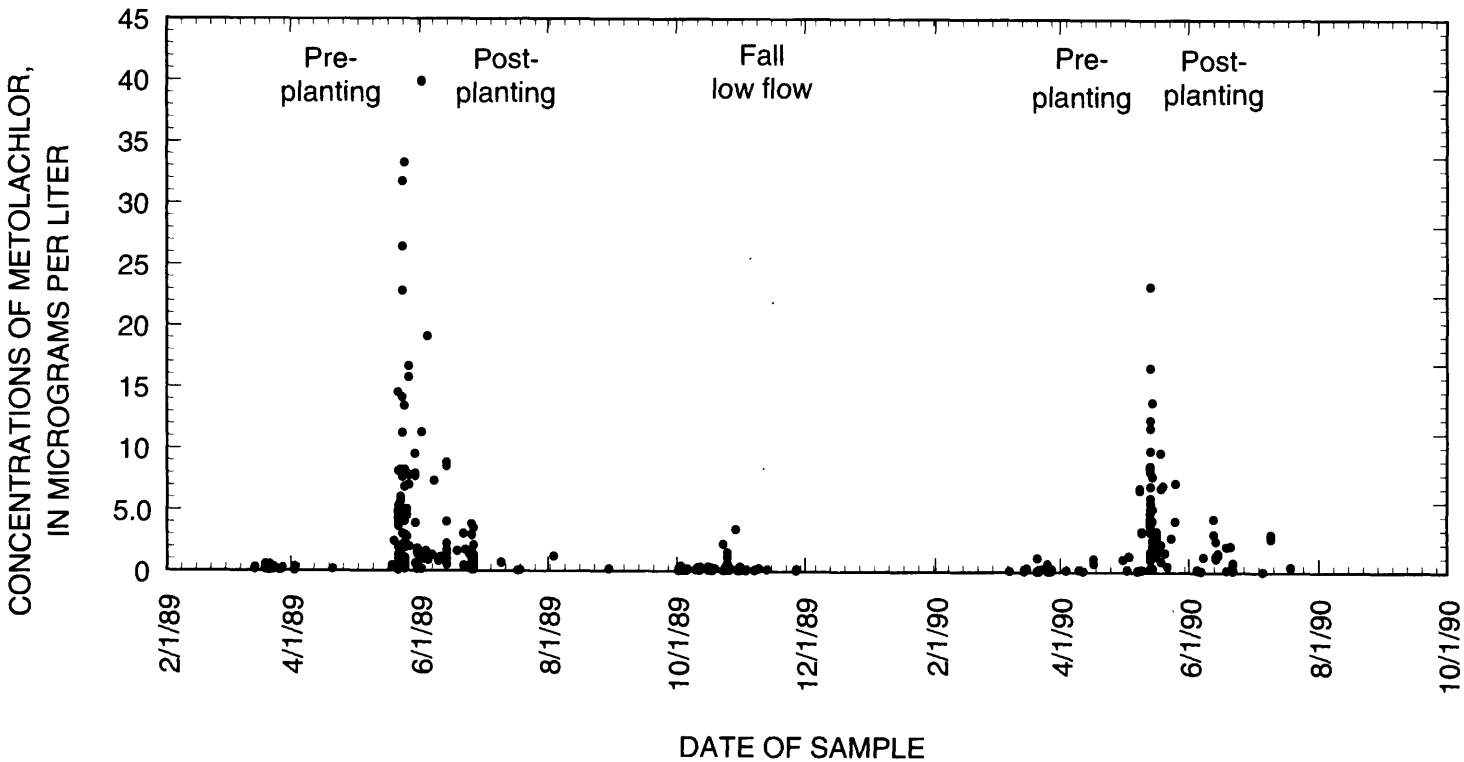

Figure 9. Concentrations of metolachlor during 1989-90 reconnaissance study.

Thurman, E.M., Goolsby, D.A., Meyer, M.T., Mills, M.S., Pomes, M.L., and Kolpin, D.W., 1992, A reconnaissance study of herbicides and their metabolites in surface water of the midwestern United States using immunoassay and gas chromatography/mass spectrometry: Environmental Science and Technology, v. 26, p. 2440-2447.

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

U.S. Environmental Protection Agency, 1988, Drinking water health advisory--Pesticides: Chelsea, Mich., Lewis Publishers, 819 p.

Table 6. *Results of analyses of water-quality samples collected from Midwest streams and comparison of laboratory analyses for atrazine by ELISA and GC/MS, 1989-90*

[ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; --, no data; <, less than; >, greater than; ELISA, enzyme-linked immunosorbent assay; GC/MS, gas chromatography/mass spectrometry]

Map no (figs. 2-5)	Site name	Date of collection (month/ day/year)	Stream-flow (ft^3/s)	Specific conduct-ance (µS/cm)	pH (standard units)	Nitrite plus nitrate as nitrogen (mg/L)	Atrazine ELISA-Iowa[1] (µg/L)	Atrazine ELISA-Kans.[2] (µg/L)	Atrazine GC/MS[3] (µg/L)
			South Dakota						
1	Big Sioux River near Watertown	04/04/89	71	360	8.5	0.44	<0.20	--	--
		06/29/89	1.5	570	9.5	<.10	<.20	--	0.08
		11/03/89	.74	790	8.0	.14	<.20	--	--
2	Big Sioux River near Castlewood	04/04/89	32	730	8.4	.45	.20	--	--
		06/29/89	4.0	980	9.7	<.10	1.5	--	1.5
		11/03/89	6.2	1,130	8.0	3.8	.40	--	--
		04/10/90	8.4	1,190	9.6	.30	--		.07
		08/27/90	12	990	8.0	.50	--	--	.14
3	Big Sioux River near Brookings	04/04/89	312	600	8.4	.83	<.20	--	--
		06/29/89	60	885	9.2	.17	.90	--	.82
		11/03/89	24	1,110	8.5	2.9	<.20	--	.06
4	Big Sioux River at N. Cliff Avenue	04/04/89	550	560	8.4	1.2	.30	--	--
		06/27/89	33	1,130	8.4	1.0	2.5	--	1.6
		11/02/89	19	1,770	8.0	17	.20	--	--
5	James River near Scotland	04/03/89	1,460	520	7.9	.88	.70	0.20	.55
		06/27/89	139	1,230	8.3	<.10	<.20	--	.19
		11/02/89	43	2,000	8.0	<.10	<.20	--	<.05

Table 6. *Results of analyses of water-quality samples collected from Midwest streams and comparison of laboratory analyses for atrazine by ELISA and GC/MS, 1989-90*--Continued

Map no (figs. 2-5)	Site name	Date of collection (month/ day/year)	Stream-flow (ft^3/s)	Specific conduct-ance (µS/cm)	pH (standard units)	Nitrite plus nitrate as nitrogen (mg/L)	Atrazine ELISA-Iowa[1] (µg/L)	Atrazine ELISA-Kans.[2] (µg/L)	Atrazine GC/MS[3] (µg/L)
			South Dakota--Continued						
6	Vermillion River near Vermillion	04/03/89	111	980	8.7	<0.10	<0.20	0.20	0.17
		06/27/89	19	1,340	8.2	<.10	<.20	--	<.05
		11/02/89	5.0	1,660	7.7	<.10	<.20	--	<.05
7	Brule Creek near Elk Point	04/03/89	18	1,000	8.9	.43	<.20	--	--
		06/27/89	7.8	950	8.4	.12	.30	--	.36
		11/02/89	2.8	1,000	8.1	<.10	<.20	--	--
8	Big Sioux River at Akron	04/03/89	2,140	500	8.5	1.8	<.20	.30	.46
		06/27/89	223	740	9.1	<.10	.90	--	.59
		11/02/89	107	1,290	9.0	2.6	<.20	--	<.05
			Nebraska						
9	Bow Creek near St. James	04/05/89	48	696	8.4	2.5	<.20	--	--
		06/26/89	449	580	8.4	1.3	<.20	--	.20
		10/18/89	30.0	666	8.3	1.8	<.20	--	<.05
10	Elkhorn River near Atkinson	04/05/89	43	231	8.4	1.5	<.20	--	--
		06/26/89	22.3	211	8.9	1.0	.20	--	--
		10/23/89	12.2	254	8.4	2.0	1.9	--	1.2
11	Clearwater Creek near Clearwater	04/05/89	30.0	316	8.3	.16	<.20	--	--
		06/26/89	13.4	307	8.2	.12	<.20	--	.20
		10/18/89	22.0	285	8.4	<.10	<.20	--	<.05

Table 6. *Results of analyses of water-quality samples collected from Midwest streams and comparison of laboratory analyses for atrazine by ELISA and GC/MS, 1989-90*--Continued

Map no (figs. 2-5)	Site name	Date of collection (month/ day/year)	Stream-flow (ft^3/s)	Specific conduct-ance (µS/cm)	pH (standard units)	Nitrite plus nitrate as nitrogen (mg/L)	Atrazine ELISA-Iowa[1] (µg/L)	Atrazine ELISA-Kans.[2] (µg/L)	Atrazine GC/MS[3] (µg/L)
			Nebraska -- Continued						
12	Mira Creek near Northloup	04/11/89	0.70	708	8.4	<0.10	<0.20	<0.30	0.27
		06/25/89	.71	544	7.9	<.10	<.20	--	.15
		10/20/89	.23	585	7.7	<.10	.70	--	.47
13	Shell Creek near Columbus	04/05/89	18.0	605	8.4	.57	<.20	--	--
		06/26/89	137	300	7.3	4.5	>5.0	--	14
		10/19/89	14.5	696	8.1	.25	.50	--	.28
14	Maple Creek near Nickerson	04/05/89	15.0	588	8.5	.65	<.20	<.20	.07
		06/26/89	333	269	7.6	2.8	>5.0	--	8.7
		10/19/89	13.0	556	8.1	.38	<.20	--	.08
15	Mud Creek at Sweetwater	04/11/89	21.0	576	8.6	.18	<.20	--	--
		06/25/89	27.8	434	8.1	1.1	1.9	--	1.7
		10/23/89	15.0	584	8.2	<.10	<.20	--	<.05
16	Big Blue River at Surprise	04/05/89	3.5	570	8.4	1.1	.20	--	--
		06/26/89	71.0	375	7.5	1.2	>5.0	--	17
		10/31/89	3.0	475	7.5	.23	1.3	--	.70
17	Wahoo Creek at Itica	04/04/89	40.0	821	8.4	1.1	<.20	<.20	<.05
		06/08/89	161	248	7.5	2.3	>5.0	--	52
		10/19/89	26.0	812	8.1	1.2	<.20	--	<.05
		03/20/90	32.0	870	8.5	1.5	--	--	.07
		06/08/90	126	548	7.8	1.9	--	--	9.6

Table 6. *Results of analyses of water-quality samples collected from Midwest streams and comparison of laboratory analyses for atrazine by ELISA and GC/MS, 1989-90*--Continued

Map no (figs. 2-5)	Site name	Date of collection (month/ day/year)	Stream-flow (ft^3/s)	Specific conduct-ance (µS/cm)	pH (standard units)	Nitrite plus nitrate as nitrogen (mg/L)	Atrazine ELISA-Iowa[1] (µg/L)	Atrazine ELISA-Kans.[2] (µg/L)	Atrazine GC/MS[3] (µg/L)
			Nebraska -- Continued						
18	W. Fork Big Blue River near Dorchester	04/04/89	70.0	632	8.1	1.7	<0.20	<0.20	0.16
		06/27/89	1,830	130	8.8	4.0	<.20	--	23
		10/31/89	56.0	572	7.9	.84	.50	--	.34
19	Salt Creek at Roca	04/06/89	10.5	735	8.8	<.10	<.20	--	--
		06/26/89	53.0	497	7.7	1.8	>5.0	--	13
		10/31/89	10.5	990	7.7	.60	2.5	--	1.7
		03/27/90	19.0	1,232	8.8	.20	--	--	.12
		06/07/90	59.0	581	8.2	.20	--	--	2.1
20	Muddy Creek near Arapahoe	03/31/89	6.74	552	8.4	1.5	<.20	--	--
		06/25/89	4,160	101	7.8	.80	4.2	--	6.6
		11/07/89	5.58	595	8.0	2.0	<.20	--	.11
21	Little Blue River near Fairbury	04/05/89	116	495	8.5	.94	<.20	--	--
		06/26/89	6,590	162	7.5	.60	>5.0	--	22
		10/30/89	106	438	7.9	1.1	.40	--	.31
		03/21/90	131	513	8.4	1.4	--	--	.21
		05/17/90	258	381	8.0	1.7	--	--	15
22	Little Nemaha River at Auburn	04/06/89	57.0	586	8.4	.36	<.20	--	--
		06/26/89	696	217	7.6	1.2	>5.0	--	10
		10/24/89	53.0	612	8.2	.12	.20	--	.24

Table 6. *Results of analyses of water-quality samples collected from Midwest streams and comparison of laboratory analyses for atrazine by ELISA and GC/MS, 1989-90*--Continued

Map no (figs. 2-5)	Site name	Date of collection (month/ day/year)	Stream-flow (ft^3/s)	Specific conduct-ance (µS/cm)	pH (standard units)	Nitrite plus nitrate as nitrogen (mg/L)	Atrazine ELISA-Iowa[1] (µg/L)	Atrazine ELISA-Kans.[2] (µg/L)	Atrazine GC/MS[3] (µg/L)
			Nebraska -- Continued						
23	Big Blue River at Barneston	04/06/89	226	696	8.9	2.0	2.1	1.7	0.91
		06/27/89	3,380	310	7.9	2.1	>5.0	--	16
		10/23/89	579	684	8.9	.55	.90	--	.51
		03/21/90	330	708	8.7	2.1	--	--	.51
		05/17/90	801	378	7.9	2.0	--	--	14
24	Big Nemaha River at Fall City	04/06/89	56.0	668	8.4	<.10	<.20	--	--
		06/26/89	656	291	7.9	1.4	>5.0	--	20
		10/24/89	56.0	746	8.2	<.10	.50	--	.54
		03/27/90	123	726	8.5	.30	--	--	.81
		05/17/90	1,447	356	7.9	1.8	--	--	5.6
			Kansas						
25	Turkey Creek near Seneca	03/21/89	2.64	712	8.6	<.10	<.20	<.20	<.05
		05/22/89	13.0	630	7.9	<.10	.30	.40	.22
		10/12/89	6.40	724	8.3	<.10	<.20	--	.23
26	Black Vermillion River near Frankfort	03/16/89	12.2	540	8.4	<.10	<.20	--	--
		06/27/89	588	205	7.8	1.4	>5.0	--	16
		10/04/89	7.30	572	8.4	<.10	.30	--	.35
		03/22/90	24.6	606	8.2	.48	--	--	.47
		05/16/90	2,560	268	7.6	1.6	--	--	6.1

Table 6. *Results of analyses of water-quality samples collected from Midwest streams and comparison of laboratory analyses for atrazine by ELISA and GC/MS, 1989-90*--Continued

Map no (figs. 2-5)	Site name	Date of collection (month/ day/year)	Stream-flow (ft^3/s)	Specific conduct-ance (µS/cm)	pH (standard units)	Nitrite plus nitrate as nitrogen (mg/L)	Atrazine ELISA-Iowa[1] (µg/L)	Atrazine ELISA-Kans.[2] (µg/L)	Atrazine GC/MS[3] (µg/L)
			Kansas--Continued						
27	Delaware River near Muscotah	03/15/89	9.87	569	8.8	<0.10	<0.20	--	--
		05/22/89	54.3	664	8.0	.19	>5.0	6.0	10
		10/11/89	3.00	629	8.2	<.10	.90	--	.82
28	Salt Creek near Ada	03/21/89	4.58	2,960	8.2	<.10	<.20	<.20	<.05
		05/22/89	550	307	8.1	.97	.40	.40	.27
		10/12/89	2.10	3,280	8.0	<.10	.40	--	.49
29	Mill Creek near Paxico	03/14/89	4.29	789	8.3	<.10	<.20	--	--
		09/05/89	330	230	7.8	.50	.30	--	--
		10/06/89	22.5	661	8.2	<.10	<.20	--	<.05
30	Kansas River at Topeka	03/14/89	842	1,050	8.8	<.10	.80	--	--
		08/30/89	3,690	440	8.1	.87	3.8	--	--
		10/06/89	2,360	546	8.4	.76	2.3	--	1.8
			Minnesota						
31	Knife River near Mora	04/21/89	114	116	8.1	.17	<.20	--	--
		07/19/89	9.20	242	7.8	.17	<.20	--	.09
		10/31/89	1.50	265	8.1	.37	<.20	--	<.05
		05/30/90	61.0	158	8.2	.10	--	--	<.05

Table 6. *Results of analyses of water-quality samples collected from Midwest streams and comparison of laboratory analyses for atrazine by ELISA and GC/MS, 1989-90*--Continued

Map no (figs. 2-5)	Site name	Date of collection (month/ day/year)	Stream-flow (ft^3/s)	Specific conduct-ance (µS/cm)	pH (standard units)	Nitrite plus nitrate as nitrogen (mg/L)	Atrazine ELISA-Iowa[1] (µg/L)	Atrazine ELISA-Kans.[2] (µg/L)	Atrazine GC/MS[3] (µg/L)
			Minnesota--Continued						
32	Sauk River near St. Cloud	03/23/89	300	720	7.9	2.0	0.30	--	--
		05/25/89	700	581	8.2	.51	.60	--	--
		11/08/89	--	--	--	.96	.40	--	0.17
33	Pomme de Terre River at Appleton	05/04/89	197	950	8.3	<.10	<.20	0.40	.06
		07/18/89	66.0	925	8.4	.21	<.20	--	.32
		10/25/89	22.0	680	8.2	<.10	<.20	--	<.05
34	Rum River near St. Francis	04/19/89	790	221	8.6	.34	<.20	--	--
		07/19/89	165	357	8.4	<.10	<.20	--	<.05
		10/31/89	150	346	8.1	.27	<.20	--	<.05
			Wisconsin						
35	St. Croix River at St. Croix Falls	04/24/90	7,590	121	7.2	.14	<.20	--	--
		05/31/89	9,910	117	--	.13	<.20	--	.14
		10/11/89	1,710	208	8.2	<.10	<.20	--	<.05
		04/23/90	5,450	168	7.8	<.10	--	--	<.05
		07/30/90	5,600	174	7.8	.30	--	--	.16
			Minnesota						
36	Crow River at Rockford	04/19/89	465	544	9.4	<.10	.20	.30	.33
		05/25/89	390	672	8.3	.74	3.3	3.4	2.8
		10/26/89	47.0	970	8.1	<.10	<.20	--	<.05

Table 6. *Results of analyses of water-quality samples collected from Midwest streams and comparison of laboratory analyses for atrazine by ELISA and GC/MS, 1989-90*--Continued

Map no (figs. 2-5)	Site name	Date of collection (month/ day/year)	Stream-flow (ft^3/s)	Specific conduct-ance (µS/cm)	pH (standard units)	Nitrite plus nitrate as nitrogen (mg/L)	Atrazine ELISA-Iowa[1] (µg/L)	Atrazine ELISA-Kans.[2] (µg/L)	Atrazine GC/MS[3] (µg/L)
			Minnesota -- Continued						
37	Minnesota River near Jordan	03/22/89	1,892	590	8.2	2.8	0.40	0.20	0.17
		07/19/89	508	868	8.1	<.10	<.20	--	.29
		10/29/89	230	995	8.2	<.10	5.0	--	3.1
38	Redwood River near Redwood Falls	05/04/89	62.0	1,670	8.3	<.10	<.20	.20	.08
		06/27/89	93.0	1,200	8.1	3.7	.30	--	.42
		10/24/89	8.70	1,440	8.3	<.10	.30	--	.11
39	Cottonwood River near New Ulm	03/21/89	126	450	7.9	3.7	<.20	--	--
		07/18/89	58.0	642	8.4	<.10	<.20	--	.15
		11/08/89	17.0	1,000	8.2	.11	.20	--	<.05
		05/01/90	71.0	962	8.6	<.10	--	--	.33
		06/05/90	316	1,223	8.4	8.5	--	--	.26
40	Le Sueur River near Rapidan	04/20/89	101	657	8.7	2.6	<.20	--	--
		07/18/89	36.0	631	8.4	<.10	<.20	--	.27
		11/07/89	14.0	775	8.3	.18	<.20	--	<.05
41	Straight River near Faribault	04/05/89	204	660	8.4	6.0	.20	.30	.29
		07/19/89	30.0	678	8.8	<.10	<.20	--	.32
		11/08/89	49.0	721	8.4	1.1	--	--	<.05
42	N. Fork Whitewater River near Elba	04/05/89	38.0	546	8.2	1.6	<.20	--	--
		07/19/89	342	531	8.4	1.9	--	--	--
		11/08/89	22.0	521	8.1	2.6	--	--	.05

Table 6. *Results of analyses of water-quality samples collected from Midwest streams and comparison of laboratory analyses for atrazine by ELISA and GC/MS, 1989-90*--Continued

Map no (figs. 2-5)	Site name	Date of collection (month/ day/year)	Stream-flow (ft^3/s)	Specific conduct-ance (µS/cm)	pH (standard units)	Nitrite plus nitrate as nitrogen (mg/L)	Atrazine ELISA-Iowa[1] (µg/L)	Atrazine ELISA-Kans.[2] (µg/L)	Atrazine GC/MS[3] (µg/L)
			Minnesota -- Continued						
43	Rock River at Luverne	05/03/89	87.0	790	8.1	1.8	<0.20	--	--
		06/27/89	200	510	7.5	4.0	3.3	--	2.9
		10/23/89	12.0	440	8.7	1.1	<.20	--	.08
		05/08/90	36.3	730	8.4	.60	--	--	.08
		06/19/90	212	390	8.2	2.1	--	--	3.5
44	Des Moines River at Jackson	05/03/89	143	1,010	8.9	<.10	<.20	--	--
		06/27/89	40.0	1,110	8.7	<.10	1.4	--	1.0
		10/23/89	1.50	835	8.3	<.10	.70	--	.61
		05/08/90	46.0	1,290	8.8	<.10	--	--	.11
		06/19/90	424	925	8.5	4.9	--	--	1.4
45	Rush Creek near Rushford	04/05/89	48.0	490	8.2	2.1	<.20	--	--
		05/25/89	55.0	445	7.9	1.8	1.7	--	2.1
		11/07/89	39.0	479	8.2	1.8	--	--	.06
			Iowa						
46	Ocheyedan River near Spencer	03/28/89	89.2	460	7.6	2.1	<.20	0.20	.13
		05/24/89	--	--	--	4.0	>5.0	8.0	12
		10/12/89	4.55	640	8.3	<.10	<.20	--	<.05
47	Des Moines River at Estherville	03/28/89	818	440	7.4	2.0	<.20	.20	.14
		10/12/89	1.30	2,950	8.0	.40	.20	--	.16

Table 6. *Results of analyses of water-quality samples collected from Midwest streams and comparison of laboratory analyses for atrazine by ELISA and GC/MS, 1989-90*--Continued

Map no (figs. 2-5)	Site name	Date of collection (month/ day/year)	Stream-flow (ft^3/s)	Specific conduct-ance (µS/cm)	pH (standard units)	Nitrite plus nitrate as nitrogen (mg/L)	Atrazine ELISA-Iowa[1] (µg/L)	Atrazine ELISA-Kans.[2] (µg/L)	Atrazine GC/MS[3] (µg/L)
			Iowa -- Continued						
48	Winnebago River at Mason City	03/20/89	163	492	7.6	6.3	0.20	0.40	0.51
		10/11/89	10.7	740	7.6	<.10	<.20	--	<.05
49	Little Cedar River near Ionia	03/21/89	66.5	350	7.7	2.4	.70	--	--
		10/16/89	9.70	430	7.7	<.10	.20	--	.14
50	Turkey River at Spillville	03/31/89	50.0	494	8.3	3.1	<.20	--	--
		10/04/89	10.4	550	7.8	1.7	<.20	--	<.05
		03/22/90	99.8	565	8.4	8.3	--	--	.43
		06/14/90	212	430	7.9	<.10	--	--	8.2
51	Upper Iowa River near Dorchester	03/31/89	348	453	8.4	2.3	<.20	--	.33
		05/31/89	300	430	7.6	<.10	--	--	10
		10/05/89	133	430	8.3	<.10	<.20	--	.15
52	Little Sioux River at Correctionville	03/23/89	509	540	7.9	3.1	--	--	--
		05/25/89	1,620	308	6.9	.10	>5.0	--	9.9
		10/02/89	42.0	970	8.7	<.10	<.20	--	.13
		03/16/90	264	575	8.5	1.2	--	--	.19
		06/14/90	788	622	7.1	6.5	--	--	7.4
53	North Racoon River near Sac City	03/24/89	163	630	7.7	4.6	4.2	--	--
		05/24/89	--	--	--	7.0	.80	--	1.1
		10/12/89	12.6	1,120	8.8	<.10	<.20	--	<.05

Table 6. *Results of analyses of water-quality samples collected from Midwest streams and comparison of laboratory analyses for atrazine by ELISA and GC/MS, 1989-90*--Continued

Map no (figs. 2-5)	Site name	Date of collection (month/ day/year)	Stream-flow (ft^3/s)	Specific conduct-ance (µS/cm)	pH (standard units)	Nitrite plus nitrate as nitrogen (mg/L)	Atrazine ELISA-Iowa[1] (µg/L)	Atrazine ELISA-Kans.[2] (µg/L)	Atrazine GC/MS[3] (µg/L)
			Iowa -- Continued						
54	Des Moines River at Fort Dodge	03/27/89	1,170	430	7.6	2.4	<0.20	--	--
		05/24/89	--	--	--	7.8	2.2	2.8	2.3
		10/13/89	57.1	690	7.6	<.10	<.20	--	<.05
		03/16/90	746	625	7.8	8.8	--	--	.12
		06/15/90	3,880	505	7.7	11	--	--	1.8
55	Iowa River near Rowan	03/23/89	122	530	7.3	3.2	<.20	--	--
		10/11/89	8.22	930	7.2	<.10	<.20	--	<.05
56	Cedar River at Cedar Falls	03/20/89	2,870	348	8.2	3.4	.90	--	--
		11/09/89	402	550	8.9	1.4	<.20	--	.15
57	Black Hawk Creek at Hudson	03/22/89	102	460	7.4	3.9	.30	--	--
		10/18/89	2.93	720	7.3	.10	.40	--	<.05
58	Wapsipinicon River at Independence	03/20/89	854	240	8.1	3.0	2.7	1.5	1.7
		11/09/89	174	555	8.5	9.7	<.20	--	.39
		03/22/90	988	488	8.3	13	--	--	.63
		05/09/90	1,270	358	8.5	8.1	--	--	22
		06/22/90	2,210	578	8.0	<.10	--	--	3.9
59	Maple River at Mapleton	03/23/89	128	700	8.0	6.40	--	--	--
		05/24/89	852	303	6.6	.10	>5.0	--	34

Table 6. *Results of analyses of water-quality samples collected from Midwest streams and comparison of laboratory analyses for atrazine by ELISA and GC/MS, 1989-90*--Continued

Map no (figs. 2-5)	Site name	Date of collection (month/ day/year)	Stream-flow (ft^3/s)	Specific conduct-ance (µS/cm)	pH (standard units)	Nitrite plus nitrate as nitrogen (mg/L)	Atrazine ELISA-Iowa[1] (µg/L)	Atrazine ELISA-Kans.[2] (µg/L)	Atrazine GC/MS[3] (µg/L)
			Iowa -- Continued						
59	Maple River at Mapleton--Continued	10/02/89	44.4	680	8.5	3.0	0.80	--	0.59
		03/16/90	150	680	8.4	6.8	--	--	.40
		06/13/90	4,960	242	6.7	3.6	--	--	13
60	Boyer River at Logan	03/23/89	158	750	7.8	5.9	<.20	<0.20	.14
		05/24/89	2,070	323	6.5	.10	>5.0	10	45
		10/02/89	50.3	630	8.5	.12	<.20	--	.23
		03/16/90	461	540	8.3	4.1	--	--	.55
		06/13/90	15,700	220	6.6	2.1	--	--	8.0
61	Raccoon River at Van Meter	03/21/89	516	512	8.1	3.3	<.20	--	--
		05/25/89	2,700	452	8.6	2.0	.70	--	1.1
		11/08/89	201	605	8.6	3.2	<.20	--	.32
		05/03/90	534	584	8.7	2.2	--	--	.12
		05/10/90	3,420	500	8.3	8.2	--	--	2.3
62	Indian Creek near Mingo	03/20/89	11.0	765	8.2	1.0	.40	--	--
		05/24/89	1,010	205	8.1	2.8	3.8	--	5.0
		10/10/89	1.30	580	8.1	<.10	<.20	--	<.05
63	Iowa River near Marengo	03/24/89	693	432	7.7	2.5	.40	.40	.42
		05/25/89	516	405	7.4	<.10	>5.0	9.4	15
		11/07/89	134	540	9.5	<.10	<.20	--	.15

Table 6. *Results of analyses of water-quality samples collected from Midwest streams and comparison of laboratory analyses for atrazine by ELISA and GC/MS, 1989-90*--Continued

Map no (figs. 2-5)	Site name	Date of collection (month/ day/year)	Stream-flow (ft^3/s)	Specific conduct-ance (µS/cm)	pH (standard units)	Nitrite plus nitrate as nitrogen (mg/L)	Atrazine ELISA-Iowa[1] (µg/L)	Atrazine ELISA-Kans.[2] (µg/L)	Atrazine GC/MS[3] (µg/L)
			Iowa -- Continued						
64	Old Mans Creek near Iowa City	03/24/89	3.40	476	7.4	1.2	1.2	--	--
		05/25/89	557	250	7.2	5.3	>5.0	--	72
		11/07/89	3.80	565	9.4	<.10	.30	--	.69
65	N. Fork Maquoketa River at Fulton	03/27/89	174	580	7.6	3.4	.20	--	--
		10/05/89	107	570	8.3	3.1	<.20	--	<.05
66	S. Skunk River near Oskaloosa	03/22/89	160	508	8.1	1.6	0.30	--	--
		05/24/89	2,090	258	7.2	6.3	>5.0	--	48
		10/16/89	55.6	680	8.2	.44	<.20	--	.19
67	N. Skunk River near Sigourney	03/22/89	65.0	400	7.9	1.5	1.0	--	--
		05/24/89	638	362	7.5	3.4	>5.0	--	42
		10/02/89	55.1	475	8.2	2.0	.40	--	.26
		03/15/90	3,100	295	7.3	8.1	--	--	.89
		05/21/90	776	490	8.2	13	--	--	1.1
68	Nishnabotna River above Hamburg	03/24/89	345	560	7.7	2.5	.30	--	--
		06/05/89	738	304	7.2	3.9	>5.0	--	37
		10/10/89	673	570	7.7	3.2	1.0	--	1.0
69	Chariton River near Chariton	03/20/89	2.70	330	8.1	.64	<.20	0.30	.21
		05/30/89	228	151	8.0	1.9	>5.0	7.2	13
		10/02/89	.10	262	7.9	<.10	1.7	--	1.3

Table 6. *Results of analyses of water-quality samples collected from Midwest streams and comparison of laboratory analyses for atrazine by ELISA and GC/MS, 1989-90*--Continued

Map no (figs. 2-5)	Site name	Date of collection (month/ day/year)	Stream-flow (ft^3/s)	Specific conduct-ance (µS/cm)	pH (standard units)	Nitrite plus nitrate as nitrogen (mg/L)	Atrazine ELISA-Iowa[1] (µg/L)	Atrazine ELISA-Kans.[2] (µg/L)	Atrazine GC/MS[3] (µg/L)
			Iowa -- Continued						
70	S. Fork Chariton River near Promise City	03/20/89	1.90	315	8.8	0.20	0.50	--	--
		05/30/89	26.0	238	7.0	1.2	>5.0	--	16
		10/03/89	.40	438	7.9	<.10	1.0	--	.96
71	Skunk River at Augusta	03/22/89	373	360	7.9	2.0	.90	0.40	.69
		05/26/89	3,200	240	7.6	7.9	>5.0	10	30
		11/13/89	165	630	8.8	<.10	.40	--	.36
		03/08/90	470	615	8.4	3.9	--	--	.36
		06/21/90	26,800	205	7.5	4.3	--	--	6.5
			Missouri						
72	Nodaway River near Graham	03/15/89	331	265	7.8	.22	1.2	1.0	1.0
		06/23/89	4,490	125	7.2	1.6	>5.0	--	7.8
		10/03/89	414	395	7.9	.86	.20	--	.21
		04/10/90	592	430	8.2	3.7	--	--	.14
		05/22/90	612	612	8.4	4.7	--	--	1.5
73	South Fabius River near Taylor	04/04/89	95.8	479	8.1	<.10	<.20	--	--
		10/05/89	3.70	370	8.1	<.10	.50	--	.57
74	Grand River near Sumner	03/08/89	325	430	7.4	2.4	.20	--	--
		05/19/89	2,420	210	7.4	1.5	>5.0	--	--
		10/04/89	241	390	7.7	<.10	.50	--	.35

Table 6. *Results of analyses of water-quality samples collected from Midwest streams and comparison of laboratory analyses for atrazine by ELISA and GC/MS, 1989-90*--Continued

Map no (figs. 2-5)	Site name	Date of collection (month/ day/year)	Stream-flow (ft^3/s)	Specific conduct-ance (µS/cm)	pH (standard units)	Nitrite plus nitrate as nitrogen (mg/L)	Atrazine ELISA-Iowa[1] (µg/L)	Atrazine ELISA-Kans.[2] (µg/L)	Atrazine GC/MS[3] (µg/L)
			Missouri--Continued						
75	Middle Fork Salr River at Paris	04/03/89	17.5	842	8.0	<0.10	0.40	<0.20	0.53
		05/30/89	3,670	113	7.1	.66	2.3	1.0	3.0
		10/06/89	3.10	310	7.9	.36	.80	--	.65
76	Blackwater River at Blue Lick	03/16/89	28.0	685	7.9	1.3	.30	--	--
		05/20/89	3,040	165	7.4	.93	>5.0	--	11
		10/04/89	13.7	580	7.6	<.10	.90	--	.50
77	Missouri River at Hermann	03/12/89	52,300	490	7.9	<.10	<.20	<.20	.18
		06/07/89	62,200	--	--	<.10	--	--	1.5
		10/11/89	45,300	665	8.2	<.10	<.20	--	.26
78	Mississippi River at Grafton	03/10/89	30,000	436	9.0	<.10	.30	.20	.24
		06/05/89	81,900	--	--	<.10	--	--	2.0
		11/13/89	57,000	430	8.5	<.10	<.20	--	.21
			Wisconsin						
79	Prairie River near Merrill	04/21/89	213	104	8.1	.21	<.20	--	--
		05/05/89	178	119	8.2	.11	<.20	--	<.05
		10/23/89	72.0	204	8.6	<.10	<.20	--	<.05
80	Trempealeau River at Dodge	03/14/89	2,320	250	7.4	.99	--	--	--
		05/30/89	810	242	--	1.9	>5.0	--	26
		10/17/89	346	300	8.0	1.3	<.20	--	.15

Table 6. *Results of analyses of water-quality samples collected from Midwest streams and comparison of laboratory analyses for atrazine by ELISA and GC/MS, 1989-90*--Continued

Map no (figs. 2-5)	Site name	Date of collection (month/ day/year)	Stream-flow (ft^3/s)	Specific conduct-ance (µS/cm)	pH (standard units)	Nitrite plus nitrate as nitrogen (mg/L)	Atrazine ELISA-Iowa[1] (µg/L)	Atrazine ELISA-Kans. [2] (µg/L)	Atrazine GC/MS[3] (µg/L)
			Wisconsin -- Continued						
81	Black River near Galesville	03/15/89	2,680	166	7.2	1.0	<0.20	--	--
		05/30/89	4,100	92	--	.39	2.4	--	3.2
		10/18/89	539	155	7.6	.47	<.20	--	<.05
82	Wisconsin River at Muscada	03/31/89	18,800	230	8.2	.82	--	--	--
		06/02/89	19,100	180	7.6	.57	.30	--	.65
		10/05/89	2,420	290	8.5	.32	<.20	--	.21
		03/20/90	20,700	280	7.7	.82	--	--	.31
		06/22/90	15,400	195	7.9	.60	--	--	.77
83	Grant River near Burton	03/23/89	285	558	8.2	3.4	<.20	0.30	.32
		05/31/89	85.0	586	8.3	1.9	1.1	--	1.7
		11/02/89	72.0	630	8.4	2.5	<.20	--	.15
84	Pecatonic River at Martintown	04/11/89	382	600	8.3	3.1	.20	--	--
		07/19/89	298	565	8.3	1.8	<.20	--	.11
		10/31/89	249	610	8.3	2.1	<.20	--	.14
85	Rock River at Afton	04/12/89	3,420	500	9.0	1.5	<.20	.20	.34
		07/19/89	747	665	8.6	1.6	.40	--	.51
		10/31/89	852	690	8.8	1.2	.30	--	.15
		04/12/90	3,350	515	9.1	1.0	--	--	.39
		07/06/90	2,540	600	8.6	.50	--	--	.72
86	Fox River at Wakesha	04/20/89	160	1,070	8.2	.92	<.20	--	--
		07/10/89	77.0	780	8.1	1.6	.50	--	--
		11/03/89	43.0	1,070	8.1	3.4	<.20	--	.12

Table 6. *Results of analyses of water-quality samples collected from Midwest streams and comparison of laboratory analyses for atrazine by ELISA and GC/MS, 1989-90*--Continued

Map no (figs. 2-5)	Site name	Date of collection (month/ day/year)	Stream-flow (ft^3/s)	Specific conduct-ance (µS/cm)	pH (standard units)	Nitrite plus nitrate as nitrogen (mg/L)	Atrazine ELISA-Iowa[1] (µg/L)	Atrazine ELISA-Kans. [2] (µg/L)	Atrazine GC/MS[3] (µg/L)
			Wisconsin--Continued						
87	Root River at Racine	03/22/89	116	985	7.8	3.1	<0.20	<0.20	0.08
		07/10/89	10.0	990	8.4	<.10	1.2	--	.88
		11/03/89	41.0	1,020	8.1	2.2	<.20	--	.11
		03/27/90	188	808	8.1	3.4	--	--	.17
		07/19/90	31.0	760	8.6	2.2	--	--	.44
			Illinois						
88	Des Plains River at Russell	04/05/89	100	990	8.3	7.4	<0.2	--	--
		05/25/89	27.4	452	7.7	.24	.40	--	.23
		11/01/89	5.50	1,260	7.7	1.4	.20	--	.15
89	Nippersink Creek at Spring Cove	04/05/89	95.0	735	8.6	3.1	.30	<.20	.37
		05/25/89	95.5	659	8.0	.96	1.3	--	.90
		11/01/89	43.0	780	8.0	1.7	<.20	--	.38
90	S. Br. Kishwaukee at Fairdale	03/22/89	145	770	7.8	8.7	.30	--	--
		05/25/89	76.7	696	7.6	2.6	>5.0	--	11
		10/24/89	76.0	857	--	5.6	.40	--	.24
		04/12/90	294	755	8.6	11	--	--	.25
		05/14/90	1,280	--	7.8	19	--	--	2.1
91	Kiswaukee River near Perryville	03/22/89	445	720	7.6	5.3	<.20	<.20	.12
		05/25/89	225	722	7.8	1.2	4.0	6.0	4.9
		10/24/89	269	796	--	3.2	<.20	--	.15

Table 6. *Results of analyses of water-quality samples collected from Midwest streams and comparison of laboratory analyses for atrazine by ELISA and GC/MS, 1989-90*--Continued

Map no (figs. 2-5)	Site name	Date of collection (month/ day/year)	Stream-flow (ft^3/s)	Specific conduct-ance (µS/cm)	pH (standard units)	Nitrite plus nitrate as nitrogen (mg/L)	Atrazine ELISA-Iowa[1] (µg/L)	Atrazine ELISA-Kans. [2] (µg/L)	Atrazine GC/MS[3] (µg/L)
			Illinois -- Continued						
92	Elkhorn Creek near Penrose	03/22/89	48.0	671	7.3	7.9	<0.20	--	--
		05/25/89	40.4	643	7.7	4.9	2.0	--	1.9
		10/24/89	30.0	704	--	6.6	.30	--	.15
93	Illinois River near Marseilles	03/21/89	9,940	1,025	7.9	5.7	.30	--	--
		05/25/89	6,390	850	7.7	8.9	2.1	--	2.5
		10/31/89	3,200	758	8.9	4.0	.40	--	.15
94	Fox River near Dayton	03/21/89	2,100	768	7.8	3.8	.30	<0.20	.20
		05/25/89	638	803	8.4	.51	.50	1.2	.80
		10/31/89	698	781	8.6	<.10	2.4	--	.26
95	Dupage River near Shorwood	04/06/89	248	1,555	9.0	7.8	<.20	<.20	<.05
		05/25/89	269	1,290	7.5	7.2	.60	1.0	.77
		11/02/89	110	1,770	8.7	10	<.20	--	<.05
		04/04/90	334	1,360	8.6	6.7	--	--	.07
		06/22/90	--	--	--	6.3	--	--	.37
96	Iroquois River near Chebanse	04/03/89	1,600	668	8.4	11	.30	.40	.47
		05/25/89	1,530	721	7.7	18	3.5	5.0	2.8
		11/03/89	477	770	8.2	5.0	.20	--	.16
		04/04/90	2,410	693	8.2	9.0	--	--	.19
		05/17/90	5,560	685	8.2	15	--	--	4.2
97	Edwards River near New Boston	03/22/89	57.0	567	7.3	2.3	<.20	<.20	.15
		10/23/89	55.0	680	--	4.3	.20	--	.34

Table 6. *Results of analyses of water-quality samples collected from Midwest streams and comparison of laboratory analyses for atrazine by ELISA and GC/MS, 1989-90*--Continued

Map no (figs. 2-5)	Site name	Date of collection (month/ day/year)	Stream-flow (ft^3/s)	Specific conduct-ance (µS/cm)	pH (standard units)	Nitrite plus nitrate as nitrogen (mg/L)	Atrazine ELISA-Iowa[1] (µg/L)	Atrazine ELISA-Kans. [2] (µg/L)	Atrazine GC/MS[3] (µg/L)
			Illinois -- Continued						
98	Spoon River at London Mills	04/21/89	58.0	820	8.6	<0.10	0.20	0.20	0.23
		06/02/89	1,620	361	7.5	5.1	>5.0	--	108
		10/17/89	81.0	700	8.3	4.2	.30	--	.24
		04/10/90	490	750	8.1	12	--	--	.18
		05/14/90	3,500	666	8.1	14	--	--	2.0
99	La Moine River at Colmar	04/20/89	8.90	700	8.3	<.10	.30	--	--
		06/03/89	12.1	648	7.4	.10	>5.0	--	11
		10/17/89	2.00	520	8.2	.10	.40	--	.29
100	Sangamon River at Oaksford	04/20/89	2,340	669	8.2	7.8	<.20	--	--
		05/23/89	2,620	664	8.4	9.2	2.5	--	2.7
		10/19/89	346	870	8.2	1.9	.60	--	.25
101	Lake Fork near Cornland	03/21/89	72.0	622	7.6	6.0	<.20	--	--
		05/22/89	120	727	8.1	13	.40	--	.64
		10/16/89	32.0	742	8.3	2.7	<.20	--	<.05
102	Sangamon River at Riverton	03/21/89	806	755	7.7	5.9	.80	--	2.6
		05/22/89	1,450	675	8.1	12	1.8	--	--
		10/12/89	77.0	1,716	8.4	1.8	.60	--	.33
		03/26/90	1,010	682	7.9	7.4	--	--	.55
		05/14/90	5,730	575	8.0	7.6	--	--	3.8
103	Illinois River at Hardin	03/10/89	14,500	--	--	<.10	<.20	<.20	.24
		06/04/89	27,500	--	--	<.10	--	--	3.1
		10/16/89	4,760	675	8.2	2.9	.70	--	.25

Table 6. *Results of analyses of water-quality samples collected from Midwest streams and comparison of laboratory analyses for atrazine by ELISA and GC/MS, 1989-90*--Continued

Map no (figs. 2-5)	Site name	Date of collection (month/ day/year)	Stream-flow (ft^3/s)	Specific conduct-ance (µS/cm)	pH (standard units)	Nitrite plus nitrate as nitrogen (mg/L)	Atrazine ELISA-Iowa[1] (µg/L)	Atrazine ELISA-Kans. [2] (µg/L)	Atrazine GC/MS[3] (µg/L)
			Illinois -- Continued						
104	Macoupin Creek near Kane	03/21/89	2,890	299	7.5	2.4	0.80	0.70	0.89
		05/23/89	128	537	7.4	2.5	>5.0	10	20
		10/16/89	2.70	519	7.4	.10	1.1	--	.62
		03/28/90	262	758	8.5	.82	--	--	.79
		05/14/90	4,020	329	8.2	3.1	--	--	16
105	Kaskaskia River near Cowden	03/20/89	1,460	447	7.8	1.7	.20	--	--
		05/22/89	1,300	527	6.9	9.2	2.0	--	2.7
		10/26/89	7.10	555	7.0	2.3	2.2	--	1.3
		03/27/90	214	553	8.3	2.7	--	--	1.3
		05/14/90	2,420	244	8.5	4.2	--	--	33
106	Kaskaskia River at Vandalia	03/20/89	4,780	253	7.5	1.2	.50	--	--
		05/23/89	1,600	532	7.4	7.4	3.5	--	4.9
		10/11/89	42.1	612	7.5	.10	.80	--	.76
107	Embarras River at Ste. Marie	04/13/89	2,320	529	7.4	12	.60	--	--
		05/22/89	1,900	540	7.5	11	>5.0	--	8.6
		10/18/89	231	663	8.2	2.9	.50	--	.33
108	Shoal Creek near Breese	03/20/89	2,040	208	7.2	1.1	.40	.30	.61
		05/23/89	152	429	7.0	1.4	>5.0	8.4	15
		10/11/89	13.8	436	7.0	.10	2.7	--	2.1
		03/28/90	196	700	8.2	.53	--	--	1.0
		05/04/90	607	458	7.5	.70	--	--	26

Table 6. *Results of analyses of water-quality samples collected from Midwest streams and comparison of laboratory analyses for atrazine by ELISA and GC/MS, 1989-90*--Continued

Map no (figs. 2-5)	Site name	Date of collection (month/ day/year)	Stream-flow (ft^3/s)	Specific conduct-ance (µS/cm)	pH (standard units)	Nitrite plus nitrate as nitrogen (mg/L)	Atrazine ELISA-Iowa[1] (µg/L)	Atrazine ELISA-Kans. [2] (µg/L)	Atrazine GC/MS[3] (µg/L)
			Illinois -- Continued						
109	Silver Creek near Freeburg	03/20/89	490	361	7.1	1.6	0.30	--	--
		05/23/89	131	550	7.8	1.8	>5.0	--	19
		10/11/89	2.00	595	6.7	.10	.50	--	.52
110	Bonpas Creek at Browns	04/12/89	104	472	6.9	2.6	.50	--	--
		05/22/89	77.0	493	6.8	5.0	>5.0	--	52
		11/27/89	12.0	824	7.8	2.2	.50	--	.41
		04/17/90	112	631	7.4	1.7	--	--	1.8
		07/10/90	2.30	26	10.1	1.6	--	--	9.2
			Indiana						
111	Wabash River near New Harmony	03/29/89	49,300	450	7.6	3.8	<.20	--	--
		06/22/89	29,700	527	7.8	4.3	4.2	--	6.7
		10/31/89	12,700	612	8.2	2.6	1.1	--	.68
			Illinois						
112	Little Wabash River at Carmi	04/12/89	18,300	160	6.6	.49	.60	--	--
		05/22/89	1,110	218	7.0	1.5	>5.0	--	34
		11/27/89	125	725	7.7	.88	2.0	--	.69
		04/17/90	6,580	381	7.2	1.0	--	--	3.8
		07/10/90	440	540	7.5	1.8	--	--	9.0
113	Big Muddy River near Murphysboro	04/11/89	12,800	310	6.7	.22	.60	--	--
		05/24/89	1,210	995	7.0	1.0	3.9	--	5.1
		10/16/89	76.2	1,160	7.2	.63	.70	--	.57

Table 6. *Results of analyses of water-quality samples collected from Midwest streams and comparison of laboratory analyses for atrazine by ELISA and GC/MS, 1989-90*--Continued

Map no (figs. 2-5)	Site name	Date of collection (month/ day/year)	Stream-flow (ft^3/s)	Specific conduct-ance (µS/cm)	pH (standard units)	Nitrite plus nitrate as nitrogen (mg/L)	Atrazine ELISA-Iowa[1] (µg/L)	Atrazine ELISA-Kans.[2] (µg/L)	Atrazine GC/MS[3] (µg/L)
			Missouri						
114	Mississippi River at Thebes	03/15/89	173,000	523	7.9	<0.10	0.20	0.20	0.27
		06/10/89	184,000	--	--	<.10	--	--	1.8
		11/08/89	89,800	520	8.0	.73	.50	--	.37
			Illinois						
115	Ohio River near Grand Chain	03/16/89	721,000	232	7.3	<.10	<.20	<.20	<.05
		06/11/89	309,000	--	--	<.10	--	--	3.1
		10/11/89	275,000	209	7.6	.10	<.20	--	<.05
			Indiana						
116	Kankakee River at Shelby	03/22/89	2,020	606	8.2	3.5	<.20	<.20	.05
		05/31/89	2,420	608	7.7	2.0	2.7	4.4	2.8
		10/16/89	871	654	7.9	.59	<.20	--	<.05
117	Tippecanoe River near Ora	03/22/89	807	631	8.2	4.8	<.20	--	--
		05/31/89	650	612	7.9	3.3	1.0	--	1.2
		10/16/89	292	638	8.3	.43	.30	--	.23
118	Iroquois River near Foresman	03/22/89	531	746	8.3	13	.20	--	--
		05/31/89	1,640	542	7.3	15	>5.0	--	5.9
		10/16/89	162	762	7.9	2.0	<.20	--	.11
119	Eel River near Logansport	03/22/89	1,190	558	8.3	7.7	<.20	.20	.26
		05/22/89	604	690	8.2	2.7	>5.0	--	8.0
		10/16/89	170	716	8.4	1.5	<.20	--	.12
		03/26/90	660	658	7.8	4.2	--	--	.19
		05/14/90	1,550	619	7.5	7.6	--	--	9.6

Table 6. *Results of analyses of water-quality samples collected from Midwest streams and comparison of laboratory analyses for atrazine by ELISA and GC/MS, 1989-90*--Continued

Map no (figs. 2-5)	Site name	Date of collection (month/ day/year)	Stream-flow (ft^3/s)	Specific conduct-ance (µS/cm)	pH (standard units)	Nitrite plus nitrate as nitrogen (mg/L)	Atrazine ELISA-Iowa[1] (µg/L)	Atrazine ELISA-Kans. [2] (µg/L)	Atrazine GC/MS[3] (µg/L)
			Indiana -- Continued						
120	Wabash River at Linn Grove	03/23/89	350	682	8.1	13	0.30	--	--
		05/26/89	2,500	229	7.3	3.3	>5.0	--	8.6
		10/17/89	20.0	1,140	7.9	.35	.50	--	.27
121	Wildcat Creek near Lafayette	03/23/89	648	739	8.4	8.1	<.20	0.20	.22
		05/27/89	11,500	288	7.6	5.5	>5.0	10	27
		10/16/89	234	767	8.3	1.9	.40	--	.26
		03/26/90	54.0	721	7.8	5.6	--	--	.22
		05/14/90	1,220	564	7.7	11	--	--	14
122	Wildcat Creek near Jerome	03/23/89	95.0	695	8.3	12	0.40	--	--
		05/22/89	91.0	685	8.1	13	1.0	--	1.5
		10/17/89	33.0	718	7.7	2.7	.40	--	.35
		03/26/90	90.0	641	8.0	3.1	--	--	.27
		05/14/90	560	588	7.4	15	--	--	10
123	Wabash River at Covington	03/24/89	5,930	663	8.5	6.5	.20	.20	.18
		05/22/89	8,080	621	8.0	8.9	>5.0	5.2	8.8
		10/16/89	2,700	678	8.3	2.6	1.5	--	.68
124	White River near Nora	03/27/89	829	727	8.4	5.1	<.20	.30	.18
		05/26/89	7,600	362	7.6	4.3	>5.0	8.0	9.8
		11/01/89	544	793	8.1	2.4	.30	--	.29
		03/26/90	959	693	7.9	3.6	--	--	.32
		05/14/90	6,430	444	7.7	6.6	--	--	17

Table 6. *Results of analyses of water-quality samples collected from Midwest streams and comparison of laboratory analyses for atrazine by ELISA and GC/MS, 1989-90*--Continued

Map no (figs. 2-5)	Site name	Date of collection (month/ day/year)	Stream-flow (ft^3/s)	Specific conduct-ance (µS/cm)	pH (standard units)	Nitrite plus nitrate as nitrogen (mg/L)	Atrazine ELISA-Iowa[1] (µg/L)	Atrazine ELISA-Kans. [2] (µg/L)	Atrazine GC/MS[3] (µg/L)
			Indiana-Continued						
125	Big Blue River at Carthage	03/27/89	136	685	8.3	5.2	<0.20	--	--
		05/23/89	1,680	335	7.6	4.4	>5.0	--	13
		10/17/89	93.0	727	8.0	3.7	<.20	--	.12
126	Whitewater River near Alpine	03/23/89	613	625	8.2	6.7	<.20	--	--
		05/23/89	4,440	377	7.2	3.8	>5.0	--	20
		10/17/89	340	682	8.0	3.2	.20	--	.25
		03/27/90	570	646	8.0	4.3	--	--	.14
		05/15/90	1,880	555	8.1	6.2	--	--	8.2
127	Big Walnut Creek near Reelsville	03/24/89	388	563	8.3	5.5	.20	0.20	.25
		05/23/89	420	488	8.2	3.0	4.0	5.6	6.6
		10/31/89	240	580	8.5	1.9	.50	--	.41
128	White River near Centerton	03/28/89	1,870	807	7.7	5.2	<.20	--	--
		05/23/89	8,900	435	7.6	3.0	4.4	--	8.7
		10/30/89	1,490	821	7.8	3.5	.60	--	.36
129	Sugar Creek near Edinburgh	03/24/89	774	617	8.2	8.2	<.20	--	--
		05/25/89	1,620	500	7.8	8.7	>5.0	--	15
		10/30/89	126	711	8.2	1.1	<.20	--	<.05
		03/27/90	295	645	8.3	6.0	--	--	.14
		05/15/90	2,191	463	7.9	7.1	--	--	20
130	Flatrock River at Columbus	03/24/89	1,070	578	8.1	9.7	<.20	--	--
		05/25/89	1,820	471	7.9	9.1	>5.0	--	15
		10/30/89	162	635	8.0	2.9	.20	--	.17

Table 6. *Results of analyses of water-quality samples collected from Midwest streams and comparison of laboratory analyses for atrazine by ELISA and GC/MS, 1989-90*--Continued

Map no (figs. 2-5)	Site name	Date of collection (month/ day/year)	Stream-flow (ft^3/s)	Specific conduct-ance (µS/cm)	pH (standard units)	Nitrite plus nitrate as nitrogen (mg/L)	Atrazine ELISA-Iowa[1] (µg/L)	Atrazine ELISA-Kans. [2] (µg/L)	Atrazine GC/MS[3] (µg/L)
			Indiana--Continued						
131	Busseron Creek near Carlisle	03/29/89	179	718	7.5	1.2	0.20	--	--
		06/22/89	22.0	1,320	7.6	.88	2.5	--	3.5
		10/31/89	74.0	1,100	7.7	.59	.30	--	.22
132	E. Fork White River near Bedford	03/28/89	10,800	419	7.7	3.6	<.20	--	--
		05/25/89	9,820	264	7.5	2.2	>5.0	--	20
		10/30/89	1,140	605	8.1	1.8	.50	--	.28
		03/27/90	4,550	512	8.0	3.0	--	--	.22
		05/15/90	11,590	373	7.4	3.5	--	--	11
133	Muscatatuck River near Deputy	03/28/89	175	377	8.0	1.8	<.20	<0.20	.06
		05/25/89	303	238	7.7	.84	2.1	4.6	2.7
		10/30/89	43.0	406	7.8	.28	.50	--	.37
134	Blue River at Fredricksburg	03/28/89	313	374	8.1	3.5	<.20	--	--
		05/25/89	185	370	7.9	2.4	3.6	--	5.1
		10/30/89	51	438	8.0	1.9	.50	--	.30
		03/27/90	231	348	8.2	2.0	--	--	.16
		05/15/90	575	323	7.6	2.3	--	--	5.1
			Ohio						
135	Tiffin River at Stryker	03/14/89	217	600	8.1	2.5	<.20	.30	.38
		06/02/89	4,570	300	7.5	6.3	>5.0	10	28
		10/25/89	100	745	7.3	1.3	.50	--	.66
		03/21/90	780	565	8.4	4.0	--	--	.45
		05/14/90	966	555	7.2	13	--	--	35

Table 6. *Results of analyses of water-quality samples collected from Midwest streams and comparison of laboratory analyses for atrazine by ELISA and GC/MS, 1989-90*--Continued

Map no (figs. 2-5)	Site name	Date of collection (month/ day/year)	Stream-flow (ft^3/s)	Specific conduct-ance (µS/cm)	pH (standard units)	Nitrite plus nitrate as nitrogen (mg/L)	Atrazine ELISA-Iowa[1] (µg/L)	Atrazine ELISA-Kans.[2] (µg/L)	Atrazine GC/MS[3] (µg/L)
			Ohio--Continued						
136	Maumee River at Waterville	03/29/89	5,060	600	8.2	7.9	0.30	--	--
		05/27/89	34,300	370	8.0	6.0	>5.0	--	7.0
		10/25/89	1,430	560	9.2	.49	1.0	--	1.1
137	Sandusky River near Fremont	03/24/89	909	640	8.2	11	.50	--	--
		05/24/89	4,640	620	7.8	7.9	3.5	--	5.9
		10/25/89	215	780	8.3	3.8	1.9	--	1.7
138	Auglaize River near Fort Jennings	03/14/89	164	770	8.2	6.2	.30	--	15
		05/27/89	4,550	300	7.4	7.5	>5.0	--	.53
		10/25/89	65.0	770	7.2	2.5	.90	--	.30
		03/21/90	200	700	8.7	6.4	--	--	16
		05/14/90	2,100	440	7.9	13	--	--	--
139	Olentangy River at Claridon	03/15/89	117	642	8.2	6.3	.20	0.40	.49
		06/14/89	94.0	620	7.9	4.3	3.3	--	2.9
		10/24/89	11.0	760	7.8	.70	.60	--	.43
		03/21/90	60.0	630	8.4	2.7	--	--	.24
		05/14/90	1,380	385	7.4	11	--	--	32
140	Scioto River near Prospect	03/21/89	487	780	8.1	7.6	>5.0	--	--
		06/14/89	344	810	8.0	5.9	1.5	--	1.9
		10/19/89	20.0	1,050	7.8	5.5	.30	--	.21
		03/23/90	248	890	8.0	5.2	--	--	.26
		05/15/90	2,540	485	7.5	14	--	--	27

Table 6. *Results of analyses of water-quality samples collected from Midwest streams and comparison of laboratory analyses for atrazine by ELISA and GC/MS, 1989-90*--Continued

Map no (figs. 2-5)	Site name	Date of collection (month/ day/year)	Stream-flow (ft^3/s)	Specific conduct-ance (µS/cm)	pH (standard units)	Nitrite plus nitrate as nitrogen (mg/L)	Atrazine ELISA-Iowa[1] (µg/L)	Atrazine ELISA-Kans. [2] (µg/L)	Atrazine GC/MS[3] (µg/L)
			Ohio--Continued						
141	Kokosing River at Mount Vernon	03/13/89	293	420	8.4	2.9	<0.20	--	--
		06/14/89	1,200	350	7.7	1.4	3.4	--	4.7
		10/12/89	47	525	7.8	1.2	1.5	--	.90
142	Mad River at Eagle City	03/23/89	330	730	8.5	4.9	<.20	--	--
		06/14/89	835	620	8.0	4.7	>5.0	--	10
		10/12/89	168	770	8.6	4.8	<.20	--	<.05
		03/22/90	323	770	8.3	3.9	--	--	.05
		05/14/90	1,100	650	8.1	7.7	--	--	11
143	Little Miami River near Oldtown	03/23/89	183	700	8.5	7.7	<.20	--	--
		06/14/89	1,160	410	8.0	4.0	>5.0	--	26
		10/12/89	35	760	8.5	<.10	<.20	--	<.05
		03/22/90	125	750	8.6	4.6	--	--	.20
		05/14/90	608	570	8.2	14	--	--	26
144	Big Darby Creek at Darbyville	03/14/89	791	625	8.2	8.0	.30	--	--
		06/14/89	481	735	8.3	6.4	2.0	--	1.4
		10/26/89	77	864	8.2	1.1	.20	--	.20
		03/22/90	295	702	8.6	3.8	--	--	.18
		05/15/90	3,090	452	8.2	10	--	--	18
145	Clear Creek near Rockbridge	03/14/89	165	398	8.2	4.2	<.20	<.20	.13
		06/14/89	245	380	8.0	5.6	>5.0	--	19
		10/16/89	43	467	7.9	1.3	<.20	--	<.05
		03/22/90	78	383	7.4	1.4	--	--	.11
		05/26/90	1,250	210	7.7	<.10	--	--	9.0

Table 6. *Results of analyses of water-quality samples collected from Midwest streams and comparison of laboratory analyses for atrazine by ELISA and GC/MS, 1989-90*--Continued

Map no (figs. 2-5)	Site name	Date of collection (month/ day/year)	Stream-flow (ft^3/s)	Specific conduct-ance (µS/cm)	pH (standard units)	Nitrite plus nitrate as nitrogen (mg/L)	Atrazine ELISA-Iowa[1] (µg/L)	Atrazine ELISA-Kans. [2] (µg/L)	Atrazine GC/MS[3] (µg/L)
			Ohio--Continued						
146	Scioto River at Higby	03/23/89	11,600	574	7.9	5.7	0.30	--	--
		06/19/89	9,910	438	8.2	3.7	2.8	--	4.1
		10/03/89	948	830	8.2	3.3	1.1	--	.95
		03/26/90	3,440	690	8.1	3.3	--	--	.24
		05/15/90	15,400	465	7.9	6.8	--	--	13
147	Little Miami River at Milford	03/23/89	2,930	560	8.3	5.0	1.0	0.40	.48
		06/14/89	2,230	620	8.2	3.4	2.0	--	2.3
		10/17/89	347	590	8.4	2.1	.40	--	.30

[1]Atrazine concentration analyzed by ELISA at U.S. Geological Survey laboratory in Iowa City, Iowa.
[2]Atrazine concentration analyzed by ELISA at U.S. Geological Survey laboratory in Lawrence, Kansas.
[3]Atrazine concentration analyzed by GC/MS at U.S. Geological Survey laboratory in Lawrence, Kansas.

Table 7. *Results of analyses of water-quality samples for selected herbicides and two atrazine metabolites in Midwest streams, 1989-90*

[µg/L, micrograms per liter; DEA, deethylatrazine; DIA, deisopropylatrazine, --, no data; <, less than; >, greater than; R, regular sample; L, laboratory duplicate; B, blind duplicate; X, extra sample]

Map no. (figs. 2-5)	Site name	Date of collection (month/ day/year)	Sample type[1]	Ala-chlor (µg/L)	Atra-zine[2] (µg/L)	Cyana-zine (µg/L)	DEA (µg/L)	DIA (µg/L)	Meto-lachlor (µg/L)	Metri-buzin (µg/L)	Pro-meton (µg/L)	Pro-pazine (µg/L)	Sima-zine (µg/L)
						South Dakota							
1	Big Sioux River near Watertown	06/29/89	R	<0.05	0.08	<0.20	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	Big Sioux River near Castlewood	06/29/89	R	<.05	1.5	<.20	.17	<.05	<.05	<.05	.93	<.05	<.05
		04/10/90	L	<.05	.07	<.20	<.05	<.05	<.05	<.05	.33	<.05	<.05
		04/10/90	R	<.05	.07	<.20	<.05	<.05	<.05	<.05	.26	<.05	<.05
		08/27/90	R	<.05	.14	<.20	<.05	<.05	<.05	<.05	.50	<.05	.20
3	Big Sioux River near Brookings	06/29/89	L	.11	.77	<.20	.11	<.05	<.05	.29	.19	<.05	<.05
		06/29/89	R	.12	.82	<.20	.12	<.05	<.05	.18	<.05	.05	<.05
		11/03/89	R	<.05	.06	<.20	.06	<.05	<.05	<.05	<.05	<.05	<.05
4	Big Sioux River at N. Cliff Ave.	06/27/89	R	<.05	1.6	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
5	James River near Scotland	04/03/89	R	<.05	.55	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		06/27/89	R	<.05	.19	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		11/02/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
6	Vermillion River near Vermillion	04/03/89	R	<.05	.17	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		06/27/89	L	<.05	.11	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		06/27/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		11/02/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
7	Brule Creek near Elk Point	06/27/89	R	.09	.36	<.20	.06	<.05	<.05	<.05	<.05	<.05	<.05
8	Big Sioux River at Akron	04/03/89	B	<.05	.43	<.20	.08	<.05	<.05	<.05	<.05	<.05	<.05
		04/03/89	B	<.05	.46	<.20	.07	<.05	<.05	<.05	<.05	<.05	<.05
		04/03/89	L	<.05	.49	<.20	.12	<.05	.06	<.05	<.05	<.05	<.05

Table 7. *Results of analyses of water-quality samples for selected herbicides and two atrazine metabolites in Midwest streams, 1989-90*--Continued

Map no. (figs. 2-5)	Site name	Date of collection (month/ day/year)	Sample type[1]	Ala-chlor (µg/L)	Atra-zine[2] (µg/L)	Cyana-zine (µg/L)	DEA (µg/L)	DIA (µg/L)	Meto-lachlor (µg/L)	Metri-buzin (µg/L)	Pro-meton (µg/L)	Pro-pazine (µg/L)	Sima-zine (µg/L)
				South Dakota--Continued									
8	Big Sioux River at Akron--Continued	04/03/89	R	<0.05	0.46	<0.20	0.10	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
		06/27/89	B	<.05	.56	<.20	<.05	<.05	.12	<.05	<.05	<.05	<.05
		06/27/89	B	<.05	.62	<.20	<.05	<.05	.14	<.05	<.05	<.05	<.05
		06/27/89	R	<.05	.59	<.20	<.05	<.05	.13	<.05	<.05	<.05	<.05
		11/02/89	B	<.05	.06	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		11/02/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
				Nebraska									
9	Bow Creek near St. James	06/26/89	R	.08	.20	.27	<.05	<.05	.12	<.05	<.05	<.05	<.05
		10/18/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
10	Elkhorn River near Atkinson	10/23/89	R	<.05	1.2	<.20	<.05	<.05	2.2	<.05	<.05	<.05	<.05
11	Clearwater Creek near Clearwater	06/26/89	R	.06	.20	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		10/18/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
12	Mira Creek near Northloup	04/11/89	R	<.05	.27	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		06/25/89	R	<.05	.15	<.20	.07	<.05	<.05	<.05	<.05	<.05	<.05
		10/20/89	R	<.05	.47	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
13	Shell Creek near Columbus	06/26/89	R	4.7	14	6.2	2.5	1.8	.74	.30	.20	.18	.15
		10/19/89	R	<.05	.28	<.20	.10	<.05	<.05	<.05	<.05	<.05	<.05
14	Maple Creek near Nickerson	04/05/89	R	<.05	.07	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		06/26/89	R	4.3	8.7	1.3	.97	1.4	.50	.35	<.05	.16	.12
		10/19/89	R	<.05	.08	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05

Table 7. *Results of analyses of water-quality samples for selected herbicides and two atrazine metabolites in Midwest streams, 1989-90*--Continued

Map no. (figs. 2-5)	Site name	Date of collection (month/ day/year)	Sample type[1]	Ala-chlor (µg/L)	Atra-zine[2] (µg/L)	Cyana-zine (µg/L)	DEA (µg/L)	DIA (µg/L)	Meto-lachlor (µg/L)	Metri-buzin (µg/L)	Pro-meton (µg/L)	Pro-pazine (µg/L)	Sima-zine (µg/L)
				Nebraska--Continued									
15	Mud Creek at Sweetwater	06/25/89	R	0.29	1.7	<0.20	0.22	<0.05	0.20	<0.05	0.41	<0.05	<0.05
		10/23/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
16	Big Blue River at Surprise	06/26/89	R	3.1	17	5.9	1.7	1.4	3.8	.41	.64	.25	.14
		10/31/89	R	.11	.70	<.20	.44	<.05	<.05	<.05	<.05	<.05	<.05
17	Wahoo Creek at Itica	04/04/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		06/08/89	R	2.1	52	4.8	1.9	3.0	7.3	5.9	<.05	.58	.31
		10/19/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		03/20/90	L	<.05	.07	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		03/20/90	R	<.05	.07	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		05/14/90	X	.28	1.7	1.8	.12	.10	.34	<.05	<.05	<.05	<.05
		05/14/90	X	.31	1.8	2.2	.13	.13	.34	<.05	<.05	<.05	<.05
		06/08/90	R	.48	9.6	6.0	.83	.72	1.3	.38	<.05	.12	.05
18	W. Fork Big Blue River near Dorchester	04/04/89	L	<.05	.10	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		04/04/89	R	<.05	.16	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		06/27/89	L	2.4	26	<.20	3.0	2.0	1.1	.30	.12	.34	1.7
		06/27/89	R	1.7	23	<.20	2.8	1.9	.83	.24	.12	.27	1.4
		10/31/89	R	<.05	.34	<.20	.14	<.05	<.05	<.05	<.05	<.05	<.05
19	Salt Creek at Roca	06/26/89	R	1.0	13	<.20	2.3	1.4	1.4	.46	<.05	.14	.07
		10/31/89	R	<.05	1.7	<.20	.56	<.05	.11	<.05	.24	<.05	<.05
		03/27/90	R	<.05	.12	<.20	.06	<.05	<.05	<.05	<.05	<.05	<.05
		05/14/90	X	.07	.86	<.20	.12	.09	.29	<.05	.08	<.05	<.05
		06/07/90	R	.08	2.1	<.20	.69	.25	.10	<.05	<.05	<.05	<.05

Table 7. *Results of analyses of water-quality samples for selected herbicides and two atrazine metabolites in Midwest streams, 1989-90*--Continued

Map no. (figs. 2-5)	Site name	Date of collection (month/ day/year)	Sample type[1]	Ala-chlor (µg/L)	Atra-zine[2] (µg/L)	Cyana-zine (µg/L)	DEA (µg/L)	DIA (µg/L)	Meto-lachlor (µg/L)	Metri-buzin (µg/L)	Pro-meton (µg/L)	Pro-pazine (µg/L)	Sima-zine (µg/L)
				Nebraska--Continued									
20	Muddy Creek near Arapahoe	06/25/89	R	1.4	6.6	1.2	1.2	0.71	1.3	0.22	0.07	0.08	0.06
		11/07/89	R	<.05	.11	<.20	.09	<.05	.10	<.05	<.05	<.05	<.05
21	Little Blue River near Fairbury	06/26/89	R	2.3	22	1.9	3.7	2.2	1.6	.30	.06	.32	1.0
		10/30/89	R	<.05	.31	<.20	.12	<.05	<.05	<.05	<.05	<.05	<.05
		03/21/90	R	<.05	.21	<.20	.10	<.05	<.05	<.05	<.05	<.05	<.05
		05/17/90	L	3.4	15	.66	1.1	.58	3.1	.06	<.05	.19	.84
		05/17/90	R	3.5	15	.73	1.1	.55	3.3	.06	<.05	.20	.81
22	Little Nemah River at Auburn	06/26/89	R	.62	10	.67	1.3	.88	1.1	.30	<.05	<.05	<.05
		10/24/89	R	<.05	.24	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
23	Big Blue River at Barneston	04/06/89	B	<.05	.87	<.20	<.05	.58	<.05	<.05	<.05	.23	8.2
		04/06/89	B	<.05	.88	<.20	<.05	.48	<.05	<.05	<.05	<.05	9.4
		04/06/89	L	<.05	.83	<.20	<.05	.41	<.05	<.05	<.05	<.05	8.8
		04/06/89	R	<.05	.91	<.20	<.05	.59	<.05	<.05	<.05	<.05	8.7
		06/27/89	B	1.2	16	.87	2.1	1.6	1.3	.37	.12	.23	.15
		06/27/89	L	1.2	18	.87	2.1	1.5	1.3	.41	.15	.22	.09
		06/27/89	R	1.2	16	.83	2.1	1.5	1.3	.36	.12	.22	.13
		10/23/89	B	<.05	.47	<.20	.16	<.05	<.05	<.05	<.05	<.05	.18
		10/23/89	R	<.05	.51	<.20	.19	<.05	<.05	<.05	<.05	<.05	.21
		03/21/90	B	<.05	.65	<.20	.10	<.05	<.05	<.05	<.05	<.05	.09
		03/21/90	R	<.05	.51	<.20	.08	<.05	<.05	<.05	<.05	<.05	.05
		05/17/90	R	5.7	14	1.8	1.1	.53	3.2	.29	<.05	.20	2.9
		05/17/90	B	5.3	13	1.7	1.0	.55	2.8	.26	<.05	.16	2.6

Table 7. *Results of analyses of water-quality samples for selected herbicides and two atrazine metabolites in Midwest streams, 1989-90*--Continued

Map no. (figs. 2-5)	Site name	Date of collection (month/ day/year)	Sample type[1]	Ala-chlor (µg/L)	Atra-zine[2] (µg/L)	Cyana-zine (µg/L)	DEA (µg/L)	DIA (µg/L)	Meto-lachlor (µg/L)	Metri-buzin (µg/L)	Pro-meton (µg/L)	Pro-pazine (µg/L)	Sima-zine (µg/L)
				Nebraska--Continued									
24	Big Nemaha River at Fall City	06/26/89	R	2.1	20	0.33	2.2	1.5	2.9	0.30	0.05	0.23	0.07
		10/24/89	R	.07	.54	<.20	.12	<.05	.10	<.05	<.05	<.05	<.05
		03/27/90	R	<.05	.81	<.20	.09	<.05	.17	<.05	<.05	<.05	<.05
		05/17/90	R	1.1	5.6	.80	.61	.25	1.5	.21	<.05	.06	<.05
				Kansas									
25	Turkey Creek near Seneca	03/21/89	B	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		03/21/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		05/22/89	B	<.05	.26	<.20	.06	<.05	.05	<.05	<.05	<.05	<.05
		05/22/89	R	<.05	.22	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		10/12/89	B	<.05	.23	<.20	.07	<.05	.06	<.05	<.05	<.05	<.05
		10/12/89	R	<.05	.23	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
26	Black Vermillion River near Frankfort	06/27/89	L	1.3	17	<.20	2.3	1.6	2.1	.65	.13	.17	.08
		06/27/89	R	1.6	16	<.20	1.8	.77	3.5	.60	<.05	<.05	.12
		10/04/89	L	<.05	.39	<.20	.11	<.05	.07	<.05	<.05	<.05	<.05
		10/04/89	R	<.05	.35	<.20	<.05	<.05	.08	<.05	<.05	<.05	<.05
		03/22/90	R	.06	.47	<.20	.14	.06	.05	<.05	<.05	<.05	<.05
		05/16/90	R	1.6	6.1	.41	.58	.24	1.3	.20	<.05	.05	<.05
27	Delaware River near Muscotah	05/22/89	L	.30	10	.22	.54	.28	4.3	<.05	.06	.09	<.05
		05/22/89	L	.34	10	<.20	.28	<.05	3.6	<.05	<.05	.10	<.05
		05/22/89	R	.33	10	<.20	.59	.35	4.2	<.05	.07	.09	<.05
		10/11/89	R	<.05	.82	<.20	.18	<.05	.16	<.05	<.05	<.05	<.05

Table 7. *Results of analyses of water-quality samples for selected herbicides and two atrazine metabolites in Midwest streams, 1989-90*--Continued

Map no. (figs. 2-5)	Site name	Date of collection (month/ day/year)	Sample type[1]	Ala-chlor (µg/L)	Atra-zine[2] (µg/L)	Cyana-zine (µg/L)	DEA (µg/L)	DIA (µg/L)	Meto-lachlor (µg/L)	Metri-buzin (µg/L)	Pro-meton (µg/L)	Pro-pazine (µg/L)	Sima-zine (µg/L)
						Kansas--Continued							
28	Salt Creek near Ada	03/21/89	R	<0.05	<0.05	<0.20	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
		05/22/89	R	<.05	.27	<.20	.11	<.05	<.05	<.05	<.05	.14	<.05
		10/12/89	R	<.05	.49	<.20	.14	<.05	<.05	<.05	<.05	<.05	<.05
29	Mill Creek near Paxico	10/06/89	L	<.05	.09	<.20	.06	<.05	<.05	<.05	<.05	<.05	<.05
		10/06/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
30	Kansas River at Topeka	10/06/89	R	.10	1.8	<.20	.39	<.05	.20	<.05	<.05	.08	<.05
						Minnesota							
31	Knife River near Mora	07/19/89	R	<.05	.09	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		10/31/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		05/30/90	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
32	Sauk River near St Cloud	05/25/89	R	.21	.56	<.20	.11	<.05	.22	<.05	<.05	<.05	<.05
		11/08/89	R	<.05	.17	<.20	.10	<.05	<.05	<.05	<.05	<.05	.10
33	Pomme de Terre River at Appleton	05/04/89	R	<.05	.06	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		07/18/89	L	<.05	.28	<.20	<.05	<.05	.06	<.05	.19	<.05	<.05
		07/18/89	R	<.05	.32	<.20	<.05	<.05	.07	<.05	.21	<.05	<.05
		10/25/89	R	<.05	<.05	<.20	.06	<.05	<.05	<.05	<.05	<.05	<.05
		10/25/89	X	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
34	Rum River near St. Francis	07/19/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		10/31/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05

Table 7. *Results of analyses of water-quality samples for selected herbicides and two atrazine metabolites in Midwest streams, 1989-90*--Continued

Map no. (figs. 2-5)	Site name	Date of collection (month/ day/year)	Sample type[1]	Ala-chlor (µg/L)	Atra-zine[2] (µg/L)	Cyana-zine (µg/L)	DEA (µg/L)	DIA (µg/L)	Meto-lachlor (µg/L)	Metri-buzin (µg/L)	Pro-meton (µg/L)	Pro-pazine (µg/L)	Sima-zine (µg/L)
						Wisconsin							
35	St. Croix River at St. Croix Falls	05/31/89	R	<0.05	0.14	<0.20	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
		10/11/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		04/23/90	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		07/30/90	R	<.05	.16	<.20	.06	<.05	<.05	<.05	<.05	<.05	<.05
						Minnesota							
36	Crow River at Rockford	04/19/89	B	<.05	.28	<.20	.09	<.05	<.05	<.05	<.05	<.05	<.05
		04/19/89	R	<.05	.33	.21	.10	<.05	<.05	<.05	<.05	<.05	<.05
		05/25/89	B	1.1	2.9	2.1	.15	.08	.22	<.05	.08	<.05	<.05
		05/25/89	L	1.1	2.9	2.3	.15	.09	.22	<.05	<.05	<.05	<.05
		05/25/89	R	1.1	2.8	2.1	.14	.09	.23	<.05	.07	<.05	<.05
		10/26/89	B	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		10/26/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
37	Minnesota River near Jordan	03/22/89	R	.11	.17	<.20	<.05	<.05	.19	<.05	<.05	<.05	<.05
		07/19/89	R	.08	.29	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		10/29/89	R	<.05	3.1	<.20	.07	<.05	3.4	<.05	<.05	<.05	<.05
38	Redwood River near Redwood Falls	05/04/89	L	<.05	.07	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		05/04/89	R	<.05	.08	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		06/27/89	R	.26	.42	<.20	<.05	<.05	.18	<.05	<.05	<.05	<.05
		10/24/89	R	<.05	.11	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
39	Cottonwood River near New Ulm	07/18/89	R	<.05	.15	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		11/08/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		05/01/90	R	.64	.33	<.20	<.05	<.05	1.0	<.05	<.05	<.05	<.05

Table 7. *Results of analyses of water-quality samples for selected herbicides and two atrazine metabolites in Midwest streams, 1989-90*--Continued

Map no. (figs. 2-5)	Site name	Date of collection (month/ day/year)	Sample type[1]	Ala-chlor (µg/L)	Atra-zine[2] (µg/L)	Cyana-zine (µg/L)	DEA (µg/L)	DIA (µg/L)	Meto-lachlor (µg/L)	Metri-buzin (µg/L)	Pro-meton (µg/L)	Pro-pazine (µg/L)	Sima-zine (µg/L)
				Minnesota--Continued									
39	Cottonwood River near New Ulm--Continued	06/05/90	R	0.26	0.26	2.0	0.07	0.22	0.25	<0.05	0.26	<0.05	<0.05
		06/05/90	L	.25	.25	1.8	.07	.20	.19	<.05	.25	<.05	<.05
40	Le Sueur River near Rapidan	07/18/89	R	<.05	.27	<.20	<.05	<.05	.05	<.05	<.05	<.05	<.05
		11/07/89	R	<.05	<.05	<.20	<.05	<.05	.06	<.05	<.05	<.05	<.05
41	Straight River near Faribault	04/05/89	R	<.05	.29	<.20	.08	<.05	<.05	<.05	<.05	<.05	<.05
		07/19/89	R	.09	.32	<.20	.05	<.05	<.05	<.05	<.05	<.05	<.05
		11/08/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
42	N. Fork Whitewater River near Elba	11/08/89	R	<.05	.05	<.20	.09	<.05	<.05	<.05	<.05	<.05	<.05
43	Rock River at Luverne	06/27/89	R	.55	2.9	2.2	.53	.47	1.3	.24	<.05	<.05	<.05
		10/23/89	R	<.05	.08	<.20	<.05	<.05	.09	<.05	<.05	<.05	<.05
		05/08/90	R	<.05	.08	<.20	.06	<.05	.10	<.05	<.05	<.05	<.05
		06/19/90	R	.63	3.5	4.0	.38	.30	2.1	<.05	<.05	.05	<.05
44	Des Moines River at Jackson	06/27/89	L	.11	1.2	5.0	.24	<.05	.47	<.05	<.05	<.05	<.05
		06/27/89	R	.08	1.0	3.9	.21	<.05	.37	<.05	<.05	<.05	<.05
		10/23/89	L	<.05	.61	<.20	<.05	<.05	.09	<.05	<.05	<.05	<.05
		10/23/89	R	<.05	.61	<.20	<.05	<.05	.09	<.05	<.05	<.05	<.05
		05/08/90	R	.16	.11	<.20	.06	<.05	.16	<.05	<.05	<.05	<.05
		05/08/90	L	.15	.10	<.20	.05	<.05	.16	<.05	<.05	<.05	<.05
		06/19/90	L	.05	1.4	.34	.17	.18	.17	<.05	.12	<.05	<.05
		06/19/90	R	<.05	1.4	.32	.17	.16	.17	<.05	.12	<.05	<.05

Table 7. *Results of analyses of water-quality samples for selected herbicides and two atrazine metabolites in Midwest streams, 1989-90*--Continued

Map no. (figs. 2-5)	Site name	Date of collection (month/ day/year)	Sample type[1]	Ala-chlor (µg/L)	Atra-zine[2] (µg/L)	Cyana-zine (µg/L)	DEA (µg/L)	DIA (µg/L)	Meto-lachlor (µg/L)	Metri-buzin (µg/L)	Pro-meton (µg/L)	Pro-pazine (µg/L)	Sima-zine (µg/L)
				Minnesota--Continued									
45	Rush Creek near Rushford	05/25/89	R	1.1	2.1	1.6	0.15	<0.05	0.89	<0.05	<0.05	<0.05	<0.05
		11/07/89	R	<.05	.06	<.20	.09	<.05	<.05	<.05	<.05	<.05	<.05
				Iowa									
46	Ocheyedan River near Spencer	03/28/89	R	<.05	.13	<.20	<.05	<.05	.19	<.05	<.05	<.05	<.05
		05/24/89	R	12	12	12	.31	.36	11	2.2	<.05	<.05	.06
		10/12/89	L	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		10/12/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
47	Des Moines River at Estherville	03/28/89	R	<.05	.14	<.20	<.05	<.05	.13	<.05	<.05	<.05	<.05
		10/12/89	R	<.05	.16	<.20	<.05	<.05	<.05	<.05	.11	<.05	<.05
48	Winnebago River at Mason City	03/20/89	L	<.05	.52	<.20	.14	<.05	.36	<.05	<.05	<.05	<.05
		03/20/89	R	<.05	.51	<.20	.13	<.05	.33	<.05	<.05	<.05	<.05
		10/11/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
49	Little Cedar River near Ionia	10/16/89	R	<.05	.14	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
50	Turkey River at Spillville	08/23/89	X	<.05	<.05	<.20	.51	<.05	<.05	<.05	<.05	<.05	<.05
		10/04/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		03/22/90	R	.10	.43	<.20	.36	.10	.09	<.05	<.05	<.05	<.05
		05/19/90	X	1.2	2.0	1.3	.35	<.05	.88	<.05	<.05	<.05	<.05
		06/14/90	R	6.7	8.2	3.4	1.4	.84	2.5	.83	<.05	.13	.05
51	Upper Iowa River near Dorchester	03/31/89	L	<.05	.36	<.20	.14	<.05	<.05	<.05	<.05	<.05	<.05
		03/31/89	R	<.05	.33	<.20	.12	<.05	<.05	<.05	<.05	<.05	<.05
		05/31/89	R	6.4	10	2.8	.52	.23	1.5	<.05	<.05	.10	<.05
		10/05/89	R	<.05	.15	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05

Table 7. *Results of analyses of water-quality samples for selected herbicides and two atrazine metabolites in Midwest streams, 1989-90*--Continued

Map no. (figs. 2-5)	Site name	Date of collection (month/ day/year)	Sample type[1]	Ala-chlor (µg/L)	Atra-zine[2] (µg/L)	Cyana-zine (µg/L)	DEA (µg/L)	DIA (µg/L)	Meto-lachlor (µg/L)	Metri-buzin (µg/L)	Pro-meton (µg/L)	Pro-pazine (µg/L)	Sima-zine (µg/L)
						Iowa--Continued							
52	Little Sioux River at Correctionville	05/25/89	R	9.1	9.9	13	0.61	0.66	8.2	5.7	<0.05	<0.05	<0.05
		10/02/89	R	<.05	.13	<.20	<.05	<.05	.07	<.05	<.05	<.05	<.05
		03/16/90	R	.09	.19	<.20	<.05	<.05	.22	<.05	<.05	<.05	<.05
		05/19/90	X	2.9	5.8	.25	.46	.37	6.8	2.0	<.05	<.05	<.05
		06/14/90	L	.18	7.4	3.1	.46	.37	1.3	.14	.11	.11	.08
		06/14/90	R	.20	7.4	3.4	.49	.43	1.3	.16	.11	.12	.09
53	North Racoon River near Sac City	05/24/89	L	5.5	.80	<.20	.07	<.05	.72	<.05	<.05	<.05	<.05
		05/24/89	R	5.5	1.1	2.4	.09	.12	.69	.29	<.05	<.05	<.05
		10/12/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
54	Des Moines River at Fort Dodge	05/24/89	L	12	2.5	2.8	.17	<.05	7.6	1.0	<.05	<.05	<.05
		05/24/89	R	12	2.3	5.4	.14	.14	7.7	.97	.09	<.05	<.05
		10/13/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		03/16/90	R	.12	.12	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		05/14/90	X	.47	.19	<.20	.10	.14	1.3	<.05	.10	<.05	<.05
		05/19/90	X	1.6	.34	.77	.14	.16	2.3	.22	<.05	<.05	<.05
		06/15/90	L	.18	2.0	.26	.19	.17	1.5	<.05	.06	<.05	<.05
		06/15/90	R	.18	1.8	.25	.20	.17	1.4	<.05	.07	<.05	<.05
55	Iowa River near Rowan	10/11/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
56	Cedar River at Cedar Falls	08/23/89	X	<.05	.14	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		11/09/89	R	<.05	.15	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
57	Black Hawk Creek at Hudson	10/18/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05

Table 7. *Results of analyses of water-quality samples for selected herbicides and two atrazine metabolites in Midwest streams, 1989-90*--Continued

Map no. (figs. 2-5)	Site name	Date of collection (month/ day/year)	Sample type[1]	Ala-chlor (µg/L)	Atra-zine[2] (µg/L)	Cyana-zine (µg/L)	DEA (µg/L)	DIA (µg/L)	Meto-lachlor (µg/L)	Metri-buzin (µg/L)	Pro-meton (µg/L)	Pro-pazine (µg/L)	Sima-zine (µg/L)
				Iowa -- Continued									
58	Wapsipinicon River at Independence	03/20/89	R	0.19	1.7	0.26	0.39	0.18	0.53	<0.05	<0.05	<0.05	<0.05
		11/09/89	L	.16	.38	<.20	.26	<.05	.21	<.05	<.05	<.05	<.05
		11/09/89	R	<.05	.39	<.20	.26	<.05	.22	<.05	<.05	<.05	<.05
		03/22/90	R	.17	.63	<.20	.35	.09	.11	<.05	<.05	<.05	<.05
		05/09/90	L	15	23	4.2	1.0	.69	6.6	<.05	<.05	.28	<.05
		05/09/90	R	19	22	2.5	1.0	.77	6.8	<.05	<.05	<.05	<.05
		06/22/90	L	.77	2.4	.60	.73	.51	.72	.34	.27	.35	.11
		06/22/90	R	.89	3.9	.51	.83	.40	.77	.09	<.05	.05	<.05
59	Maple River at Mapleton	05/24/89	R	5.3	34	30	.98	.77	26	7.6	<.05	.50	.26
		10/02/89	R	.49	.59	<.20	<.05	<.05	.19	<.05	<.05	<.05	<.05
		03/16/90	R	.18	.40	<.20	.17	<.05	.31	<.05	<.05	<.05	<.05
		05/19/90	X	1.8	6.8	15	.63	.52	9.8	1.1	<.05	.06	<.05
		06/13/90	R	.90	13	5.3	1.0	.76	4.3	.50	<.05	.18	.09
60	Boyer River at Logan	03/23/89	R	<.05	.14	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		05/24/89	R	13	45	27	1.3	1.1	32	5.6	<.05	.32	.26
		10/02/89	R	<.05	.23	<.20	<.05	<.05	.10	<.05	<.05	<.05	<.05
		03/16/90	R	.12	.55	<.20	.21	<.05	.25	<.05	.06	<.05	<.05
		05/10/90	X	.08	.09	<.20	<.05	<.05	.19	<.05	<.05	<.05	<.05
		05/20/90	X	4.1	4.6	5.8	.51	.35	7.0	.80	<.05	.06	<.05
		06/13/90	R	.75	8.0	2.8	.48	.65	3.0	.07	<.05	.37	.07
61	Raccoon River at Van Meter	05/25/89	R	.95	1.1	1.3	.09	.07	1.0	.22	<.05	<.05	<.05
		11/08/89	R	<.05	.32	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		05/03/90	R	.08	.12	.23	.08	<.05	.18	<.05	<.05	<.05	<.05

Table 7. *Results of analyses of water-quality samples for selected herbicides and two atrazine metabolites in Midwest streams, 1989-90*--Continued

Map no. (figs. 2-5)	Site name	Date of collection (month/ day/year)	Sample type[1]	Ala-chlor (µg/L)	Atra-zine[2] (µg/L)	Cyana-zine (µg/L)	DEA (µg/L)	DIA (µg/L)	Meto-lachlor (µg/L)	Metri-buzin (µg/L)	Pro-meton (µg/L)	Pro-pazine (µg/L)	Sima-zine (µg/L)
						Iowa--Continued							
61	Raccoon River at Van Meter--Continued	05/03/90	B	0.08	0.13	<0.20	0.09	<0.05	0.19	<0.05	<0.05	<0.05	<0.05
		05/10/90	L	3.0	2.4	<.20	.24	.25	3.2	.20	<.05	<.05	.06
		05/10/90	R	3.1	2.3	<.20	.23	.24	3.3	.20	<.05	<.05	.06
		05/10/90	B	3.1	2.2	<.20	.21	.20	3.2	<.05	<.05	<.05	<.05
		06/14/90	X	.42	2.3	1.3	.25	.25	1.1	.21	<.05	<.05	<.05
62	Indian Creek near Mingo	05/24/89	R	3.4	5.0	7.9	.40	<.05	14	.62	<.05	.05	<.05
		10/10/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
63	Iowa River near Marengo	03/24/89	R	.06	.42	<.20	.07	<.05	.30	<.05	<.05	<.05	<.05
		05/25/89	R	13	15	10	.77	.63	13	.33	<.05	.19	.14
		11/07/89	R	<.05	.15	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
64	Old Mans Creek near Iowa City	05/25/89	R	51	72	36	3.7	3.2	33	4.2	<.05	.91	.43
		11/07/89	R	<.05	.69	<.20	.16	<.05	<.05	<.05	<.05	<.05	<.05
		03/15/90	X	.10	.78	<.20	.40	.16	.08	<.05	<.05	<.05	<.05
65	N. Fork Maquoketa River at Fulton	08/04/89	X	<.05	.21	<.20	.16	<.05	1.2	<.05	<.05	<.05	<.05
		10/05/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
66	S. Skunk River near Oskaloosa	05/24/89	R	41	48	45	3.1	3.1	23	4.9	.12	.64	.42
		10/16/89	R	<.05	.19	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
67	N. Skunk River near Sigourney	05/24/89	R	40	42	61	2.4	2.0	4.9	2.7	<.05	.51	.41
		10/02/89	R	<.05	.26	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		03/15/90	R	.12	.89	<.20	.49	.26	.23	<.05	<.05	<.05	<.05
		05/21/90	R	.66	1.1	1.6	.22	.10	1.6	<.05	<.05	<.05	<.05

Table 7. *Results of analyses of water-quality samples for selected herbicides and two atrazine metabolites in Midwest streams, 1989-90--Continued*

Map no. (figs. 2-5)	Site name	Date of collection (month/ day/year)	Sample type[1]	Ala-chlor (µg/L)	Atra-zine[2] (µg/L)	Cyana-zine (µg/L)	DEA (µg/L)	DIA (µg/L)	Meto-lachlor (µg/L)	Metri-buzin (µg/L)	Pro-meton (µg/L)	Pro-pazine (µg/L)	Sima-zine (µg/L)
						Iowa--Continued							
68	Nishnabotna River above Hamburg	06/05/89	R	12	37	34	2.2	2.0	19	1.5	0.05	0.51	0.39
		10/10/89	R	.20	1.0	<.20	<.05	<.05	.14	<.05	<.05	<.05	<.05
69	Chariton River near Chariton	03/20/89	R	<.05	.21	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		05/30/89	R	2.9	13	7.8	1.2	1.5	3.9	1.9	.06	.18	.16
		10/02/89	R	<.05	1.3	<.20	.40	<.05	.25	<.05	<.05	<.05	<.05
70	S. Fork Chariton River near Promise City	05/30/89	L	2.2	15	8.0	1.3	.88	7.7	1.0	<.05	.17	.12
		05/30/89	R	2.4	16	8.7	1.5	1.4	7.9	1.2	<.05	.21	.16
		10/03/89	R	<.05	.96	<.20	.30	<.05	.30	<.05	<.05	<.05	<.05
71	Skunk River at Augusta	03/22/89	R	<.05	.69	<.20	.12	<.05	.50	<.05	<.05	<.05	<.05
		05/26/89	R	8.9	30	31	1.5	1.8	5.0	1.6	.06	<.05	.36
		11/13/89	R	.14	.36	<.20	.10	<.05	.14	<.05	<.05	<.05	<.05
		03/08/90	R	.10	.36	<.20	.15	.17	.11	<.05	<.05	<.05	<.05
		05/24/90	X	2.0	1.6	3.0	.29	.31	2.8	.12	<.05	<.05	<.05
		06/21/90	R	1.5	6.5	<.20	1.4	1.6	2.1	.26	<.05	<.05	.07
						Missouri							
72	Nodaway River near Graham	03/15/89	B	<.05	.78	<.20	.17	.08	.20	<.05	<.05	<.05	<.05
		03/15/89	R	<.05	1.0	<.20	.22	.09	.27	<.05	<.05	<.05	<.05
		06/23/89	R	.30	7.8	5.6	.82	.58	1.7	.42	<.05	.07	.06
		10/03/89	B	<.05	.20	<.20	<.05	<.05	.07	<.05	<.05	<.05	<.05
		10/03/89	R	<.05	.21	<.20	<.05	<.05	.06	<.05	<.05	<.05	<.05

Table 7. *Results of analyses of water-quality samples for selected herbicides and two atrazine metabolites in Midwest streams, 1989-90--Continued*

Map no. (figs. 2-5)	Site name	Date of collection (month/ day/year)	Sample type[1]	Ala- chlor (µg/L)	Atra- zine[2] (µg/L)	Cyana- zine (µg/L)	DEA (µg/L)	DIA (µg/L)	Meto- lachlor (µg/L)	Metri- buzin (µg/L)	Pro- meton (µg/L)	Pro- pazine (µg/L)	Sima- zine (µg/L)
				Missouri--Continued									
72	Nodaway River near Graham--Continued	04/10/90	R	<0.05	0.14	<0.20	.10	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
		05/22/90	R	.12	1.5	1.5	.19	.14	.50	<.05	<.05	<.05	<.05
73	South Fabius River near Taylor	08/30/89	X	<.05	.82	<.20	<.05	<.05	.17	<.05	<.05	<.05	<.05
		10/05/89	R	<.05	.57	<.20	.18	<.05	.09	<.05	<.05	<.05	<.05
74	Grand River near Sumner	10/04/89	R	<.05	.35	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
75	Middle Fork Salr River at Paris	04/03/89	R	<.05	.53	<.20	.08	<.05	.17	<.05	<.05	<.05	<.05
		05/30/89	L	.93	3.1	1.6	.30	.39	.62	<.05	<.05	<.05	<.05
		05/30/89	R	.87	3.0	1.4	.28	.34	.60	<.05	<.05	<.05	<.05
		10/06/89	L	<.05	.42	<.20	.11	<.05	.08	<.05	<.05	.07	<.05
		10/06/89	R	<.05	.65	<.20	.17	<.05	<.05	<.05	<.05	<.05	<.05
76	Blackwater River at Blue Lick	05/20/89	R	2.0	11	<.20	.30	<.05	2.4	.54	<.05	<.05	<.05
		10/04/89	R	<.05	.50	<.20	.21	<.05	.09	<.05	<.05	<.05	<.05
77	Missouri River at Hermann	03/12/89	R	<.05	.18	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		06/07/89	R	.47	1.5	.94	.08	<.05	1.3	.20	<.05	<.05	<.05
		10/11/89	R	<.05	.26	<.20	<.05	<.05	.12	<.05	<.05	<.05	<.05
78	Mississippi River at Grafton	03/10/89	R	.22	.24	<.20	.07	<.05	<.05	<.05	<.05	<.05	<.05
		06/05/89	R	.97	2.0	1.4	.13	.09	.87	.16	<.05	<.05	<.05
		11/13/89	R	.18	.21	<.20	.09	<.05	<.05	<.05	<.05	<.05	<.05

Table 7. *Results of analyses of water-quality samples for selected herbicides and two atrazine metabolites in Midwest streams, 1989-90--Continued*

Map no. (figs. 2-5)	Site name	Date of collection (month/ day/year)	Sample type[1]	Ala-chlor (µg/L)	Atra-zine[2] (µg/L)	Cyana-zine (µg/L)	DEA (µg/L)	DIA (µg/L)	Meto-lachlor (µg/L)	Metri-buzin (µg/L)	Pro-meton (µg/L)	Pro-pazine (µg/L)	Sima-zine (µg/L)
						Wisconsin							
79	Prairie River near Merrill	05/05/89	R	<0.05	<0.05	<0.20	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
		10/23/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
80	Trempealeau River at Dodge	05/30/89	R	4.5	26	21	.84	.69	9.5	<.05	<.05	.37	.40
		10/17/89	R	<.05	.15	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
81	Black River near Galesville	05/30/89	R	2.0	3.2	.94	.11	<.05	.57	<.05	<.05	<.05	.05
		10/18/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
82	Wisconsin River at Muscada	06/02/89	R	.38	.65	<.20	.06	<.05	.15	<.05	<.05	<.05	<.05
		10/05/89	L	<.05	.22	<.20	.08	<.05	<.05	<.05	<.05	<.05	<.05
		10/05/89	R	<.05	.21	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		03/20/90	R	.06	.31	<.20	.15	<.05	<.05	<.05	<.05	<.05	<.05
		06/22/90	R	.20	.77	.23	.13	.15	.19	<.05	<.05	<.05	<.05
83	Grant River near Burton	03/23/89	B	<.05	.32	<.20	.12	<.05	<.05	<.05	<.05	<.05	<.05
		03/23/89	R	<.05	.32	<.20	.11	<.05	<.05	<.05	<.05	<.05	<.05
		05/31/89	L	.17	1.4	.68	.16	.07	.53	<.05	<.05	<.05	<.05
		05/31/89	R	.15	1.7	.61	.20	.09	.56	<.05	<.05	<.05	<.05
		11/02/89	B	<.05	.22	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		11/02/89	R	.06	.15	<.20	.13	<.05	<.05	<.05	<.05	<.05	<.05
84	Pecatonic River at Martintown	07/19/89	R	<.05	.11	<.20	.14	<.05	<.05	<.05	<.05	<.05	<.05
		10/31/89	R	<.05	.14	<.20	.17	<.05	<.05	<.05	<.05	<.05	<.05
85	Rock River at Afton	04/12/89	L	<.05	.29	<.20	.10	<.05	<.05	<.05	<.05	<.05	<.05
		04/12/89	R	<.05	.34	<.20	.11	<.05	<.05	<.05	<.05	<.05	<.05

Table 7. *Results of analyses of water-quality samples for selected herbicides and two atrazine metabolites in Midwest streams, 1989-90--Continued*

Map no. (figs. 2-5)	Site name	Date of collection (month/ day/year)	Sample type[1]	Ala-chlor (µg/L)	Atra-zine[2] (µg/L)	Cyana-zine (µg/L)	DEA (µg/L)	DIA (µg/L)	Meto-lachlor (µg/L)	Metri-buzin (µg/L)	Pro-meton (µg/L)	Pro-pazine (µg/L)	Sima-zine (µg/L)
						Wisconsin--Continued							
85	Rock River at Afton--Continued	07/19/89	L	<0.05	0.59	<0.20	0.27	<0.05	0.09	<0.05	<0.05	<0.05	<0.05
		07/19/89	R	<.05	.51	<.20	.19	<.05	<.05	<.05	<.05	<.05	<.05
		10/31/89	R	<.05	.15	<.20	.10	<.05	<.05	<.05	<.05	<.05	<.05
		04/12/90	R	<.05	.39	<.20	.27	.06	<.05	<.05	<.05	<.05	<.05
		07/06/90	R	.08	.72	.29	.25	<.05	.05	<.05	<.05	<.05	<.05
86	Fox River at Wakesha	11/03/89	R	<.05	.12	<.20	.11	<.05	<.05	<.05	<.05	<.05	<.05
87	Root River at Racine	03/22/89	R	<.05	.08	<.20	<.05	<.05	.16	<.05	<.05	<.05	<.05
		07/10/89	L	.10	.82	.32	.15	<.05	.66	<.05	.34	<.05	<.05
		07/10/89	R	.09	.88	.61	.16	<.05	.69	.14	.38	<.05	<.05
		11/03/89	R	<.05	.11	<.20	.09	<.05	.06	<.05	<.05	<.05	.09
		03/27/90	R	.07	.17	<.20	.11	<.05	.09	<.05	<.05	<.05	<.05
		07/19/90	R	.06	.44	.40	.17	.21	.43	<.05	.07	<.05	<.05
						Illinois							
88	Des Plains River at Russell	05/25/89	R	.18	.23	<.20	.10	<.05	<.05	<.05	<.05	<.05	<.05
		11/01/89	R	<.05	.15	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
89	Nippersink Creek at Spring Cove	04/05/89	R	<.05	.37	<.20	.16	.11	<.05	<.05	<.05	<.05	<.05
		05/25/89	L	.52	1.7	<.20	.19	<.05	.46	<.05	<.05	<.05	.51
		05/25/89	R	.32	.90	<.20	.12	.10	.16	<.05	<.05	<.05	.33
		11/01/89	R	<.05	.38	<.20	.30	<.05	<.05	<.05	<.05	<.05	<.05
90	S. Br. Kishwaukee River at Fairdale	05/25/89	R	44	11	14	.75	<.05	.62	<.05	<.05	<.05	<.05
		10/24/89	L	<.05	.23	<.20	.09	<.05	.14	<.05	.11	<.05	<.05

Table 7. *Results of analyses of water-quality samples for selected herbicides and two atrazine metabolites in Midwest streams, 1989-90--Continued*

Map no. (figs. 2-5)	Site name	Date of collection (month/ day/year)	Sample type[1]	Ala-chlor (µg/L)	Atra-zine[2] (µg/L)	Cyana-zine (µg/L)	DEA (µg/L)	DIA (µg/L)	Meto-lachlor (µg/L)	Metri-buzin (µg/L)	Pro-meton (µg/L)	Pro-pazine (µg/L)	Sima-zine (µg/L)
				Illinois--Continued									
90	S. Br. Kishwaukee River at Fairdale--Continued	10/24/89	R	<0.05	0.24	<0.20	<0.05	<0.05	0.16	<0.05	0.11	<0.05	<0.05
		04/12/90	R	.07	.25	<.20	.29	.10	.08	<.05	<.05	<.05	<.05
		05/14/90	R	1.6	2.1	<.20	.70	<.05	1.0	<.05	<.05	<.05	.06
91	Kishwaukee River near Perryville	03/22/89	R	<.05	.12	<.20	.09	<.05	.05	<.05	<.05	<.05	<.05
		05/25/89	R	.57	4.9	<.20	.16	.08	2.9	<.05	.05	<.05	<.05
		10/24/89	R	<.05	.15	<.20	.12	<.05	.31	<.05	<.05	<.05	<.05
92	Elkhorn Creek near Penrose	05/25/89	R	1.2	1.9	1.7	.54	<.05	.76	<.05	<.05	<.05	<.05
		10/24/89	R	<.05	.15	<.20	.19	<.05	.08	<.05	<.05	<.05	<.05
93	Illinois River near Marseilles	05/25/89	R	.91	2.5	1.1	.12	<.05	.68	<.05	<.05	<.05	.15
		10/31/89	R	<.05	.15	<.20	<.05	<.05	.09	<.05	.18	<.05	<.05
94	Fox River near Dayton	03/21/89	R	<.05	.20	<.20	.08	<.05	<.05	<.05	<.05	<.05	<.05
		05/25/89	R	.23	.80	1.5	.12	.09	1.9	.11	.07	<.05	.17
		10/31/89	R	<.05	.26	<.20	.17	<.05	<.05	<.05	<.05	<.05	.11
95	Dupage River near Shorwood	04/06/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	.06
		05/25/89	B	.71	.91	1.7	.12	.13	.57	.21	.08	<.05	.26
		05/25/89	R	.30	.77	.42	.07	<.05	.28	<.05	.05	<.05	.13
		11/02/89	B	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		11/02/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		04/04/90	R	<.05	.07	<.20	.07	.06	<.05	<.05	<.05	<.05	<.05
		06/22/90	L	<.05	.30	<.20	.10	.12	.12	<.05	<.05	<.05	.14
		06/22/90	R	<.05	.37	<.20	.12	.08	.15	<.05	<.05	<.05	.17

Table 7. *Results of analyses of water-quality samples for selected herbicides and two atrazine metabolites in Midwest streams, 1989-90--Continued*

Map no. (figs. 2-5)	Site name	Date of collection (month/ day/year)	Sample type[1]	Ala-chlor (µg/L)	Atra-zine[2] (µg/L)	Cyana-zine (µg/L)	DEA (µg/L)	DIA (µg/L)	Meto-lachlor (µg/L)	Metri-buzin (µg/L)	Pro-meton (µg/L)	Pro-pazine (µg/L)	Sima-zine (µg/L)
				Illinois--Continued									
96	Iroquois River near Chebanse	04/03/89	R	0.13	0.47	0.52	<0.05	<0.05	0.34	<0.05	<0.05	<0.05	<0.05
		05/19/89	X	.43	1.2	.62	<.05	<.05	.43	<.05	<.05	<.05	<.05
		05/25/89	L	.34	1.1	.62	.06	<.05	.42	<.05	<.05	<.05	<.05
		05/25/89	R	1.0	2.8	2.4	.13	.09	.77	.16	<.05	<.05	<.05
		11/03/89	R	<.05	.16	<.20	.13	<.05	.14	<.05	<.05	<.05	<.05
		04/04/90	R	.07	.19	<.20	.12	.07	.14	<.05	<.05	<.05	<.05
		05/17/90	R	4.7	4.2	8.2	.43	.41	1.9	<.05	<.05	.13	.09
97	Edwards River near New Boston	03/22/89	R	<.05	.15	<.20	<.05	<.05	<.05	.16	<.05	<.05	<.05
		10/23/89	R	<.05	.34	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
98	Spoon River at London Mills	04/21/89	R	<.05	.23	<.20	<.05	<.05	.16	<.05	<.05	<.05	<.05
		06/02/89	L	47	109	11	4.2	2.5	40	1.4	<.05	1.4	1.7
		06/02/89	R	47	108	11	4.4	2.2	40	1.5	<.05	1.4	1.9
		10/17/89	R	<.05	.24	<.20	.12	<.05	.24	<.05	<.05	<.05	<.05
		04/10/90	R	.06	.18	<.20	.15	<.05	.19	<.05	<.05	<.05	<.05
		05/14/90	R	1.6	2.0	<.20	.45	.27	4.3	<.05	<.05	<.05	.08
99	La Moine River at Colmar	06/03/89	R	.87	11	11	.80	.45	1.0	<.05	<.05	.08	.15
		10/17/89	R	<.05	.29	<.20	.09	<.05	.08	<.05	<.05	<.05	<.05
100	Sangamon River at Oaksford	05/23/89	R	.74	2.7	.28	.20	<.05	1.3	<.05	<.05	<.05	.12
		10/19/89	R	<.05	.25	<.20	.19	<.05	<.05	<.05	<.05	<.05	<.05
101	Lake Fork near Cornland	05/22/89	R	.18	.64	<.20	<.05	<.05	.26	.15	<.05	<.05	<.05
		10/16/89	L	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		10/16/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05

Table 7. *Results of analyses of water-quality samples for selected herbicides and two atrazine metabolites in Midwest streams, 1989-90--Continued*

Map no. (figs. 2-5)	Site name	Date of collection (month/ day/year)	Sample type[1]	Ala-chlor (µg/L)	Atra-zine[2] (µg/L)	Cyana-zine (µg/L)	DEA (µg/L)	DIA (µg/L)	Meto-lachlor (µg/L)	Metri-buzin (µg/L)	Pro-meton (µg/L)	Pro-pazine (µg/L)	Sima-zine (µg/L)
				Illinois--Continued									
102	Sangamon River at Riverton	05/22/89	R	0.91	2.6	0.94	0.27	<0.05	1.9	<0.05	0.06	<0.05	0.09
		10/12/89	R	<.05	.33	<.20	.11	<.05	<.05	<.05	<.05	<.05	<.05
		03/26/90	R	.09	.55	<.20	.27	.13	.44	<.05	<.05	<.05	<.05
		05/14/90	R	1.2	3.8	2.4	.37	.19	1.3	.20	.27	.05	.11
103	Illinois River at Hardin	03/10/89	R	<.05	.24	<.20	.05	<.05	<.05	<.05	<.05	<.05	<.05
		06/04/89	R	.48	3.1	.74	.25	.17	1.6	.20	<.05	<.05	.07
		10/16/89	R	<.05	.25	<.20	.10	<.05	.13	<.05	.13	<.05	<.05
104	Macoupin Creek near Kane	03/21/89	R	<.05	.89	<.20	.18	.18	.20	<.05	<.05	<.05	<.05
		05/23/89	R	.94	20	2.0	1.5	.61	5.2	.34	.07	.94	<.05
		10/16/89	R	<.05	.62	<.20	.15	<.05	.15	<.05	<.05	<.05	<.05
		03/28/90	R	.26	.79	<.20	.16	.06	.23	<.05	.08	<.05	<.05
		05/14/90	B	2.2	19	2.8	1.8	1.4	5.1	.80	<.05	.20	<.05
		05/14/90	B	1.6	17	3.7	1.4	.79	4.8	.68	<.05	.18	.11
		05/14/90	R	1.3	16	4.6	1.2	.52	3.8	.33	<.05	.17	.09
105	Kaskaskia River near Cowden	05/22/89	R	.23	2.7	<.20	.16	<.05	1.0	.23	<.05	<.05	.55
		10/26/89	R	<.05	1.3	<.20	.34	<.05	.28	<.05	<.05	<.05	<.05
		03/27/90	B	<.05	1.4	<.20	.57	.27	.29	<.05	1.0	<.05	.08
		03/27/90	R	<.05	1.3	<.20	.45	.20	.25	<.05	.07	<.05	<.05
		05/14/90	R	1.4	33	<.20	2.4	1.6	12	2.2	<.05	.41	4.4
106	Kaskaskia River at Vandalia	05/23/89	R	.43	4.9	<.20	.37	.16	2.0	.23	<.05	.05	.55
		10/11/89	L	<.05	.81	<.20	.20	<.05	.20	<.05	<.05	<.05	<.05
		10/11/89	R	<.05	.76	<.20	<.05	<.05	.17	<.05	<.05	<.05	<.05

Table 7. *Results of analyses of water-quality samples for selected herbicides and two atrazine metabolites in Midwest streams, 1989-90--Continued*

Map no. (figs. 2-5)	Site name	Date of collection (month/ day/year)	Sample type[1]	Ala-chlor (µg/L)	Atra-zine[2] (µg/L)	Cyana-zine (µg/L)	DEA (µg/L)	DIA (µg/L)	Meto-lachlor (µg/L)	Metri-buzin (µg/L)	Pro-meton (µg/L)	Pro-pazine (µg/L)	Sima-zine (µg/L)
						Illinois -- Continued							
107	Embarras River at Ste. Marie	05/22/89	L	4.4	11	<0.20	0.21	<0.05	4.1	<0.05	<0.05	<0.05	<0.05
		05/22/89	R	4.9	8.6	<.20	.22	<.05	3.9	<.05	<.05	<.05	<.05
		10/18/89	R	<.05	.33	<.20	<.05	<.05	.08	<.05	<.05	<.05	<.05
108	Shoal Creek near Breese	03/20/89	R	.11	.61	<.20	.10	<.05	.14	<.05	<.05	<.05	<.05
		05/23/89	R	5.5	15	4.4	.79	.58	6.0	.69	<.05	<.05	.41
		10/11/89	R	<.05	2.1	<.20	.42	<.05	.21	<.05	<.05	<.05	<.05
		03/28/90	R	<.05	1.0	<.20	.27	.12	.09	<.05	<.05	<.05	<.05
		05/04/90	R	1.4	26	.40	.65	1.6	1.3	<.05	<.05	<.05	<.05
109	Silver Creek near Freeburg	05/23/89	R	4.8	19	6.4	1.5	.72	8.2	1.4	<.05	.23	.92
		10/11/89	R	<.05	.52	<.20	.18	<.05	.29	<.05	<.05	<.05	<.05
110	Bonpas Creek at Browns	05/22/89	R	16	52	4.5	3.8	2.1	14	.81	<.05	.75	7.0
		11/27/89	R	<.05	.41	<.20	.22	<.05	.09	<.05	<.05	<.05	<.05
		04/17/90	R	.09	1.8	<.20	.20	.12	.68	<.05	<.05	<.05	.13
		07/10/90	R	1.1	9.2	1.3	2.8	1.6	2.7	.13	.05	.14	.35
						Indiana							
111	Wabash River near New Harmony	06/22/89	R	1.1	6.7	.39	.46	<.05	3.0	<.05	<.05	<.05	.44
		10/31/89	R	.12	.68	<.20	.32	<.05	.37	<.05	<.05	<.05	<.05
						Illinois							
112	Little Wabash River at Carmi	05/22/89	R	15	34	3.1	2.5	1.7	8.1	1.4	<.05	.46	4.9
		11/27/89	R	.21	.69	<.20	.19	<.05	.21	<.05	<.05	<.05	<.05
		04/17/90	R	.41	3.8	.50	.40	.34	1.1	<.05	<.05	<.05	1.4
		07/10/90	R	3.9	9.0	2.4	3.2	2.0	3.0	.79	<.05	.16	.17

Table 7. *Results of analyses of water-quality samples for selected herbicides and two atrazine metabolites in Midwest streams, 1989-90--Continued*

Map no. (figs. 2-5)	Site name	Date of collection (month/ day/year)	Sample type[1]	Ala-chlor (µg/L)	Atra-zine[2] (µg/L)	Cyana-zine (µg/L)	DEA (µg/L)	DIA (µg/L)	Meto-lachlor (µg/L)	Metri-buzin (µg/L)	Pro-meton (µg/L)	Pro-pazine (µg/L)	Sima-zine (µg/L)
						Illinois--Continued							
113	Big Muddy River near Murphysboro	05/24/89	R	1.4	5.1	2.1	0.25	0.13	0.29	<0.05	<0.05	<0.05	0.46
		10/16/89	R	<.05	.57	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
114	Mississippi River at Thebes	03/15/89	R	.44	.27	<.20	.08	<.05	<.05	<.05	<.05	<.05	<.05
		06/10/89	R	.65	1.8	.45	.15	.05	.80	.15	<.05	<.05	.06
		11/08/89	R	.13	.37	<.20	.11	<.05	.15	<.05	<.05	<.05	<.05
115	Ohio River near Grand Chain	03/16/89	R	<.05	<.05	<.20	.05	<.05	<.05	<.05	<.05	<.05	<.05
		06/11/89	R	.57	3.1	.47	.29	.16	1.1	.18	<.05	<.05	.21
		10/11/09	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
						Indiana							
116	Kankakee River at Shelby	03/22/89	R	<.05	.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		05/31/89	R	1.0	2.8	<.20	.17	<.05	1.4	<.05	<.05	<.05	.05
		10/16/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
117	Tippecanoe River near Ora	05/31/89	R	.42	1.2	<.20	.13	<.05	.16	.14	<.05	<.05	.43
		10/16/89	R	<.05	.23	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
118	Iroquois River near Foresman	05/31/89	R	2.1	5.9	4.5	.39	.14	1.8	.30	<.05	.07	.16
		10/16/89	R	.09	.11	<.20	.08	<.05	<.05	<.05	<.05	<.05	<.05
119	Eel River near Logansport	03/22/89	R	.08	.26	<.20	.06	<.05	<.05	<.05	<.05	<.05	<.05
		05/22/89	L	1.3	7.4	2.3	.16	.09	4.7	<.05	.06	.05	.34
		05/22/89	R	1.7	8.0	2.5	.17	<.05	5.3	.24	<.05	.06	.37
		10/16/89	R	<.05	.12	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		03/26/90	R	.05	.19	<.20	.09	<.05	.15	<.05	<.05	<.05	<.05

Table 7. *Results of analyses of water-quality samples for selected herbicides and two atrazine metabolites in Midwest streams, 1989-90--Continued*

Map no. (figs. 2-5)	Site name	Date of collection (month/ day/year)	Sample type[1]	Ala-chlor (µg/L)	Atra-zine[2] (µg/L)	Cyana-zine (µg/L)	DEA (µg/L)	DIA (µg/L)	Meto-lachlor (µg/L)	Metri-buzin (µg/L)	Pro-meton (µg/L)	Pro-pazine (µg/L)	Sima-zine (µg/L)
				Indiana--Continued									
119	Eel River near Logansport--Continued	05/14/90	R	4.3	9.6	10	0.91	0.46	3.3	<0.05	<0.05	0.12	0.13
120	Wabash River at Linn Grove	05/26/89	R	7.7	8.6	1.4	.57	.23	2.8	.74	.08	.09	1.4
		10/17/89	R	<.05	.27	<.20	.08	<.05	.25	<.05	<.05	<.05	<.05
121	Wildcat Creek near Lafayette	03/23/89	R	.07	.22	<.20	.05	<.05	.35	<.05	<.05	<.05	<.05
		05/27/89	L	11	29	6.9	1.5	.86	17	1.5	.19	.14	.74
		05/27/89	R	10	27	6.1	1.4	.78	16	1.3	.16	.25	.64
		10/16/89	R	<.05	.26	<.20	.12	<.05	.14	<.05	<.05	<.05	<.05
		03/26/90	R	<.05	.22	<.20	.15	.06	.12	<.05	<.05	<.05	<.05
		05/14/90	R	5.4	14	3.6	1.2	.53	8.6	.53	<.05	.20	.93
122	Wildcat Creek near Jerome	05/22/89	R	.53	1.5	<.20	.13	<.05	1.3	<.05	<.05	<.05	<.05
		10/17/89	R	<.05	.35	<.20	.14	<.05	.32	<.05	<.05	<.05	<.05
		03/26/90	R	<.05	.27	<.20	.21	.09	.16	<.05	<.05	<.05	<.05
		05/14/90	L	7.9	9.8	4.8	.98	.43	8.1	1.2	<.05	.14	<.05
		05/14/90	R	7.9	10	5.2	1.0	.45	8.4	1.2	<.05	.14	<.05
123	Wabash River at Covington	03/24/89	R	<.05	.18	<.20	<.05	<.05	.14	<.05	<.05	<.05	<.05
		05/22/89	R	3.1	8.8	2.7	.55	.23	4.9	.34	.07	.07	.39
		10/16/89	L	<.05	.79	<.20	.26	<.05	.33	<.05	<.05	<.05	<.05
		10/16/89	R	.13	.68	<.20	.20	<.05	.29	<.05	<.05	<.05	<.05
124	White River near Nora	03/27/89	B	<.05	.22	<.20	.08	<.05	.05	<.05	<.05	<.05	<.05
		03/27/89	R	<.05	.18	<.20	.07	<.05	<.05	<.05	<.05	<.05	<.05
		05/26/89	B	3.3	9.8	4.2	.61	.35	4.6	.19	<.05	.06	.55

Table 7. *Results of analyses of water-quality samples for selected herbicides and two atrazine metabolites in Midwest streams, 1989-90--Continued*

Map no. (figs. 2-5)	Site name	Date of collection (month/ day/year)	Sample type[1]	Ala- chlor (µg/L)	Atra- zine[2] (µg/L)	Cyana- zine (µg/L)	DEA (µg/L)	DIA (µg/L)	Meto- lachlor (µg/L)	Metri- buzin (µg/L)	Pro- meton (µg/L)	Pro- pazine (µg/L)	Sima- zine (µg/L)
				Indiana--Continued									
124	White River near Nora--Continued	05/26/89	R	3.1	9.8	4.0	0.57	0.33	4.5	0.19	<0.05	0.08	0.51
		11/01/89	B	<.05	.28	<.20	.17	<.05	.14	<.05	<.05	<.05	<.05
		11/01/89	R	.07	.29	<.20	.19	<.05	.14	<.05	<.05	<.05	<.05
		03/26/90	B	<.05	.21	<.20	.13	.07	.09	<.05	<.05	<.05	<.05
		03/26/90	R	.06	.32	<.20	.20	.10	.14	<.05	.05	<.05	<.05
		05/14/90	B	10	19	5.2	1.6	1.0	6.0	1.3	.09	.29	.70
		05/14/90	R	9.8	17	13	1.4	.86	5.6	1.2	<.05	.27	.62
125	Big Blue River at Carthage	05/23/89	L	13	13	3.9	.67	<.05	.18	.28	.15	.13	.87
		05/23/89	R	13	13	4.5	.78	<.05	.20	.30	.17	.13	.92
		10/17/89	R	<.05	.12	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
126	Whitewater River near Alpine	05/23/89	R	9.9	20	14	1.0	.53	5.7	.38	.09	.23	.83
		10/17/89	R	<.05	.25	<.20	.16	<.05	.14	<.05	<.05	<.05	<.05
		03/27/90	L	<.05	.13	<.20	.12	<.05	<.05	<.05	<.05	<.05	<.05
		03/27/90	R	<.05	.14	<.20	.13	<.05	<.05	<.05	<.05	<.05	<.05
		05/15/90	R	3.2	8.2	<.20	1.1	.57	2.6	.31	<.05	.11	.78
		05/15/90	L	2.2	5.9	2.6	.84	.38	2.1	.18	<.05	<.05	.48
127	Big Walnut Creek near Reelsville	03/24/89	R	<.05	.25	<.20	.11	<.05	<.05	<.05	<.05	<.05	<.05
		05/23/89	R	.73	6.6	<.20	.34	.13	1.8	<.05	<.05	.06	1.2
		10/31/89	R	<.05	.41	<.20	.22	<.05	<.05	<.05	<.05	<.05	<.05
128	White River near Centerton	05/23/89	R	1.7	8.7	<.20	0.23	<.05	1.6	<.05	<.05	.10	1.7
		10/30/89	R	<.05	.36	<.20	.21	<.05	.17	<.05	<.05	<.05	<.05

Table 7. *Results of analyses of water-quality samples for selected herbicides and two atrazine metabolites in Midwest streams, 1989-90--Continued*

Map no. (figs. 2-5)	Site name	Date of collection (month/ day/year)	Sample type[1]	Ala-chlor (µg/L)	Atra-zine[2] (µg/L)	Cyana-zine (µg/L)	DEA (µg/L)	DIA (µg/L)	Meto-lachlor (µg/L)	Metri-buzin (µg/L)	Pro-meton (µg/L)	Pro-pazine (µg/L)	Sima-zine (µg/L)
				Indiana--Continued									
129	Sugar Creek near Edinburgh	05/25/89	L	4.4	14	9.7	0.89	0.86	2.2	<0.05	<0.05	0.37	0.23
		05/25/89	R	4.3	15	7.7	.91	.32	2.1	.27	<.05	.18	.24
		10/30/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		03/27/90	R	<.05	.14	<.20	.11	<.05	<.05	<.05	<.05	<.05	<.05
		05/15/90	R	7.0	20	7.5	2.0	1.0	4.2	.34	<.05	.27	.26
130	Flatrock River at Columbus	05/25/89	L	8.1	14	6.6	.65	<.05	1.9	<.05	<.05	.17	.92
		05/25/89	R	8.5	15	6.9	.96	<.05	2.2	.41	<.05	.15	.78
		10/30/89	R	<.05	.17	<.20	.12	<.05	<.05	<.05	<.05	<.05	<.05
131	Busseron Creek near Carlisle	06/22/89	R	.17	3.5	<.20	.24	<.05	.43	<.05	<.05	<.05	<.05
		10/31/89	R	<.05	.22	<.20	.13	<.05	.05	<.05	<.05	<.05	<.05
132	E. Fork White River near Bedford	05/25/89	R	4.0	20	9.4	1.1	.59	6.8	.29	.09	.23	1.5
		10/30/89	R	<.05	.28	<.20	.12	<.05	<.05	<.05	<.05	<.05	<.05
		03/27/90	R	<.05	.22	<.20	.15	<.05	.05	<.05	<.05	<.05	<.05
		05/15/90	R	2.2	11	4.7	1.2	.69	3.1	<.05	<.05	.14	.64
133	Muscatatuck River near Deputy	03/28/89	R	<.05	.06	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		05/25/89	R	.23	2.7	2.8	.37	.24	1.0	.14	<.05	<.05	.46
		10/30/89	R	<.05	.37	<.20	.17	<.05	.11	<.05	<.05	<.05	<.05
134	Blue River at Fredricksburg	05/25/89	R	.14	5.1	2.8	.42	.19	4.0	<.05	<.05	.06	.36
		10/30/89	R	.23	.30	<.20	.38	<.05	.07	<.05	<.05	<.05	<.05
		03/27/90	R	<.05	.16	<.20	.15	<.05	<.05	<.05	<.05	<.05	<.05
		05/15/90	R	.17	5.1	1.4	.49	.23	.34	<.05	<.05	.09	.11

Table 7. *Results of analyses of water-quality samples for selected herbicides and two atrazine metabolites in Midwest streams, 1989-90--Continued*

Map no. (figs. 2-5)	Site name	Date of collection (month/ day/year)	Sample type[1]	Ala-chlor (µg/L)	Atra-zine[2] (µg/L)	Cyana-zine (µg/L)	DEA (µg/L)	DIA (µg/L)	Meto-lachlor (µg/L)	Metri-buzin (µg/L)	Pro-meton (µg/L)	Pro-pazine (µg/L)	Sima-zine (µg/L)
						Ohio							
135	Tiffin River at Stryker	03/14/89	R	<0.05	0.38	<0.20	0.16	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
		06/02/89	R	11	28	8.7	2.5	1.9	11	4.7	<.05	.27	.60
		10/25/89	R	.30	.66	<.20	.20	<.05	.54	<.05	<.05	<.05	<.05
		03/21/90	R	.08	.45	<.20	.28	.14	.08	<.05	<.05	<.05	.07
		05/14/90	L	22	35	44	3.7	3.4	17	4.5	<.05	.56	.57
		05/14/90	R	10	.14	22	1.4	.85	7.0	1.5	<.05	.14	.12
136	Maumee River at Waterville	05/27/89	R	4.5	7.0	9.0	.30	.12	2.0	1.2	<.05	.05	.39
		10/25/89	R	.23	1.1	<.20	.45	<.05	.63	<.05	.23	<.05	<.05
137	Sandusky River near Fremont	05/24/89	R	.96	5.9	.38	.56	<.05	3.0	.21	<.05	<.05	.21
		10/25/89	R	.50	1.7	<.20	.37	<.05	1.1	<.05	<.05	<.05	<.05
138	Auglaize River near Fort Jennings	05/27/89	L	3.4	12	4.6	.87	.54	7.0	1.2	.12	.14	2.6
		05/27/89	R	4.2	15	3.4	.74	.66	7.8	<.05	<.05	.20	3.4
		10/25/89	R	<.05	.53	<.20	<.05	<.05	1.5	<.05	.17	<.05	<.05
		03/21/90	R	.07	.30	<.20	.22	.12	1.1	<.05	<.05	<.05	.12
		05/14/90	R	4.5	16	11	1.6	.64	12	1.1	<.05	.22	1.6
139	Olentangy River at Claridon	03/15/89	R	.19	.49	<.20	.12	<.05	.13	<.05	<.05	<.05	.08
		06/14/89	R	.75	2.9	.35	.33	.18	1.4	.21	<.05	<.05	.10
		10/24/89	L	.12	.48	<.20	.18	<.05	.24	<.05	.15	<.05	<.05
		10/24/89	R	<.05	.43	<.20	.15	<.05	.21	<.05	.07	<.05	<.05
		03/21/90	L	<.05	<.05	<.20	.10	<.05	.06	<.05	<.05	<.05	.30
		03/21/90	R	<.05	.24	<.20	.14	<.05	.10	<.05	.05	<.05	<.05
		05/14/90	R	15	32	12	2.3	<.05	23	<.05	<.05	.57	.85

Table 7. *Results of analyses of water-quality samples for selected herbicides and two atrazine metabolites in Midwest streams, 1989-90--Continued*

Map no. (figs. 2-5)	Site name	Date of collection (month/ day/year)	Sample type[1]	Ala-chlor (µg/L)	Atra-zine[2] (µg/L)	Cyana-zine (µg/L)	DEA (µg/L)	DIA (µg/L)	Meto-lachlor (µg/L)	Metri-buzin (µg/L)	Pro-meton (µg/L)	Pro-pazine (µg/L)	Sima-zine (µg/L)
				Ohio--Continued									
140	Scioto River near Prospect	06/14/89	R	0.49	1.9	<0.20	0.14	<0.05	0.95	<0.05	<0.05	0.10	0.28
		10/19/89	R	<.05	.21	<.20	<.05	<.05	.23	<.05	<.05	<.05	<.05
		03/23/90	R	.10	.26	<.20	.14	.13	.23	<.05	<.05	<.05	.07
		05/15/90	R	7.9	27	19	2.1	1.1	14	1.9	<.05	.31	2.1
141	Kokosing River at Mount Vernon	06/14/89	R	.63	4.7	1.0	.37	.16	2.2	.23	<.05	<.05	.92
		10/12/89	R	<.05	.90	<.20	<.05	<.05	.34	<.05	<.05	<.05	<.05
142	Mad River at Eagle City	06/14/89	R	2.1	10	2.4	.97	.46	4.0	.90	<.05	.12	.17
		10/12/89	R	<.05	<.05	<.20	<.05	<.05	.09	<.05	<.05	<.05	<.05
		03/22/90	R	<.05	.05	<.20	.06	<.05	<.05	<.05	<.05	<.05	<.05
		05/14/90	R	2.9	11	5.2	.96	.41	4.1	.28	<.05	.10	.50
143	Little Miami River near Oldtown	06/14/89	R	17	26	9.3	1.0	<.05	1.7	1.1	<.05	<.05	.12
		10/12/89	R	<.05	<.05	<.20	<.05	<.05	<.05	<.05	<.05	<.05	<.05
		03/22/90	R	<.05	.20	<.20	.19	<.05	.13	<.05	<.05	<.05	<.05
		05/14/90	R	20	26	22	2.4	1.5	9.8	2.3	<.05	.42	1.3
144	Big Darby Creek at Darbyville	06/14/89	R	.14	1.4	1.0	.14	<.05	.51	<.05	<.05	<.05	.33
		10/26/89	L	<.05	.20	<.20	<.05	<.05	.10	<.05	<.05	<.05	<.05
		10/26/89	R	<.05	.20	<.20	<.05	<.05	.10	<.05	<.05	<.05	<.05
		03/22/90	R	.05	.18	<.20	.15	.10	.05	<.05	<.05	<.05	<.05
		05/15/90	R	2.7	18	18	1.8	.98	7.8	.58	<.05	.23	1.3
145	Clear Creek near Rockbridge	03/14/89	B	<.05	.12	<.20	.07	<.05	<.05	<.05	<.05	<.05	.05
		03/14/89	R	<.05	.13	<.20	.08	<.05	<.05	<.05	<.05	<.05	<.05
		06/14/89	B	3.6	14	8.3	1.6	1.5	8.5	.91	<.05	.15	2.4
		06/14/89	R	3.6	19	8.3	1.5	1.5	8.8	.96	<.05	.08	3.8

Table 7. *Results of analyses of water-quality samples for selected herbicides and two atrazine metabolites in Midwest streams, 1989-90--Continued*

Map no. (figs. 2-5)	Site name	Date of collection (month/ day/year)	Sample type[1]	Ala-chlor (µg/L)	Atra-zine[2] (µg/L)	Cyana-zine (µg/L)	DEA (µg/L)	DIA (µg/L)	Meto-lachlor (µg/L)	Metri-buzin (µg/L)	Pro-meton (µg/L)	Pro-pazine (µg/L)	Sima-zine (µg/L)
				Ohio--Continued									
145	Clear Creek near Rockbridge--Continued	10/16/89	B	<0.05	0.17	<0.20	<0.05	<0.05	0.09	<0.05	<0.05	<0.05	<0.05
		10/16/89	L	<.05	.24	<.20	<.05	<.05	.19	<.05	<.05	<.05	<.05
		10/16/89	R	<.05	<.05	<.20	<.05	<.05	.09	<.05	<.05	<.05	<.05
		03/21/90	B	<.05	.09	<.20	.08	<.05	<.05	<.05	<.05	<.05	.05
		03/22/90	R	<.05	.11	<.20	.10	<.05	.05	<.05	<.05	<.05	.07
		05/14/90	B	.26	4.7	4.7	.47	.31	1.6	<.05	<.05	.06	.73
		05/15/90	X	.23	4.8	4.4	.46	.28	1.7	<.05	<.05	.05	.74
		05/15/90	X	.29	4.8	4.8	.48	.32	1.7	<.05	<.05	.06	.72
		05/26/90	L	1.8	13	3.7	2.2	2.1	7.2	.98	<.05	.22	2.2
		05/26/90	R	1.7	9.0	5.2	1.5	1.5	4.2	.12	<.05	.12	2.2
146	Scioto River at Higby	06/19/89	R	.73	4.1	<.20	.18	<.05	1.6	.05	.05	.05	<.05
		10/03/89	R	<.05	.95	<.20	.19	<.05	.40	<.05	<.05	<.05	<.05
		03/26/90	L	<.05	.49	<.20	.14	.10	.64	<.05	<.05	<.05	2.1
		03/26/90	R	<.05	.24	<.20	.08	.07	.31	<.05	<.05	<.05	<.05
		05/15/90	R	2.6	13	12	.98	.63	5.1	.34	.07	.17	1.0
147	Little Miami River at Milford	03/23/89	R	<.05	.48	<.20	.25	<.05	.21	<.05	<.05	<.05	.12
		06/14/89	R	.37	2.3	1.8	.22	.13	.56	<.05	<.05	<.05	.33
		10/17/89	R	<.05	.30	<.20	<.05	<.05	.12	<.05	<.05	<.05	<.05

[1]Sample type: B, blind sample;
L, duplicate sample;
R, regular sample; and
X, extra sample.

[2]Analyses by gas chromatography/mass spectrometry at U.S. Geological Survey in Lawrence, Kansas.

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