Shaughnessy No.: 080803

Date Out of EFGWB: MARCH 10, 1992

TO: Anne Sibold
Product Manager #63
Special Review and Reregistration Division (H7508W)

FROM: Henry Nelson, Ph.D., Acting Section Head H/Nelson
Surface Water Section
Environmental Fate and Groundwater Branch/EFED (H7507C)

THRU: Hank Jacoby, Chief
Environmental Fate and Groundwater Branch
Environmental Fate and Effects Division (H7507C)

Attached, please find the EFGWB review of:

Reg./File #(s): 080803-0

Common Names: Atrazine

Type of Product: Herbicide
Product Name:

Company Name: Ciba-Geigy

Purpose: Review of surface water monitoring data for atrazine and other triazines

Action Code: 860 EFGWB #(s): 92-0002, 92-0199

Total Reviewing Time: 4 month

The American Water Works Association has written several letters to EFGWB/EFED concerning the contamination of mid-western surface waters by herbicides, particularly atrazine. This package contains EFGWB reviews (DERs) for 10 study reports containing data on atrazine concentrations, and in some cases the concentrations of atrazine degradates and/or other triazines such as cyanazine and simazine in surface waters.

1

1. CHEMICAL:
Common Name: Atrazine
Chemical Name: 2-Chloro-4-ethylamino-6-isopropylamino-1,3,5-triazine
Type of Product: Herbicide

Chemical Structure:

Physical/Chemical Properties
Molecular Weight: 354
Physical State : White crystalline solid
Aqueous Solubility: 70 mg/L @ 22_oC
Vapor Pressure: 3.0 X 10_{-7} mm Hg
Log Octanol/Water Partition Coefficient 2.33 to 2.71

2. INTRODUCTION/BACKGROUND:

Under Phase II of the Drinking Water Regulations, water supply systems will be required to collect a minimum of 4 finished water samples a year, one per quarter. A water supply system will be considered out of compliance if the annual mean concentration of a regulated pesticide exceeds the Maximum Contaminant Level (MCL) for the pesticide. If the concentration of a pesticide in any quarterly sample exceeds 4 times the MCL, the annual mean concentration will exceed the MCL regardless of the pesticide concentration in the other 3 quarterly samples. It is unclear whether a water supply system reporting a pesticide concentration exceeding 4 times the MCL in a single quarterly sample will be automatically considered out of compliance

The American Water Works Association has written several letters to EFGWB/EFED expressing concern over the contamination of mid-western surface waters by herbicides, particularly atrazine. They have submitted a number of studies conducted by various groups which indicate that atrazine concentrations in samples collected mid-April to mid-July from surface waters throughout the midwestern corn belt frequently exceed the MCL (3 ug/L) and in many cases 4 times the MCL (12 ug/L).

Although most of the available data is on raw water, the concentrations of atrazine in finished water are expected to be comparable to those in raw water in most cases. The reason is that concentrations of chemicals with relatively low soil/water partition coefficients such as atrazine are generally not effectively reduced by the sole primary precipitation/filtration treatment processes employed by most water supply systems. Consequently, the use of activated carbon or other costly more advanced treatment methods may be necessary if an effective reduction in the concentrations of atrazine and/or other pesticides with relatively low soil/water partition coefficients is required under Phase II.

This package contains EFGWB reviews (DERs) for 10 study reports containing data on atrazine concentrations, and in some cases the concentrations of atrazine degradates and/or other triazines such as cyanazine and simazine in surface waters. The 10 study reports reviewed include the 2 USGS studies, the Illinois State report, the Baker study report, and the Missouri River review submitted by the AWWA with their letters for review. In addition, reviews of a USGS report on the Cedar River Basin, 3 reports submitted by CIBA-GEIGY, and a community water system report submitted by Monsanto are included in this package.

Five of the 10 DERs were originally produced as part of EFGWB review 89-0569 dated August 28, 1991, but have been revised to emphasize in conjunction with the new DERs a spreadsheet aided comparison of pesticide concentrations and annual means to the MCL and 4 times the MCL (atrazine and simazine). If a MCL is not available, comparison is made to the MCL for a pesticide with a similar structure (concentrations and means of atrazine degradates are compared to the MCL for atrazine) or to the lifetime drinking water HA (cyanazine).

CIBA-GEIGY and DuPont has submitted to OPP data summaries for ongoing studies on the levels of atrazine and in some cases atrazine degradates and cyanazine in 3 reservoirs/lakes (West Lake at Osceola IA, Rathburn Reservoir in Iowa, and Hoover Reservoir at Columbus OH). The summaries are not detailed enough to warrant formal reviews with DERs, but will be briefly discussed.

<u>This review focuses on atrazine, its degradates and other triazines (cyanazine and simazine). A future review will cover other pesticides including alachlor, metalochlor, and metribuzin.</u>

3. <u>STUDY IDENTIFICATION:</u>

<u>STUDY 1:</u> Baker D. 1988. Sediment, nutrient and pesticide transport in selected Great Lakes Tributaries. Completed February 1988. Performed by Water Quality Laboratory of Heidelberg College, Tiffin, Ohio for the Great Lakes National Program Office of U.S. EPA (Region 5).

<u>STUDY 2:</u> Goolsby DA and Thurman EM. 1991. Herbicides in rivers and streams of the upper midwestern United States. To be published in: Proc. 46th Ann. Meeting Upper Mississippi River Conservation Committee.

<u>STUDY 3:</u> Goolsby DA, Coup RC, and Markovchick DJ. 1991. Distribution of selected herbicides and nitrate in the Mississippi River and its major tributaries, April through June 1991.

STUDY 4: Smith RG, Triebe FM, and Baszis SR. 1987. Alachlor, atrazine, cyanazine, metolachlor, and simazine in surface water from 30 community water systems located in regions of Lasso use. Performed by Monsanto.

STUDY 5: Roux P. 1989. Summary of atrazine surface-water monitoring program. Completed in February 1988. Performed by Roux Associates and submitted by Ciba Geigy Corp., Greensboro, NC. Laboratory Study No. CG-02814

STUDY 6: Ross R. and Balu K. 1985. Summary of atrazine surface water monitoring data during 1975-1985. Submitted by CIBA-GEIGY.

STUDY 7: Keck P. 1991. Missouri River Public Water Supplies Association. 1991 Missouri River Monitoring Study. September 19, 1991.

STUDY 8: Moyer L and Cross J. 1990. Pesticide monitoring: Illinois EPA's summary of results. 1985-1989.

STUDY 9: Squillace P and Engberg R. 1988. Surface-water quality of the Cedar River Basin, Iowa-Minnesota with emphasis on the occurrence and transport of herbicides, May 1984 through November 1985. US Geological Survey Water Resources Investigations Report 88-4060.

STUDY 10: Roux P. 1988. Summary of atrazine/metolachlor cross-over in the surface-water monitoring program. Completed in February 1988. Performed by Roux Associates and submitted by Ciba Geigy Corp., Greensboro, NC. Laboratory study #CG-02814.

Miscellaneous 6(a)(2) Data: Miscellaneous data submitted by CIBA-GEIGY or DuPont on the concentrations of atrazine and in some cases atrazine degradates and cyanazine in West Lake at Osceola IA (D171803, D170748, D173513/421667-01, D174704/422019-01), Rathburn Reservoir in Iowa (D173509/421668-01), and Hoover Reservoir at Columbus OH (D173497/421669-01).

4. REVIEWED BY:
Henry Nelson, Ph.D., Acting Section Head H Nelson
Surface Water Section
Environmental Fate and Groundwater Branch/EFED

5. APPROVED BY:
Hank Jacoby, Chief
Environmental Fate and Groundwater Branch
Environmental Fate and Effects Division/OPP

6. CONCLUSIONS:

Based upon a review of 10 studies covering numerous locations, and reservoir/lake data summaries submitted by CIBA-

GEIGY, EFGWB has developed and/or concurs with the following conclusions concerning the distribution and time dependence of atrazine, atrazine degradates, cyanazine, and simazine concentrations in surface waters:

(1) Atrazine is typically applied at or within a few days after corn planting which typically takes place from early April through late May depending upon the location. In surface waters draining high atrazine use areas, peak observed concentrations (frequently > 10 ug/L but rarely greater than 50 ug/L) are typically observed in conjunction with the first major runoff event following corn planting/atrazine application. After that, atrazine concentrations generally gradually decline over several weeks to 2-3 months to concentrations < 1.0 ug/L (most samples collected from September through March at most locations have atrazine concentrations < 1.0 ug/L). In a few locations, peak atrazine concentrations continued to occur in conjunction with additional runoff events occurring within approximately 2 months after application.

(2) In locations with extensive tile drainage systems and/or groundwater discharge, additional atrazine peaks may occur substantially after runoff events.

(3) Atrazine concentration versus time plots are typically simpler for streams and tributaries draining small watersheds than for surface waters draining larger watersheds. Atrazine peaks are typically smaller in number, but sharper and frequently greater in magnitude for small watershed surface waters than for large watershed surface waters. Atrazine versus time plots for surface waters draining large watersheds reflect averaging and dilution over multiple tributary and runoff pesticide inputs from areas receiving different amounts of rainfall at different times and from areas receiving different degrees of pesticide application. Consequently, atrazine peaks are generally more numerous and elevated pesticide concentrations are more persistent for surface waters draining large watersheds than for those draining small watersheds.

(4) A high percentage (26.4%) of the samples collected in 1989 by the USGS from 150 midwestern locations during the first major runoff after atrazine application had atrazine concentrations exceeding 12 ug/L (4 times the MCL). Atrazine concentrations also exceeded 4 times the MCL in most of the other studies, but the percentage post-application exceeding 4 times the MCL was generally much lower because post-application samples were collected at regular intervals not necessarily in conjunction with runoff events.

(5) A significant percentage of sampling locations in both streams and lakes in high atrazine use areas have or may have average annual atrazine concentrations greater than the MCL (3 ug/L). Many of the locations with 6 month to less than one year averages

exceeding 4 ug/L or 3 to 6 month averages exceeding 5 ug/L could have annual averages exceeding the MCL of 3 ug/L.

Study 1: Nine of the 24 April 15-August 15 atrazine TWMCs (1983-1985) representing 6 of the 8 Lake Erie tributaries sampled exceeded the MCL for atrazine (3 ug/L). Six of those exceeded 5 ug/L.

Study 4: Seven of the 30 primarily midwestern community water supply systems sampled had April-August or April-September 1986 mean atrazine concentrations greater than the MCL (3 ug/L). Three of those exceeded 5 ug/L. In addition, one system had an annual average exceeding the MCL.

Study 5: Three of the 14 surface waters sampled had a 3/86-11/86 and/or 3/87-11/87 mean atrazine concentration greater than the MCL (3 ug/L). Two of the surface waters had one or two March-November means exceeding 4 ug/L.

Study 8: Five of the 30 Illinois surface waters sampled had a 9-11 month mean atrazine concentration in 1987 or 1988 greater than the MCL (3 ug/L). All 5 had means greater than 4 ug/L.

(6) Data summaries submitted by CIBA-GEIGY on 3 mid-western reservoirs/lakes (West Lake at Osceola IA, Rathburn Reservoir in Iowa, and Hoover Reservoir at Columbus OH) suggest that atrazine levels may remain elevated in those 3 systems most or all of the year and that the annual average may therefore exceed the MCL (3 ug/L). This has led to speculation that with all other affecting factors being comparable, water supply systems which depend primarily upon reservoirs/lakes for water may have a greater chance of being out of compliance with drinking water regulations for atrazine than systems that pump directly from streams or rivers. However, most of the sampling locations in the 10 studies EFGWB reviewed were in streams or rivers, not reservoirs or lakes. Therefore, substantial comparisons could not generally be made between atrazine concentrations in reservoirs/lakes and those in streams/rivers. The data from the Monsanto study of 30 community water systems (which included a substantial number of reservoir/lake sources in addition to stream/river sources) did not show any significant correlation between atrazine concentrations and source types.

EFGWB has not yet seen any hydrological/microbiological information on the 3 reservoirs/lakes being currently studied by CIBA-GEIGY. Some reservoirs/lakes with longer than average water residence times and low microbiological populations might have elevated atrazine concentrations at least most of ~~the~~ year since the rate of abiotic hydrolysis for atrazine is negligible and the rates of microbiological degradation and dissipation by convection and/or dilution would also be low in such systems.

(7) Various atrazine degradates including desisopropyl-atrazine, desethyl-atrazine, and hydroxy-atrazine are frequently detected in surface waters contaminated with atrazine, but generally at concentrations 10 times or more less than atrazine. No MCL or lifetime drinking water HA has yet been established for any of the atrazine degradates.

(8) There is no MCL yet established for cyanazine. The lifetime drinking water HA (which has often been set equal to the MCL for other chemicals) for cyanazine is 10 ug/L. Analyses were performed for cyanazine in 6 of the 10 studies reviewed and in the samples collected from West Lake. Cyanazine concentrations occasionally exceeded the lifetime drinking water HA and on extremely rare occasions exceeded 4 times the HA. However, the only annual or shorter mean exceeding the lifetime drinking water HA was a June-September 1991 mean computed from data reported by DuPont for West Lake.

(9) The MCL for simazine is 1 ug/L. Analyses were performed for simazine in 5 of the 10 studies reviewed. Simazine concentrations occasionally exceeded the MCL and on extremely rare occasions exceeded 4 times the MCL (4 ug/L). Four of the 30 community water systems sampled in Study 4 had April-August 1986 or April-September 1986 simazine arithmetic mean concentrations (in 7 day composite samples) $\geq$ the MCL (1 ug/L): Iowa City, IA (1.39 ug/L); Jacksonville, IA (1.16 ug/L); and U. of Iowa (1.44 ug/L). No other annual or shorter simazine means in the studies reviewed exceeded the MCL.

7. SUMMARY OF STUDIES/RESULTS:

STUDY 1: Baker D. 1988. Eight tributaries of Lake Erie (7 in OH, 1 in MI) were sampled for 10 pesticides including atrazine, each at one location within the tributary. Samples were collected from April 15-August 15 in 1982 through 1985. Samples were analyzed for 10 pesticides including the triazines atrazine, cyanazine, and simazine. Time weighted mean concentrations (TWMCs) and maximum observed concentrations of samples collected during April 15 to August 15 of 1982 through 1985 were reported for each of the 8 Lake Erie tributaries sampled. The results of the analysis of individual samples (other than those with the maximum observed concentration) were not tabularly reported.

Atrazine

Nine of the 24 April 15-August 15 atrazine TWMCs representing 6 of the 8 tributaries sampled exceeded the MCL for atrazine (3 ug/L). The April 15-August 15 atrazine TMWCs over sampling years 1983-1985 and the 8 tributaries sampled which exceeded the MCL were in decreasing order as follows: 7.673 (Honey Creek 1985), 6.583 ug/L (Lost Creek 1984), 6.406 ug/L (Sandusky River 1985), 5.366 ug/L (U. Honey Creek 1985), 5.200 ug/L (Rock Creek 1985), 5.194

ug/L (Honey Creek 1984), 3.768 ug/L (Lost Creek 1983), 3.464 ug/L (Maumee River 1984), and 3.029 ug/L (Honey Creek 1983). The other 15 atrazine TWMCs were < than 3 ug/L.

Sixteen of the 30 peak observed atrazine concentrations exceeded 4 X the MCL (12 ug/L). The highest peak observed atrazine concentrations in samples collected from the 8 tributaries during April 15 to August 15 of 1982 through 1985 were in decreasing order as follows: 245.0 ug/L (Lost Creek 1984), 226.0 ug/L (U. Honey Creek 1985), 48.41 ug/L (Honey Creek 1982), and 48.09 ug/L (Rock Creek 1985), 38.91 ug/L (Lost Creek 1982), 37.46 ug/L (Honey Creek 1984), and 31.44 ug/L (Lost Creek 1983) All other peak observed atrazine concentrations were < 30 ug/L.

Cyanazine

None of the 24 April 15-August 15 cyanazine TWMCs exceeded 10 ug/L (the lifetime drinking water HA for cyanazine). The highest April 15-August 15 cyanazine TMWCs over sampling years 1983-1985 and the 8 tributaries sampled were in decreasing order as follows: 3.056 ug/L (U. Honey Creek 1985), 1.569 ug/L (Lost Creek 1984), 1.466 ug/L (Honey Creek 1985), and 1.166 ug/L (Maumee River 1984). The other 20 cyanazine TWMCs were < 1.0 ug/L.

Six of the 30 peak observed cyanazine concentrations exceeded 10 ug/L (the lifetime drinking water HA for cyanazine). One of the 6 peak observed cyanazine concentrations exceeding 10 ug/L also exceeded 40 ug/L (4 X the drinking water HA).

The highest peak observed cyanazine concentrations in samples collected from the 8 tributaries during April 15 to August 15 of 1982 through 1985 were in decreasing order as follows: 86.1 ug/L (U. Honey Creek 1985), 23.09 ug/L (Lost Creek 1984), 14.88 ug/L (Honey Creek 1982), 10.25 ug/L (Lost Creek 1983), 10.16 ug/L (Maumee River 1984), and 10.08 ug/L (Lost Creek 1982). All other peak observed concentrations were < 10 ug/L.

Simazine

All of the 24 April 15-August 15 simazine TWMCs (one 4/15-8/15 TWMC for each of 3 years and each of 8 tributaries sampled = 24 total TWMCs) were < 1 ug/L (the MCL for simazine).

The highest April 15-August 15 simazine TMWCs over sampling years 1983-1985 and the 8 tributaries sampled were in decreasing order as follows: 0.842 ug/L (Cuyahoga River 1984), 0.597 ug/L (Cuyahoga River 1985), 0.266 ug/L (Sandusky River 1985), 0.254 ug/L (River Raisin 1985), 0.235 ug/L (Honey Creek 1985), 0.223 ug/L (Maumee River 1985), and 0.210 ug/L (Maumee River 1984). The other 17 simazine TWMCs were < 0.2 ug/L.

Twelve of the 30 peak observed simazine concentrations exceeded 1 ug/L (the MCL for simazine). Three of the 12 peak observed simazine concentrations exceeding 1 ug/L also exceeded 4 ug/L (4 X the MCL).

The highest peak observed simazine concentrations in samples collected from the 8 tributaries during April 15 to August 15 of 1982 through 1985 were in decreasing order as follows: 10.77 ug/L (Cuyahoga River 1982), 6.926 ug/L (Maumee River 1982), 4.952 ug/L (River Raisin 1982), 3.603 ug/L (Honey Creek 1982), 3.355 ug/L (Sandusky River 1982), and 3.278 ug/L (Lost Creek 1982). All other peak observed simazine concentrations were < 3 ug/L.

STUDY 2: Goolsby DA and Thurman EM. 1991. Surface water samples were collected at 150 U.S. Geological Survey stream flow gaging stations over 10 midwestern states (IA, IL, IN, KS, MN, MO, NE, OH, SD, and WI). Surface waters sampled had drainage areas ranging from < 100 to > 700,000 sq. miles. Surface waters were sampled prior to pesticide application (March-April), during the first runoff event following pesticide applications (May-June), and during the fall (October-November). However, at some locations only a post-application sample was collected and at a few locations only a pre-application sample was collected. The samples were analyzed for 11 herbicides including 4 triazines (atrazine, cyanazine, propazine, simazine) and for 2 degradates of atrazine (desethyl-atrazine and desisopropyl-atrazine)

Atrazine

Atrazine was detected (DL = 0.05 ug/L) in 87.2% (48/55) of the pre-application samples and in 76.8% (109/142) of the Fall samples collected from surface waters across the 10 states sampled. However, 97.9% (47/48) of the detectable atrazine concentrations in the pre-application samples and 91.7% (100/109) of the detectable atrazine concentrations in the Fall samples were less than 1 ug/L. None of either the pre-application or Fall samples had atrazine concentrations greater than the MCL (3 ug/L).

Atrazine was detected in 98.4% (127/129) of the post-application samples. Atrazine was detected at greater than the MCL (3 ug/L) in 52.8% (68/129) of the post-application samples and at greater than 4 times the MCL (12 ug/L) in 26.4% (34/129) of the post-application samples.

Desethyl-atrazine

Desethyl-atrazine was detected (DL = 0.05 ug/L) in 47.2% (26/55) of the pre-application samples and 48.6% (~~69~~/142) of the Fall samples collected from surface waters across the 10 states sampled. However, all of the detectable desethyl-atrazine concentrations in both the pre-application and Fall samples were <

1 ug/L.

Desethyl-atrazine was detected in 84.5% (109/129) of the post-application samples, but 76.1% (83/109) of the detectable concentrations were less than 1 mg/L. Desethyl-atrazine was detected at greater than the MCL for atrazine (3 ug/L) in 3.9% (5/129) of the post-application samples, but no concentrations exceeded 4 times the MCL (12 ug/L).

Desisopropyl-atrazine

Desisopropyl-atrazine was detected (DL = 0.05 ug/L) in only 7.3% (4/55) of the pre-application samples and was not detected (0/142) in any of the Fall samples. All of the 4 detectable isopropyl-atrazine concentrations in the pre-application samples were less than 1 ug/L.

Desisopropyl-atrazine was detected in 52.7% (68/129) of the post-application samples, but 70.6% (48/68) of the detectable concentrations were less than 1 ug/L. Desisopropyl-atrazine was at greater than the MCL for atrazine (3 ug/L) in 2 of the 129 post-application samples, but neither concentration exceeded 4 times the MCL for atrazine (12 ug/L).

Cyanazine

Cyanazine was detected (DL = 0.20 ug/L) in only 5.5% (3/55) of the pre-application samples and in only one (1/142) of the Fall samples collected from surface waters across the 10 states sampled. All of the detectable concentrations were less than 1 ug/L.

Cyanazine was detected in 63.4% (82/129) of the post-application samples. It was detected at greater than its lifetime drinking water HA (10 ug/L) in 11.6% (15/129) of the post-application samples and at greater than 4 times its HA (40 ug/L) in 1.6% (2/129) of the post-application samples.

Simazine

Simazine was detected (DL = 0.05 ug/L) in only 7.3% (4/55) of the pre-application samples and in only 2.8% (4/142) of the Fall samples collected from surface waters across the 10 states sampled. All of the detectable simazine concentrations in both the pre-application and Fall samples were less than the MCL for simazine (1 ug/L).

Simazine was detected in 53.4% (69/129) of the post-application samples. Simazine concentrations were greater than the MCL (1 ug/L) in 8.5% (11/129) and exceeded 4 times the MCL (4 ug/L) in 1.6% (2/129) of the post-application samples.

STUDY 3: Goolsby DA, Coup RC, and Markovchick DJ. 1991.

Eight locations were sampled (Figure 3.1 from Figure 1 of the study report). One location was near the outflow of the lower Mississippi R. to the Gulf of Mexico (Baton Rouge, LA). Three locations were near the outflow of the 3 major tributaries to the lower Mississippi River (the upper Mississippi R. at Thebes IL, the Missouri R. at Hermann MO, and the Ohio R. at Grand Chain IL). The upper Mississippi R. was also sampled at Clinton, Iowa. The remaining 3 locations were on tributaries to the upper Mississippi R. (the Illinois R. at Valley City, IL), to the Missouri R. (the Platte R. at Louisville, NE), and to the Wabash R. which discharges to the Ohio R. (the White R. at Hazelton, IN).

Sampling was begun in early April 1991 and will continue for one year. Samples were collected at each location weekly during April and biweekly during May, June, and July. Samples will be collected weekly during other months. This USGS report contains the results of the analyses of samples collected in April, May, and June 1991. Results for samples collected thereafter through March 1992 will be published by USGS in a subsequent report.

Atrazine

Atrazine was detected at greater than 0.05 ug/L (the detection limit) in all of the 146 samples collected during April-June 1991 at the 8 sites sampled. Atrazine was detected at greater than 3 ug/L (the MCL) in 28.8 % of the samples over 6 of the 8 sites. However, all of the samples collected from the Ohio R. at Grand Chain IL and the upper Mississippi R. at Clinton, IA had atrazine concentrations < 3 ug/L, and all but one of the samples collected in the lower Mississippi at Baton Rouge had atrazine concentrations < 3 ug/L. None of the samples collected from any of the sites had atrazine concentrations greater than 12 ug/L (4 times the MCL).

The highest atrazine concentrations reported in the 146 samples were 10.0 ug/L on 6/7/91, 6.80 ug/L on 5/31/91, and 6.50 ug/L on 5/29/91 in the Platte R. at Louisville, NE; 9.20 ug/L on 5/30/91, 8.60 ug/L on 5/28/91, and 8.20 ug/L on 6/3/91 in the White R. at Hazelton, IN ; and 6.30 ug/L on 5/10/91 in the Illinois River at Valley City, IL. All other samples had atrazine concentrations < 6.0 ug/L.

The following 4 sampling sites had overall (April to June or May to June) arithmetic mean atrazine concentrations $\geq$ 3 ug/L (the MCL): the White R. at Hazelton IN (3.73ug/L), the Illinois R. at Valley City IL (3.31 ug/L), the Platte R. at Louisville NE (3.15 ug/L), and the Missouri R. at Hermann MO (3.00 ug/L).

Annual means could not be computed from the available data. However, since the Spring 1991 means are only slightly larger than the MCL and since Spring means are generally much greater than annual means at most locations throughout the Mississippi Basin, it

11

is unlikely that the 1991 annual means exceeded the MCL at any of the 8 locations sampled in this study.

Cyanazine

Cyanazine was detected at greater than 0.20 ug/L (the detection limit) in 73.9% of the 146 samples Cyanazine concentrations exceeded 1 ug/L in 39.7% of the samples collected, but none exceeded 10 ug/L (the lifetime drinking water HA).

The highest cyanazine concentrations reported in the 146 samples were 4.40 ug/L on 5/28/91 in the White River at Hazelton, IN; 6.60 ug/L on 5/19/91 and 5.60 ug/L on 5/8/91 in the Illinois River at Valley City, IL; 7.30 ug/L on 6/7/91, 7.00 ug/L on 5/31/91, and 6.80 ug/L on 5/21/91 in the Platte River at Louisville, NE; and 4.70 ug/L on 6/13/91 and 4.30 ug/L on 6/1/91 in the Missouri River at Hermann, MO.

The highest overall (April to June or May to June) arithmetic mean cyanazine concentrations were 2.18 ug/L in the Illinois River at Valley City, 1.99 ug/L in the Platte River at Louisville, 1.52 ug/L in the Missouri River at Hermann, and 1.41 ug/L in the Mississippi River at Thebes.

Simazine

Simazine was detected at greater than 0.05 ug/L (the detection limit) in 42.5% of the 146 samples collected during April-June 1991 at the 8 sites sampled, but none of the concentrations exceeded 1 ug/L (the MCL).

The highest simazine concentrations reported in the 146 samples were 0.72 ug/L on 5/30/91, 0.58 ug/L on 6/3/91, 0.51 ug/L on 5/28/91, and 0.45 ug/L on 6/13/91 in the White River at Hazelton, IN; and 0.40 ug/L on 5/21/91 in the Ohio River near Grand Chain, IL.

The highest monthly arithmetic mean simazine concentrations were 0.26 ug/L for May and 0.33 ug/L for June in the White River at Hazelton, IN; and 0.15 ug/L for May and 0.11 ug/L for June in the Ohio River near Grand Chain, IL.

STUDY 4: Smith RG, Triebe FM, and Baszis SR. 1987.

30 community water systems which use surface water as the primary source and are located in areas of Lasso use (alachlor is the a.i. in Lasso) were sampled (7 in OH, 5 in KS, 5 in IL, 4 in MO, 3 in IA, 2 in VA, and 1 each in WI, MI, and IN; see Figure 4.1 from Figure 1 of the study report, and Table 4.1 from Table 5 of the study report). Samples were collected daily from April through August or September at all but one site. Samples were collected an additional 8 months at the IL site because of extremely high

herbicide concentrations.

Atrazine

Atrazine was detected at > 0.20 ug/L (the detection limit) in 80.3% (545/678) of the samples collected during April-August or April-September 1986 from the finished water of the 30 community water systems sampled. Atrazine was detected at greater than the 3 ug/L (the MCL) in 28.9% (196/678) of the samples collected from 16 of the 30 systems and at greater than 12 ug/L (4 times the MCL) in 2.5% of the samples (17/678) from 4 of the 30 systems.

The highest peak atrazine concentrations reported in the 7 day composite samples were 22.5 ug/L and 21.5 ug/L on 5/7/86, 21.2 ug/L and 21.0 ug/L on 5/21/86, and 20.5 ug/L on 5/14/86 all in the finished water of the Jacksonville, IL Community Water System. Other community water systems with at least one atrazine concentration $\geq$ 12 ug/L (4 times the MCL) were Calendonia, OH; Columbus OH; Fort Wayne, IN; and Shipman, IL.

Community water systems with April-August 1986 or April-September 1986 atrazine arithmetic mean concentrations (in 7 day composite samples) $\geq$ 3 ug/L (the MCL) were Jacksonville,IL (8.90 ug/L); Pomona Lake, KS (5.49 ug/L); Columbus, OH (5.16 ug/L); Sabetha, KS (3.7 ug/L); Fort Wayne, IN (3.4 ug/L); Bowling Green, OH (3.11 ug/L); and Jefferson Co., KS (3.04 ug/L). The Shipman, IL Community Water System had an April 1986-April 1987 atrazine arithmetic mean of 6.04 ug/L.

Cyanazine

Cyanazine was detected at > 0.20 ug/L (the detection limit) in 34.9% (237/678) of the samples collected during April-August or April-September 1986 from the finished water of the 30 community water systems sampled. However, 71.3% (169/237) of the detects were less than 1 ug/L. None of the 237 detects exceeded 10 ug/L (the lifetime drinking water HA).

The highest peak cyanazine concentrations reported in the 7 day composite samples of finished water were 4.11 ug/L on 5/21/86 in the Bowling Green, OH CWS; 4.95 ug/L on 6/18/86, 4.20 ug/L on 6/11/91, and 4.18 ug/L on 6/25/86 in the Columbus , OH CWS; 6.14 ug/L on 5/21/86 and 4.72 ug/L on 5/28/86 in the Iowa City IA CWS; and 5.61 ug/L on 5/28/86 and 5.52 ug/L on 5/21/86 in the U. of Iowa CWS. All other cyanazine concentrations were less than 4 ug/L.

Community water systems with April-August 1986 or April-September 1986 cyanazine arithmetic mean concentrations (in 7 day composite samples) $\geq$ 1 ug/L were Columbus, OH (1.22 ug/L); Iowa City, IA (1.39 ug/L); Jacksonville, IA (1.16 ug/L); and U. of Iowa (1.44 ug/L).

Simazine

Simazine was detected at > 0.20 ug/L (the detection limit) in 19.5% (132/678) of the samples collected during April-August or April-September 1986 from the finished water of the 30 community water systems sampled. However, 90.9% (120/132) of the detects were less than 1 ug/L (the MCL). None of the 132 detects exceeded 4 ug/L (4 times the MCL).

The highest peak simazine concentrations reported in the 7 day composite samples of finished water were 1.19 ug/L on 5/28/86, 1.52 ug/L on 6/4/86, 1.11 ug/L on 6/11/86, and 1.06 ug/L on 7/2/86 in the Columbus, OH CWS; 1.19 ug/L on 6/4/86 and 1.06 ug/L on 6/11/86 in the Fort Wayne, IN CWS; 2.23 ug/L on 7/3/86 and 1.15 ug/L on 7/10/86 in the Jarrat, VA CWS; 1.58 ug/L on 7/16/86 in the Macomb, IL CWS; and 2.54 ug/L on 6/4/86, 1.73 ug/L on 6/11/86, and 1.40 ug/L on 7/2/86 in the Westerville, OH CWS. All other Simazine concentrations were less than 1 ug/L (the MCL).

Community water systems with April-August 1986 or April-September 1986 simazine arithmetic mean concentrations (in 7 day composite samples) $\geq$ the MCL (1 ug/L) were Iowa City, IA (1.39 ug/L); Jacksonville, IA (1.16 ug/L); and U. of Iowa (1.44 ug/L).

STUDY 5: Roux P. 1989.

Surface waters sampled included 4 in Indiana, 3 in Illinois, 3 in Michigan, and one each in Iowa, Kansas, and Florida (Table 5.1 and Figure 5.1 from Table 1 and Figure 1 of the study report). Surface water samples were collected in 1986 and 1987. Samples were collected every 2 weeks in the peak growing period of April, May, and June and monthly in March, July, August, September, October, and November. Samples were not collected in December, January, or February.

Atrazine

Atrazine was detected at > 0.1 ug/L in 88.7% (298/336) of the samples collected from the 14 surface waters. However, 74.8% of the detects (223/298) were less than 1 ug/L. Atrazine was detected at greater than 3 ug/L (the MCL) in 9.5% (32/336) of the samples and at greater than 12 ug/L (4 times the MCL) in 3.0% (12/336) of the samples.

The highest peak concentrations reported were 30.5, 30, 29, 28, 18, 14, and 12 ug/L in Little Crooked Creek, IL; 30 and 13.0 ug/L in Clifty Creek, IN; and 14 and 12 ug/L in the Wabash River, IN; All other reported concentrations were < 10 ug/L.

Arithmetic means that exceeded 3 ug/L (the MCL) were 9.45 ug/L (3/86-11/86) and 7.00 ug/L (3/87-11/87) in Little Crooked Creek, IL; 4.52 ug/L (3/86-11/86) in Wabash River, IN; and 3.75 ug/L

(3/87-11/87) in Clifty Creek, IN. The arithmetic means over the 3/86-11/87 sampling period for the remaining 11 surface waters sampled in the Roux 1989 study were all less than 1 ug/L.

STUDY 6: Ross R. and Balu K. 1985.

Sampling locations included 11 in the Mississippi River (1 in MO, 2 in AR, 2 in TN, 3 in MS, 3 in LA), 4 in the Missouri River (all in MO), 3 in the Des Moines River (all in IA), 17 in other miscellaneous surface freshwaters (2 in IA, 4 in IL, 3 in AL, 1 in FL, 2 in TX, 2 in KS, 2 in CA, 1 in PA), and over 20 in the Gulf of Mexico (Table 6.1 and Figures 6.1 through 6.4 from Table 2 and Figures through 5 of the study report). Samples were also collected of 2 tap water supplies (Baton Rouge, LA and St. Gabriel, LA). The report covers surface water samples collected from 1975 through 1985 by Ciba Geigy. The years in which samples were taken varied depending upon the sampling location (Table 6.2 from Table 1 of the study report).

(1) 1975-1985 Atrazine in Surface Freshwaters

(a) 1975-1981: Atrazine was detected at greater than 0.1 ug/L (the detection limit) in 90.3% of the 1407 samples collected during 1975-1981 from 33 locations in 18 surface waters, but 69.4% of the 1269 detects were less than 1 ug/L. Atrazine was detected at greater than 3 ug/L (the MCL) in 5.6% (79/1406) of the samples, and at greater than 12 ug/L in 0.5% (7/1406) of the samples.

Peak concentrations exceeding 4 times the MCL (12 ug/L) were 234 ug/L on 10/4/76 and 56 ug/L on 10/18/76 in the Mississippi River 10 miles above Vicksburg; 17.8 ug/L on 6/25/75 in the Mississippi River 10 miles below Helena, AR; 16.7 ug/L on 6/25/75 in the Mississippi River 1 mile above Helena, AR; 14.0 ug/L on 6/9/75 in the Missouri River 10 miles below St. Joseph; 13.59 ug/L on 6/30/75 in the Des Moines River at the Mississippi River confluence; and 13.0 ug/L on 5/27/75 in the Wabash River at the Ohio River confluence. All other atrazine concentrations were < 10 ug/L.

Annual (or longest available less than annual) arithmetic means exceeding the MCL (3 ug/L) were 3.77 ug/L in the Missouri River 10 miles below St. Joseph (19 samples 4/75-12/75), 3.19 ug/L in the Des Moines River at the Miss. Confluence (21 samples 3/75-12/75), and 9.66 ug/L in the Mississippi River 10 miles south of Vicksburg, MS (32 samples 2/76-11/76). The elevated mean in the Mississippi River was due primarily to abnormally high atrazine concentrations (234 and 56 ug/L) in 2 samples collected in October 1976. The magnitude of the concentrations, the fact that the samples

were collected in October well after when peak atrazine concentrations are normally observed, and atrazine concentrations < 3 ug/L in all samples other samples collected 3/75-12/79 suggests that the abnormally high atrazine concentrations in the two October 1976 samples did not result from normal agricultural practice.

Annual (or longest available less than annual) arithmetic mean atrazine concentrations less than the MCL, but greater than 2 ug/L were 2.42 ug/L in the Republican River at the Miss. River confluence (18 samples 4/75-2/76) and 2.25 ug/L in the Wabash River at the Ohio River confluence (19 samples 4/75-3/76).

(b) 1982-1985: Atrazine was detected at > 0.1 ug/L (the detection limit) in 89.8% of the 461 samples collected during 1982-1985 from 6 locations in 3 surface waters, but 74.6% of the 414 detects were less than 1 ug/L. Atrazine was detected at greater than 3 ug/L (the MCL) in 6.5% (30/461) of the samples, but at greater than 12 ug/L (4 times the MCL) in only 2 samples.

Peak observed atrazine concentrations exceeding 4 times the MCL (12 ug/L) were 28.0 ug/L on 11/16/82 in the Mississippi River 1 mile above Vicksburg and 16.0 ug/L on 7/12/82 in the Mississippi River at Greenville, KS. All other atrazine concentrations were < 10 ug/L.

The highest annual (or longest available less than annual) arithmetic means were 1.60 ug/L in the Missouri River near St. Charles (16 samples 5/52-12/82), 1.76 ug/L in the Mississippi River at Greenville KS (16 samples 5/82-12/82), 1.87 ug/L in the Mississippi River 1 mile above Vicksburg MS (52 samples 1/82-12/82), and 1.80 ug/L in the Mississippi River 8 miles above CIBA GEIGY plant at St. Gabriel LA (19 samples 1/84-12/84).

(2) Atrazine Degradates in Surface Freshwaters Some of the surface freshwater samples collected in 1975 were analyzed for 1 to 4 of the following degradates : 2-hydroxy-4-ethylamino-6-isopropylamino-s-triazine (G-34048 - hydroxylated atrazine), 2-chloro-4-ethylamino-6-amino-s-triazine (G-28279 - desisopropylated atrazine), 2-chloro-4-amino-6-isopropylamino-s-triazine (G30033 - desethylated atrazine), and 2-chloro-4,6-diamino-s-triazine (G28273 - dealkylated atrazine)(Figure 6.5 from Figure 1 of the study report).

Most of the samples analyzed had atrazine degradate concentrations less than detection limits of 0.5 to 1.0 ug/L. Hydroxylated atrazine was detected at concentrations ≥ 1 ug/L in 5

samples ranging from 1.0 to 1.8 ug/L. Desisopropylated atrazine was detected at concentrations $\geq$ 1 ug/L in 4 samples ranging from 1.1 to 2.1 ug/L. Dealkylated atrazine was detected at concentrations $\geq$ 1 ug/L in 2 samples (1.89 and 1.80 ug/L). Desethylated atrazine was not detected at concentrations $\geq$ 1 ug/L in any samples. Atrazine degradate concentrations were typically 2X to > 10X lower than the atrazine concentration, but were occasionally comparable.

(3) 1982-1985 Atrazine in Surface Water Source Tap Water:

Atrazine was detected at greater than 0.1 ug/L (the detection limit) in 70.6% of the 221 samples collected during 1982-1985 from 4 surface water source tap waters. However, 88.5% of the 156 detects were less than 1 ug/L. Atrazine was detected at greater than 3 ug/L (the MCL) in only one sample.

The highest observed peak concentrations reported were 5.10 ug/L on 7/10/84, 5.0 ug/L on 7/25/84, 3.90 ug/L on 6/15/84, and 3.10 ug/L on 7/21/82 all in Missouri River St. Charles, MO tap water. All other tap water concentrations were < 3.0 ug/L.

The arithmetic means over the entire sampling period for the 4 tap water locations were as follows: 0.89 ug/L in the Missouri River source St. Charles tap water (68 samples 7/82-2/85); 0.39 ug/L in the Ohio River source tap water (51 samples 7/82-2/85); 0.14 ug/L in the Miss. River source Baton Rouge tap water (30 samples 2/83-6/85); and 0.12 ug/L in the Sacramento River source tap water (72 samples 5/82-7/85).

(4) Atrazine Concentrations in the Gulf of Mexico Of 48 samples collected in the Gulf of Mexico at the mouth of the Mississippi River from 1975 to 1985, 5 had atrazine concentrations $\geq$ 1 ug/L ranging from 1.2 to 2.5 ug/L. The atrazine concentration distribution for 174 samples collected at 11 locations off Venice, LA in the Gulf of Mexico from 1975 through 1985 was as follows: C $\leq$ 0.1 ug/L (51 samples; 29.3%), 0.1 < C $\leq$ 1.0 ug/L (100 samples; 55.9%), 1.0 < C $\leq$ 5.0 ug/L (17 samples; 9.5%), 5.0 < C $\leq$ 10 ug/L (3 samples; 1.7%), and C > 10 ug/L (1 sample at 56.4 ug/L; 0.6%). The majority of observed atrazine concentrations > 1 ug/L were in samples collected in 1975 and in 1980. Only 2 samples collected from 1981 through 1985 had atrazine concentrations > 1 ug/L.

STUDY 7: Keck P. 1991. Missouri River Public Water Supplies Association. 1991 Missouri River Monitoring Study. September 19, 1991.

Samples were collected at 7 locations along the lower Missouri River (Figure 7.1 and Table 7.1 from Figure 1 and Table 1 of the study report). The sampling locations selected bracketed entry points of major tributaries to the lower Missouri River. The sampling locations were all far enough downstream from tributary

entrance points to assure mixing within the Missouri Samples were collected daily at all 7 sampling locations in May, June, and July 1991.

Atrazine

Atrazine was detected (detection limit not provided) in 62.9% of the 589 samples analyzed. Atrazine concentrations greater than the MCL (3 ug/L) were reported in 28.0% (165/589) of the samples analyzed. Arithmetic mean atrazine concentrations ranged from 0.72 ug/L at Omaha NE to 3.22 ug/L at Boonville MO. Boonville was the only sampling location where the arithmetic mean exceeded the MCL (3 ug/L), but 4 other sampling locations had arithmetic means greater than 2 ug/L. Maximum observed atrazine concentrations ranged from 6.71 ug/L at Chesterfield MO to 11.1 ug/L at Kansas City MO. None exceeded 4 times the MCL (12 ug/L).

Simazine

Simazine was detected (detection limit not provided) in only 2 of the 589 samples analyzed. Both detections were in samples collected from the Kansas City location. The maximum simazine concentration reported (0.48 ug/L) is well below the MCL (1 ug/L).

STUDY 8: Moyer L and Cross J. 1990.

Samples for pesticide analyses were collected from a 30 station subnetwork of the 208 station Illinois Ambient Water Quality Monitoring Network (Table 8.1 and Figure 8.1 from Table 2 and Figure 2 of the study report). Twenty-six of the 30 stations selected for pesticide monitoring drain predominantly agricultural watersheds and have historically reported high suspended sediment loads (both together indicate high potential for pesticide runoff).

Four of the 30 stations drain predominantly non-agricultural watersheds and were selected to serve as controls. The 4 control stations were in the Des Plaines River, the upper Illinois River, the Big Muddy River, and Lusk Creek.

Samples were collected at each of the 30 stations twice in the spring, twice in the summer, once in the fall, and once in the winter from October 1985 to October 1988. A total of 580 samples were collected under that schedule.

To determine the magnitude and duration of elevated pesticide concentrations during high runoff post-application periods in the spring, additional more intensive sampling was conducted at 2 additional sites. A total of 25 additional samples at another Macoupin Creek site and 15 additional samples at a Spring Creek site were collected from May 1 through May 20, 1989.

Atrazine

Atrazine was detected (detection limit 0.1 ug/L) in 66.7% of the 575 samples analyzed, but 75.2% of the 441 detects were less than 1 ug/L. Atrazine concentrations exceeded the MCL (3 ug/L) in 7.3% (42/575) of the samples over 17 locations and 4 times the MCL (12 ug/L) in 1.4% (8/575) of the samples over 6 locations.

Atrazine concentrations exceeding four times the MCL (12 ug/L) were 13.0 ug/L on 6/18/87 in the Little Wabash River, 16.0 ug/L on 6/26/86 in the Spoon River (2 miles W of Wyoming IL), 39.0 ug/L on 5/11/88 and 14.0 ug/L on 6/16/88 in Bay Creek, 19.0 ug/L on 5/12/88 in Bear Creek, 24.0 ug/L on 5/19/87 in the Plum River, and 13.0 ug/L on 5/21/86 and 18.0 ug/L on 5/6/87 in Silver Creek.

Annual (or the longest available if less than annual) arithmetic mean atrazine concentrations exceeding the MCL (3 ug/L) were 5.22 ug/L (1/87-11/87) in the Little Wabash River NE of Louisville IL, 9.33 ug/L (1/88-10/88) in Bay Creek at Nebo IL, 4.40 ug/L (1/88-9/88) in Bear Creek 2.2 miles NE of Marcelline IL, 4.24 ug/L (1/87-10/87) in Plum River at E. Savanna IL, and 4.26 ug/L (1/87-10/87) in Silver Creek 2.2 miles SE of Freeburg IL. Mean atrazine concentrations over the entire October 1985 to October 1988 sampling period for each of the 30 sampling locations are presented in Figure 8.4 (from Figure 10 of the study report).

Cyanazine

Cyanazine was detected (detection limit 0.1 ug/L) in 37.7% of the 575 samples analyzed, but 76.0% of the 217 detects were less than 1 ug/L. Five cyanazine concentrations over 5 locations exceeded the lifetime drinking water HA (10 ug/L). No cyanazine concentrations exceeded 4 times the lifetime drinking water HA (40 ug/L).

Cyanazine concentrations exceeding the lifetime drinking water HA (10 ug/L) were 11.0 ug/L on 4/16/87 in the Embarass River, 17.0 ug/L on 4/16/87 in the Little Wabash River, 38.0 ug/L on 5/11/88 in Bay Creek, 31.0 ug/L on 5/12/88 in Bear Creek, and 28.0 ug/L on 5/19/87 in the Plum River.

None of the annual (or longest available less than annual) arithmetic mean cyanazine concentrations were greater than the lifetime drinking water HA (10 ug/L). The highest arithmetic mean cyanazine concentrations were 3.51 ug/L (1/87-11/87) in the Little Wabash River, 7.85 ug/L (1/88-10/88) in Bay Creek, 6.04 ug/L (1/88-9/88) in Bear Creek, and 4.71 ug/L (1/87-10/87) in the Plum River.

STUDY 9: Squillace P and Engberg R. 1988.

Samples were collected at 6 locations within the Cedar River Basin (5 along the Cedar River and one along the Shell Rock River; Figure 9.1 from Figure 2 of the study report). The Cedar River discharges into the Iowa River with an average discharge of 4800

ft_3/sec. The total drainage area of the Cedar River is 7819 mi^2. Samples were collected approximately monthly from May 1984 through September 1985 at the Floyd and Cedar Falls sampling locations, and from May 1984 through November 1985 at the other 4 locations.

Atrazine:

Dissolved atrazine was detected in 91.0% of the 100 samples analyzed, but 76.9% of the 91 detects were less than 1 ug/L. Dissolved atrazine concentrations exceeded the MCL (3 ug/L) in 12% (12/100) of the samples over 5 locations and 4 times the MCL (12 ug/L) in 4% (4/100) of the samples over 3 locations.

Atrazine concentrations exceeding 4 times the MCL (12 ug/L) were 16.0 ug/L on 6/19/84 in Cedar River near Carville IA, 16.0 ug/L on 6/10/84 and 15.0 ug/L on 6/20/84 in Cedar River at Cedar Falls IA, and 15.0 ug/L on 6/10/84 in Cedar River at Gilbertville IA. All other atrazine concentrations were less than 9 ug/L.

Six to 7 month arithmetic mean dissolved atrazine concentrations exceeding or approximately equal to the MCL (3 ug/L) were 3.43 ug/L (5/84-12/84) in Cedar River near Carville IA, 3.76 ug/L (5/84-12/84) in Cedar River at Cedar Falls IA, 3.21 ug/L ug/L (5/84-12/84) in Cedar River at Gilbertville IA, and 2.98 ug/L (6/84-12/84) in Cedar River near Bertram IA.

Cyanazine

Dissolved cyanazine was detected in 35.0% of the 100 samples analyzed, but 65.7% of the 35 detects were less than 1 ug/L. No cyanazine concentrations exceeded the lifetime drinking water HA (10 ug/L).

The highest dissolved cyanazine concentrations reported were 8.0 ug/L on 6/9/84 in Cedar River at Floyd IA, 8.0 ug/L on 6/9/84 and 6.8 ug/l on 6/19/84 in Cedar River near Carville IA, 8.70 ug/L on 6/10/84 and 7.20 ug/L on 6/20/84 in Cedar River at Cedar Falls IA, and 8.10 ug/L on 6/10/84 in Cedar River at Gilbertville IA. All were below the lifetime drinking water HA for cyanazine of 10 ug/L.

The highest annual (or the longest available if shorter than annual) arithmetic mean dissolved cyanazine concentrations were 1.65 ug/L (5/84-12/84) in Cedar River at Floyd IA, 1.95 ug/L (5/84-12/84) in Cedar River near Carville IA, 1.87 ug/L (5/84-12/84) in Cedar River at Cedar Falls IA, 1.72 ug/L (5/84-12/84) in Cedar River at Gilbertville IA, and 1.68 ug/L (6/84-12/84) in Cedar River near Bertram IA. All of the means were far below the lifetime drinking water HA for cyanazine of 10 ug/L.

STUDY 10: Roux P. 1988.

Surface waters sampled were 3 in Iowa, 2 in Georgia, and one each in Delaware, Louisiana, Michigan, Minnesota, Ohio, and South Dakota (Table 10.1 and Figure 10.1 from Table 1 and Figure 1 of the study report). Surface water samples were collected monthly in September, October, and November of 1986; monthly in March, July, August, September, October, and November 1987; and bimonthly in April, May, and June 1987. Samples were not collected in December, January, or February.

Atrazine

Atrazine was detected at $\geq$ 0.1 ug/L in 65.7% of the 163 samples collected from the 14 rivers, but 93.5% of the detects were less than 1.0 ug/L. The highest peak concentrations observed were 4.5 ug/L in the Skunk River, IA; 4.5 ug/L in the Bayou Tech River, LA; 2.70 ug/L in Skunk Creek, SD; 1.90 ug/L in the Mad River, OH; 1.80 ug/L in the North River, IA; 1.40 ug/L in the Rum River, MN; and 1.20 ug/L in Strockly Branch, DE. However, those were the only observed concentrations > 1.0 ug/L.

MISCELLANEOUS FIFRA 6(a)(2) DATA on 3 Reservoirs/Lakes

(1) West Lake at Osceola, IA

CIBA-GEIGY indicated that in cooperation with the Osceola Water Department, one raw and one finished water sample were collected in April, May, June, July, August, September, and December 1991. Twelve of the 14 total samples (7 raw, 7 finished) including all of the ones collected in August, September, and December had atrazine concentrations exceeding the MCL (3 ug/L) ranging from 3.9 to 9.3 ug/L.

Three atrazine degradates (desethyl-atrazine, desisopropyl-atrazine, and desalkyl-atrazine) were detected in all 14 samples at concentrations ranging from 0.58 to 1.7 ug/L.

Cyanazine was detected in the July raw and finished water samples at 13 and 12 ug/L which exceed the cyanazine lifetime drinking water HA of 10 ug/L (no MCL has yet been established for cyanazine, but the Office of Drinking Water frequently ends up setting the MCL equal to the lifetime drinking water HA). All 4 of the samples collected in August and September had cyanazine concentrations exceeding the lifetime drinking water HA for cyanazine (10 ug/L).

DuPont indicated that in cooperation with the town of Osceola, samples of finished water from West Lake were collected monthly in March and April 1991, and weekly "since May" to 9/21/91. Atrazine concentrations (maximum 8.7 ug/L) in all samples collected "since June" were reported to have exceeded the atrazine MCL of 3 ug/L

(see atrazine graph in the DuPont attachment). Cyanazine concentrations (maximum 15.9 ug/L) in all samples collected since "mid-June" were reported to have exceeded the cyanazine lifetime drinking water HA of 10 ug/L.

(2) Rathburn Reservoir in Iowa

Based upon data submitted by CIBA-GEIGY, none of the 18 water samples collected from Rathburn Reservoir on April 10, 1990 had atrazine concentrations exceeding the MCL (3 ug/L). However, 9 of the 20 water samples collected on 6/6/90, 18 of the 20 water samples collected on 7/30/90, 17 of the 19 water samples collected on 11/1/90, and 17 of the 20 water samples collected on 12/11/90 had atrazine concentrations exceeding the MCL ranging from 3.4 to 13.7 ug/L.

Average atrazine concentrations exceeded the MCL of 3 ug/L on each day except 4/10/90. Average atrazine concentrations in water samples were 0.9 ug/L for the 18 collected on 4/10/90, 3.8 ug/L for the 20 collected on 6/6/90, 4.9 ug/L for the 20 collected on 7/30/90, 4.2 ug/L for the 19 collected on 11/1/90, and 4.3 ug/L for the 20 collected on 12/11/90. The overall average atrazine concentration of 3.7 ug/L also exceeded the MCL.

The atrazine degradate G-30033 (2-amino-4-chloro-6-isopropylamino-s-triazine) was detected in 74 of the 77 water samples for which it was analyzed at concentrations up to 1.35 ug/L. The atrazine degradate G-28279 (2-amino-4-chloro-6-ethylamino-s-triazine) was detected in 51 of the 58 water samples for which it was analyzed at concentrations up to 1.03 ug/L.

(3) Hoover Reservoir at Columbus, OH

Samples were collected monthly from October 1990 to March 1991 from the Hoover Reservoir. Three of the 6 samples (October, November, and December 1990) had atrazine concentrations exceeding the MCL (3 ug/L) ranging from 6.0 to 6.3 ug/L. Atrazine concentrations in the January, February, and March 1991 samples were all below the MCL ranging from 0.58 to 1.7 ug/L.

(2) One or more of 3 chloro-triazine degradates of atrazine (G-30033: 2-amino-4-chloro-6-isopropylamino-s-triazine; G-28279: 2-amino-4-chloro-6-ethylamino-s-triazine; and G-28273: 2,4-diamino-6-chloro-s-triazine) were detected in 4 of the 6 samples at concentrations ranging from 0.23 to 1.5 ug/L.

1. STUDY 1: Baker D. 1988. Sediment, nutrient and pesticide transport in selected Great Lakes Tributaries. Completed February 1988. Performed by Water Quality Laboratory of Heidelberg College, Tiffin, Ohio for the Great Lakes National Program Office of U.S. EPA (Region 5). (Included as Appendix D of MRID #41065205).

1.1) Sampling Locations:

Eight tributaries of Lake Erie (7 in OH, 1 in MI) were sampled for 10 pesticides including atrazine, each at one location within the tributary (Table 1.1 and Figure 1.1 from Table 5.1 and Figure 5.1 of the study report).

1.2) Sampling Periods/Years:

Samples were collected from April 15-August 15 in 1982 through 1985.

1.3) Sampling Methodology:

Grab samples were collected at the Cuyahoga River and River Raisin sites. Automatic samplers housed in USGS gauging stations and capable of collecting samples either twice a day for six consecutive days or 4 times a day for 7 consecutive days were used at the other 6 sampling locations. However, the total number of samples analyzed for pesticides at each location for each year (Table 1.1) was generally less than the total number of days in the April 15 to August 15 sampling period (122) and always much less than 122 times 2 (twice a day sampling) or 4 (four times a day sampling). The reason for the number of samples analyzed for pesticides being much lower than the theoretical maximum possible number of sample collections is unclear.

The times, frequency, and compositing (if any) of sample collection for pesticides were not provided. Based upon the total number of samples collected over the April 15-August 15 sampling periods, there were probably at least 3 samples collected per week at each location. No information was provided on the depth of sampling or on whether samples included the surface film. The use of single automatic samplers at 6 of the 8 locations indicates that samples were not taken at various points across the width of the surface water and composited.

1.4) Analytical Procedures:

Samples were analyzed for as many as 18 separate pesticides including atrazine. The pesticides were extracted from the water samples with methylene chlrazine for 1984 and 1985 were 86 and 69%, respectively. The reported concentrations were corrected for recoveries less than 100%.

1.5) QA/QC Procedures:

The QC program reportedly included the analysis of blanks, spiked samples, and replicates, but no details were provided in this report other than the mean percent recoveries given above. No information was provided on the shipping and storage of samples, the storage stability of samples, or the elapsed time between sampling and analysis. Therefore, EFGWB could not evaluate the accuracy of the data.

The study author indicates that more detailed information on the QA/QC procedures and analytical methods used can be obtained from the following paper:

> Kramer J and Baker D. 1985. An analytical method and quality control program for studies of currently used pesticides in surface waters. IN: Taylor J and Stanley T, eds. Quality assurance for environmental measurements. ASTM STP 867. Amer. Soc. Testing and Materials, Philadelphia, P. 116-132.

1.6) Reported Results:

Samples were analyzed for 10 pesticides including the triazines atrazine, cyanazine, and simazine. Time weighted mean concentrations (TWMCs) and maximum observed concentrations of samples collected during April 15 to August 15 of 1982 through 1985 were reported for each of the 8 Lake Erie tributaries sampled (Tables 1.2 and 1.3 from Tables 7.2 and 7.3 of the study report). The results of the analysis of individual samples (other than those with the maximum observed concentration) were not tabularly reported. However, same page plots of flow and concentrations of 4 of the pesticides (including atrazine and cyanazine) vs. time during the April 15 - August 15 sampling period were presented for each year and the 3 sampled surface waters with the highest pesticide concentrations (Surface Water Appendix Figures 1.1 through 1.12 from Figures 7.1 through 7.12 of the study report). In addition, based upon pooled results from the April 15-August 16 sampling periods, "concentration exceedency curves" (concentration vs. percent of April 15 - August 15 sampling period concentration is exceeded) were presented for six of the pesticides (including atrazine and cyanazine) and all 8 sampled surface waters (Surface Water Appendix Figure 1.13 from Figure 7.14 of the study report).

Under Phase II of the Drinking Water Regulations, water supply systems will be required to collect a minimum of 4 finished water samples a year, one per quarter. A water supply system will be considered out of compliance if the annual mean concentration of a regulated pesticide in the 4 quartely samples exceeds the MCL for the pesticide. If the pesticide concentration exceeds 4 times the MCL in any individual sample, the annual mean will obviously exceed the MCL if only the minimum number of samples is collected (4 per year; 1 per quarter).

The maximum observed concentrations of pesticides were compared to 4 times their MCL (or 4 times their lifetime drinking water HA if a MCL was not available). The April 15-August 15 TWMCs of pesticides (the longest available means) were compared to their MCLs (or their lifetime drinking water HA if a MCL was not available). Annual TWMCs are more appropriate for comparison to the MCLs because of the Phase II regulations, but could not be computed because samples were collected only from April 15 to August 15. It should be noted that the ratios of April 15-August 15 TWMCs to MCLs are probably generally substantially greater than the ratios of annual TWMCs to MCLs.

1.6.1 Atrazine

Atrazine TWMCs for samples collected from the 8 tributaries during April 15 to August 15 of 1983 through 1985 ranged from 0.254 ug/L (Cuyahoga river 1984) to 7.67 ug/L (Honey Creek 1985). The distribution of the April 15-August 15 atrazine TWMCs (one 4/15-8/15 TWMC for each of 3 years and each of 8 tributaries sampled = 24 total TWMCs) was as follows:

TWMCs $\leq$ 1.0 ug/L (6 over 3 tributaries; 25%)
1.0 ug/L < TWMCs $\leq$ 3.0 ug/L (9 over 4 tributaries; 37.5%)
TWMCs > 3 ug/L (9 over 6 tributaries; 37.5%)

Nine of the 24 April 15-August 15 atrazine TWMCs representing 6 of the 8 tributaries sampled exceeded 3 ug/L (the MCL and lifetime drinking water HA for atrazine). The highest April 15-August 15 atrazine TMWCs over sampling years 1983-1985 and the 8 tributaries sampled were in decreasing order as follows: 7.673 (Honey Creek 1985), 6.583 ug/L (Lost Creek 1984), 6.406 ug/L (Sandusky River 1985), 5.366 ug/L (U. Honey Creek 1985), 5.200 ug/L (Rock Creek 1985), 5.194 ug/L (Honey Creek 1984), 3.768 ug/L (Lost Creek 1983), 3.464 ug/L (Maumee River 1984), and 3.029 ug/L (Honey Creek 1983). The other 15 atrazine TWMCs were < than 3 ug/L.

Peak observed atrazine concentrations for samples collected from the 8 tributaries during April 15 to August 15 of 1982 through 1985 ranged from 0.742 ug/L (Cuyahoga River 1982) to 245. ug/L (Lost Creek 1984). The distribution of the peak observed atrazine concentrations (one peak observed concentration for each of 3 or 4 years and each of 8 tributaries sampled = 30 total peak observed concentrations) was as follows:

$C_{max} \leq$ 1.0 ug/L (1; 3.3%)
1.0 ug/L < $C_{max} \leq$ 3 ug/L (2 over 1 tributaries; 6.7%)
3 ug/L < $C_{max} \leq$ 12 ug/L (11 over 6 tributaries; 36.7%)
C_{max} > 12 ug/L (16 over 6 tributaries; 53.3%)

Twenty-seven of the 30 peak observed atrazine concentrations exceeded 3 ug/L (the MCL and lifetime drinking water HA for atrazine). Sixteen of the 27 peak observed atrazine concentrations exceeding 3 ug/L also exceeded 12 ug/L (4 X the MCL).

The highest peak observed atrazine concentrations in samples collected from the 8 tributaries during April 15 to August 15 of 1982 through 1985 were in decreasing order as follows: 245.0 ug/L (Lost Creek 1984), 226.0 ug/L (U. Honey Creek 1985), 48.41 ug/L (Honey Creek 1982), and 48.09 ug/L (Rock Creek 1985), 38.91 ug/L (Lost Creek 1982), 37.46 ug/L (Honey Creek 1984), and 31.44 ug/L (Lost Creek 1983) All other peak observed atrazine concentrations were < 30 ug/L.

1.6.2 Cyanazine

Cyanazine TWMCs for samples collected from the 8 tributaries during April 15 to August 15 of 1982 through 1984 ranged from 0.01 ug/L (Cuyahoga river 1984) to 3.06 ug/L (Honey Creek 1985). The distribution of the April 15-August 15 cyanazine TWMCs (one 4/15-8/15 TWMC for each of 3 years and each of 8 tributaries sampled = 24 total TWMCs) was as follows:

TWMCs $\leq$ 1.0 ug/L (20 over 8 tributaries; 83.3%)
1.0 ug/L < TWMCs $\leq$ 10.0 ug/L (4 over 4 tributaries; 16.7%)
TWMCs > 10 ug/L (0; 0.0%)

None of the 24 April 15-August 15 cyanazine TWMCs exceeded 10 ug/L (the lifetime drinking water HA for cyanazine).

The highest April 15-August 15 cyanazine TMWCs over sampling years 1983-1985 and the 8 tributaries sampled were in decreasing order as follows: 3.056 ug/L (U. Honey Creek 1985), 1.569 ug/L (Lost Creek 1984), 1.466 ug/L (Honey Creek 1985), and 1.166 ug/L (Maumee River 1984). The other 20 cyanazine TWMCs were < 1.0 ug/L.

Peak observed cyanazine concentrations for samples collected from the 8 tributaries during April 15 to August 15 of 1982 through 1985 ranged from 0.085 ug/L (Cuyahoga River 1984) to 86.1 ug/L (U Honey Creek 1985). The distribution of the peak observed cyanazine concentrations (one peak observed concentration for each of 3 or 4 years and each of 8 tributaries sampled = 30 total peak observed concentrations) was as follows:

$C_{max} \leq$ 1.0 ug/L (3 over 2 tributaries; 10.0%)
1.0 ug/L < $C_{max} \leq$ 10 ug/L (21 over 8 tributaries; 70.0%)
10 ug/L < $C_{max} \leq$ 40 ug/L (5 over 3 tributaries; 16.7%)
C_{max} > 40 ug/L (1; 3.3%)

Six of the 30 peak observed cyanazine concentrations exceeded 10 ug/L (the lifetime drinking water HA for cyanazine). One of the 6

peak observed cyanazine concentrations exceeding 10 ug/L also exceeded 40 ug/L (4 X the drinking water HA).

The highest peak observed cyanazine concentrations in samples collected from the 8 tributaries during April 15 to August 15 of 1982 through 1985 were in decreasing order as follows: 86.1 ug/L (U. Honey Creek 1985), 23.09 ug/L (Lost Creek 1984), 14.88 ug/L (Honey Creek 1982), 10.25 ug/L (Lost Creek 1983), 10.16 ug/L (Maumee River 1984), and 10.08 ug/L (Lost Creek 1982). All other peak observed concentrations were < 10 ug/L.

1.6.3 Simazine

Simazine TWMCs for samples collected from the 8 tributaries during April 15 to August 15 of 1983 through 1985 ranged from 0.0 ug/L (Maumee River 1983, Sandusky River 1983, Honey Creek 1983, Rock Creek 1983) to 0.842 ug/L (Cuyahoga River 1984). All of the 24 April 15-August 15 simazine TWMCs (one 4/15-8/15 TWMC for each of 3 years and each of 8 tributaries sampled = 24 total TWMCs) were < 1 ug/L (the MCL and lifetime drinking water HA for simazine).

The highest April 15-August 15 simazine TMWCs over sampling years 1983-1985 and the 8 tributaries sampled were in decreasing order as follows: 0.842 ug/L (Cuyahoga River 1984), 0.597 ug/L (Cuyahoga River 1985), 0.266 ug/L (Sandusky River 1985), 0.254 ug/L (River Raisin 1985), 0.235 ug/L (Honey Creek 1985), 0.223 ug/L (Maumee River 1985), and 0.210 ug/L (Maumee River 1984). The other 17 simazine TWMCs were < 0.2 ug/L.

Peak observed simazine concentrations for samples collected from the 8 tributaries during April 15 to August 15 of 1982 through 1985 g/L ranged from below the detection limit (3 locations in 1983) to 10.77 ug/L (Cuyahoga River 1982). The distribution of the peak observed simazine concentrations (one peak observed concentration for each of 3 or 4 years and each of 8 tributaries sampled = 30 total peak observed concentrations) was as follows:

$C_{max} \leq 1.0$ ug/L (18 over 8 tributaries; 60.0%)
1.0 ug/L < $C_{max} \leq 4$ ug/L (9 over 5 tributaries; 30.0%)
$C_{max} > 4$ ug/L (3 over 3 tributaries; 10.0%)

Twelve of the 30 peak observed simazine concentrations exceeded 1 ug/L (the MCL and lifetime drinking water HA for simazine). Three of the 12 peak observed simazine concentrations exceeding 1 ug/L also exceeded 4 ug/L (4 X the MCL).

The highest peak observed simazine concentrations in samples collected from the 8 tributaries during April 15 to August 15 of 1982 through 1985 were in decreasing order as follows: 10.77 ug/L (Cuyahoga River 1982), 6.926 ug/L (Maumee River 1982), 4.952 ug/L (River Raisin 1982), 3.603 ug/L (Honey Creek 1982), 3.355 ug/L

(Sandusky River 1982), and 3.278 ug/L (Lost Creek 1982). All other peak observed simazine concentrations were < 3 ug/L.

1.7) Comments:

(1) The sampling and QA/QC information provided was inadequate for EFGWB to assess the accuracy of the data in the Baker 1988 study.

(2) The April 15-August 15 TWMCs and the peak observed concentrations were generally much greater for atrazine than those for cyanazine, and those for cyanazine were generally much greater than those for simazine. The arithmetic means of the April 15-August 15 TWMCs over the 8 tributaries and 1983-1985 were 2.84±2.19 ug/L for atrazine, 0.643±0.654 ug/L for cyanazine, and 0.133±0.205 ug/L for simazine. The arithmetic means of the annual peak observed concentrations over the 8 tributaries and 1982-1985 were 30.8±57.4 for atrazine, 7.50±15.6 for cyanazine, and 1.64±2.4 for simazine.

(3) Based upon the same page plots of flow, atrazine concentrations and cyanazine concentrations vs. time within the April 15 - August sampling period of 1982-1985 for Honey Creek, the Sandusky River, and the Maumee River, the study author developed the following conclusions with which EFGWB concurs:

> (a) Atrazine and cyanazine concentrations in late April to early May were generally low (< 1 ug/L), reached peak concentrations in late May to early July during or shortly after major runoff events and then gradually declined to relatively low levels again toward mid-August even in conjunction with runoff events.
>
> (b) Atrazine and cyanazine concentrations continued to peak in conjunction with runoff events several times over at least 2 months after application in Honey Creek during 1985.

(4) Based upon the concentration exceedency curves, the study author indicated that although maximum concentrations of atrazine are frequently less than those of metalochlor and alachlor, atrazine generally remains at elevated concentrations for longer periods of time. EFGWB concurs and believes that is also reflected by the fact that atrazine TWMCs are frequently greater than those for metalochlor and alachlor even in surface waters where the maximum observed concentrations for atrazine are less than those for metalochlor and alachlor.

(5) The study author indicates that low pesticide concentrations in the Cuyahoga River are due to the small percentage of agricultural land use within the Cuyahoga watershed (Table 1.4 from Table 5.2 of the study report).

(6) Although much of the River Raisin watershed drains agricultural use areas, the pesticide concentrations in the River Raisin were

generally much lower than those in the 6 other surface waters sampled which also drain high agricultural use areas. The study author indicates the reason may be due to many of the soils in the River Raisin watershed being more permeable to water infiltration than those in the watersheds of the other surface waters sampled (thereby leading to greater dissipation through leaching than through runoff).

(7) The study author indicates that the April 15-August 15 TWMCs, the peak observed concentrations, and the rates of increase and decrease of pesticide concentrations for pesticides generally increases with decreasing drainage area.

(8) Based upon estimates by the study author of pesticide loadings to Lake Erie from the 8 tributaries sampled, the Maumee River (which drains the largest area (16,395 km^2) followed by the Sandusky river (which drains 3,240 km^2) account for the majority of atrazine and cyanazine loadings to Lake Erie (Surface Water Appendix Table 1.1 from Table 7.10 of the study report). Lost Creek contributes the greatest unit loading on a gram/hectare basis (Surface Water Appendix Table 1.2 from Table 7.11 of the study report), but the total area it drains (11.3 km^2) is so small compared to that of the Maumee and Sandusky Rivers that its total loading to Lake Erie is small by comparison.

Table 8.1. Listing of tributary monitoring stations, watershed areas, mean annual discharges, and, for the 1982-1985 water years, the water year discharges and the number of nutrient and pesticide samples analyzed.

Station USGS No.	Area Km^2 (Mean Annual Discharge, 10^6m^3)	Water Year	USGS Annual Discharge 10^6m^3	Samples Analyzed Nutrients	Pesticides
Maumee R. 01493500	16,395 km^2 (4,422)	1982	7,107	479	53
		1983	4,748	546	62
		1984	5,878	482	88
		1985	4,365	454	56
Sandusky R. 04198000	3,240 km^2 (891.3)	1982	1,390	469	51
		1983	649.6	448	58
		1984	1,940	441	79
		1985	769.8	502	82
Cuyahoga R. 04208000	1,831 km^2 (738)	1982	919.8	447	24
		1983	919.9	475	25
		1984	1,030	437	20
		1985	921.7	502	29
Raisin R. 04176500	2,699 km^2 (650.2)	1982	925.3	223	25
		1983	874.4	312	32
		1984	753.0	313	43
		1985	816.7	310	31
Honey Cr. 04197100	386 km^2 (124.1)	1982	157.7	536	65
		1983	88.72	514	68
		1984	188.2	483	100
		1985	91.43	480	121
Upper Honey Creek 04197020	44.0 km^2 (15.36)	1982	16.58	151	--
		1983	11.06	416	58
		1984	21.07	409	32
		1985	12.07	430	85
Rock Cr. 04197170	88.0 km^2	1983	--	434	46
		1984	43.13	522	87
		1985	19.83	540	143
Lost Creek Trib. 04185440	11.3 km^2	1982	6.799*	518	51
		1983	5.175*	784	51
		1984	4.956*	399	57
		1985	4.840*	457	63
Genesee R. 04232000	6,390 km^2 (2,512)	1982	3,362.3	56	--
		1983	2,431.4	60	--
		1984	3,828.4	43	--
		1985	2,201.0	75	--
Oswego R. 04249000	13,209 km^2 (5,991)	1982	6,715.1	52	--
		1983	5,085.3	60	--
		1984	6,748.7	43	--
		1985	4,682.1	75	--
Black R. (NY) 04260500	4,854 km^2 (3,598)	1982	3,976	61	--
		1983	3,570	65	--
		1984	4,296	62	--
		1985	3,802	30	--

* Discharge records subject to revision.

Table 12. Time weighted mean concentrations (µg/L) during the April 15 - August 15 periods for the Michigan and Ohio tributaries to Lake Erie for the years 1983, 1984 and 1985. Data of 1984 and 1985 corrected for recoveries less than 100%. (Baker, 1988).

Year	Maumee River	Sandusky River	Honey Creek	Rock Creek	U. Honey Creek	Lost Creek	River Raisin	Cuyahoga River
Atrazine								
1983	1.751	1.805	3.029	2.516	0.636	3.768	1.067	0.358
1984	3.464	2.940	5.194	1.084	0.969	6.583	1.128	0.254
1985	2.756	6.406	7.673	5.200	5.366	0.938	2.618	0.640
Alachlor								
1983	1.046	0.508	1.381	0.525	0.287	2.369	0.540	0.090
1984	1.688	1.206	2.042	0.240	0.274	1.657	0.754	0.092
1985	0.738	2.933	3.324	0.882	0.399	0.104	1.603	0.021
Metolachlor								
1983	1.308	2.252	2.989	2.917	0.618	1.483	0.317	0.516
1984	1.819	3.151	3.468	2.513	0.361	0.694	0.514	0.001
1985	1.964	7.200	6.577	9.960	2.136	0.613	1.175	0.160
Cyanazine								
1983	0.622	0.447	0.660	0.221	0.202	0.826	0.341	0.292
1984	1.166	0.494	0.664	0.038	0.152	1.569	0.492	0.006
1985	0.407	0.782	1.466	0.252	3.056	0.567	0.580	0.120
Metribuzin								
1983	0.443	0.296	0.353	0.304	0.159	0.586	0.135	0.174
1984	0.830	0.687	0.502	0.075	0.163	0.457	0.086	0.088
1985	0.390	1.410	1.020	0.882	0.402	0.077	0.232	0.0
Linuron								
1983	0.036	0.088	0.332	0.645	0.027	0.367	0.079	0.090
1984	0.040	0.003	0.052	0.0	0.0	0.0	0.013	0.380
1985	0.016	0.407	0.836	0.860	0.059	0.005	0.540	0.132
Simazine								
1983	0.0	0.0	0.0	0.0	0.001	0.002	0.001	0.034
1984	0.210	0.121	0.059	0.079	0.010	0.050	0.048	0.842
1985	0.223	0.266	0.235	0.079	0.076	0.014	0.254	0.597
Carbofuran								
1983	0.175	0.154	0.105	0.061	0.083	0.066	0.172	0.596
1984	0.211	0.154	0.299	0.143	0.063	0.130	0.032	0.205
1985	0.060	0.241	0.338	0.297	0.154	0.031	0.052	0.056
Terbufos								
1983	0.001	0.0	0.001	0.0	0.001	0.036	0.028	0.096
1984	<0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.007
1985	0.002	0.002	0.005	0.002	<0.001	<0.001	0.0	0.0
Fonofos								
1983	0.0	0.004	0.0	0.0	0.002	0.002	0.003	0.167
1984	0.004	0.0	0.0	0.0	0.0	0.003	0.034	0.014
1985	0.001	0.008	0.002	<0.001	0.0	0.0	0.012	0.026

Table 13. Maximum pesticide concentrations (µg/L) observed at river transport stations during the years 1982, 1983, 1984, and 1985. Data of 1984 and 1985 corrected for recoveries less than 100%. (Baker, 1988).

Year	Maumee River	Sandusky River	Honey Creek	Rock Creek	U. Honey Creek	Lost Creek	River Raisin	Cuyahoga River
Atrazine								
1982	14.04	18.76	48.41	---	---	38.91	9.263	0.742
1983	5.415	7.971	17.48	16.36	8.492	31.44	9.608	1.436
1984	13.62	10.15	37.46	15.55	5.743	245.4	5.893	1.031
1985	9.000	28.42	29.23	48.09	225.9	6.110	10.00	3.010
Alachlor								
1982	9.266	18.20	74.99	---	---	18.46	8.163	0.603
1983	7.485	4.924	8.871	11.88	8.688	34.44	8.522	1.164
1984	17.64	8.754	22.01	7.137	0.817	31.84	4.837	0.336
1985	5.640	26.31	27.06	20.19	2.250	1.610	8.760	0.380
Metolachlor								
1982	10.06	40.64	90.80	---	---	12.71	3.317	0.733
1983	7.033	16.70	23.42	66.50	29.02	13.28	4.586	5.683
1984	13.73	19.45	35.42	57.15	2.145	7.894	4.313	0.0
1985	8.520	42.40	35.00	154.0	25.10	6.260	7.120	0.850
Cyanazine								
1982	4.260	6.993	14.88	---	---	10.08	4.288	6.618
1983	1.942	1.392	2.231	1.495	1.336	10.25	2.667	1.357
1984	10.16	3.401	4.984	1.179	0.857	23.09	3.823	0.085
1985	1.580	3.440	8.500	2.830	86.10	2.510	2.270	0.540
Metribuzin								
1982	3.356	8.208	8.241	---	---	5.418	1.726	0.526
1983	4.200	2.447	3.423	4.885	6.937	6.940	2.456	1.050
1984	10.69	8.085	6.319	0.713	0.730	5.731	0.761	0.204
1985	2.530	4.750	7.350	24.53	3.020	2.030	1.690	0.038
Linuron								
1982	2.324	3.513	13.12	---	---	159.9	2.788	7.683
1983	0.390	1.029	4.300	7.655	1.220	4.122	0.973	10.93
1984	1.379	0.421	1.930	0.0	0.0	0.0	0.448	2.692
1985	0.420	3.860	5.910	14.16	3.890	0.360	2.410	6.310
Simazine								
1982	6.926	3.355	3.603	---	---	3.278	4.952	10.77
1983	0.0	0.005	0.0	0.0	0.015	0.078	0.022	0.429
1984	0.781	1.424	1.197	0.830	0.102	0.407	0.244	2.875
1985	0.840	1.320	0.650	0.590	1.180	0.081	0.730	1.810
Carbofuran								
1982	---	---	---	---	---	---	---	---
1983	0.478	0.500	0.425	0.226	0.569	0.545	0.582	1.976
1984	2.717	1.588	5.747	6.036	1.634	4.054	0.565	1.454
1985	0.760	1.610	3.120	4.770	2.440	0.640	0.390	0.880
Terbufos								
1982	2.250	0.104	1.338	---	---	0.090	0.127	0.058
1983	0.030	0.0	0.016	0.012	0.047	0.483	0.341	1.057
1984	0.021	0.0	0.0	0.0	0.0	0.0	0.0	0.042
1985	0.019	0.081	0.075	0.044	0.022	0.048	0.0	0.0
Fonofos								
1982	0.215	0.050	0.024	---	---	0.082	0.205	0.0
1983	0.0	0.033	0.0	0.0	0.030	0.052	0.027	0.810
1984	0.057	0.0	0.0	0.0	0.0	0.060	0.945	0.067
1985	0.024	0.086	0.018	0.0	0.0	0.0	0.091	0.056
Pendimethalin								
1982	---	---	---	---	---	---	---	---
1983	0.269	0.371	0.623	0.470	3.660	3.455	0.333	1.057
1984	0.666	0.570	1.248	0.276	0.055	0.346	0.080	0.139
1985	0.0	0.130	0.230	0.0	0.0	0.310	0.0	0.0

10

Table 5.4. Summary of land use and gross erosion rates for Lake Erie Basin tributary watersheds.

Watershed	Cropland %	Pasture %	Forest %	Water %	Other %	Gross Erosion Rate kg/ha/yr
Maumee R.	75.6	3.2	8.4	3.5	9.4	6,840
Sandusky R.	79.9	2.3	8.9	2.0	6.8	8,250
Cuyahoga R.	4.2	43.1	29.1	3.0	20.6	896.*
Raisin R.	67.1	6.8	9.0	3.0	14.1	9,750
Honey Cr.	82.6	0.6	10.0	0.5	6.3	6,860
Upper Honey Cr.	89.1	---	7.5	---	3.4	7,060
Rock Cr.	80.9	2.3	11.8	0.9	4.2	9,540
Lost Cr.	83.0	---	10.6	1.4	5.0	7,610.**

*This gross erosion rate was calculated using the normal cover factor for forested areas. Due to unusual combinations of soils and slopes in portions of the Cuyahoga River basin, erosion from this watershed area is much higher than the calculated value.

**This calculation was completed in 1987 by the U.S. Soil Conservation Service and includes the impacts of conservation tillage demonstration programs to increase residue levels on the soil.

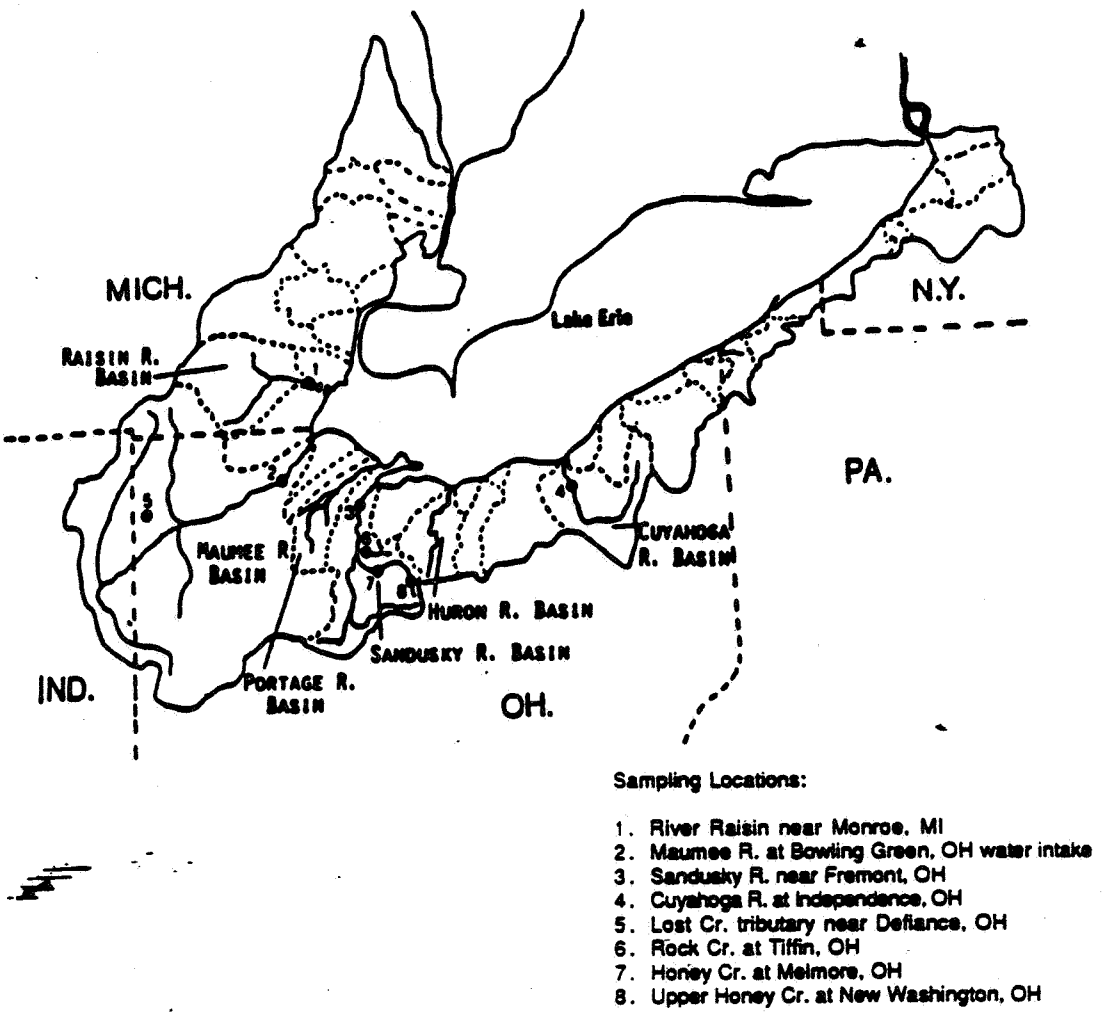


Figure 8.1. Locations of the tributary monitoring stations in the Lake Erie Basin.

2. STUDY 2: Goolsby DA and Thurman EM. 1991. Herbicides in rivers and streams of the upper midwestern United States. To be published in: Proc. 46th Ann. Meeting Upper Mississippi River Conservation Committee.

2.1) Locations Sampled:

Surface water samples were collected at 150 U.S. Geological Survey stream flow gaging stations over 10 midwestern states (IA, IL, IN, KS, MN, MO, NE, OH, SD, and WI) (Figure 2.1 from Figure 1 of the study report). Surface waters sampled had drainage areas ranging from < 100 to > 700,000 sq. miles.

2.2) Sampling Times:

Surface waters were sampled prior to pesticide application (March-April), during the first runoff event following pesticide applications (May-June), and during the fall (October-November). However, at some locations only a post-application sample was collected and at a few locations only a pre-application sample was collected.

2.3) Sampling Methodology: No information was provided.

2.4) Analytical Methodology:

The samples were analyzed for 11 herbicides including 4 triazines (atrazine, cyanazine, propazine, simazine) and for 2 degradates of atrazine (desethyl-atrazine and desisopropyl-atrazine) by immunoassay. Approximately 35% of the pre-application and almost all of the post-application and Fall samples were also analyzed by GC/MS for confirmation and comparative purposes.

2.5) Results:

The percent detections, and 25th percentile, median, 75th percentile and maximum concentrations of the herbicides are presented in Table 2.1 (from Table 1 of the study report). The results of the pre-application, post-application and Fall sample analyses for the 11 herbicide and 2 atrazine degradates along with the pH, streamflow and drainage area are presented in Surface Water Appendix Tables 2.1 through 2.10 (from the study report) for each sampling location within each of the 10 states from which samples were collected.

The results of the sample analyses for 4 triazines (atrazine, cyanazine, propazine, simazine) and 2 degradates of atrazine (desethyl-atrazine and desisopropyl-atrazine) are more clearly presented in EFGWB Spreadsheets 2.1 through 2.10. Those spreadsheets also give for each state and sample type (pre-application, post-application, Fall) the maximum, arithmetic mean and concentration distribution of each of the six compounds over the sampling locations with respect to the detection limit, 1 ug/L,

the MCL (or lifetime drinking water HA if a MCL is not available), and 4 times the MCL or drinking water HA. There is no MCL or lifetime drinking water HA for either of the atrazine degradates so their MCL was assumed to be identical to that of atrazine. Concentrations of atrazine, desethyl-atrazine, desisopropyl-atrazine, cyanazine, propazine, and simazine which exceed the MCL (or lifetime drinking water HA if a MCL is not available) are shaded in Spreadsheets 2.1 through 2.10.

2.5.1 Atrazine

Table 2.2 summarizes the atrazine portion of Spreadsheets 2.1 through 2.10. It lists for each state and sample type (pre-application, post-application, and Fall) the maximum, the arithmetic mean, and concentration distribution of atrazine over the sampling locations with respect to its detection limit (0.05 mg/L), 1 ug/L, its MCL (3 ug/L), and 4 times its MCL (12 ug/L).

Atrazine was detected (detection limit 0.05 ug/L) in 87.2% (48/55) of the pre-application samples and in 76.8% (109/142) of the Fall samples collected from surface waters across the 10 states sampled. However, 97.9% (47/48) of the detectable atrazine concentrations in the pre-application samples and 91.7% (100/109) of the detectable atrazine concentrations in the Fall samples were less than 1 ug/L. None of either the pre-application or Fall samples had atrazine concentrations greater than the MCL (3 ug/L).

Atrazine was detected (detection limit 0.05 ug/L) in 98.4% (127/129) of the post-application samples. Atrazine was detected at greater than the MCL (3 ug/L) in 52.8% (68/129) of the post-application samples and at greater than 4 times the MCL (12 ug/L) in 26.4% (34/129) of the post-application samples. The distribution of atrazine concentrations in samples collected during the first post-application runoff event (one per sampling location - 129 total) over the 10 states from which samples were collected was as follows:

$C \leq 0.05$ ug/L (1.6%; 2/129)
0.05 ug/L $< C \leq 1.0$ ug/L (23.3%; 30/129)
1.0 ug/L $< C \leq 3.0$ ug/L (22.5%; 29/129)
3.0 ug/L $< C \leq 12$ ug/L (26.4%%; 34/129 over 8 states)
$C > 12$ ug/L (26.4%; 34/129 over 7 states)

The states with the highest percentages of post-application samples (one/sampling location) at atrazine concentrations greater than the MCL (3 ug/L) were Iowa (80%; 12/15), Indiana (80%; 16/20), Nebraska (73.3%; 11/15), Ohio (69.2%; 9/13), and Illinois (53.8%; 14/26). The states with the highest percentages of post-application samples at atrazine concentrations greater than 4 times the MCL (12 ug/L) were Iowa (53.3%; 8/15), Nebraska (53.3%; 8/15), Ohio (30.8%; 4/13), Indiana (30.0%; 6/20), and Illinois (23.1%; 6/26).

The highest observed concentrations of atrazine in the post-application samples were 108 ug/L in Spoon River at London Mill, IL; 71.6 ug/L in Old Man Creek near Iowa City, IA; 52.2 ug/L in Bonapas Creek at Browns, IL; 52.0 ug/L in Wahoo Creek at Itica, NE; 48.4 ug/L in South Skunk River near Oskaloosa, IA; and 42.10 ug/L in North Skunk River near Sigourney, IA. All other post-application samples had atrazine concentrations less than 40 ug/L.

2.5.2 Desethyl-atrazine

Table 2.3 summarizes the desethyl-atrazine portion of Spreadsheets 2.1 through 2.10. It lists for each state and sample type (pre-application, post-application, and Fall) the maximum, the arithmetic mean, and concentration distribution of desethyl-atrazine over the sampling locations with respect to its detection limit (0.05 mg/L), 1 ug/L, atrazine's MCL (3 ug/L), and 4 times atrazine's MCL (12 ug/L).

Desethyl-atrazine was detected (detection limit 0.05 ug/L) in 47.2% (26/55) of the pre-application samples and 48.6% (69/142) of the Fall samples collected from surface waters across the 10 states sampled. However, all of the detectable desethyl-atrazine concentrations were less than 1 ug/L in both the pre-application (26 of 26 detects) and Fall (69 of 69 detects) samples.

Desethyl-atrazine was detected (detection limit 0.05 ug/L) in 84.5% (109/129) of the post-application samples, but 76.1% (83/109) of the detectable concentrations were less than 1 mg/L. Desethyl-atrazine was detected at greater than the MCL for atrazine (3 ug/L) in only 3.9% (5/129) of the post-application samples, and was not detected at greater than 4 times the MCL for atrazine (12 ug/L) in any of the 129 post-application samples. The distribution of desethyl-atrazine concentrations in samples collected during the first post-application runoff event (one per sampling location - 129 total) over the 10 states from which samples were collected was as follows:

$C \leq 0.05$ ug/L (15.5%; 20/129)
0.05 ug/L $< C \leq 1.0$ ug/L (64.3%; 83/129)
1.0 ug/L $< C \leq 3.0$ ug/L (16.3%; 21/129)
3.0 ug/L $< C \leq 12$ ug/L (3.9%; 5/129 over 3 states)
$C > 12$ ug/L (0.0%; 0/129)

The highest observed concentrations of desethyl-atrazine in the post-application samples were 4.40 ug/L in Spoon River at London Mill, IL; 3.80 ug/L in Bonapas Creek at Browns, IL; 3.70 ug/L in Old Man Creek near Iowa City, IA; 3.70 ug/L in the Little Blue River near Fairbury, NE; and 3.10 ug/L in South Skunk River near Oskaloosa, IA. All other post-application samples had atrazine concentrations less than 3 ug/L.

2.5.3 Desisopropyl-atrazine

Table 2.4 summarizes the desisopropyl-atrazine portion of Spreadsheets 2.1 through 2.10. It lists for each state and sample type (pre-application, post-application, and Fall) the maximum, the arithmetic mean, and concentration distribution of desisopropyl-atrazine over the sampling locations with respect to its detection limit (0.05 mg/L), 1 ug/L, atrazine's MCL (3 ug/L), and 4 times atrazine's MCL (12 ug/L).

Desisopropyl-atrazine was detected (detection limit 0.05 ug/L) in only 7.3% (4/55) of the pre-application samples and was not detected in any (0/142) of the Fall samples collected from surface waters across the 10 states sampled. All of the detectable desisopropyl-atrazine concentrations in the pre-application samples (4 of 4 detects) were $\leq$ 1 ug/L.

Desisopropyl-atrazine was detected (detection limit 0.05 ug/L) in 52.7% (68/129) of the post-application samples, but 70.6% (48/68) of the detectable concentrations were less than 1 mg/L. Desisopropyl-atrazine was detected at greater than the MCL for atrazine (3 ug/L) in only 1.6% (2/129) of the post-application samples, and was not detected at greater than 4 times the MCL for atrazine (12 ug/L) in any of the 129 post-application samples. The distribution of desisopropyl-atrazine concentrations in samples collected during the first post-application runoff event (one per sampling location - 129 total) over the 10 states from which samples were collected was as follows:

$C \leq 0.05$ ug/L (47.3%; 61/129)
0.05 ug/L $< C \leq 1.0$ ug/L (37.2%; 48/129)
1.0 ug/L $< C \leq 3.0$ ug/L (14.0%; 18/129)
3.0 ug/L $< C \leq 12$ ug/L (1.6%; 2/129 over 2 states)
$C > 12$ ug/L (0.0%; 0/129)

Post atrazine application concentrations of desethyl-atrazine were almost always less than 10% of the atrazine concentrations. The highest observed concentrations of desisopropyl-atrazine in the post-application samples were 3.20 ug/L in Old Man Creek near Iowa City, IA; and 3.10 ug/L in South Skunk River near Oskaloosa, IA. All other post-application samples had desisopropyl-atrazine concentrations less than 3 ug/L.

2.5.4 Comparison of Atrazine, Desethyl-atrazine, Desisopropyl-atrazine

Post-atrazine application concentrations of desethyl-atrazine and desisopropyl-atrazine were comparable to each other (generally within a factor of less than 2) and were both generally less than 10% of the post-application concentrations of atrazine. Desethyl-

atrazine was detected in a much higher percentage of both the pre-application and Fall samples than desisopropyl-atrazine and detectable concentrations of desethyl-atrazine were generally greater than detectable concentrations of desisopropyl-atrazine. Detectable concentrations of desethyl-atrazine in the pre-application and Fall samples were generally less than those of atrazine, but the difference was generally less than between the post-application concentrations of desethyl-atrazine and atrazine.

2.5.5 Cyanazine

Table 2.5 summarizes the cyanazine portion of Spreadsheets 2.1 through 2.10. It lists for each state and sample type (pre-application, post-application, and Fall) the maximum, the arithmetic mean, and concentration distribution of cyanazine over the sampling locations with respect to its detection limit (0.20 ug/L), 1 ug/L, its lifetime drinking water HA (10 ug/L), and 4 times its lifetime drinking water HA (40 ug/L).

Cyanazine was detected (detection limit 0.20 ug/L) in only 5.5% (3/55) of the pre-application samples and in only one (1/142) of the Fall samples collected from surface waters across the 10 states sampled. The 3 detectable concentrations in the pre-application samples and the 1 detectable concentration in the Fall samples were all less than 1 ug/L.

Cyanazine was detected (detection limit 0.20 ug/L) in 63.4% (82/129) of the post-application samples. Cyanazine was detected at greater than the lifetime drinking water HA (10 ug/L) in 11.6% (15/129) of the post-application samples and at greater than 4 times the HA (40 ug/L) in 1.6% (2/129) of the post-application samples. The distribution of cyanazine concentrations in samples collected during the first post-application runoff event (one per sampling location - 129 total) over the 10 states from which samples were collected was as follows:

$C \leq 0.20$ ug/L (36.4%; 47/129)
0.20 ug/L $< C \leq 1.0$ ug/L (15.5%; 20/129)
1.0 ug/L $< C \leq 10.0$ ug/L (36.4%; 47/129)
10.0 ug/L $< C \leq 40$ ug/L (10.1%; 13/129 over 3 states)
$C > 40$ ug/L (1.6%; 2/129 both in IA)

The states with the highest percentages of post-application samples (one/sampling location) with cyanazine concentrations greater than the lifetime drinking water HA (10 ug/L) were Iowa (66.7%; 10/15) and Illinois (11.5%; 3/26). Only 2 other post-application samples (one each from Indiana and Wisconsin) had cyanazine concentrations exceeding the lifetime drinking water HA. The 2 post-application samples with cyanazine concentrations exceeding 4 times the lifetime drinking water HA were both collected from Iowa.

The highest observed concentrations of cyanazine in the post-application samples were 61.2 ug/L in North Skunk River near Sigourney, IA; 45.2 ug/L in South Skunk River near Oskaloosa, IA; 36.0 ug/L in Old Man Creek near Iowa City, IA; 34.5 ug/L in Nishnabotna River above Hamburg, IA; 31.0 ug/L in Skunk River at Augusta, IA; 30.2 ug/L in Maple River at Mapleton, IA; 26.9 ug/L in Boyer River at Logan, IA; and 20.9 ug/L in Trempealeau River at Dodge, WI. All other post-application samples had cyanazine concentrations less than 20 ug/L.

2.5.6 Propazine

Table 2.6 summarizes the propazine portion of Spreadsheets 2.1 through 2.10. It lists for each state and sample type (pre-application, post-application, and Fall) the maximum, the arithmetic mean, and concentration distribution of cyanazine over the sampling locations with respect to its detection limit (0.05 ug/L), 1 ug/L, its lifetime drinking water HA (10 ug/L), and 4 times its lifetime drinking water HA (40 ug/L).

Propazine was detected (detection limit 0.05 ug/L) in none (0/55) of the pre-application samples and in only one (1/142) of the Fall samples collected from surface waters across the 10 states sampled. The one detectable concentration in the Fall samples was much less than 1 ug/L (0.08 ug/L).

Propazine was detected (detection limit 0.05 ug/L) in 32.6% (42/129) of the post-application samples, but all but one (1.40 ug/L) had a propazine concentration less than 1 ug/L.

2.5.7 Simazine

Table 2.7 summarizes the simazine portion of Spreadsheets 2.1 through 2.10. It lists for each state and sample type (pre-application, post-application, and Fall) the maximum, the arithmetic mean, and concentration distribution of atrazine over the sampling locations with respect to its detection limit (.05 mg/L), its MCL (1 ug/L), and 4 times its MCL (4 ug/L).

Simazine was detected (detection limit 0.05 ug/L) in only 7.3% (4/55) of the pre-application samples and in only 2.8% (4/142) of the Fall samples collected from surface waters across the 10 states sampled. All of the detectable simazine concentrations in both the pre-application and Fall samples were less than the MCL (1 ug/L).

Simazine was detected (detection limit 0.05 ug/L) in 53.4% (69/129) of the post-application samples. Simazine was detected at greater than the MCL (1 ug/L) in 8.5% (11/129) of the post-application samples and at greater than 4 times the MCL (4 ug/L) in 1.6% (2/129) of the post-application samples. The distribution of simazine concentrations in samples collected during the first post-

application runoff event (one per sampling location - 129 total) over the 10 states from which samples were collected was as follows:

$C \leq 0.05$ ug/L (46.5%; 60/129)
0.05 ug/L $< C \leq 1.0$ ug/L (45.0%; 58/129)
1.0 ug/L $< C \leq 4.0$ ug/L (7.0%; 9/129 over 4 states)
$C > 4$ ug/L (1.6%; 2/129 both in Illinois)

The highest observed concentrations of simazine in the post-application samples were 6.99 ug/L in Bonpas Creek at Browns, IL; 4.88 ug/L in Little Wabash River at Carmi, IL; 3.82 ug/L in Clear Creek near Rockbridge, OH; 3.40 ug/L in Auglaize River near Fort Jenkins, OH; 1.89 ug/L in Spoon River at London Mill, IL; 1.70 ug/L in White River near Centeron, IN; 1.47 ug/L in East Fork of White River near Bedford, IN; 1.43 ug/L in Wabash River at Linn Grove, IN; 1.38 ug/L in West Fork of Big Blue River near Dorchester, NE; 1.15 ug/L in Big Walnut Creek near Reelsville, IN; and 1.01 ug/L in Little Blue River near Fairbury, NE. All other post-application samples had simazine concentrations less than 1 ug/L.

2.6) Comments:

(1) The analytical procedure and QA/QC information provided was inadequate for EFGWB to assess the accuracy of the data.

(2) This was the only one of the 5 studies reviewed in which post application sampling times were determined by runoff events instead of by pre-set intervals. The results of this study indicate the importance of sampling in conjunction with runoff events if one of the objectives of the study is to determine maximum atrazine concentrations. The percentage of locations sampled with an atrazine concentration exceeding 12 ug/L is substantially higher than in the other studies reviewed for this document.

Table 2.2) Atrazine maximums, arithmetic means, and concentration distributions for surface water samples collected pre-application, post-application, and Fall 1989 from 150 locations in 10 mid-western states. The concentration distributions of atrazine were computed with respect to its detection limit (0.05 ug/L), 1 ug/L, its MCL (3 ug/L), and 4 times its MCL (12 ug/L). Data from Goolsby and Thurman (1991; USGS).

Atrazine (Pre-application)	Atrazine Maximum (ug/L)	Atrazine Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Iowa	1.66	0.47	0	8	1	0	0
Illinois	0.89	0.31	2	9	0	0	0
Indiana	0.26	0.18	1	6	0	0	0
Kansas	0.05	0.05	2	0	0	0	0
Minnesota	0.33	0.19	0	5	0	0	0
Missouri	1.00	0.44	0	5	0	0	0
Nebraska	0.91	0.29	1	4	0	0	0
Ohio	0.49	0.37	0	4	0	0	0
South Dakota	0.55	0.39	0	3	0	0	0
Wisconsin	0.34	0.20	1	3	0	0	0
Total (Pre-Application)			7 (12.7%)	47 (85.5%)	1 (1.8%)	0 (0.0%)	0 (0.0%)

Atrazine (Post-application)	Atrazine Maximum (ug/L)	Atrazine Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Iowa	71.6	24.27	0	0	3	4	8
Illinois	108	12.32	0	5	7	8	6
Indiana	27	9.48	0	0	4	10	6
Kansas	15.9	6.65	0	2	0	1	1
Minnesota	2.9	0.87	1	9	3	0	0
Missouri	11	3.99	0	1	4	2	0
Nebraska	52	13.58	0	3	1	3	8
Ohio	28.5	9.93	0	0	4	5	4
South Dakota	1.6	0.65	1	5	2	0	0
Wisconsin	26.4	4.20	0	5	1	1	1
Total (Post-application)			2 (1.6%)	30 (23.3%)	29 (22.5%)	34 (26.4%)	34 (26.4%)

Atrazine (Fall)	Atrazine Maximum (ug/L)	Atrazine Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Iowa	1.30	0.28	9	16	1	0	0
Illinois	2.10	0.42	3	21	2	0	0
Indiana	0.68	0.28	2	18	0	0	0
Kansas	1.80	0.62	1	4	1	0	0
Minnesota	3.10	0.34	7	6	0	1	0
Missouri	0.65	0.39	0	8	0	0	0
Nebraska	1.70	0.42	4	10	2	0	0
Ohio	1.70	0.56	2	9	2	0	0
South Dakota	0.06	0.06	2	2	0	0	0
Wisconsin	0.21	0.11	3	6	0	0	0
Total (Fall)			33 (23.2%)	100 (70.4%)	8 (5.6%)	1 (0.7%)	0 (0.0%)

Table 2.3) Desethyl-atrazine maximums, arithmetic means, and concentration distributions for surface water samples collected pre-application, post-application, and Fall 1989 from 150 locations in 10 mid-western states. The concentration distributions of desethyl-atrazine were computed with respect to its detection limit (0.05 ug/L), 1 ug/L, atrazine's MCL (3 ug/L), and 4 times atrazine's MCL (12 ug/L). Data from Goolsby and Thurman (1991; USGS).

Desethyl-atrazine (Pre-application)	Desethyl-Atrazine Maximum (ug/L)	Desethyl-Atrazine Ar. Mean (ug/L)	Desethyl-Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Iowa	0.39	0.11	4	5	0	0	0
Illinois	0.18	0.08	6	5	0	0	0
Indiana	0.11	0.06	4	3	0	0	0
Kansas	0.05	0.05	2	0	0	0	0
Minnesota	0.10	0.07	3	2	0	0	0
Missouri	0.22	0.10	1	4	0	0	0
Nebraska	0.05	0.05	5	0	0	0	0
Ohio	0.25	0.15	0	4	0	0	0
South Dakota	0.07	0.06	2	1	0	0	0
Wisconsin	0.12	0.08	2	2	0	0	0
Total (Pre-application)			29 (52.7%)	26 (47.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

Desethyl-atrazine (Post-application)	Desethyl-Atrazine Maximum (ug/L)	Desethyl-Atrazine Ar. Mean (ug/L)	Desethyl-Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Iowa	3.70	1.21	0	9	4	2	0
Illinois	4.40	0.75	2	19	3	2	0
Indiana	1.40	0.55	0	18	2	0	0
Kansas	1.80	0.64	1	2	1	0	0
Minnesota	0.53	0.12	8	5	0	0	0
Missouri	0.82	0.26	1	6	0	0	0
Nebraska	3.70	1.54	2	3	9	1	0
Ohio	2.50	0.69	0	11	2	0	0
South Dakota	0.17	0.08	5	3	0	0	0
Wisconsin	0.84	0.22	1	7	0	0	0
Total (Post-application)			20 (15.5%)	83 (64.3%)	21 (16.3%)	5 (3.9%)	0 (0.0%)

Desethyl-atrazine (Fall)	Desethyl-Atrazine Maximum (ug/L)	Desethyl-Atrazine Ar. Mean (ug/L)	Desethyl-Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Iowa	0.51	0.10	21	5	0	0	0
Illinois	0.42	0.14	10	16	0	0	0
Indiana	0.38	0.14	5	15	0	0	0
Kansas	0.39	0.15	2	4	0	0	0
Minnesota	0.1	0.07	8	6	0	0	0
Missouri	0.21	0.11	3	5	0	0	0
Nebraska	0.56	0.42	8	8	0	0	0
Ohio	0.45	0.14	8	5	0	0	0
South Dakota	0.06	0.05	3	1	0	0	0
Wisconsin	0.17	0.08	5	4	0	0	0
Total (Fall)			73 (51.4%)	69 (48.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

Table 2.4) Desisopropyl-atrazine maximums, arithmetic means, and concentration distributions for surface water samples collected pre-application, post-application, and Fall 1989 from 150 locations in 10 mid-western states. The concentration distributions of desisopropyl-atrazine were computed with respect to its detection limit (0.05 ug/L), 1 ug/L, atrazine's MCL (3 ug/L), and 4 times atrazine's MCL (12 ug/L). Data from Goolsby and Thurman (1991; USGS).

Desisopropyl-atrazine (Pre-application)	Desisopropy Atrazine Maximum (ug/L)	Desisopropy Atrazine Ar. Mean (ug/L)	Desisopropyl Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Iowa	0.18	0.06	8	1	0	0	0
Illinois	0.18	0.06	10	1	0	0	0
Indiana	0.05	0.05	7	0	0	0	0
Kansas	0.05	0.05	2	0	0	0	0
Minnesota	0.05	0.05	5	0	0	0	0
Missouri	0.09	0.06	4	1	0	0	0
Nebraska	0.59	0.16	4	1	0	0	0
Ohio	0.05	0.05	4	0	0	0	0
South Dakota	0.05	0.05	3	0	0	0	0
Wisconsin	0.05	0.05	4	0	0	0	0
Total (Pre-application)			51 (92.7%)	4 (7.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

Desisopropyl-atrazine (Post-application)	Desisopropy Atrazine Maximum (ug/L)	Desisopropy Atrazine Ar. Mean (ug/L)	Desisopropyl Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Iowa	3.20	1.08	1	8	4	2	0
Illinois	2.20	0.38	11	12	3	0	0
Indiana	0.78	0.21	9	11	0	0	0
Kansas	0.77	0.31	2	2	0	0	0
Minnesota	0.47	0.08	11	2	0	0	0
Missouri	0.58	0.17	4	3	0	0	0
Nebraska	3.00	1.19	4	2	9	0	0
Ohio	1.90	0.41	5	6	2	0	
South Dakota	0.05	0.05	8	0	0	0	0
Wisconsin	0.69	0.14	6	2	0	0	0
Total (Post-application)			61 (47.3%)	48 (37.2%)	18 (14.0%)	2 (1.6%)	0 (0.0%)

Desisopropyl-atrazine (Fall)	Desisopropy Atrazine Maximum (ug/L)	Desisopropy Atrazine Ar. Mean (ug/L)	Desisopropyl Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Iowa	0.05	0.05	26	0	0	0	0
Illinois	0.05	0.05	26	0	0	0	0
Indiana	0.05	0.05	20	0	0	0	0
Kansas	0.05	0.05	6	0	0	0	0
Minnesota	0.05	0.05	14	0	0	0	0
Missouri	0.05	0.05	8	0	0	0	0
Nebraska	0.05	0.05	16	0	0	0	0
Ohio	0.05	0.05	13	0	0	0	0
South Dakota	0.05	0.05	4	0	0	0	0
Wisconsin	0.05	0.05	9	0	0	0	0
Total (Fall)			142 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

Table 2.5) Cyanazine maximums, arithmetic means, and concentration distributions for surface water samples collected pre-application, post-application, and Fall 1989 from 150 locations in 10 mid-western states. The concentration distributions of cyanazine were computed with respect to its detection limit (0.20 ug/L), 1 ug/L, its lifetime drinking water HA (10 ug/L), and 4 times its lifetime drinking water HA (40 ug/L). Data from Goolsby and Thurman (1991; USGS).

Cyanazine (Pre-application)	Cyanazine Maximum (ug/L)	Cyanazine Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.20	0.20<C<1	1<C<10	10<C<40	C>40
Iowa	0.26	0.21	8	1	0	0	0
Illinois	0.52	0.23	10	1	0	0	0
Indiana	0.20	0.20	7	0	0	0	0
Kansas	0.20	0.20	2	0	0	0	0
Minnesota	0.21	0.20	4	1	0	0	0
Missouri	0.20	0.20	5	0	0	0	0
Nebraska	0.20	0.20	5	0	0	0	0
Ohio	0.20	0.20	4	0	0	0	0
South Dakota	0.20	0.20	3	0	0	0	0
Wisconsin	0.20	0.20	4	0	0	0	0
Total (Pre-application)			52 (94.5%)	3 (5.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

Cyanazine (Post-application)	Cyanazine Maximum (ug/L)	Cyanazine Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.20	0.20<C<1	1<C<10	10<C<40	C>40
Iowa	61.20	21.35	0	0	5	8	2
Illinois	13.60	2.66	7	6	10	3	0
Indiana	14.40	3.57	6	1	12	1	0
Kansas	0.20	0.20	4	0	0	0	0
Minnesota	3.90	0.89	9	0	4	0	0
Missouri	5.60	1.46	2	2	3	0	0
Nebraska	6.20	1.63	5	4	6	0	0
Ohio	9.30	3.54	2	4	7	0	0
South Dakota	0.20	0.20	8	0	0	0	0
Wisconsin	20.90	2.98	4	3	0	1	0
Total (Post-application)			47 (36.4%)	20 (15.5%)	47 (36.4%)	13 (10.1%)	2 (1.6%)

Cyanazine (Fall)	Cyanazine Maximum (ug/L)	Cyanazine Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.20	0.20<C<1	1<C<10	10<C<40	C>40
Iowa	0.2	0.2	26	0	0	0	0
Illinois	0.20	0.20	26	0	0	0	0
Indiana	0.20	0.20	20	0	0	0	0
Kansas	0.20	0.20	6	0	0	0	0
Minnesota	0.21	0.20	13	1	0	0	0
Missouri	0.20	0.20	8	0	0	0	0
Nebraska	0.20	0.20	16	0	0	0	0
Ohio	0.20	0.20	13	0	0	0	0
South Dakota	0.20	0.20	4	0	0	0	0
Wisconsin	0.20	0.20	9	0	0	0	0
Total (Fall)			141 (99.3%)	1 (0.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

Table 2.6) Propazine maximums, arithmetic means, and concentration distributions for surface water samples collected pre-application, post-application, and Fall 1989 from 150 locations in 10 mid-western states. The concentration distributions of propazine were computed with respect to its detection limit (0.05 ug/L), 1 ug/L, its lifetime drinking watwer HA (10 ug/L), and 4 times its lifetime drinking water HA (40 ug/L). Data from Goolsby and Thurman (1991; USGS).

Propazine (Pre-application)	Propazine Maximum (ug/L)	Propazine Ar. Mean (ug/L)	Propazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
Iowa	0.05	0.05	9	0	0	0	0
Illinois	0.05	0.05	11	0	0	0	0
Indiana	0.05	0.05	7	0	0	0	0
Kansas	0.05	0.05	2	0	0	0	0
Minnesota	0.05	0.05	5	0	0	0	0
Missouri	0.05	0.05	5	0	0	0	0
Nebraska	0.05	0.05	5	0	0	0	0
Ohio	0.05	0.05	4	0	0	0	0
South Dakota	0.05	0.05	3	0	0	0	0
Wisconsin	0.05	0.05	4	0	0	0	0
Total (Pre-application)			55	0	0	0	0
			(100.0%)	(0.0%)	(0.0%)	(0.0%)	(0.0%)

Propazine (Post-application)	Propazine Maximum (ug/L)	Propazine Ar. Mean (ug/L)	Propazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
Iowa	0.91	0.27	7	8	0	0	0
Illinois	1.40	0.19	20	5	1	0	0
Indiana	0.25	0.10	6	14	0	0	0
Kansas	0.14	0.08	2	2	0	0	0
Minnesota	0.05	0.05	13	0	0	0	0
Missouri	0.07	0.05	6	1	0	0	0
Nebraska	0.58	0.18	10	5	0	0	0
Ohio	0.27	0.09	8	5	0	0	0
South Dakota	0.05	0.05	8	0	0	0	0
Wisconsin	0.37	0.09	7	1	0	0	0
Total (Post-application)			87	41	1	0	0
			(67.4%)	(31.8%)	(0.8%)	(0.0%)	(0.0%)

Propazine (Fall)	Propazine Maximum (ug/L)	Propazine Ar. Mean (ug/L)	Propazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
Iowa	0.05	0.05	26	0	0	0	0
Illinois	0.05	0.05	26	0	0	0	0
Indiana	0.05	0.05	20	0	0	0	0
Kansas	0.08	0.06	5	1	0	0	0
Minnesota	0.05	0.05	14	0	0	0	0
Missouri	0.05	0.05	8	0	0	0	0
Nebraska	0.05	0.05	16	0	0	0	0
Ohio	0.05	0.05	13	0	0	0	0
South Dakota	0.05	0.05	4	0	0	0	0
Wisconsin	0.05	0.05	9	0	0	0	0
Total (Fall)			141	1	0	0	0
			(99.3%)	(0.7%)	(0.0%)	(0.0%)	(0.0%)

Table 2.7) Simazine maximums, arithmetic means, and concentration distributions for surface water samples collected pre-application, post-application, and Fall 1989 from 150 locations in 10 mid-western states. The concentration distributions of simazine were computed with respect to its detection limit (0.05 ug/L), its MCL (1 ug/L), and 4 times its MCL (4 ug/L). Data from Goolsby and Thurman (1991; USGS).

Simazine (Pre-application)	Simazine Maximum (ug/L)	Simazine Ar. Mean (ug/L)	Simazine Concentration Distribution C<0.05	0.05<C<1	1<C<4	C>4	
Iowa	0.05	0.05	9	0	0	0	
Illinois	0.11	0.06	10	1	0	0	
Indiana	0.05	0.05	7	0	0	0	
Kansas	0.05	0.05	2	0	0	0	
Minnesota	0.05	0.05	5	0	0	0	
Missouri	0.05	0.05	5	0	0	0	
Nebraska	8.68	1.78	4	0	0	1	
Ohio	0.12	0.08	2	2	0	0	
South Dakota	0.05	0.05	3	0	0	0	
Wisconsin	0.05	0.05	4	0	0	0	
Total (Pre-application)			51	3	0	1	0
			(92.7%)	(5.5%)	(0.0%)	(1.8%)	

Simazine (Post-application)	Simazine Maximum (ug/L)	Simazine Ar. Mean (ug/L)	Simazine Concentration Distribution C<0.05	0.05<C<1	1<C<4	C>4	
Iowa	0.43	0.20	6	9	0	0	
Illinois	6.99	0.71	9	14	1	2	
Indiana	1.70	0.62	3	13	4	0	
Kansas	0.12	0.07	3	1	0	0	
Minnesota	0.05	0.05	13	0	0	0	
Missouri	0.06	0.05	5	2	0	0	
Nebraska	1.38	0.25	5	8	2	0	
Ohio	3.82	0.82	1	10	2	0	
South Dakota	0.05	0.05	8	0	0	0	
Wisconsin	0.40	0.09	7	1	0	0	
Total (Post-application)			60	58	9	2	0
			(46.5%)	(45.0%)	(7.0%)	(1.6%)	

Simazine (Fall)	Simazine Maximum (ug/L)	Simazine Ar. Mean (ug/L)	Simazine Concentration Distribution C<0.05	0.05<C<1	1<C<4	C>4	
Iowa	0.05	0.05	26	0	0	0	
Illinois	0.11	0.05	25	1	0	0	
Indiana	0.05	0.05	20	0	0	0	
Kansas	0.05	0.05	6	0	0	0	
Minnesota	0.10	0.05	13	1	0	0	
Missouri	0.05	0.05	8	0	0	0	
Nebraska	0.21	0.06	15	1	0	0	
Ohio	0.05	0.05	13	0	0	0	
South Dakota	0.05	0.05	4	0	0	0	
Wisconsin	0.09	0.05	8	1	0	0	
Total (Fall)			138	4	0	0	0
			(97.2%)	(2.8%)	(0.0%)	(0.0%)	(0.0%)

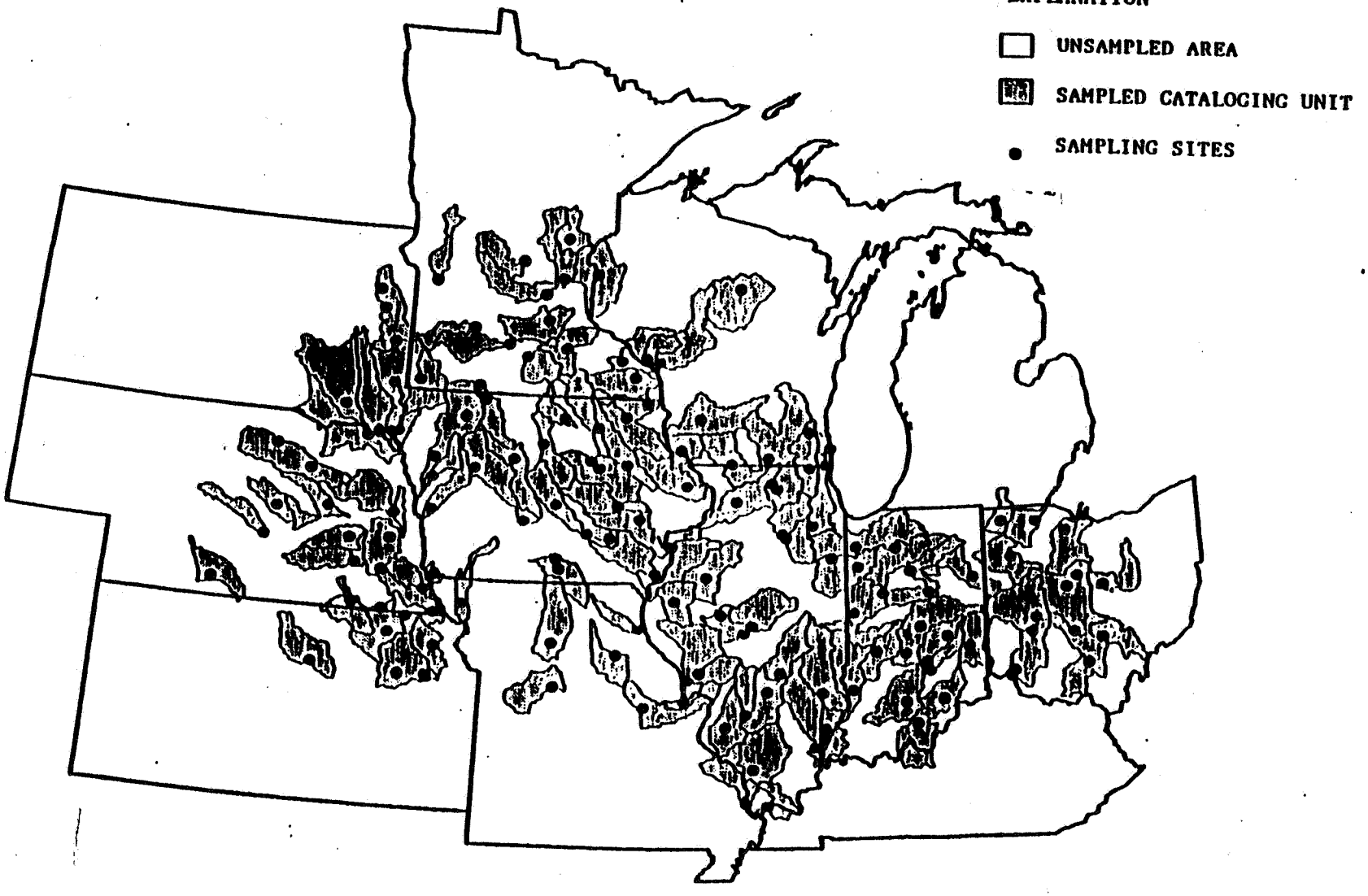


FIGURE 2.4-Location of sites and hydrologic cataloging units sampled for midwestern United States herbicide reconnaissance during 1989.

Table 21.--Summary of Herbicides and Metabolites Detected in Pre- and Post-Application Samples

[Number of samples: pre-application=55, post-application=132; ug/L, micrograms per liter; <, less than; detection limits are 0.05 ug/L for all herbicides and metabolites except cyanazine which is 0.2 ug/L; ametryn, prometryn, and terbutryn were not detected]

Herbicide or metabolite	percent detections		Concentration (ug/L)							
			25th percentile		median		75th percentile		maximum	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Alachlor	18	86	<.05	0.18	<.05	0.92	<.05	4.2	0.44	51
Atrazine	90	98	.13	.92	.23	3.8	.42	14	1.7	108
Desethyl-atrazine	51	86	<.05	.12	.05	.28	.11	.97	.39	4.4
Desisopropyl-atrazine	9	54	<.05	<.05	<.05	.09	<.05	.61	.59	3.2
Cyanazine	5	63	<.2	<.2	<.2	.97	<.2	4.5	.52	61
Metolachlor	34	83	<.05	.20	<.05	1.3	.16	4.0	.53	40
Metribuzin	2	53	<.05	<.05	<.05	.14	<.05	.38	.16	7.6
Propazine	0	40	<.05	<.05	<.05	<.05	<.05	<.05	<.05	1.4
Prometon	0	23	<.05	<.05	<.05	<.05	<.05	<.05	<.05	.93
Simazine	13	60	<.05	<.05	<.05	.15	<.05	.83	35.	15

Spreadsheet 2.1) Iowa Surface Waters 1989

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Atrazine (Pre-application)	1.66	0.47	0	8	1	0	0
Atrazine Post-application	71.6	24.27	0	0	3	4	8
Atrazine Fall	1.3	0.28	9	16	1	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Desethyl-atrazine (Pre-app.)	0.39	0.11	4	5	0	0	0
Desethyl-atrazine (Post-app.)	3.7	1.21	0	9	4	2	0
Desethyl-atrazine (Fall)	0.51	0.10	21	5	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Desisopropyl-atrazine (Pre-)	0.18	0.06	8	1	0	0	0
Desisopropyl-atrazine (Post-)	3.2	1.08	1	8	4	2	0
Desisopropyl-atrazine (Fall)	0.05	0.05	26	0	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.20	0.20<C<1	1<C<10	10<C<40	C>40
Cyanazine (Pre-application)	0.26	0.21	8	1	0	0	0
Cyanazine (Post-application)	61.2	21.35	0	0	5	8	2
Cyanazine (Fall)	0.2	0.20	26	0	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
Propazine (Pre-application)	0.05	0.05	9	0	0	0	0
Propazine (Post-application)	0.91	0.27	7	8	0	0	0
Propazine (Fall)	0.05	0.05	26	0	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<4	C>4
Simazine (Pre-application)	0.05	0.05	9	0	0	0
Simazine (Post-application)	0.43	0.20	6	9	0	0
Simazine (Fall)	0.05	0.05	26	0	0	0

Spreadsheet 2.1) Iowa Surface Waters 1989 - continued

Location	Sample Date	Atrazine Concn. (ug/L)	Desethyl Atrazine Concn. (ug/L)	Desisopropyl Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Propazine Concn. (ug/L)	Simazine Concn. (ug/L)
PRE-APLLICATION							
Upper Iowa R. nr. Dorchester	3/31/89	0.33	0.12	0.05	0.2	0.05	0.05
Wapsipinicon R. at Independ.	3/20/89	1.66	0.39	0.18	0.26	0.05	0.05
Iowa River near Marengo	3/24/89	0.42	0.07	0.05	0.2	0.05	0.05
Winnebago R. at Mason City	3/20/89	0.51	0.13	0.05	0.2	0.05	0.05
Skunk River at Augusta	3/22/89	0.69	0.12	0.05	0.2	0.05	0.05
Des Moines R. at Estherville	3/28/89	0.14	0.05	0.05	0.2	0.05	0.05
Ocheyedan R. near Spencer	3/28/89	0.13	0.05	0.05	0.2	0.05	0.05
Boyer River at Logan	3/23/89	0.14	0.05	0.05	0.2	0.05	0.05
Chariton River near Chariton	3/20/89	0.21	0.05	0.05	0.2	0.05	0.05
POST-APPLICATION							
Upper Iowa R. nr. Dorchester	5/31/89	[illegible]	0.52	0.23	2.80	0.10	0.05
Iowa River near Marengo	5/25/89	[illegible]	0.77	0.63	[illegible]	0.19	0.14
Old Man Cr. near Iowa City	5/25/89	[illegible]	[illegible]	[illegible]	[illegible]	0.91	0.43
Indian Creek near Mingo	5/24/89	[illegible]	0.40	0.05	7.90	0.05	0.05
S. Skunk River nr Oskaloosa	5/24/89	[illegible]	[illegible]	[illegible]	[illegible]	0.64	0.42
N. Skunk R. nr Sigourney	5/24/89	[illegible]	2.40	2.00	[illegible]	0.51	0.41
Skunk River at Augusta	5/26/89	[illegible]	1.50	1.80	[illegible]	0.05	0.36
Des Moines R. at Fort Dodge	5/24/89	2.30	0.14	0.14	5.40	0.05	0.05
N. Racoon River nr Sac City	5/24/89	1.10	0.09	0.12	2.40	0.05	0.05
Raccoon River at Van Meter	5/25/89	1.10	0.09	0.07	1.30	0.05	0.05
Ocheyedan R. near Spencer	5/24/89	[illegible]	0.31	0.36	[illegible]	0.05	0.06
Little Sioux R. at Correct.	5/25/89	[illegible]	0.61	0.66	[illegible]	0.05	0.05
Maple River at Mapleton	5/24/89	[illegible]	0.98	0.77	[illegible]	0.50	0.26
Boyer River at Logan	5/24/89	[illegible]	1.30	1.10	[illegible]	0.32	0.26
Nishnabotna R. above Hamburg	6/5/89	[illegible]	2.20	2.00	[illegible]	0.51	0.39
FALL							
Upper Iowa R. nr. Dorchester	10/5/89	0.15	0.05	0.05	0.2	0.05	0.05
Turkey R. at Spillville	8/23/89	0.05	0.51	0.05	0.2	0.05	0.05
Turkey R. at Spillville	10/4/89	0.05	0.05	0.05	0.2	0.05	0.05
Iowa River near Rowan	10/11/89	0.05	0.05	0.05	0.2	0.05	0.05
Iowa River near Marengo	11/7/89	0.15	0.05	0.05	0.2	0.05	0.05
Old Man Cr. near Iowa City	11/7/89	0.69	0.16	0.05	0.2	0.05	0.05
Little Cedar R. nr. Ionia	10/16/89	0.14	0.05	0.05	0.2	0.05	0.05
Winnebago R. at Mason City	10/11/89	0.05	0.05	0.05	0.2	0.05	0.05
Cedar R. at Cedar Falls	8/23/89	0.14	0.05	0.05	0.2	0.05	0.05
Cedar R. at Cedar Falls	11/9/89	0.15	0.05	0.05	0.2	0.05	0.05
Black Hawk Creek at Hudson	10/18/89	0.05	0.05	0.05	0.2	0.05	0.05
Indian Creek near Mingo	10/10/89	0.05	0.05	0.05	0.2	0.05	0.05
S. Skunk River nr Oskaloosa	10/16/89	0.19	0.05	0.05	0.2	0.05	0.05
N. Skunk R. nr Sigourney	10/2/89	0.26	0.05	0.05	0.2	0.05	0.05
Skunk River at Augusta	11/13/89	0.36	0.1	0.05	0.2	0.05	0.05
Des Moines R. at Estherville	10/12/89	0.16	0.05	0.05	0.2	0.05	0.05
Des Moines R. at Fort Dodge	10/13/89	0.05	0.05	0.05	0.2	0.05	0.05
N. Racoon River nr Sac City	10/12/89	0.05	0.05	0.05	0.2	0.05	0.05
Raccoon River at Van Meter	11/8/89	0.32	0.05	0.05	0.2	0.05	0.05
Ocheyedan R. near Spencer	10/12/89	0.05	0.05	0.05	0.2	0.05	0.05
Little Sioux R. at Correct.	10/2/89	0.13	0.05	0.05	0.2	0.05	0.05
Maple River at Mapleton	10/2/89	0.59	0.05	0.05	0.2	0.05	0.05
Boyer River at Logan	10/2/89	0.23	0.05	0.05	0.2	0.05	0.05
Nishnabotna R. above Hamburg	10/10/89	1.00	0.05	0.05	0.2	0.05	0.05
Chariton R. nr Charito	10/2/89	1.30	0.4	0.05	0.2	0.05	0.05
SF Chariton R. nr Promise CI	10/3/89	0.96	0.3	0.05	0.2	0.05	0.05

Spreadsheet 2.2) Illinois Surface Waters 1989

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Atrazine (Pre-application)	0.89	0.31	2	9	0	0	0
Atrazine Post-application	108	12.32	0	5	7	8	6
Atrazine Fall	2.1	0.42	3	21	2	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Desethyl-atrazine (Pre-app.)	0.18	0.08	6	5	0	0	0
Desethyl-atrazine (Post-app.)	4.4	0.75	2	19	3	2	0
Desethyl-atrazine (Fall)	0.42	0.14	10	16	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Desisopropyl-atrazine (Pre-)	0.18	0.06	10	1	0	0	0
Desisopropyl-atrazine (Post-)	2.2	0.38	11	12	3	0	0
Desisopropyl-atrazine (Fall)	0.05	0.05	26	0	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.20	0.20<C<1	1<C<10	10<C<40	C>40
Cyanazine (Pre-application)	0.52	0.23	10	1	0	0	0
Cyanazine (Post-application)	13.6	2.66	7	6	10	3	0
Cyanazine (Fall)	0.2	0.20	26	0	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
Propazine (Pre-application)	0.05	0.05	11	0	0	0	0
Propazine (Post-application)	1.4	0.19	20	5	1	0	0
Propazine (Fall)	0.05	0.05	26	0	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<4	C>4
Simazine (Pre-application)	0.11	0.06	10	1	0	0
Simazine (Post-application)	6.99	0.71	9	14	1	2
Simazine (Fall)	0.11	0.05	25	1	0	0

Spreadsheet 2.2) Illinois Surface Waters 1989 - continued

Location	Sample Date	Atrazine Concn. (ug/L)	Desethyl Atrazine Concn. (ug/L)	Desisopropyl Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Propazine Concn. (ug/L)	Simazine Concn. (ug/L)
PRE-APLLICATION							
Ohio River at Olmstead	3/16/89	0.05	0.05	0.05	0.2	0.05	0.05
Kiswaukee R. nr Perryville	3/22/89	0.12	0.09	0.05	0.2	0.05	0.05
Edwards R. near New Boston	3/22/89	0.15	0.05	0.05	0.2	0.05	0.05
Iroquois River near Chebanse	4/3/89	0.47	0.05	0.05	0.52	0.05	0.05
Dupage River near Shorwood	4/6/89	0.05	0.05	0.05	0.2	0.05	0.05
Nippersink Cr., Spring Grove	4/5/89	0.37	0.16	0.05	0.2	0.05	0.05
Fox River near Dayton	3/21/89	0.20	0.08	0.05	0.2	0.05	0.05
Spoon River at London Mill	4/21/89	0.23	0.05	0.05	0.2	0.05	0.11
Illinois River at Hardin	3/10/89	0.24	0.05	0.05	0.2	0.05	0.05
Macoupin Creek near Kane	3/21/89	0.89	0.18	0.18	0.2	0.05	0.05
Shoal Creek near Breese	3/20/89	0.61	0.1	0.05	0.2	0.05	0.05
POST-APPLICATION							
Ohio River at Olmstead	6/11/89	[illegible]	0.29	0.16	0.47	0.05	0.21
Embarras River at Ste. Marie	5/22/89	[illegible]	0.22	0.05	0.20	0.05	0.05
Bonpas Creek at Browns	5/22/89	[illegible]	[illegible]	2.10	[illegible]	0.75	[illegible]
Little Wabash at Carmi	5/22/89	[illegible]	2.50	1.70	[illegible]	0.46	[illegible]
S. Br. Kishwaukee at Fairdale	5/25/89	[illegible]	0.75	0.05	[illegible]	0.05	0.05
Kiswaukee R. nr Perryville	5/25/89	[illegible]	0.16	0.08	0.20	0.05	0.05
Elkhorn Creek near Penrose	5/25/89	1.90	0.54	0.05	1.70	0.05	0.05
Iroquois River near Chebanse	5/25/89	2.80	0.13	0.09	2.40	0.05	0.05
Iroquois River near Chebanse	5/25/89	1.20	0.05	0.05	0.62	0.05	0.05
Des Plains River at Russel	5/25/89	0.23	0.10	0.05	0.20	0.05	0.05
Dupage River near Shorwood	5/25/89	0.77	0.07	0.05	0.42	0.05	0.13
Illinois River nr Marseilles	5/25/89	2.50	0.12	0.05	1.10	0.05	0.15
Nippersink Cr., Spring Grove	5/25/89	0.90	0.12	0.10	0.20	0.05	0.33
Fox River near Dayton	5/25/89	0.80	0.12	0.09	1.52	0.05	0.17
Spoon River at London Mill	6/2/89	[illegible]	[illegible]	2.20	[illegible]	1.40	[illegible]
Sangamon River at Riverton	5/22/89	2.60	0.27	0.05	0.94	0.05	0.09
Lake Fork near Cornland	5/22/89	0.64	0.05	0.05	0.20	0.05	0.05
Sangamon River at Oaksford	5/23/89	2.70	0.20	0.05	0.28	0.05	0.12
La Moine River at Colmar	6/3/89	[illegible]	0.80	0.45	[illegible]	0.08	0.15
Macoupin Creek near Kane	5/23/89	[illegible]	1.50	0.61	2.00	0.94	0.05
Illinois River at Hardin	6/4/89	[illegible]	0.25	0.17	0.74	0.05	0.07
Kaskaskia near Cowden	5/22/89	2.70	0.16	0.05	0.20	0.05	0.55
Kaskaskia River at Vandalia	5/23/89	[illegible]	0.37	0.16	0.20	0.05	0.55
Shoal Creek near Breese	5/23/89	[illegible]	0.79	0.58	[illegible]	0.05	0.41
Silver Creek near Freeburg	5/23/89	[illegible]	1.50	0.72	[illegible]	0.23	0.92
Big Muddy near Murphysboro	5/24/89	[illegible]	0.25	0.13	2.10	0.05	0.46
FALL							
Ohio River at Olmstead	10/11/89	0.05	0.05	0.05	0.2	0.05	0.05
Embarras River at Ste. Marie	10/18/89	0.33	0.05	0.05	0.2	0.05	0.05
Bonpas Creek at Browns	11/27/89	0.41	0.22	0.05	0.2	0.05	0.05
Little Wabash at Carmi	11/27/89	0.69	0.19	0.05	0.2	0.05	0.05
S. Br. Kishwaukee at Fairdale	10/24/89	0.24	0.05	0.05	0.2	0.05	0.05
Kiswaukee R. nr Perryville	10/24/89	0.15	0.12	0.05	0.2	0.05	0.05
Elkhorn Creek near Penrose	10/24/89	0.15	0.19	0.05	0.2	0.05	0.05
Edwards R. nr New Boston	10/23/89	0.34	0.05	0.05	0.2	0.05	0.05
Iroquois River near Chebanse	11/03/89	0.16	0.13	0.05	0.2	0.05	0.05
Des Plains River at Russel	11/1/89	0.15	0.05	0.05	0.2	0.05	0.05
Dupage River near Shorwood	11/2/89	0.05	0.05	0.05	0.2	0.05	0.05
Illinois River nr Marseilles	10/31/89	0.15	0.05	0.05	0.2	0.05	0.05
Nippersink Cr., Spring Grove	11/1/89	0.38	0.3	0.05	0.2	0.05	0.05

Spreadsheet 2.2) Illinois Surface Waters 1989 - continued

Location	Sample Date	Atrazine Concn. (ug/L)	Desethyl Atrazine Concn. (ug/L)	Desisopropyl Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Propazine Concn. (ug/L)	Simazine Concn. (ug/L)
Fox River near Dayton	10/31/89	0.26	0.17	0.05	0.2	0.05	0.11
Spoon River at London Mill	10/17/89	0.24	0.12	0.05	0.2	0.05	0.05
Sangamon River at Riverton	10/12/89	0.33	0.11	0.05	0.2	0.05	0.05
Lake Fork near Cornland	10/16/89	0.05	0.05	0.05	0.2	0.05	0.05
Sangamon River at Oaksford	10/19/89	0.25	0.19	0.05	0.2	0.05	0.05
La Moine River at Colmar	10/17/89	0.29	0.09	0.05	0.2	0.05	0.05
Macoupin Creek near Kane	10/16/89	0.62	0.15	0.05	0.2	0.05	0.05
Illinois River at Hardin	10/16/89	0.25	0.1	0.05	0.2	0.05	0.05
Kaskaskia River nr Cowden	10/26/89	1.30	0.34	0.05	0.2	0.05	0.05
Kaskaskia River at Vandalia	10/11/89	0.76	0.05	0.05	0.2	0.05	0.05
Shoal Creek near Breese	10/11/89	2.10	0.42	0.05	0.2	0.05	0.05
Silver Creek near Freeburg	10/11/89	0.52	0.18	0.05	0.2	0.05	0.05
Big Muddy near Murphysboro	10/16/89	0.57	0.05	0.05	0.2	0.05	0.05

Spreadsheet 2.3) Indiana Surface Waters 1989

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Atrazine (Pre-application)	0.26	0.18	1	6	0	0	0
Atrazine Post-application	27	9.48	0	0	4	10	6
Atrazine Fall	0.68	0.28	2	18	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Desethyl-atrazine (Pre-app.)	0.11	0.06	4	3	0	0	0
Desethyl-atrazine (Post-app.)	1.4	0.55	0	18	2	0	0
Desethyl-atrazine (Fall)	0.38	0.14	5	15	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Desisopropyl-atrazine (Pre-)	0.05	0.05	7	0	0	0	0
Desisopropyl-atrazine (Post-)	0.78	0.21	9	11	0	0	0
Desisopropyl-atrazine (Fall)	0.05	0.05	20	0	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.20	0.20<C<1	1<C<10	10<C<40	C>40
Cyanazine (Pre-application)	0.2	0.20	7	0	0	0	0
Cyanazine (Post-application)	14.4	3.57	6	1	12	1	0
Cyanazine (Fall)	0.2	0.20	20	0	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
Propazine (Pre-application)	0.05	0.05	7	0	0	0	0
Propazine (Post-application)	0.25	0.10	6	14	0	0	0
Propazine (Fall)	0.05	0.05	20	0	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<4	C>4
Simazine (Pre-application)	0.05	0.05	7	0	0	0
Simazine (Post-application)	1.7	0.62	3	13	4	0
Simazine (Fall)	0.05	0.05	20	0	0	0

Spreadsheet 2.3) Indiana Surface Waters 1989 - continued

Location	Sample Date	Atrazine Concn. (ug/L)	Desethyl Atrazine Concn. (ug/L)	Desisopropyl Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Propazine Concn. (ug/L)	Simazine Concn. (ug/L)
PRE-APPLICATION							
Eel River near Logansport	3/22/89	0.26	0.06	0.05	0.2	0.05	0.05
Wildcat Creek near Lafayette	3/23/89	0.22	0.05	0.05	0.2	0.05	0.05
Wabash River at Covington	3/24/89	0.18	0.05	0.05	0.2	0.05	0.05
White River near Nora	3/27/89	0.22	0.08	0.05	0.2	0.05	0.05
Big Walnut Cr. nr Reelsville	3/24/89	0.25	0.11	0.05	0.2	0.05	0.05
Muscatatuck River nr Deputy	3/28/89	0.06	0.05	0.05	0.2	0.05	0.05
Kankakee River at Shelby	3/22/89	0.05	0.05	0.05	0.2	0.05	0.05
POST-APPLICATION							
Wabash River near Griffin	6/22/89	[illegible]	0.46	0.05	0.39	0.05	0.44
Whitewater River near Alpin	5/23/89	[illegible]	1	0.53	[illegible]	0.23	0.83
Blue River at Fredricksburg	5/25/89	[illegible]	0.42	0.19	2.8	0.06	0.36
Wabash River at Linn Grove	5/26/89	[illegible]	0.57	0.23	1.4	0.09	[illegible]
Eel River near Logansport	5/22/89	[illegible]	0.17	0.05	2.5	0.06	0.37
Tippecanoe River near Ora	5/31/89	1.20	0.13	0.05	0.2	0.05	0.43
Wildcat Creek near Jerome	5/22/89	1.50	0.13	0.05	0.2	0.05	0.05
Wildcat Creek near Lafayette	5/27/89	[illegible]	1.4	0.78	6.1	0.25	0.64
Wabash River at Covington	5/22/89	[illegible]	0.55	0.23	2.7	0.07	0.39
Busseron Creek near Carisle	6/22/89	[illegible]	0.24	0.05	0.2	0.05	0.05
White River near Nora	5/26/89	[illegible]	0.61	0.35	4.2	0.06	0.55
White River near Centeron	5/23/89	[illegible]	0.23	0.05	0.2	0.1	[illegible]
Big Walnut Cr. nr Reelsville	5/23/89	[illegible]	0.34	0.13	0.2	0.06	[illegible]
Big Blue River at Carthage	5/23/89	[illegible]	0.78	0.05	4.5	0.13	0.92
Sugar Creek near Edinburgh	5/25/89	[illegible]	0.91	0.32	7.7	0.18	0.24
Flatrock River at Columbus	5/25/89	[illegible]	0.96	0.05	6.9	0.15	0.78
Muscatatuck River nr Deputy	5/25/89	2.70	0.37	0.24	2.8	0.05	0.46
E. Fork White R. nr Bedford	5/25/89	[illegible]	1.1	0.59	9.4	0.23	[illegible]
Kankakee River at Shelby	5/31/89	2.80	0.17	0.05	0.2	0.05	0.05
Iroquois R. near Foresman	5/31/89	[illegible]	0.39	0.14	4.5	0.07	0.16
FALL							
Wabash River near Griffin	10/31/89	0.68	0.32	0.05	0.2	0.05	0.05
Whitewater River near Alpin	10/17/89	0.25	0.16	0.05	0.2	0.05	0.05
Blue River at Fredricksburg	10/30/89	0.30	0.38	0.05	0.2	0.05	0.05
Wabash River at Linn Grove	10/17/89	0.27	0.08	0.05	0.2	0.05	0.05
Eel River near Logansport	10/16/89	0.12	0.05	0.05	0.2	0.05	0.05
Tippecanoe River near Ora	10/16/89	0.23	0.05	0.05	0.2	0.05	0.05
Wildcat Creek near Jerome	10/17/89	0.35	0.14	0.05	0.2	0.05	0.05
Wildcat Creek near Lafayette	10/16/89	0.26	0.12	0.05	0.2	0.05	0.05
Wabash River at Covington	10/16/89	0.68	0.2	0.05	0.2	0.05	0.05
Busseron Creek near Carisle	10/31/89	0.22	0.13	0.05	0.2	0.05	0.05
White River near Nora	11/1/89	0.29	0.19	0.05	0.2	0.05	0.05
White River near Centeron	10/30/89	0.36	0.21	0.05	0.2	0.05	0.05
Big Walnut Cr. nr Reelsville	10/31/89	0.41	0.22	0.05	0.2	0.05	0.05
Big Blue River at Carthage	10/17/89	0.12	0.05	0.05	0.2	0.05	0.05
Sugar Creek near Edinburgh	10/30/89	0.05	0.05	0.05	0.2	0.05	0.05
Flatrock River at Columbus	10/30/89	0.17	0.12	0.05	0.2	0.05	0.05
Muscatatuck River nr Deputy	10/30/89	0.37	0.17	0.05	0.2	0.05	0.05
E. Fork White R. nr Bedford	10/30/89	0.28	0.12	0.05	0.2	0.05	0.05
Kankakee River at Shelby	10/16/89	0.05	0.05	0.05	0.2	0.05	0.05
Iroquois R. near Foresman	10/16/89	0.11	0.08	0.05	0.2	0.05	0.05

Spreadsheet 2.4) Kansas Surface Waters 1989

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Atrazine (Pre-application)	0.05	0.05	2	0	0	0	0
Atrazine Post-application	15.9	6.65	0	2	0	1	1
Atrazine Fall	1.8	0.62	1	4	1	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Desethyl-atrazine (Pre-app.)	0.05	0.05	2	0	0	0	0
Desethyl-atrazine (Post-app.)	1.8	0.64	1	2	1	0	0
Desethyl-atrazine (Fall)	0.39	0.15	2	4	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Desisopropyl-atrazine (Pre-)	0.05	0.05	2	0	0	0	0
Desisopropyl-atrazine (Post-)	0.77	0.31	2	2	0	0	0
Desisopropyl-atrazine (Fall)	0.05	0.05	6	0	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.20	0.20<C<1	1<C<10	10<C<40	C>40
Cyanazine (Pre-application)	0.2	0.20	2	0	0	0	0
Cyanazine (Post-application)	0.2	0.20	4	0	0	0	0
Cyanazine (Fall)	0.2	0.20	6	0	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
Propazine (Pre-application)	0.05	0.05	2	0	0	0	0
Propazine (Post-application)	0.14	0.08	2	2	0	0	0
Propazine (Fall)	0.08	0.06	5	1	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<4	C>4
Simazine (Pre-application)	0.05	0.05	2	0	0	0
Simazine (Post-application)	0.12	0.07	3	1	0	0
Simazine (Fall)	0.05	0.05	6	0	0	0

Spreadsheet 2.4) Kansas Surface Waters - continued

Location	Sample Date	Atrazine Concn. (ug/L)	Desethyl Atrazine Concn. (ug/L)	Desisopropyl Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Propazine Concn. (ug/L)	Simazine Concn. (ug/L)
PRE-APPLICATION							
Turkey Creek near Seneca	3/21/89	0.05	0.05	0.05	0.2	0.05	0.05
Salt Creek near Ada	3/21/89	0.05	0.05	0.05	0.2	0.05	0.05
POST-APPLICATION							
Turkey Creek near Seneca	5/22/89	0.22	0.05	0.05	0.2	0.05	0.05
Salt Creek near Ada	5/22/89	0.27	0.11	0.05	0.2	0.14	0.05
Bl. Vermillion R. nr Frankfor	6/27/89	[illegible]	1.8	0.77	0.2	0.05	0.12
Delaware River near Muscotah	5/22/89	[illegible]	0.59	0.35	0.2	0.09	0.05
FALL							
Turkey Creek near Seneca	10/12/89	0.23	0.07	0.05	0.2	0.05	0.05
Salt Creek near Ada	10/12/89	0.49	0.14	0.05	0.2	0.05	0.05
Bl. Vermillion R. nr Frankfor	10/4/89	0.35	0.05	0.05	0.2	0.05	0.05
Mill Creek nr Paxico	10/6/89	0.05	0.05	0.05	0.2	0.05	0.05
Kansas River at Topeka	10/6/89	1.80	0.39	0.05	0.2	0.08	0.05
Delaware River near Muscotah	10/11/89	0.82	0.18	0.05	0.2	0.05	0.05

Spreadsheet 2.5) Minnesota Surface Waters 1989

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Atrazine (Pre-application)	0.33	0.19	0	5	0	0	0
Atrazine Post-application	2.9	0.87	1	9	3	0	0
Atrazine Fall	3.1	0.34	7	6	0	1	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Desethyl-atrazine (Pre-app.)	0.1	0.07	3	2	0	0	0
Desethyl-atrazine (Post-app.)	0.53	0.12	8	5	0	0	0
Desethyl-atrazine (Fall)	0.1	0.07	8	6	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Desisopropyl-atrazine (Pre-)	0.05	0.05	5	0	0	0	0
Desisopropyl-atrazine (Post-)	0.47	0.08	11	2	0	0	0
Desisopropyl-atrazine (Fall)	0.05	0.05	14	0	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.20	0.20<C<1	1<C<10	10<C<40	C>40
Cyanazine (Pre-application)	0.21	0.20	4	1	0	0	0
Cyanazine (Post-application)	3.9	0.89	9	0	4	0	0
Cyanazine (Fall)	0.21	0.20	13	1	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
Propazine (Pre-application)	0.05	0.05	5	0	0	0	0
Propazine (Post-application)	0.05	0.05	13	0	0	0	0
Propazine (Fall)	0.05	0.05	14	0	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<4	C>4
Simazine (Pre-application)	0.05	0.05	5	0	0	0
Simazine (Post-application)	0.05	0.05	13	0	0	0
Simazine (Fall)	0.1	0.05	13	1	0	0

Spreadsheet 2.5) Minnesota Surface Waters 1989 - continued

Location	Sample Date	Atrazine Concn. (ug/L)	Desethyl Atrazine Concn. (ug/L)	Desisopropyl Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Propazine Concn. (ug/L)	Simazine Concn. (ug/L)
PRE-APPLICATION							
Crow River at Rockford	4/19/89	0.33	0.1	0.05	0.21	0.05	0.05
Pomme de Terre R. at Appleton	5/4/89	0.06	0.05	0.05	0.20	0.05	0.05
Redwood R. nr Redwood Falls	5/4/89	0.08	0.05	0.05	0.20	0.05	0.05
Minnesota R. near Jordan	3/22/89	0.17	0.05	0.05	0.20	0.05	0.05
Straight R. near Faribault	4/5/89	0.29	0.08	0.05	0.20	0.05	0.05
POST-APPLICATION							
Sauk River near St. Cloud	5/25/89	0.56	0.11	0.05	0.20	0.05	0.05
Crow River at Rockford	5/25/89	2.90	0.15	0.08	2.10	0.05	0.05
Rum River nr St. Francis	7/19/89	0.05	0.05	0.05	0.20	0.05	0.05
Pomme de Terre R. at Appleton	7/18/89	0.32	0.05	0.05	0.20	0.05	0.05
Redwood R. nr Redwood Falls	6/27/89	0.42	0.05	0.05	0.20	0.05	0.05
Cottonwood R. nr New Ulm	7/18/89	0.15	0.05	0.05	0.20	0.05	0.05
Le Seur River nr Rapidan	7/18/89	0.27	0.05	0.05	0.20	0.05	0.05
Minnesota R. near Jordan	7/19/89	0.29	0.05	0.05	0.20	0.05	0.05
Knife River near Mora	7/19/89	0.09	0.05	0.05	0.20	0.05	0.05
Straight R. near Faribault	7/19/89	0.32	0.05	0.05	0.20	0.05	0.05
Rush Creek near Rushford	5/25/89	2.10	0.15	0.05	1.60	0.05	0.05
Des Moines R. at Jackson	6/27/89	1.00	0.21	0.05	3.90	0.05	0.05
Rock River at Luverne	6/27/89	2.90	0.53	0.47	2.20	0.05	0.05
FALL							
Sauk River near St. Cloud	11/8/89	0.17	0.1	0.05	0.20	0.05	0.1
Crow River at Rockford	10/26/89	0.33	0.1	0.05	0.21	0.05	0.05
Rum River nr St. Francis	10/31/89	0.05	0.05	0.05	0.20	0.05	0.05
Pomme de Terre R. at Appleton	10/25/89	0.05	0.06	0.05	0.20	0.05	0.05
Redwood R. nr Redwood Falls	10/24/89	0.11	0.05	0.05	0.20	0.05	0.05
Cottonwood R. nr New Ulm	11/8/89	0.05	0.05	0.05	0.20	0.05	0.05
Le Seur River nr Rapidan	11/7/89	0.05	0.05	0.05	0.20	0.05	0.05
Minnesota R. near Jordan	10/29/89	0.10	0.07	0.05	0.20	0.05	0.05
Knife River near Mora	10/31/89	0.05	0.05	0.05	0.20	0.05	0.05
Straight R. near Faribault	11/8/89	0.05	0.05	0.05	0.20	0.05	0.05
N. Fork White R. nr Elba	11/8/89	0.05	0.09	0.05	0.20	0.05	0.05
Rush Creek near Rushford	11/7/89	0.06	0.09	0.05	0.20	0.05	0.05
Des Moines R. at Jackson	10/23/89	0.61	0.05	0.05	0.20	0.05	0.05
Rock River at Luverne	10/23/89	0.08	0.05	0.05	0.20	0.05	0.05

Sreadsheet 2.6) Missouri Surface Waters 1989

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Atrazine (Pre-application)	1	0.44	0	5	0	0	0
Atrazine Post-application	11	3.99	0	1	4	2	0
Atrazine Fall	0.65	0.39	0	8	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Desethyl-atrazine (Pre-app.)	0.22	0.10	1	4	0	0	0
Desethyl-atrazine (Post-app.)	0.82	0.26	1	6	0	0	0
Desethyl-atrazine (Fall)	0.21	0.11	3	5	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Desisopropyl-atrazine (Pre-)	0.09	0.06	4	1	0	0	0
Desisopropyl-atrazine (Post-)	0.58	0.17	4	3	0	0	0
Desisopropyl-atrazine (Fall)	0.05	0.05	8	0	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.20	0.20<C<1	1<C<10	10<C<40	C>40
Cyanazine (Pre-application)	0.2	0.20	5	0	0	0	0
Cyanazine (Post-application)	5.6	1.46	2	2	3	0	0
Cyanazine (Fall)	0.2	0.20	8	0	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
Propazine (Pre-application)	0.05	0.05	5	0	0	0	0
Propazine (Post-application)	0.07	0.05	6	1	0	0	0
Propazine (Fall)	0.05	0.05	8	0	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<4	C>4
Simazine (Pre-application)	0.05	0.05	5	0	0	0
Simazine (Post-application)	0.06	0.05	5	2	0	0
Simazine (Fall)	0.05	0.05	8	0	0	0

Spreadsheet 2.6) Missouri Surface Waters 1989 - continued

Location	Sample Date	Atrazine Concn. (ug/L)	Desethyl Atrazine Concn. (ug/L)	Desisopropyl Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Propazine Concn. (ug/L)	Simazine Concn. (ug/L)
PRE-APPLICATION							
Miss. River at Winfield	3/10/89	0.24	0.07	0.05	0.20	0.05	0.05
Middle Fork Salr R. at Paris	4/3/89	0.53	0.08	0.05	0.20	0.05	0.05
Nodaway River near Graham	3/15/89	1.00	0.22	0.09	0.20	0.05	0.05
Missouri River at Herman	3/12/89	0.18	0.05	0.05	0.20	0.05	0.05
Miss. R. at Thebes	3/15/89	0.27	0.08	0.05	0.20	0.05	0.05
POST-APPLICATION							
Miss. River at Winfield	6/5/89	2.00	0.13	0.09	1.40	0.05	0.05
South Fabius R. nr Taylor	8/30/89	0.82	0.05	0.05	0.20	0.05	0.05
Middle Fork Salr R. at Paris	5/30/89	3.00	0.28	0.34	1.40	0.05	0.05
Nodaway River near Graham	6/23/89	[illegible]	0.82	0.58	5.60	0.07	0.06
Blackwater R. at Blue Lick	5/20/89	[illegible]	0.30	0.05	0.20	0.05	0.05
Missouri River at Herman	6/7/89	1.50	0.08	0.05	0.94	0.05	0.05
Miss. R. at Thebes	6/10/89	1.80	0.15	0.05	0.45	0.05	0.06
FALL							
Miss. River at Winfield	11/13/89	0.21	0.09	0.05	0.20	0.05	0.05
South Fabius R. nr Taylor	10/05/89	0.57	0.18	0.05	0.20	0.05	0.05
Middle Fork Salr R. at Paris	10/6/89	0.65	0.17	0.05	0.20	0.05	0.05
Nodaway River near Graham	10/3/89	0.21	0.05	0.05	0.20	0.05	0.05
Grand River near Sumner	10/4/89	0.35	0.05	0.05	0.20	0.05	0.05
Blackwater R. at Blue Lick	10/4/89	0.50	0.21	0.05	0.20	0.05	0.05
Missouri River at Herman	10/11/89	0.26	0.05	0.05	0.20	0.05	0.05
Miss. R. at Thebes	11/8/89	0.37	0.11	0.05	0.20	0.05	0.05

Spreadsheet 2.7) Nebraska Surface Waters 1989

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Atrazine (Pre-application)	0.91	0.29	1	4	0	0	0
Atrazine Post-application	52	13.58	0	3	1	3	8
Atrazine Fall	1.7	0.42	4	10	2	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Desethyl-atrazine (Pre-app.)	0.05	0.05	5	0	0	0	0
Desethyl-atrazine (Post-app.)	3.7	1.54	2	3	9	1	0
Desethyl-atrazine (Fall)	0.56	0.42	8	8	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Desisopropyl-atrazine (Pre-)	0.59	0.16	4	1	0	0	0
Desisopropyl-atrazine (Post-)	3	1.19	4	2	9	0	0
Desisopropyl-atrazine (Fall)	0.05	0.05	16	0	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.20	0.20<C<1	1<C<10	10<C<40	C>40
Cyanazine (Pre-application)	0.2	0.20	5	0	0	0	0
Cyanazine (Post-application)	6.2	1.63	5	4	6	0	0
Cyanazine (Fall)	0.2	0.20	16	0	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
Propazine (Pre-application)	0.05	0.05	5	0	0	0	0
Propazine (Post-application)	0.58	0.18	10	5	0	0	0
Propazine (Fall)	0.05	0.05	16	0	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<4	C>4
Simazine (Pre-application)	8.68	1.78	4	0	0	1
Simazine (Post-application)	1.38	0.25	5	8	2	0
Simazine (Fall)	0.21	0.06	15	1	0	0

Spreadsheet 2.7) Nebraska Surface Waters 1989 - continued

Location	Sample Date	Atrazine Concn. (ug/L)	Desethyl Atrazine Concn. (ug/L)	Desisopropyl Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Propazine Concn. (ug/L)	Simazine Concn. (ug/L)
PRE-APPLICATION							
Mira Creek near Northloup	4/11/89	0.27	0.05	0.05	0.20	0.05	0.05
Maple Creek near Nickerson	4/5/89	0.07	0.05	0.05	0.20	0.05	0.05
Wahoo Creek at Itica	4/4/89	0.05	0.05	0.05	0.20	0.05	0.05
W. Fork Big Blue nr Dorchest.	4/4/89	0.16	0.05	0.05	0.20	0.05	0.05
Big Blue River at Barneston	4/6/89	0.91	0.05	0.59	0.20	0.05	8.68
POST-APPLICATION							
Bow Creek North of St. James	6/26/89	0.20	0.05	0.05	0.27	0.05	0.05
Mud Creek at Sweetwater	6/25/89	1.70	0.22	0.05	0.20	0.05	0.05
Mira Creek near Northloup	6/25/89	0.15	0.07	0.05	0.20	0.05	0.05
Shell Creek near Columbus	6/26/89	[illegible]	2.50	1.80	6.20	0.18	0.15
Clearwater Cr. nr Clearwater	6/26/89	0.20	0.05	0.05	0.20	0.05	0.05
Maple Creek near Nickerson	6/26/89	[illegible]	0.97	1.40	1.30	0.16	0.12
Salt Creek at Roca	6/26/89	[illegible]	2.30	1.40	0.20	0.14	0.07
Wahoo Creek at Itica	6/8/89	[illegible]	1.90	3.00	4.80	0.58	0.31
Little Nemaha at Auburn	6/26/89	[illegible]	1.30	0.88	0.67	0.05	0.05
Big Nemaha at Fall City	6/26/89	[illegible]	2.20	1.50	0.33	0.23	0.07
Muddy Creek near Arapahoe	6/25/89	[illegible]	1.20	0.71	1.20	0.08	0.06
Big Blue River at Suprise	6/26/89	[illegible]	1.70	1.40	5.90	0.25	0.14
W. Fork Big Blue nr Dorchest.	6/27/89	[illegible]	2.80	1.90	0.20	0.27	[illegible]
Big Blue River at Barneston	6/27/89	[illegible]	2.10	1.50	0.83	0.22	0.13
Little Blue R. nr Fairbury	6/26/89	[illegible]	[illegible]	2.20	1.90	0.32	[illegible]
FALL							
Bow Creek North of St. James	10/18/89	0.05	0.05	0.05	0.20	0.05	0.05
Mud Creek at Sweetwater	10/23/89	0.05	0.05	0.05	0.20	0.05	0.05
Mira Creek near Northloup	10/20/89	0.47	0.05	0.05	0.20	0.05	0.05
Shell Creek near Columbus	10/19/89	0.28	0.10	0.05	0.20	0.05	0.05
Elkhorn Creek nr Atkinson	10/23/89	1.20	0.05	0.05	0.20	0.05	0.05
Clearwater Cr. nr Clearwater	10/18/89	0.05	0.05	0.05	0.20	0.05	0.05
Maple Creek near Nickerson	10/19/89	0.08	0.05	0.05	0.20	0.05	0.05
Salt Creek at Roca	10/31/89	1.70	0.56	0.05	0.20	0.05	0.05
Wahoo Creek at Itica	10/19/89	0.05	0.05	0.05	0.20	0.05	0.05
Little Nemaha at Auburn	10/24/89	0.24	0.05	0.05	0.20	0.05	0.05
Big Nemaha at Fall City	10/24/89	0.54	0.12	0.05	0.20	0.05	0.05
Muddy Creek near Arapahoe	11/7/89	0.11	0.09	0.05	0.20	0.05	0.05
Big Blue River at Suprise	10/31/89	0.70	0.44	0.05	0.20	0.05	0.05
W. Fork Big Blue nr Dorchest.	10/31/89	0.34	0.14	0.05	0.20	0.05	0.05
Big Blue River at Barneston	10/23/89	0.51	0.19	0.05	0.20	0.05	0.21
Little Blue R. nr Fairbury	10/30/89	0.31	0.12	0.05	0.20	0.05	0.05

Spreadsheet 2.8) Ohio Surface Waters 1989

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Atrazine (Pre-application)	0.49	0.37	0	4	0	0	0
Atrazine Post-application	28.5	9.93	0	0	4	5	4
Atrazine Fall	1.7	0.56	2	9	2	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Desethyl-atrazine (Pre-app.)	0.25	0.15	0	4	0	0	0
Desethyl-atrazine (Post-app.)	2.5	0.69	0	11	2	0	0
Desethyl-atrazine (Fall)	0.45	0.14	8	5	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Desisopropyl-atrazine (Pre-)	0.05	0.05	4	0	0	0	0
Desisopropyl-atrazine (Post-)	1.9	0.41	5	6	2	0	0
Desisopropyl-atrazine (Fall)	0.05	0.05	13	0	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.20	0.20<C<1	1<C<10	10<C<40	C>40
Cyanazine (Pre-application)	0.2	0.20	4	0	0	0	0
Cyanazine (Post-application)	9.3	3.54	2	4	7	0	0
Cyanazine (Fall)	0.2	0.20	13	0	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
Propazine (Pre-application)	0.05	0.05	4	0	0	0	0
Propazine (Post-application)	0.27	0.09	8	5	0	0	0
Propazine (Fall)	0.05	0.05	13	0	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<4	C>4
Simazine (Pre-application)	0.12	0.08	2	2	0	0
Simazine (Post-application)	3.82	0.82	1	10	2	0
Simazine (Fall)	0.05	0.05	13	0	0	0

Spreadsheet 2.8) Ohio Surface Waters 1989 - continued

Location	Sample Date	Atrazine Concn. (ug/L)	Desethyl Atrazine Concn. (ug/L)	Desisopropyl Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Propazine Concn. (ug/L)	Simazine Concn. (ug/L)
PRE-APPLICATION							
Clear Creek near Rockbridge	3/14/89	0.13	0.08	0.05	0.20	0.05	0.05
Olentangy River at Claridon	3/15/89	0.49	0.12	0.05	0.20	0.05	0.08
L. Miami River at Milford	3/23/89	0.48	0.25	0.05	0.20	0.05	0.12
Tiffin River at Stryker	3/14/89	0.38	0.16	0.05	0.20	0.05	0.05
POST-APPLICATION							
Kokosing R. at Mount Vernon	6/14/89	[illegible]	0.37	0.16	1.00	0.05	0.92
Clear Creek near Rockbridge	6/14/89	[illegible]	1.50	1.50	8.30	0.08	[illegible]
Scioto River near Prospect	6/14/89	1.90	0.14	0.05	0.20	0.10	0.28
Olentangy River at Claridon	6/14/89	2.90	0.33	0.18	0.35	0.05	0.10
Big Darby Cr. at Darbyville	6/14/89	1.40	0.14	0.05	1.00	0.05	0.33
Scioto River at Higby	6/19/89	[illegible]	0.18	0.05	0.20	0.05	0.05
L. Miami River near Oldtown	6/14/89	[illegible]	1.00	0.05	9.30	0.05	0.12
L. Miami River at Milford	6/14/89	2.30	0.22	0.13	1.80	0.05	0.33
Mad River at Eagle City	6/14/89	[illegible]	0.97	0.46	2.40	0.12	0.17
Tiffin River at Stryker	6/2/89	[illegible]	2.50	1.90	8.70	0.27	0.60
Auglaize R. nr Fort Jenkins	5/27/89	[illegible]	0.74	0.66	3.40	0.20	[illegible]
Maumee River at Waterville	5/27/89	[illegible]	0.30	0.12	9.00	0.05	0.39
Sandusky River near Fremont	5/24/89	[illegible]	0.56	0.05	0.38	0.05	0.21
FALL							
Kokosing R. at Mount Vernon	10/12/89	0.90	0.05	0.05	0.20	0.05	0.05
Clear Creek near Rockbridge	10/16/89	0.17	0.05	0.05	0.20	0.05	0.05
Scioto River near Prospect	10/19/89	0.21	0.05	0.05	0.20	0.05	0.05
Olentangy River at Claridon	10/24/89	0.43	0.15	0.05	0.20	0.05	0.05
Big Darby Cr. at Darbyville	10/26/89	0.20	0.05	0.05	0.20	0.05	0.05
Scioto River at Higby	10/3/89	0.95	0.19	0.05	0.20	0.05	0.05
L. Miami River near Oldtown	10/12/89	0.05	0.05	0.05	0.20	0.05	0.05
L. Miami River at Milford	10/17/89	0.30	0.05	0.05	0.20	0.05	0.05
Mad River at Eagle City	10/12/89	0.05	0.05	0.05	0.20	0.05	0.05
Tiffin River at Stryker	10/25/89	0.66	0.20	0.05	0.20	0.05	0.05
Auglaize R. nr Fort Jenkins	10/25/89	0.53	0.05	0.05	0.20	0.05	0.05
Maumee River at Waterville	10/25/89	1.10	0.45	0.05	0.20	0.05	0.05
Sandusky River near Fremont	10/25/89	1.70	0.37	0.05	0.20	0.05	0.05

Spreadsheet 2.9) South Dakota Surface Waters 1989

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Atrazine (Pre-application)	0.55	0.39	0	3	0	0	0
Atrazine Post-application	1.6	0.65	1	5	2	0	0
Atrazine Fall	0.06	0.06	2	2	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Desethyl-atrazine (Pre-app.)	0.07	0.06	2	1	0	0	0
Desethyl-atrazine (Post-app.)	0.17	0.08	5	3	0	0	0
Desethyl-atrazine (Fall)	0.06	0.05	3	1	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Desisopropyl-atrazine (Pre-)	0.05	0.05	3	0	0	0	0
Desisopropyl-atrazine (Post-)	0.05	0.05	8	0	0	0	0
Desisopropyl-atrazine (Fall)	0.05	0.05	4	0	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.20	0.20<C<1	1<C<10	10<C<40	C>40
Cyanazine (Pre-application)	0.2	0.20	3	0	0	0	0
Cyanazine (Post-application)	0.2	0.20	8	0	0	0	0
Cyanazine (Fall)	0.2	0.20	4	0	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
Propazine (Pre-application)	0.05	0.05	3	0	0	0	0
Propazine (Post-application)	0.05	0.05	8	0	0	0	0
Propazine (Fall)	0.05	0.05	4	0	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<4	C>4
Simazine (Pre-application)	0.05	0.05	3	0	0	0
Simazine (Post-application)	0.05	0.05	8	0	0	0
Simazine (Fall)	0.05	0.05	4	0	0	0

Spreadsheet 2.9) South Dakota Surface Waters 1989 - continued

Location	Sample Date	Atrazine Concn. (ug/L)	Desethyl Atrazine Concn. (ug/L)	Desisopropyl Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Propazine Concn. (ug/L)	Simazine Concn. (ug/L)
PRE-APPLICATION							
James River near Scotland	4/3/89	0.55	0.05	0.05	0.20	0.05	0.05
Vermillion R. nr Vermillion	4/3/89	0.17	0.05	0.05	0.20	0.05	0.05
Big Sioux River at Akron	4/3/89	0.46	0.07	0.05	0.20	0.05	0.05
POST-APPLICATION							
James River near Scotland	6/27/89	0.19	0.05	0.05	0.20	0.05	0.05
Vermillion R. nr Vermillion	6/27/89	0.05	0.05	0.05	0.20	0.05	0.05
Big Sioux R. near Watertown	6/29/89	0.08	0.05	0.05	0.20	0.05	0.05
Big Sioux R. near Castlewood	6/29/89	1.50	0.17	0.05	0.20	0.05	0.05
Big Sioux R. near Brooking	6/29/89	0.82	0.12	0.05	0.20	0.05	0.05
Big Sioux R. at N. Cliff Ave.	6/27/89	1.60	0.05	0.05	0.20	0.05	0.05
Big Sioux River at Akron	6/27/89	0.59	0.05	0.05	0.20	0.05	0.05
Brule Creek near Elk Point	6/27/89	0.36	0.06	0.05	0.20	0.05	0.05
FALL							
James River near Scotland	11/2/89	0.05	0.05	0.05	0.20	0.05	0.05
Vermillion R. nr Vermillion	11/2/89	0.05	0.05	0.05	0.20	0.05	0.05
Big Sioux R. near Brooking	11/3/89	0.06	0.06	0.05	0.20	0.05	0.05
Big Sioux River at Akron	11/2/89	0.06	0.05	0.05	0.20	0.05	0.05

Spreadsheet 2.10) Wisconsin Surface Waters 1989

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Atrazine (Pre-application)	0.34	0.20	1	3	0	0	0
Atrazine Post-application	26.4	4.20	0	5	1	1	1
Atrazine Fall	0.21	0.11	3	6	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Desethyl-atrazine (Pre-app.)	0.12	0.08	2	2	0	0	0
Desethyl-atrazine (Post-app.)	0.84	0.22	1	7	0	0	0
Desethyl-atrazine (Fall)	0.17	0.08	5	4	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
Desisopropyl-atrazine (Pre-)	0.05	0.05	4	0	0	0	0
Desisopropyl-atrazine (Post-)	0.69	0.14	6	2	0	0	0
Desisopropyl-atrazine (Fall)	0.05	0.05	9	0	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.20	0.20<C<1	1<C<10	10<C<40	C>40
Cyanazine (Pre-application)	0.2	0.20	4	0	0	0	0
Cyanazine (Post-application)	20.9	2.98	4	3	0	1	0
Cyanazine (Fall)	0.2	0.20	9	0	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
Propazine (Pre-application)	0.05	0.05	4	0	0	0	0
Propazine (Post-application)	0.37	0.09	7	1	0	0	0
Propazine (Fall)	0.05	0.05	9	0	0	0	0

Triazine (Sampling Time)	Maximum (ug/L)	Ar. Mean (ug/L)	Concentration Distribution C<0.05	0.05<C<1	1<C<4	C>4
Simazine (Pre-application)	0.05	0.05	4	0	0	0
Simazine (Post-application)	0.4	0.09	7	1	0	0
Simazine (Fall)	0.09	0.05	8	1	0	0

Spreadsheet 2.10) Wisconsin Surface Waters 1989 - continued

Location	Sample Date	Atrazine Concn. (ug/L)	Desethyl Atrazine Concn. (ug/L)	Desisopropyl Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Propazine Concn. (ug/L)	Simazine Concn. (ug/L)
PRE-APPLICATION							
Root River at Racine	3/22/89	0.08	0.05	0.05	0.20	0.05	0.05
Prairie River nr Merrill	5/5/89	0.05	0.05	0.05	0.20	0.05	0.05
Grant River near Burton	3/23/89	0.32	0.12	0.05	0.20	0.05	0.05
Rock River at Afton	4/12/89	0.34	0.11	0.05	0.20	0.05	0.05
POST-APPLLICATION							
Root River at Racine	7/10/89	0.88	0.16	0.05	0.61	0.05	0.05
St. Croix R., St. Croix Falls	5/31/89	0.14	0.05	0.05	0.20	0.05	0.05
Trempealeau R. at Dodge	5/30/89		0.84	0.69		0.37	0.4
Black River nr Galesville	5/30/89		0.11	0.05	0.94	0.05	0.05
Wisconsin R. at Muscada	6/2/89	0.65	0.06	0.05	0.20	0.05	0.05
Grant River near Burton	5/31/89	1.70	0.2	0.09	0.61	0.05	0.05
Rock River at Afton	7/19/89	0.51	0.19	0.05	0.20	0.05	0.05
Pecatonic R. at Martintown	7/19/89	0.11	0.14	0.05	0.20	0.05	0.05
FALL							
Root River at Racine	11/3/89	0.11	0.09	0.05	0.20	0.05	0.09
St. Croix R., St. Croix Falls	10/11/89	0.05	0.05	0.05	0.20	0.05	0.05
Trempealeau R. at Dodge	10/17/89	0.15	0.05	0.05	0.20	0.05	0.05
Black River nr Galesville	10/18/89	0.05	0.05	0.05	0.20	0.05	0.05
Prairie River nr Merrill	10/23/89	0.05	0.05	0.05	0.20	0.05	0.05
Wisconsin R. at Muscada	10/5/89	0.21	0.05	0.05	0.20	0.05	0.05
Grant River near Burton	11/2/89	0.15	0.13	0.05	0.20	0.05	0.05
Pecatonic R. at Martintown	10/31/89	0.14	0.17	0.05	0.20	0.05	0.05
Fox River at Waukesha	11/3/89	0.12	0.11	0.05	0.20	0.05	0.05

STUDY 3: **Goolsby DA, Coup RC, and Markovchick DJ. 1991. Distribution of selected herbicides and nitrate in the Mississippi River and its major tributaries, April through June 1991. U.S. Geological Survey. Water Resources Investigations Report 91-4163.**

3.1) Locations Sampled:

Eight locations were sampled (Figure 3.1 from Figure 1 of the study report). One location was near the outflow of the lower Mississippi R. to the Gulf of Mexico (Baton Rouge, LA). Three locations were near the outflow of the 3 major tributaries to the lower Mississippi River (the upper Mississippi R. at Thebes IL, the Missouri R. at Hermann MO, and the Ohio R. at Grand Chain IL). The upper Mississippi R. was also sampled at Clinton, Iowa. The remaining 3 locations were on tributaries to the upper Mississippi R. (the Illinois R. at Valley City, IL), to the Missouri R. (the Platte R. at Louisville, NE), and to the Wabash R. which discharges to the Ohio R. (the White R. at Hazelton, IN).

Drainage areas above the sampling locations ranged from 11,305 sq. mi. for the White R. at Hazelton, IN to 1,125,000 sq. mi. for the lower Mississippi R. at Baton Rouge.

3.2) Sampling Times:

Sampling was begun in early April 1991 and will continue for one year. Samples were collected at each location weekly during April and biweekly during May, June, and July. Samples will be collected weekly during other months. This USGS report contains the results of the analyses of samples collected in April, May, and June 1991. Results for samples collected thereafter through March 1992 will be published by USGS in a subsequent report.

3.3) Sampling Methodology:

Samples were collected in glass containers at either 5 equal discharge increments or 5 equal width increments across the river at each sampling site using depth integrating samplers. Samples collected at each of the 5 increments across the river were composited, filtered through 0.7 um glass fiber filters and chilled prior to shipping to the USGS lab in Arvada, CO.

3.4) Analytical Methodology:

The water samples were extracted with reverse phase C-18 columns, eluted from the C-18 columns with hexane-isopropanol (3:1), and analyzed 5 herbicides including atrazine by capillary column GC/MS. A few samples split in the field were extracted with methylene chloride and then analyzed by GC with dual nitrogen-phosphorous detectors.

3.5) Results:

The results of the analyses of the April, May, and June 1991 samples reported by USGS for atrazine and 4 other herbicides are presented in Surface Water Appendix Tables 3.1 through 3.8 (from Table 3 of the study report) for each of the 8 sites from which samples were collected. Statistical summaries are provided in Surface Water Appendix Table 3.9 (from Table 4 of the study report). The results of the analyses of July 1991 through March 1992 samples will be published in a later USGS report.

Under Phase II of the Drinking Water Regulations, water supply systems will be required to collect a minimum of 4 finished water samples a year, one per quarter. A water supply system will be considered out of compliance if the annual mean concentration of a regulated pesticide in the 4 quartely samples exceeds the MCL for the pesticide. If the pesticide concentration exceeds 4 times the MCL in any individual sample, the annual mean will obviously exceed the MCL if only the minimum number of samples is collected (4 per year; 1 per quarter).

Concentrations of pesticides were compared to 4 times their MCL (or 4 times their lifetime drinking water HA if a MCL was not available). The April or May to June arithmetic mean concentrations of pesticides (the longest available means) were compared to their MCLs (or their lifetime drinking water HA if a MCL was not available). Annual means are more appropriate for comparison to the MCLs because of the Phase II regulations, but could not be computed because samples were collected only from April or May through June. It should be noted that the ratios of April-June or May-June means to MCLs are probably generally substantially greater than the ratios of annual means to MCLs.

Maximum observed concentrations, overall arithmetic mean concentrations, concentration distributions, ratios of concentrations to 4 times the MCL (or 4 times the lifetime drinking water HA), and ratios of overall (April to June or May to June) arithmetic mean concentrations to the MCL (or lifetime drinking water HA) of the triazines (atrazine, cyanazine, and simazine) in the raw water samples collected from each of the 8 locations sampled are presented in EFGWB Spreadsheets 3.1 through 3.8. and are summarized in Table 3.1. Concentrations greater than the MCL (or lifetime HA), ratios of concentrations to 4 times the MCL (or to 4 times the lifetime HA) greater than 1, and ratios of overall arithmetic meams to the MCL (or to the lifetime HA) greater than 1 are shaded in the spreadsheets.

Maximum observed concentrations, overall arithmetic mean concentrations, and concentration distributions from the spreadsheets are summarized in Table 3.1. The concentration distributions were computed with respect to the detection limit, 1 ug/L, the MCL (or lifetime drinking water HA if a MCL is not available), and 4 times the MCL (or 4 times the lifetime drinking water HA).

3.5.2 Cyanazine

Cyanazine was detected at greater than 0.20 ug/L (the detection limit) in 73.9% of the 146 samples Cyanazine concentrations exceeded 1 ug/L in 39.7% of the samples collected, but none exceeded 10 ug/L (the lifetime drinking water HA). The overall cyanazine concentration distribution for the 146 samples was as follows :

$C \leq 0.20$ ug/L (26.0%; 38/146)
0.20 ug/L $< C \leq 1.0$ ug/L (34.2%; 50/146)
1.0 ug/L $< C \leq 10$ ug/L (39.7%; 58/146)
10 ug/L $< C \leq 40$ ug/L (0.0%; 0/146)
$C > 40$ ug/L (0.0%; 0/146)

The highest cyanazine concentrations reported in the 146 samples were 4.40 ug/L on 5/28/91 in the White River at Hazelton, IN; 6.60 ug/L on 5/19/91 and 5.60 ug/L on 5/8/91 in the Illinois River at Valley City, IL; 7.30 ug/L on 6/7/91, 7.00 ug/L on 5/31/91, and 6.80 ug/L on 5/21/91 in the Platte River at Louisville, NE; and 4.70 ug/L on 6/13/91 and 4.30 ug/L on 6/1/91 in the Missouri River at Hermann, MO.

The highest overall (April to June or May to June) arithmetic mean cyanazine concentrations were 2.18 ug/L in the Illinois River at Valley City, 1.99 ug/L in the Platte River at Louisville, 1.52 ug/L in the Missouri River at Hermann, and 1.41 ug/L in the Mississippi River at Thebes.

3.5.3 Simazine

Simazine was detected at greater than 0.05 ug/L (the detection limit) in 42.5% of the 146 samples collected during April-June 1991 at the 8 sites sampled, but none of the concentrations exceeded 1 ug/L (the MCL).

The highest simazine concentrations reported in the 146 samples were 0.72 ug/L on 5/30/91, 0.58 ug/L on 6/3/91, 0.51 ug/L on 5/28/91, and 0.45 ug/L on 6/13/91 in the White River at Hazelton, IN; and 0.40 ug/L on 5/21/91 in the Ohio River near Grand Chain, IL.

The highest monthly arithmetic mean simazine concentrations were 0.26 ug/L for May and 0.33 ug/L for June in the White River at Hazelton, IN; and 0.15 ug/L for May and 0.11 ug/L for June in the Ohio River near Grand Chain, IL.

3.6) Comments:

The study authors pointed out the following:

(1) QA/QC data included:

(a) field and laboratory blanks to determine contamination during sampling, shipping, storage, and analysis.

(b) field and laboratory spikes to determine storage stability and accuracy

(c) analyses of split samples by different methods.

(2) The highest atrazine concentrations and steepest rates of increase in atrazine concentrations occurred in the smallest tributaries (White R., Platte R., and Illinois R.) where atrazine concentrations started to increase in early May, peak in late May to early June, and then decrease to slightly above April levels in late June (Figure 3.4 from Figure 4 of the study report).

(3) In the larger tributaries (Missouri R. and Ohio R.), in the upper Mississippi R. at Thebes IL, and in the lower Mississippi R. at Baton Rouge, peak atrazine concentrations were lower than for the small tributaries as were the rates of increase in the atrazine concentration (Figures 3.4 and 3.5 from Figures 5 and 6 of the study report). In addition, peak atrazine concentrations occurred at later dates (mid-June for the Missouri River at Hermann MO, the Ohio River at Grand Chain IL, and the upper Mississippi at Thebes IL; late June for the lower Mississippi River at Baton Rouge, LA).

(4) The temporal patterns for cyanazine were comparable to those of atrazine.

(5) Based upon atrazine concentrations and streamflows, the study authors estimated that 517,000 pounds of atrazine flowed past Baton Rouge into the Gulf of Mexico during April-June 1991. They estimated the following contributions to that load:

	% of load	drainage area
Mississippi R. basin above Clinton, IA	4.8	85,600
Miss. R. basin Clinton to Missouri R.	36.7	103,600
Missouri R. basin	25.4	524,000
Ohio River basin	18.5	203,100
Undetermined	14.6	208,700

Table 3.1) The maximums, arithmetic means, and concentration distributions of atrazine, cyanazine, and simazine with respect to their detection limits (0.05 ug/L, 0.20 ug/L, 0.05 ug/L), 1 ug/L, their MCLs or lifetime drinking water HAs (3 ug/L, 10 ug/L, 1 ug/L), and 4 times their MCL or lifetime drinking water HA (12 ug/L, 40 ug/L, 4 ug/L) for each of 8 Mississippi Basin sampling locations in April through June 1991. Data from Goolsby, Coupe, and Markovchick (1991; USGS).

Sampling Location	Atrazine Maximum (ug/L)	Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
White R. at Hazelton, IN	9.20	3.73	0	4	4	9	0
Ohio R. nr Grand Chain, IL	2.10	0.90	0	7	5	0	0
Mississippi R. at Clinton, IA	1.60	0.44	0	19	2	0	0
Illinois River at Valley City, I	6.30	3.31	0	3	6	9	0
Platte River at Louisville, NE	8.30	3.15	0	7	5	8	0
Missouri R. at Hermann, MO	5.70	3.00	0	1	9	9	0
Mississippi R. at Thebes, IL	4.20	2.27	0	4	9	6	0
Mississippi R. at Baton Rouge, L	3.60	1.32	0	9	10	1	0
Atrazine Over All Sites	9.2	2.27	0 (0.0%)	54 (37.0%)	50 (34.2%)	42 (28.8%)	0 (0.0%)

Sampling Location	Cyanazine Maximum (ug/L)	Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.2	0.2<C<1	1<C<10	10<C<40	C>40
White R. at Hazelton, IN	4.40	1.19	3	7	7	0	0
Ohio R. nr Grand Chain, IL	0.70	0.33	6	6	0	0	0
Mississippi R. at Clinton, IA	1.20	0.36	13	7	1	0	0
Illinois River at Valley City, I	6.60	2.18	1	3	14	0	0
Platte River at Louisville, NE	7.30	1.99	6	4	10	0	0
Missouri R. at Hermann, MO	4.70	1.52	1	8	10	0	0
Mississippi R. at Thebes, IL	3.10	1.41	2	5	12	0	0
Mississippi R. at Baton Rouge, L	1.80	0.64	6	10	4	0	0
Cyanazine Over All Sites	7.30	1.20	38 (26.0%)	50 (34.2%)	58 (39.7%)	0 (0.0%)	0 (0.0%)

Sampling Location	Simazine Maximum (ug/L)	Ar. Mean (ug/L)	Simazine Concentration Distribution C<0.05	0.05<C<1	1<C<4	C>4
White R. at Hazelton, IN	0.72	0.29	1	16	0	0
Ohio R. nr Grand Chain, IL	0.40	0.11	3	9	0	0
Mississippi R. at Clinton, IA	0.11	0.05	18	3	0	0
Illinois River at Valley City, I	0.14	0.08	5	13	0	0
Platte River at Louisville, NE	0.07	0.05	15	5	0	0
Missouri R. at Hermann, MO	0.09	0.06	14	5	0	0
Mississippi R. at Thebes, IL	0.10	0.05	17	2	0	0
Mississippi R. at Baton Rouge, L	0.11	0.07	11	9	0	0
Simazine Over All Sites	0.72	0.10	84 (57.5%)	62 (42.5%)	0 (0.0%)	0 (0.0%)

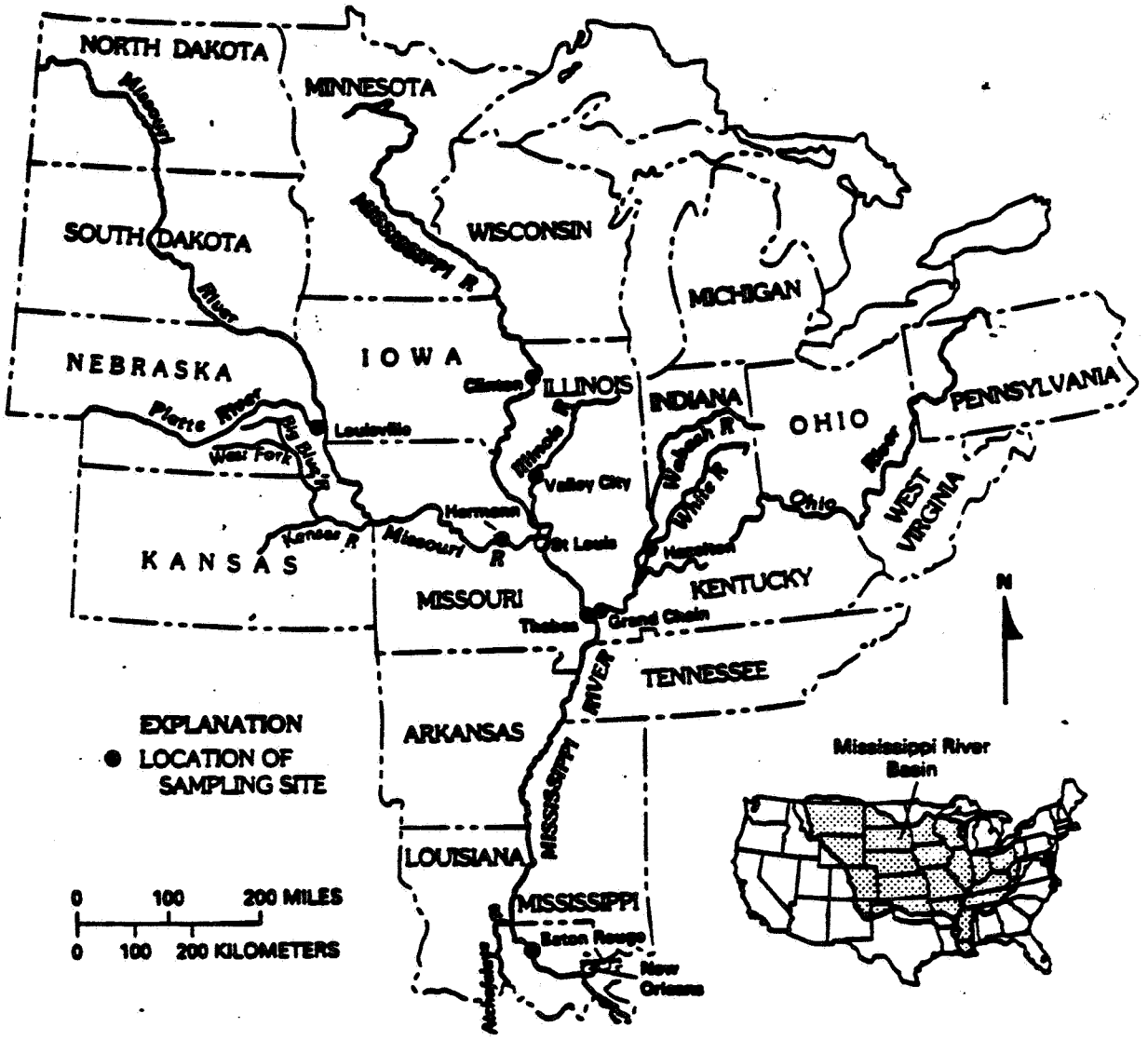


Figure 3.1-Location of sampling sites.

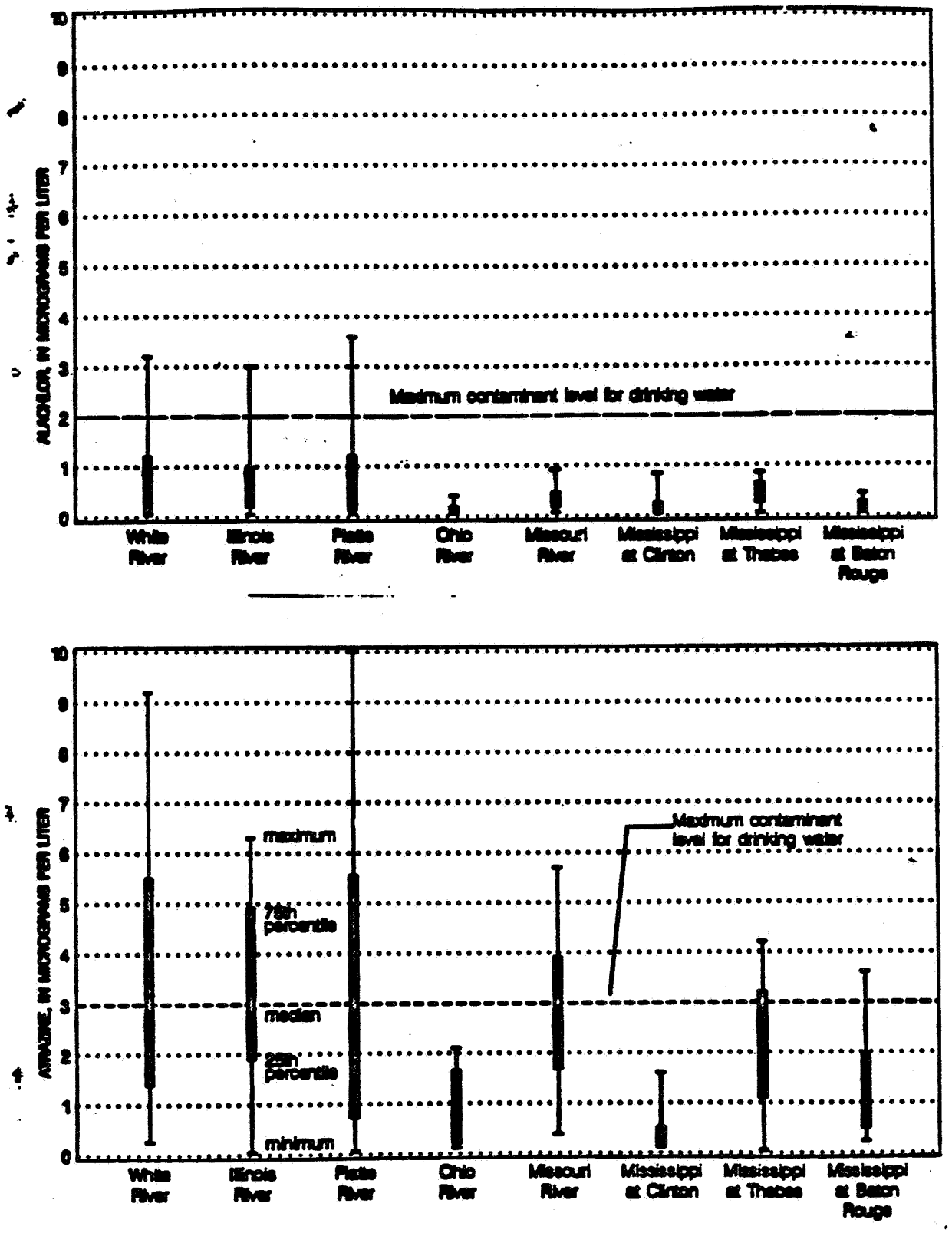


Figure 2.–Boxplots of alachlor and atrazine concentrations arranged by downstream order for 3.2 samples collected in April, May, and June 1991.

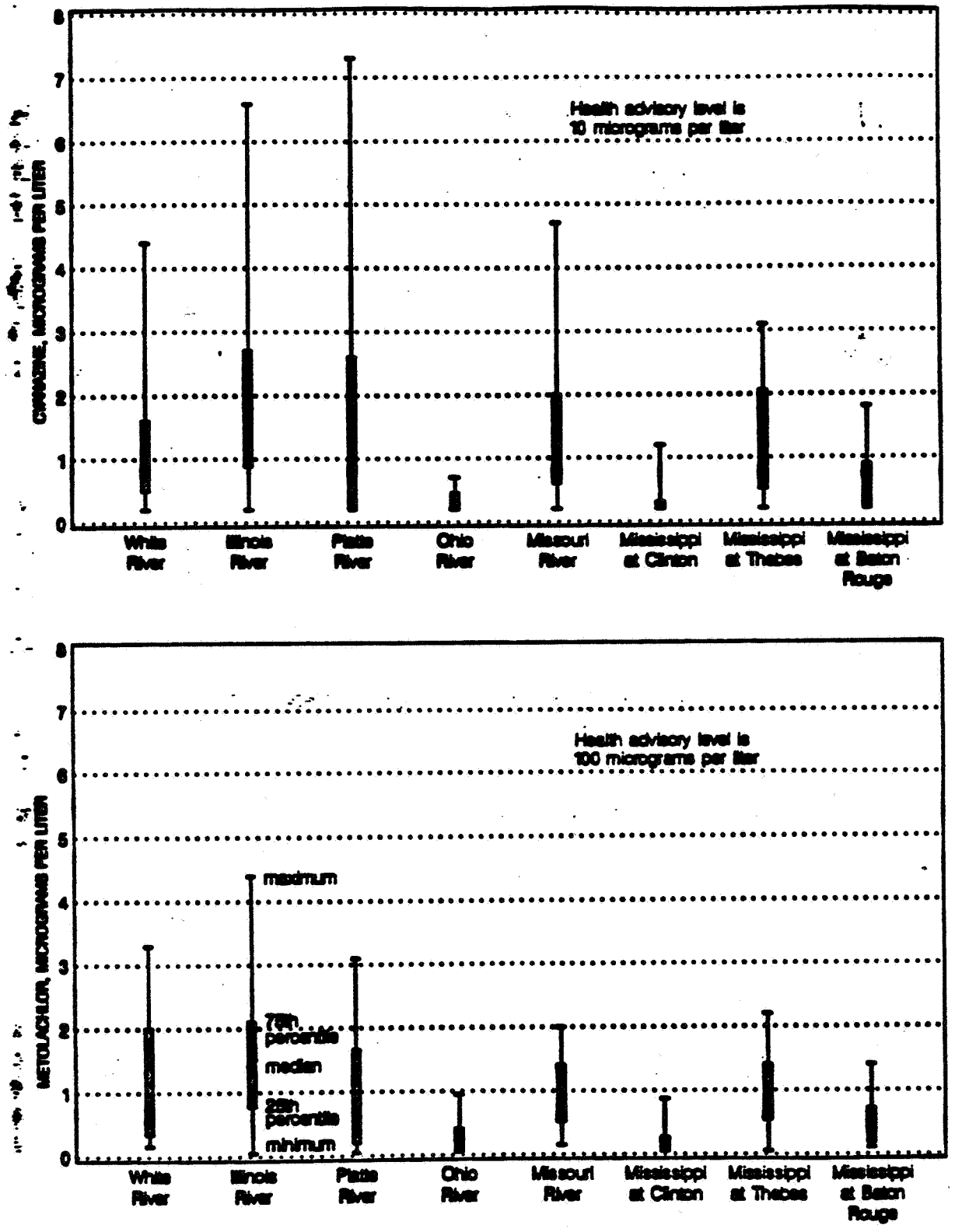


Figure 8.–Boxplots of cyanazine and metolachlor concentrations arranged by downstream order for samples collected in April, May, and June 1991.

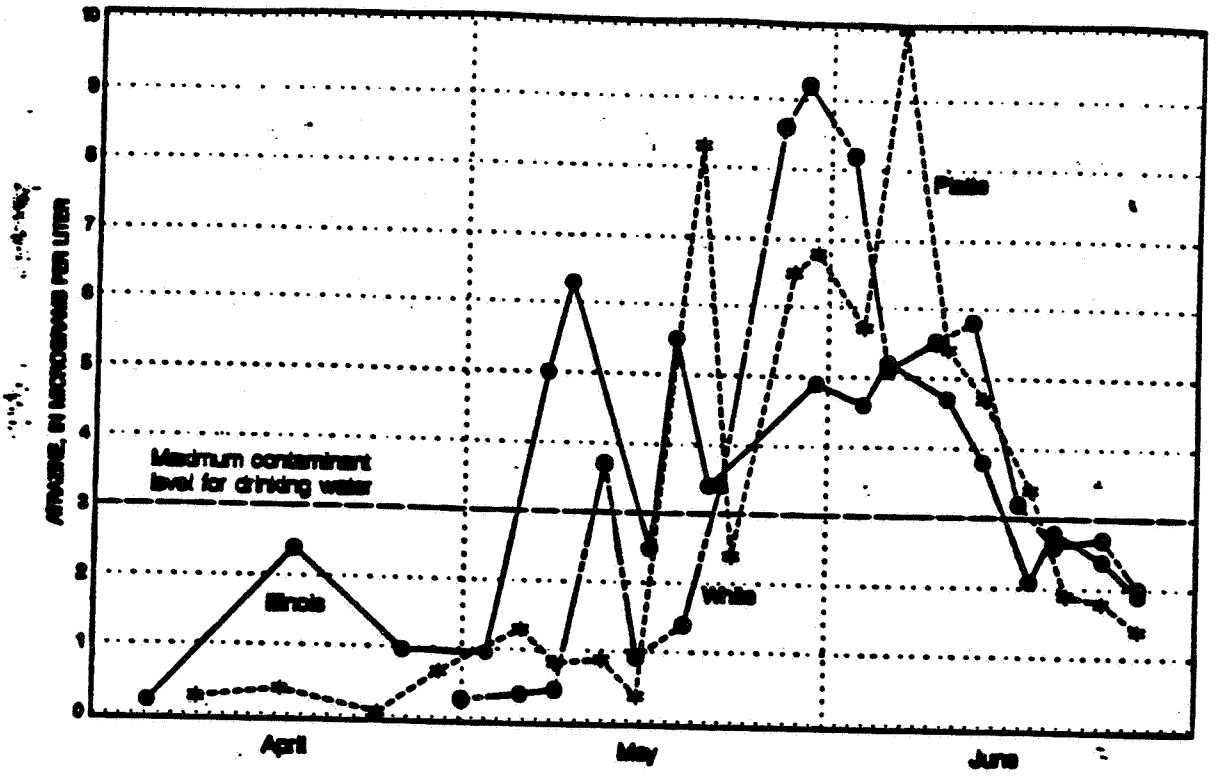


Figure 4.–Time-series plots of atrazine concentrations in the Illinois River at Valley City, Ill., Platte River at Louisville, Nebr., and White River at Hazelton, Ind., April through June 1991.

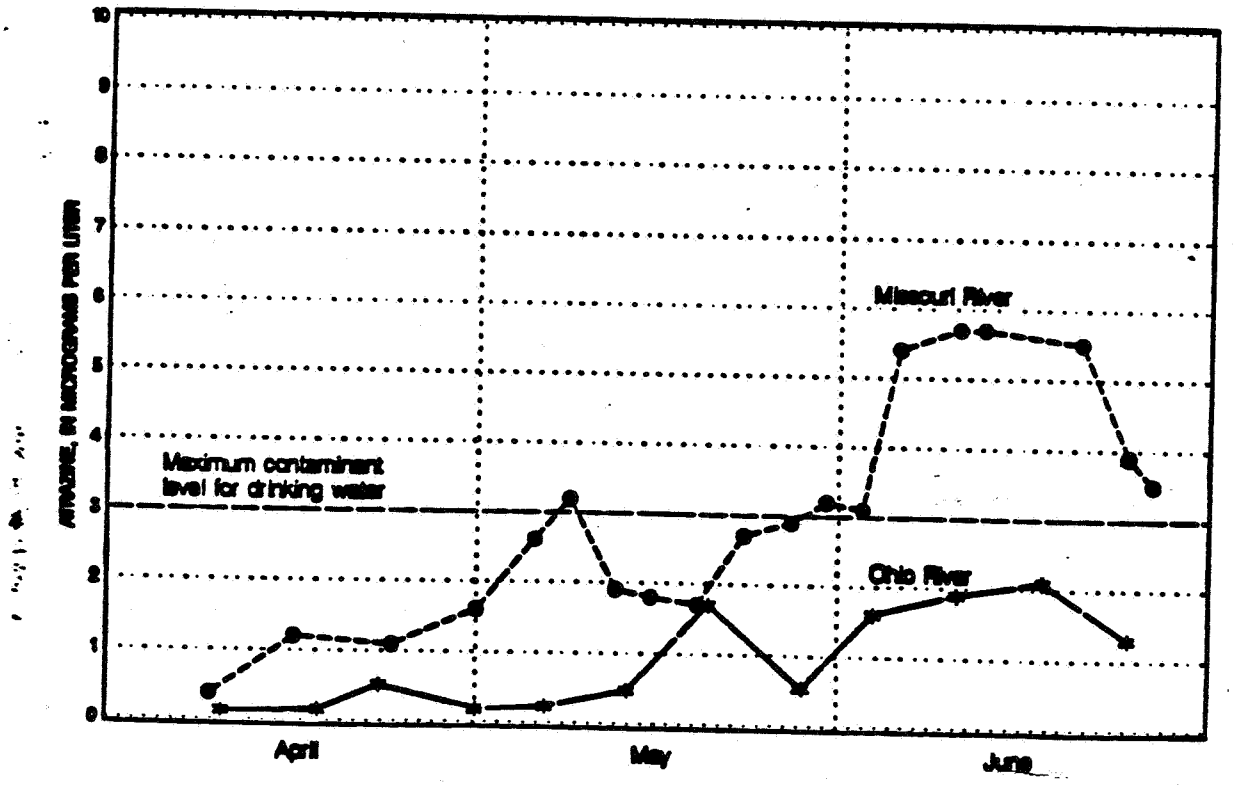


Figure 5.–Time-series plots of atrazine concentrations in the Missouri River at Hermann, Mo., and the Ohio River at Grand Chain, Ill., April through June 1991.

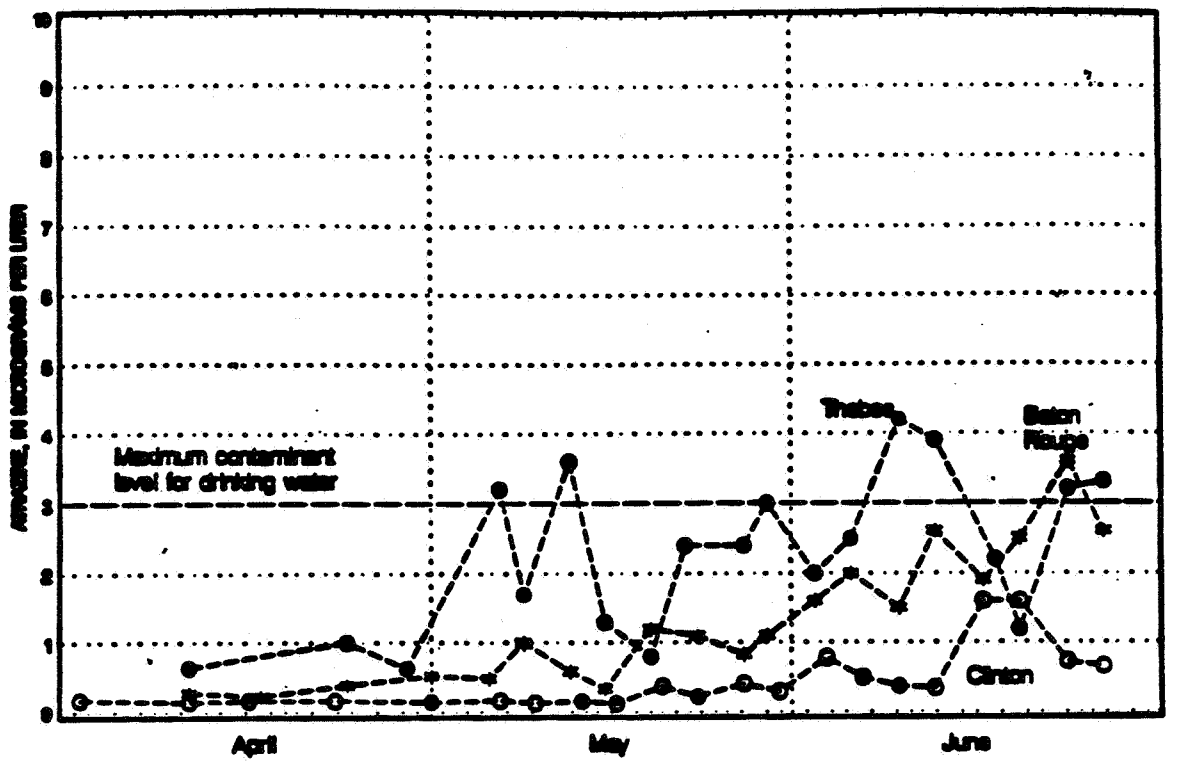


Figure 6.—Time-series plots of atrazine concentrations in the Mississippi River at Clinton, Iowa, Thebes, Ill., and Baton Rouge, La., April through June 1991.

An even smaller and more gradual increase in herbicide concentrations was measured on the Mississippi River main stem at the Thebes and Baton Rouge sites (fig. 6) than was measured on most tributaries. The increase in concentration at the Thebes site results from inflow to the Mississippi River from the Missouri River and streams draining from Iowa and Illinois. The concentrations at Baton Rouge result from inflow from the entire upper Mississippi River basin as measured by the Thebes site, inflow from the Ohio River, and to a small extent inflow from tributaries that enter the Mississippi below the Ohio River. The peak concentrations at Baton Rouge occurred 10 to 14 days later than at Thebes (fig. 6), which is the approximate travel time for this reach of the river (about 760 river miles).

Generally, the concentrations of herbicides began to decrease by mid-June, which is consistent with findings reported by Thurman and others (1991). It is also consistent with the concept of an annual cycle of increasing herbicide concentrations in streams after application and a subsequent decrease in concentrations as a result of chemical and biological degradation, sorption, transport in storm runoff, volatilization, and other processes.

Spreadsheet 3.1) White River at Hazelton, IN

Atrazine Maximum (ug/L)	5/1-6/27 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
9.20	3.73	0	4	4	9	0

Cyanazine Maximum (ug/L)	5/1-6/27 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.2	0.2<C<1	1<C<10	10<C<40	C>40
4.40	1.19	3	7	7	0	0

Simazine Maximum (ug/L)	5/1-6/27 Ar. Mean (ug/L)	Simazine Concentration Distribution C<0.05	0.05<C<1	1<C<4	C>4
0.72	0.29	1	16	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Simazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X HA (40 ug/L)	Simazine Concn./ 4 X MCL (4 ug/L)
5/1/91	0.26	0.02	0.05	0.02	0.00	0.01
5/6/91	0.35	0.02	0.07	0.03	0.00	0.02
5/9/91	0.42	0.20	0.06	0.04	0.01	0.02
5/13/91	[illegible]	0.70	0.33	0.31	0.02	0.08
5/16/91	0.91	0.60	0.12	0.08	0.02	0.03
5/20/91	1.40	0.70	0.14	0.12	0.02	0.04
5/23/91	[illegible]	1.40	0.30	0.28	0.04	0.08
5/28/91	[illegible]	4.40	0.51	0.72	0.11	0.13
5/30/91	[illegible]	2.80	0.72	0.77	0.07	0.18
6/3/91	[illegible]	2.10	0.58	0.68	0.05	0.15
6/6/91	[illegible]	1.30	0.38	0.43	0.03	0.10
6/10/91	[illegible]	2.00	0.70	0.46	0.05	0.18
6/13/91	[illegible]	1.60	0.45	0.48	0.04	0.11
6/17/91	[illegible]	0.87	0.17	0.27	0.02	0.04
6/20/91	2.60	0.50	0.10	0.22	0.01	0.03
6/24/91	2.70	0.60	0.16	0.23	0.02	0.04
6/27/91	2.00	0.50	0.12	0.17	0.01	0.03

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Simazine Arithmetic Mean (ug/L)	Atrazine M-JMean MCL (3 ug/L)	Cyanazine M-JMean/ Life HA (10 ug/L)	Simazine M-JMean/ MCL (1 ug/L)
5/1-6/27	[illegible]	1.19	0.29	[illegible]	0.12	0.29

Spreadsheet 3.2) Ohio River at Dam 53 near Grand Chain, IL

Atrazine Maximum (ug/L)	4/10-6/25 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
2.10	0.90	0	7	5	0	0

Cyanazine Maximum (ug/L)	4/10-6/25 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.2	0.2<C<1	1<C<10	10<C<40	C>40
0.70	0.33	6	6	0	0	0

Simazine Maximum (ug/L)	4/10-6/25 Ar. Mean (ug/L)	Simazine Concentration Distribution C<0.05	0.05<C<1	1<C<4	C>4
0.40	0.11	3	9	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Simazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X HA (40 ug/L)	Simazine Concn./ 4 X MCL (4 ug/L)
4/10/91	0.12	0.20	0.06	0.01	0.01	0.02
4/18/91	0.15	0.20	0.05	0.01	0.01	0.01
4/23/91	0.51	0.21	0.07	0.04	0.01	0.02
5/1/91	0.18	0.20	0.05	0.02	0.01	0.01
5/7/91	0.23	0.20	0.08	0.02	0.01	0.02
5/14/91	0.47	0.20	0.16	0.04	0.01	0.04
5/21/91	1.70	0.40	0.40	0.14	0.01	0.10
5/29/91	0.54	0.20	0.05	0.05	0.01	0.01
6/4/91	1.60	0.50	0.12	0.13	0.01	0.03
6/11/91	1.90	0.50	0.07	0.16	0.01	0.02
6/18/91	2.10	0.70	0.12	0.18	0.02	0.03
6/25/91	1.30	0.40	0.11	0.11	0.01	0.03

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Simazine Arithmetic Mean (ug/L)	Atrazine A-JMean/ MCL (3 ug/L)	Cyanazine A-JMean/ Life HA (10 ug/L)	Simazine A-JMean/ MCL (1 ug/L)
4/10-6/25	0.9	0.33	0.11	0.30	0.03	0.11

Spreadsheet 3.3) Mississippi R. at Clinton, IA

Atrazine Maximum (ug/L)	4/2-6/27 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
1.60	0.44	0	19	2	0	0

Cyanazine Maximum (ug/L)	4/2-6/27 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.2	0.2<C<1	1<C<10	10<C<40	C>40
1.20	0.36	13	7	1	0	0

Simazine Maximum (ug/L)	4/2-6/27 Ar. Mean (ug/L)	Simazine Concentration Distribution C<0.05	0.05<C<1	1<C<4	C>4
0.11	0.05	18	3	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Simazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X HA (40 ug/L)	Simazine Concn./ 4 X MCL (4 ug/L)
4/2/91	0.18	0.20	0.05	0.02	0.01	0.01
4/11/91	0.15	0.20	0.05	0.01	0.01	0.01
4/16/91	0.17	0.20	0.05	0.01	0.01	0.01
4/23/91	0.17	0.20	0.05	0.01	0.01	0.01
5/1/91	0.15	0.20	0.05	0.01	0.01	0.01
5/7/91	0.17	0.20	0.05	0.01	0.01	0.01
5/10/91	0.13	0.20	0.05	0.01	0.01	0.01
5/14/91	0.16	0.20	0.05	0.01	0.01	0.01
5/17/91	0.12	0.20	0.05	0.01	0.01	0.01
5/21/91	0.37	0.20	0.05	0.03	0.01	0.01
5/24/91	0.22	0.20	0.05	0.02	0.01	0.01
5/28/91	0.41	0.30	0.05	0.03	0.01	0.01
5/31/91	0.29	0.20	0.05	0.02	0.01	0.01
6/4/91	0.78	0.30	0.11	0.07	0.01	0.03
6/7/91	0.50	0.30	0.05	0.04	0.01	0.01
6/10/91	0.37	0.20	0.05	0.03	0.01	0.01
6/13/91	0.35	0.30	0.05	0.03	0.01	0.01
6/17/91	1.60	0.94	0.06	0.13	0.02	0.02
6/20/91	1.60	0.82	0.06	0.13	0.02	0.02
6/24/91	0.73	0.78	0.05	0.06	0.02	0.01
6/27/91	0.66	1.20	0.05	0.06	0.03	0.01

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Simazine Arithmetic Mean (ug/L)	Atrazine A-JMean/ MCL (3 ug/L)	Cyanazine A-JMean/ Life HA (10 ug/L)	Simazine A-JMean/ MCL (1 ug/L)
4/2-6/27	0.44	0.36	0.05	0.15	0.04	0.05

Spreadsheet 3.4) Illinois River at Valley City, IL

Atrazine Maximum (ug/L)	4/5-6/27 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
6.30	3.31	0	3	6	9	0

Cyanazine Maximum (ug/L)	4/5-6/27 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.2	0.2<C<1	1<C<10	10<C<40	C>40
6.60	2.18	1	3	14	0	0

Simazine Maximum (ug/L)	4/5-6/27 Ar. Mean (ug/L)	Simazine Concentration Distribution C<0.05	0.05<C<1	1<C<4	C>4
0.14	0.08	5	13	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Simazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X HA (40 ug/L)	Simazine Concn./ 4 X MCL (4 ug/L)
4/5/91	0.18	0.20	0.06	0.02	0.01	0.02
4/17/91	2.40	1.30	0.05	0.20	0.03	0.01
4/26/91	0.96	0.70	0.05	0.08	0.02	0.01
5/3/91	0.95	1.10	0.05	0.08	0.03	0.01
5/8/91	[illegible]	5.60	0.06	0.42	0.14	0.02
5/10/91	[illegible]	2.90	0.14	0.53	0.07	0.04
5/17/91	2.50	2.50	0.05	0.21	0.06	0.01
5/19/91	[illegible]	6.60	0.07	0.46	0.17	0.02
5/22/91	[illegible]	2.90	0.05	0.28	0.07	0.01
5/31/91	[illegible]	2.50	0.07	0.41	0.06	0.02
6/4/91	[illegible]	2.70	0.09	0.38	0.07	0.02
6/6/91	[illegible]	2.00	0.09	0.43	0.05	0.02
6/11/91	[illegible]	1.80	0.14	0.39	0.05	0.04
6/14/91	[illegible]	2.00	0.12	0.32	0.05	0.03
6/18/91	2.10	0.90	0.07	0.18	0.02	0.02
6/20/91	2.80	1.40	0.12	0.23	0.04	0.03
6/24/91	2.40	1.40	0.09	0.20	0.04	0.02
6/27/91	1.90	0.80	0.07	0.16	0.02	0.02

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Simazine Arithmetic Mean (ug/L)	Atrazine A-JMean/ MCL (3 ug/L)	Cyanazine A-JMean/ Life HA (10 ug/L)	Simazine A-JMean/ MCL (1 ug/L)
4/5-6/27	[illegible]	2.18	0.08	[illegible]	0.22	0.08

Speadsheet 3.5) Platte River at Louisville, NE

Atrazine Maximum (ug/L)	4/9-6/27 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
8.30	3.15	0	7	5	8	0

Cyanazine Maximum (ug/L)	4/9-6/27 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.2	0.2<C<1	1<C<10	10<C<40	C>40
7.30	1.99	6	4	10	0	0

Simazine Maximum (ug/L)	4/9-6/27 Ar. Mean (ug/L)	Simazine Concentration Distribution C<0.05	0.05<C<1	1<C<4	C>4
0.07	0.05	15	5	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Simazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X HA (40 ug/L)	Simazine Concn./ 4 X MCL (4 ug/L)
4/9/91	0.25	0.20	0.05	0.02	0.01	0.01
4/16/91	0.37	0.20	0.05	0.03	0.01	0.01
4/24/91	0.06	0.20	0.05	0.01	0.01	0.01
4/29/91	0.66	0.20	0.05	0.06	0.01	0.01
5/6/91	1.30	0.38	0.05	0.11	0.01	0.01
5/9/91	0.81	0.20	0.09	0.07	0.01	0.02
5/13/91	0.87	0.20	0.05	0.07	0.01	0.01
5/16/91	0.35	0.40	0.05	0.03	0.01	0.01
5/21/91	[illegible]	6.80	0.05	0.69	0.17	0.01
5/24/91	2.40	1.40	0.05	0.20	0.04	0.01
5/29/91	[illegible]	1.70	0.07	0.54	0.04	0.02
5/31/91	[illegible]	7.00	0.06	0.57	0.18	0.02
6/4/91	[illegible]	3.70	0.06	0.48	0.09	0.02
6/7/91	[illegible]	7.30	0.06	0.83	0.18	0.02
6/11/91	[illegible]	2.00	0.05	0.45	0.05	0.01
6/14/91	[illegible]	1.90	0.05	0.39	0.05	0.01
6/18/91	[illegible]	3.20	0.05	0.28	0.08	0.01
6/21/91	1.90	1.30	0.05	0.16	0.03	0.01
6/24/91	1.80	0.70	0.05	0.15	0.02	0.01
6/27/91	1.40	0.90	0.05	0.12	0.02	0.01

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Simazine Arithmetic Mean (ug/L)	Atrazine A-JMean/ MCL (3 ug/L)	Cyanazine A-JMean/ Life HA (10 ug/L)	Simazine A-JMean/ MCL (1 ug/L)
4/9-6/27	[illegible]	1.99	0.05	[illegible]	0.20	0.05

Speadsheet 3.6) Missouri R. at Hermann, MO

Atrazine Maximum (ug/L)	4/9-6/27 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
5.70	3.00	0	1	9	9	0

Cyanazine Maximum (ug/L)	4/9-6/27 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.2	0.2<C<1	1<C<10	10<C<40	C>40
4.70	1.52	1	8	10	0	0

Simazine Maximum (ug/L)	4/9-6/27 Ar. Mean (ug/L)	Simazine Concentration Distribution C<0.05	0.05<C<1	1<C<4	C>4
0.09	0.06	14	5	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Simazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X HA (40 ug/L)	Simazine Concn./ 4 X MCL (4 ug/L)
4/9/91	0.37	0.20	0.05	0.03	0.01	0.01
4/16/91	1.20	0.60	0.05	0.10	0.02	0.01
4/24/91	1.10	0.45	0.05	0.09	0.01	0.01
5/1/91	1.60	0.70	0.05	0.13	0.02	0.01
5/6/91	2.60	1.50	0.05	0.22	0.04	0.01
5/9/91	[illegible]	0.80	0.09	0.27	0.02	0.02
5/13/91	1.90	0.60	0.07	0.16	0.02	0.02
5/16/91	1.80	0.50	0.05	0.15	0.01	0.01
5/20/91	1.70	0.70	0.05	0.14	0.02	0.01
5/24/91	2.70	2.10	0.05	0.23	0.05	0.01
5/28/91	2.90	1.60	0.05	0.24	0.04	0.01
5/31/91	[illegible]	2.00	0.05	0.27	0.05	0.01
6/3/91	[illegible]	1.60	0.05	0.26	0.04	0.01
6/6/91	[illegible]	2.00	0.05	0.45	0.05	0.01
6/11/91	[illegible]	4.30	0.08	0.48	0.11	0.02
6/13/91	[illegible]	4.70	0.06	0.48	0.12	0.02
6/21/91	[illegible]	1.80	0.05	0.46	0.05	0.01
6/25/91	[illegible]	2.10	0.05	0.33	0.05	0.01
6/27/91	[illegible]	0.60	0.07	0.29	0.02	0.02

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Simazine Arithmetic Mean (ug/L)	Atrazine A-JMean/ MCL (3 ug/L)	Cyanazine A-JMean/ Life HA (10 ug/L)	Simazine A-JMean/ MCL (1 ug/L)
4/9-6/27	[illegible]	1.52	0.06	[illegible]	0.15	0.06

Spreadsheet 3.7) Mississippi R. At Thebes, IL

Atrazine Maximum (ug/L)	4/9-6/27 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
4.20	2.27	0	4	9	6	0

Cyanazine Maximum (ug/L)	4/9-6/27 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.2	0.2<C<1	1<C<10	10<C<40	C>40
3.10	1.41	2	5	12	0	0

Simazine Maximum (ug/L)	4/9-6/27 Ar. Mean (ug/L)	Simazine Concentration Distribution C<0.05	0.05<C<1	1<C<4	C>4
0.10	0.05	17	2	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Simazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X HA (40 ug/L)	Simazine Concn./ 4 X MCL (4 ug/L)
4/11/91	0.64	0.20	0.05	0.05	0.01	0.01
4/24/91	1.00	0.52	0.05	0.08	0.01	0.01
4/29/91	0.63	0.40	0.05	0.05	0.01	0.01
5/7/91	[illegible]	3.10	0.05	0.27	0.08	0.01
5/9/91	1.70	1.40	0.05	0.14	0.04	0.01
5/13/91	[illegible]	1.60	0.10	0.30	0.04	0.03
5/16/91	1.30	1.00	0.05	0.11	0.03	0.01
5/20/91	0.80	0.50	0.05	0.07	0.01	0.01
5/23/91	2.40	2.30	0.05	0.20	0.06	0.01
5/28/91	2.40	2.80	0.05	0.20	0.07	0.01
5/30/91	3.00	2.50	0.05	0.25	0.06	0.01
6/3/91	2.00	1.30	0.05	0.17	0.03	0.01
6/6/91	2.50	1.30	0.05	0.21	0.03	0.01
6/10/91	[illegible]	1.80	0.05	0.35	0.05	0.01
6/13/91	[illegible]	2.30	0.05	0.33	0.06	0.01
6/18/91	2.20	1.40	0.05	0.18	0.04	0.01
6/20/91	1.20	0.50	0.05	0.10	0.01	0.01
6/24/91	[illegible]	1.80	0.05	0.27	0.05	0.01
6/27/91	[illegible]	0.06	0.08	0.28	0.00	0.02

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Simazine Arithmetic Mean (ug/L)	Atrazine A-JMean/ MCL (3 ug/L)	Cyanazine A-JMean/ Life HA (10 ug/L)	Simazine A-JMean/ MCL (1 ug/L)
4/11-6/27	2.27	1.41	0.05	0.76	0.14	0.05

Spreadsheet 3.8) Mississippi R. at Baton Rouge

Atrazine Maximum (ug/L)	4/9-6/27 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
3.60	1.32	0	9	10	1	0

Cyanazine Maximum (ug/L)	4/9-6/27 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.2	0.2<C<1	1<C<10	10<C<40	C>40
1.80	0.64	6	10	4	0	0

Simazine Maximum (ug/L)	4/9-6/27 Ar. Mean (ug/L)	Simazine Concentration Distribution C<0.05	0.05<C<1	1<C<4	C>4
0.11	0.07	11	9	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Simazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X HA (40 ug/L)	Simazine Concn./ 4 X MCL (4 ug/L)
4/11/91	0.28	0.20	0.05	0.02	0.01	0.01
4/17/91	0.23	0.20	0.05	0.02	0.01	0.01
4/24/91	0.39	0.20	0.05	0.03	0.01	0.01
5/1/91	0.52	0.30	0.05	0.04	0.01	0.01
5/6/91	0.49	0.20	0.05	0.04	0.01	0.01
5/9/91	1.00	0.21	0.10	0.08	0.01	0.03
5/13/91	0.59	0.20	0.08	0.05	0.01	0.02
5/16/91	0.34	0.20	0.05	0.03	0.01	0.01
5/20/91	1.20	0.90	0.05	0.10	0.02	0.01
5/24/91	1.10	0.60	0.05	0.09	0.02	0.01
5/28/91	0.83	0.30	0.05	0.07	0.01	0.01
5/30/91	1.10	0.40	0.09	0.09	0.01	0.02
6/3/91	1.60	0.90	0.08	0.13	0.02	0.02
6/6/91	2.00	1.10	0.08	0.17	0.03	0.02
6/10/91	1.50	0.80	0.05	0.13	0.02	0.01
6/13/91	2.60	1.20	0.11	0.22	0.03	0.03
6/17/91	1.90	0.80	0.05	0.16	0.02	0.01
6/20/91	2.50	0.88	0.07	0.21	0.02	0.02
6/24/91	[illegible]	1.80	0.08	0.30	0.05	0.02
6/27/91	2.60	1.50	0.07	0.22	0.04	0.02

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Simazine Arithmetic Mean (ug/L)	Atrazine A-JMean/ MCL (3 ug/L)	Cyanazine A-JMean/ Life HA (10 ug/L)	Simazine A-JMean/ MCL (1 ug/L)
4/11-6/27	1.32	0.64	0.07	0.44	0.06	0.07

STUDY 4: Smith RG, Triebe FM, and Baszis SR. 1987. Alachlor, atrazine, cyanazine, metolachlor, and simazine in surface water from 30 community water systems located in regions of Lasso use.

4.1) Community Water Systems Sampled:

30 community water systems which use surface water as the primary source and are located in areas of Lasso use (alachlor is the a.i. in Lasso) were sampled (7 in OH, 5 in KS, 5 in IL, 4 in MO, 3 in IA, 2 in VA, and 1 each in WI, MI, and IN; see Figure 4.1 from Figure 1 of the study report, and Table 4.1 from Table 5 of the study report).

4.2 Sampling Times:

Samples were collected daily from April through August or September at all but one site. Samples were collected an additional 8 months at the IL site because of extremely high herbicide concentrations.

4.3) Sampling Methodology:

Samples were collected daily in 500 mL bottles from finished water. Daily samples collected on 7 consecutive days were composited in a 4L bottle for shipment to the lab for analysis.

4.4 Analytical Methodology:

Herbicides were extracted from the samples by passing them down reverse phase C-18 columns. The herbicides were then eluted from the C-18 columns with 5% ethyl acetate/45% iso-octane/50% methylene chloride. The 3 mL eluates were then evaporated down to 1.5 mL and analyzed for the herbicides by capillary GC/MS. Identity confirmation was by comparison of retention times to standards and comparison of levels determined at 2 m/z values.

4.5) QA/QC Methodology:

The QA/QC program included laboratory and field blanks (to determine any contamination during sampling, shipping, storage, sample preparation and analysis), laboratory and field spikes (to determine method accuracy and storage stability), and duplicate analyses (to determine method precision). In addition, the reverse phase C-18 extraction efficiency was compared to that of the more classical methylene chloride extraction. The QA/QC results indicate that the data on the concentration of herbicides in the finished water have acceptable accuracy and precision.

4.6) Results:

The results of the 7 day composite sample analyses for atrazine, cyanazine, simazine and 2 other herbicides in the finished water of the 30 community water systems sampled and also in the raw water of the 3 systems which use activated carbon are presented in Surface Water Appendix Tables 4.1 through 4.30 (from Appendix B of the study report). Information on the water source and water treatment for each of the 30 community water systems is also presented in the Surface Water Appendix (as presented in Appendix B of the study report). The results are graphically presented by concentration vs. time plots in Surface Water Appendix Figures 4.1 through 4.30 for atrazine, in Surface Water Appendix Figures 4.31 through 4.60 for cyanazine, and Surface Water Appendix Tables 4.61 through 4.90 for simazine (all from Figures in the study report).

Under Phase II of the Drinking Water Regulations, water supply systems will be required to collect a minimum of 4 finished water samples a year, one per quarter. A water supply system will be considered out of compliance if the annual mean concentration of a regulated pesticide in the 4 quartely samples exceeds the MCL for the pesticide. If the pesticide concentration exceeds 4 times the MCL in any individual sample, the annual mean will obviously exceed the MCL if only the minimum number of samples is collected (4 per year; 1 per quarter).

Concentrations of pesticides were compared to 4 times their MCL (or 4 times their lifetime drinking water HA if a MCL was not available). The April to August or September arithmetic mean concentrations of pesticides (the longest available means) were compared to their MCLs (or their lifetime drinking water HA if a MCL was not available). Annual means are more appropriate for comparison to the MCLs because of the Phase II regulations, but could not be computed because samples were collected only from April May through August or September. It should be noted that the ratios of April-August or April-September means to MCLs are probably generally substantially greater than the ratios of annual means to MCLs.

The maximum observed concentrations, April-August or April-September arithmetic mean concentrations, concentration distributions, ratios of concentrations to 4 times the MCL (or 4 times the lifetime drinking water HA), and ratios of arithmetic means to the MCL (or lifetime drinking water HA) of the triazines (atrazine, cyanazine, simazine) in the finished water samples collected from each of the 30 community water systems sampled are presented in Spreadsheets 4.1 through 4.30. and are summarized in Tables 4.2, 4.3, and 4.4. Concentrations greater than the MCL (or lifetime drinking water HA), ratios of concentrations to 4 times the MCL (or 4 times the lifetime drinking water HA) greater than 1, and ratios of arithmetic means to the MCL (or lifetime drinking water HA) greater than 1 are shaded in the spreadsheets.

Maximum concentrations, overall arithmetic mean concentrations, and concentration distributions from the spreadsheets are summarized in Tables 4.2, 4.3, and 4.4 for atrazine, cyanazine, and simazine, respectively. The concentration distributions were computed with respect to the detection limit, 1 ug/L, the MCL (or lifetime drinking water HA if a MCL is not available), and 4 times the MCL (or 4 times the lifetime drinking water HA).

4.6.1 Atrazine

Atrazine was detected at > 0.20 ug/L (the detection limit) in 80.3% (545/678) of the samples collected during April-August or April-September 1986 from the finished water of the 30 community water systems sampled. Atrazine was detected at greater than the 3 ug/L (the MCL) in 28.9% (196/678) of the samples collected from 16 of the 30 systems and at greater than 12 ug/L (4 times the MCL) in 2.5% of the samples (17/678) from 4 of the 30 systems. The overall atrazine concentration distribution for the 678 samples collected from 30 systems was as follows :

$C \leq 0.2$ ug/L (19.7%; 133/678))
0.2 ug/L $< C \leq 1.0$ ug/L (25.1%; 170/678)
1.0 ug/L $< C \leq 3.0$ ug/L (26.5%; 179/678)
3.0 ug/L $< C \leq 12$ ug/L (26.5%; 179/678 over 16 systems
$C \geq 12$ ug/L (2.5%; 17/678 over samples over 2 locations)

The highest peak atrazine concentrations reported in the 7 day composite samples were 22.5 ug/L and 21.5 ug/L on 5/7/86, 21.2 ug/L and 21.0 ug/L on 5/21/86, and 20.5 ug/L on 5/14/86 all in the finished water of the Jacksonville, IL Community Water System. Other community water systems with at least one atrazine concentration $\geq$ 12 ug/L (4 times the MCL) were Calendonia, OH; Columbus OH; Fort Wayne, IN; and Shipman, IL.

Community water systems with April-August 1986 or April-September 1986 atrazine arithmetic mean concentrations (in 7 day composite samples) $\geq$ 3 ug/L (the MCL) were Jacksonville,IL (8.90 ug/L); Pomona Lake, KS (5.49 ug/L); Columbus, OH (5.16 ug/L); Sabetha, KS (3.7 ug/L); Fort Wayne, IN (3.4 ug/L); Bowling Green, OH (3.11 ug/L); and Jefferson Co., KS (3.04 ug/L). The Shipman, IL Community Water System had an April 1986-April 1987 atrazine arithmetic mean of 6.04 ug/L.

4.6.2 Cyanazine

Cyanazine was detected at > 0.20 ug/L (the detection limit) in 34.9% (237/678) of the samples collected during April-August or April-September 1986 from the finished water of the 30 community water systems sampled. However, 71.3% (169/237) of the detects were less than 1 ug/L. None of the 237 detects exceeded 10 ug/L (the lifetime drinking water HA). The overall cyanazine

concentration distribution for the 678 samples collected from 30 systems was as follows :

C ≤ 0.2 ug/L 65.0%; 441/678)
0.2 ug/L < C ≤1.0 ug/L (24.9%; 169/678)
1.0 ug/L < C ≤ 10.0 ug/L (10.0%; 68/678)
10.0 ug/L < C ≤ 40 ug/L (0.0%; 0/678)
C ≥ 40 ug/L (0.0%; 0/678)

The highest peak cyanazine concentrations reported in the 7 day composite samples of finished water were 4.11 ug/L on 5/21/86 in the Bowling Green, OH CWS; 4.95 ug/L on 6/18/86, 4.20 ug/L on 6/11/91, and 4.18 ug/L on 6/25/86 in the Columbus , OH CWS; 6.14 ug/L on 5/21/86 and 4.72 ug/L on 5/28/86 in the Iowa City IA CWS; and 5.61 ug/L on 5/28/86 and 5.52 ug/L on 5/21/86 in the U. of Iowa CWS. All other cyanazine concentrations were less than 4 ug/L.

Community water systems with April-August 1986 or April-September 1986 cyanazine arithmetic mean concentrations (in 7 day composite samples) ≥ 1 ug/L were Columbus, OH (1.22 ug/L); Iowa City, IA (1.39 ug/L); Jacksonville, IA (1.16 ug/L); and U. of Iowa (1.44 ug/L).

4.6.3 Simazine

Simazine was detected at > 0.20 ug/L (the detection limit) in 19.5% (132/678) of the samples collected during April-August or April-September 1986 from the finished water of the 30 community water systems sampled. However, 90.9% (120/132) of the detects were less than 1 ug/L (the MCL). None of the 132 detects exceeded 4 ug/L (4 times the MCL). The overall simazine concentration distribution for the 678 samples collected from 30 systems was as follows :

C ≤ 0.2 ug/L (80.5%; 546/678)
0.2 ug/L < C ≤1.0 ug/L (17.7%; 120/678)
1.0 ug/L < C ≤ 4.0 ug/L (1.8%; 12/678)
C ≥ 4 ug/L (0.0%; 0/678)

The highest peak simazine concentrations reported in the 7 day composite samples of finished water were 1.19 ug/L on 5/28/86, 1.52 ug/L on 6/4/86, 1.11 ug/L on 6/11/86, and 1.06 ug/L on 7/2/86 in the Columbus, OH CWS; 1.19 ug/L on 6/4/86 and 1.06 ug/L on 6/11/86 in the Fort Wayne, IN CWS; 2.23 ug/L on 7/3/86 and 1.15 ug/L on 7/10/86 in the Jarrat, VA CWS; 1.58 ug/L on 7/16/86 in the Macomb, IL CWS; and 2.54 ug/L on 6/4/86, 1.73 ug/L on 6/11/86, and 1.40 ug/L on 7/2/86 in the Westerville, OH CWS. All other Simazine concentrations were less than 1 ug/L (the MCL).

Community water systems with April-August 1986 or April-September 1986 simazine arithmetic mean concentrations (in 7 day composite samples) ≥ 0.3 ug/L were Bowling Green, OH (0.39 ug/L),

Columbus, OH (0.57 ug/L); Fort Wayne, IN (0.40 ug/L), Jarrat, VA (0.35 ug/L), Waterville, OH (0.36 ug/L), and Westerville, OH (0.53 ug/L).Iowa City, IA (1.39 ug/L); Jacksonville, IA (1.16 ug/L); and U. of Iowa (1.44 ug/L).

4.7) Comments:

(1) The community water systems sampled were all randomly selected in areas of 4 extreme combinations of Lasso (alachlor) use and average soil susceptibility to runoff (high use/high runoff, low use/high runoff, high use/low runoff, low use/low runoff). The susceptibility to runoff was estimated from the weighted average of hydrological classifications (A, B, C, D) of soils within the drainage area. Of the 30 community water systems sampled, 13, 2, and 15 were classified as using sources which drain areas with high, intermediate, and low susceptibility to runoff, respectively (Table 4.1 from Table 5 of the study report). Of the 12 community water systems with substantial percentages of atrazine concentrations exceeding the MCL, 7 of 13, 2 of 2, and 3 of 15 use sources which drain areas with predicted high, intermediate and low susceptibility to runoff, respectively.

(2) The study authors attribute the low herbicide concentrations at at least 2 of the community water systems using sources which drain areas predicted to be highly susceptible to runoff (Delta, OH and Swanton, OH) to water management practices. To prolong the lives of holding reservoirs, neither system pumps water from the sources when the source water is turbid (e.g., after runoff events). Consequently, peak herbicide concentrations are not pumped into the holding reservoirs.

(3) The study authors (who were primarily concerned with alachlor) found a much higher correlation between elevated alachlor concentrations and high alachlor use within the drainage area of the sources than between elevated alachlor concentrations and predicted high susceptibility to runoff. Unfortunately, the community water systems were not classified according to atrazine use within the drainage areas of the sources.

(4) All of the 30 community water systems sampled treat their water by precipitation followed by filtration, but 3 (Appleton, WI; Creston, IA, and White House, TN) also use activated granular carbon. Raw as well as finished water was sampled at those 3 systems. Unfortunately, atrazine, cyanazine, and simazine concentrations were low in both the raw and finished water of all 3 systems. Therefore, no conclusion can be reached from this data concerning the effectiveness of activated carbon in decreasing triazine concentrations.

(5) Source types included small creeks (Swan, Bad, Alum), rivers (Maumee, Scioto, Iowa, Olentangy, Nottoway, St. Joseph, Maraisdes

Cygnes, Shipman), large man-made impoundments (Perry Lake, Pomona Lake, Mauviasterre Lake), and 13 lakes from small to large (Lake Winnebago). The only obvious correlation between atrazine concentrations and source type was that all 3 of the large man made impoundments (Perry Lake, Pomona Lake, and Mauviasterre Lake) supplied systems that had substantial percentages of atrazine concentrations greater than the MCL. Whether or not the source type contributed to the high atrazine concentrations is unclear. In large reservoirs with long detention times, herbicide concentrations may actually be lower than in the sources supplying the reservoir. Two of the 3 impoundments drain areas predicted to be highly susceptible to runoff, but one (Mauviasterre Lake) drains an area predicted to have low susceptibility to runoff. Again, no information was available concerning atrazine use in the drainage areas.

(6) The study authors indicate that one or more point sources may be responsible for the continuously elevated alachlor concentrations throughout the year in the finished water of the Shipman, IL community water system. Point sources could also be responsible for the continuously elevated atrazine concentrations throughout the year at the Shipman facility. Continuously elevated concentrations of atrazine throughout the year is inconsistent with non=point pollution through normal agricultural use. Most of the agricultural use is in May and June, and the persistence of atrazine though sufficient to insure widespread surface water transport is not sufficient enough to lead to elevated concentrations throughout the year via normal agricultural use.

ATRAZINE 080803

Page_____ is not included in this copy.

Pages 95 through 129 are not included.

The material not included contains the following type of information:

____ Identity of product inert ingredients.

____ Identity of product impurities.

____ Description of the product manufacturing process.

____ Description of quality control procedures.

____ Identity of the source of product ingredients.

____ Sales or other commercial/financial information.

____ A draft product label.

____ The product confidential statement of formula.

____ Information about a pending registration action.

X FIFRA registration data.

____ The document is a duplicate of page(s) _____.

____ The document is not responsive to the request.

The information not included is generally considered confidential by product registrants. If you have any questions, please contact the individual who prepared the response to your request.

5. STUDY 5: Roux P. 1988. MRID #411352-06. Summary of atrazine surface-water monitoring program. Completed in February 1988. Performed by Roux Associates and submitted by Ciba Geigy Corp., Greensboro, NC. Laboratory Study No. CG-02814. Note: The main text of this study also appears as Appendix B of 411352-05

5.1) Surface Waters Sampled:

Surface waters sampled included 4 in Indiana, 3 in Illinois, 3 in Michigan, and one each in Iowa, Kansas, and Florida (Table 5.1 and Figure 5.1 from Table 1 and Figure 1 of the study report). The estimated atrazine use in lbs ai/acre for the watershed of each sampled surface water is given in Surface Water Table 5.2 (from Table 3 of the study report). The 14 surface waters sampled in 6 states were randomly selected from a larger group of 60 surface waters in 19 states whose watersheds included one or more counties in which atrazine is sold (and assumed to be used). Surface waters whose watersheds were sufficiently large such that drainage from any one county would contribute negligibly to the total flow were not included in the 60 candidates for sampling.

5.2) Sampling Times:

Surface water samples were collected in 1986 and 1987. Samples were collected every 2 weeks in the peak growing period of April, May, and June and monthly in March, July, August, September, October, and November. Samples were not collected in December, January, or February.

5.3) Sampling Methodology:

Bailers suspended from bridges were used to collect water samples from the water surface to a depth of approximately one foot at one or more cross-section points across the width of the surface water. If the computed mixing length was less than the distance to the nearest significant upstream tributary, the surface water was considered well mixed at the sampling location (theoretically requiring sampling at only one cross-sectional point near the center of the surface water). However, in such cases grab samples were generally collected at 3 evenly spaced cross-section points across the width of the surface water to account for the possibility of incomplete mixing due to direct atrazine runoff to the river at the sampling location. If the computed mixing length was greater than the distance to the nearest significant upstream tributary, grab samples were collect at a number of evenly spaced cross sectional points equal to the smallest integer ≥ 3 and greater than the ratio of the surface water width to the computed mixing width. For each sampling interval, multiple bailings from the same cross-sectional point and from different cross-sectional points across the width of the surface water were composited. Samples were shipped in glass containers packed with ice and stored refrigerated until analysis.

5.4) Analytical Procedures:

All samples were analyzed only for atrazine. Samples were filtered through one Reeve-Angel and one Whatman 2V filter paper. Atrazine was adsorbed from the water samples by drawing the samples by suction through pre-conditioned C-8 Bond-Elut reverse phase cartridges. The adsorption of atrazine to the columns was enhanced by the addition of 50 mL of saturated sodium chloride to each 1000 mL of sample prior to drawing the samples through the columns. Adsorbed atrazine was eluted from each column with 6 X 0.5 mL ethyl acetate. The combined ethyl acetate eluates were evaporated to dryness followed by re-dissolving of the resulting residues in methyl ethyl ketone for analysis by isothermal (between 165 and 185°C) GC using a Hall electrolytic conductivity detector operating in the oxidative halogen specific mode. Confirmations of atrazine's identity by GC/MS were generally performed on samples with apparent atrazine levels > 3 ppb. A "screening level" (quantification limit) of 0.1 ug/L atrazine based upon a 1 liter sample was reported.

5.5) QA/QC Procedures:

Calibration curves of peak height vs. concentration were developed from injections of various concentrations of standard atrazine solutions (8 solutions ranging from 0.05 ug/L to 10 ug/L) at the beginning and end of each GC run, and after each 3-6 sample injections during each GC run. River water samples with atrazine peak heights exceeding the highest peak height on the calibration curve were diluted to reduce the peak height to within the peak height range of the calibration curve.

One field (bailer) or laboratory blank was analyzed for each 12-15 samples analyzed to check for contamination during sampling and analysis. Atrazine was detected in only 2 of the 88 field (bailer) controls and was not detected in any of the 65 laboratory controls.

One spiked laboratory sample (of de-ionized water) was analyzed for each 12-15 surface water samples analyzed to determine the accuracy of the analytical procedure in determining atrazine in de-ionized water. The mean recovery for 102 laboratory de-ionized water samples spiked at levels ranging from 0.10 to 25 ppb (the approximate range of atrazine detections in the river water) was 98%±14%.

Spiked field surface water samples at 10 or 25 ug/L were used to determine the stability of atrazine during shipping and storage, and the accuracy of the analytical method in determining atrazine in actual river water. The mean recovery for the 55 spiked field surface water samples analyzed at the same time as the (unspiked) river water samples was 90%±11%. In a separate storage stability

study, the mean recovery for 17 spiked field surface water samples stored for 6 months under refrigeration was 109%± 9.6%.

5.6) Reported Results:

The samples were analyzed for atrazine using GC with a Hall electrolytic conductivity detector. The results of the sample analyses for each of the 14 surface waters sampled in the Roux 1989 study are presented in Table 5.3 (from Table 4 of the study report). Same page plots of the atrazine concentration, precipitation, and river flow (discharge) vs. time in 1986 and 1987 are given for each sampling location in Surface Water Appendix Figures 5.1 through 5.14 (from Figures 6 through 19 of the study report).

Under Phase II of the Drinking Water Regulations, water supply systems will be required to collect a minimum of 4 finished water samples a year, one per quarter. A water supply system will be considered out of compliance if the annual mean concentration of a regulated pesticide in the 4 quartely samples exceeds the MCL for the pesticide. If the pesticide concentration exceeds 4 times the MCL in any individual sample, the annual mean will obviously exceed the MCL if only the minimum number of samples is collected (4 per year; 1 per quarter).

Concentrations of pesticides were compared to 4 times their MCL (or 4 times their lifetime drinking water HA if a MCL was not available). The March to November arithmetic mean concentrations of pesticides (the longest available means) were compared to their MCLs (or their lifetime drinking water HA if a MCL was not available). Annual means are more appropriate for comparison to the MCLs because of the Phase II regulations, but could not be computed because samples were collected only from March through November of 1986 and 1987. It should be noted that the ratios of March-November means to MCLs are probably generally somewhat greater than the ratios of annual means to MCLs.

The maximum observed atrazine concentrations, overall and March-November arithmetic mean atrazine concentrations, atrazine concentration distributions, ratios of atrazine concentrations to 4 times the MCL, and ratios of March-November arithmetic mean atrazine concentrations to the MCL are presented in EFGWB Spreadsheets 2.1 through 2.14 for each of the 14 surface waters sampled. Atrazine concentrations exceeding the MCL, ratios of atrazine concentrations to 4 times the MCL which exceed 1, and ratios of March-November arithmetic mean atrazine concentrations to the MCL exceeding 1 are shaded in the spreadsheets.

Maximum atrazine concentrations, overall arithmetic mean atrazine concentrations, and atrazine concentration distributions from the spreadsheets are summarized in Table 5.4. The concentration distributions of atrazine were computed with respect

to its detection limit (0.10 ug/L), 1 ug/L, its MCL (3 ug/L), and 4 times its MCL (12 ug/L).

Atrazine was detected at > 0.1 ug/L in 88.7% (298/336) of the samples collected from the 14 surface waters. However, 74.8% of the detects (223/298) were less than 1 ug/L. Atrazine was detected at greater than 3 ug/L (the MCL) in 9.5% (32/336) of the samples and at greater than 12 ug/L (4 times the MCL) in 3.0% (12/336) of the samples. The overall concentration distribution for the 336 samples collected from 14 locations in 14 surface waters was as follows:

$C \leq 0.1$ ug/L (11.3%; 38/336)
0.1 ug/L $< C \leq$ 1.0 ug/L (66.4%; 223/336)
1.0 ug/L $< C \leq$ 5.0 ug/L (12.8%; 43/336)
3.0 ug/L $< C \leq$ 12 (6.5%; 22/336 over 7 locations)
$C >$ 10 ug/L (3.0%; 10/336 over 3 locations)

The highest peak concentrations reported were 30.5, 30, 29, 28, 18, 14, and 12 ug/L in Little Crooked Creek, IL; 30 and 13.0 ug/L in Clifty Creek, IN; and 14 and 12 ug/L in the Wabash River, IN; All other reported concentrations were < 10 ug/L.

Arithmetic means that exceeded 3 ug/L (the MCL) were 9.45 ug/L (3/86-11/86) and 7.00 ug/L (3/87-11/87) in Little Crooked Creek, IL; 4.52 ug/L (3/86-11/86) in Wabash River, IN; and 3.75 ug/L (3/87-11/87) in Clifty Creek, IN. The arithmetic means over the 3/86-11/87 sampling period for the remaining 11 surface waters sampled in the Roux 1989 study were all less than 1 ug/L.

5.7) Comments:

(1) The accuracy of the data as evidenced by the QA/QC procedures and results appears to be generally good. However, the study was apparently designed more for determining typical rather than peak atrazine concentrations as discussed in items 2 and 3 below.

(2) Although atrazine was applied to at least part of the drainage area, the drainage surface area above the sampling locations was apparently not a factor in the selection of the initial 60 candidate surface waters nor in the final random selection of 14 surface waters for sampling.

(3) Although the frequency of sampling was doubled during the peak corn planting/early growing period of April, May, and June, set sampling intervals were used which were not modified to reflect rainfall or runoff events. However, as part of the data analysis, the study author did relate the sampling dates to observed runoff events.

(4) Atrazine is used primarily as a pre-emergent herbicide for corn. It is therefore applied within a few days after planting

which occurs between the first part of April and the last part of May in most of the country (Figure 5.2 from Figure 21 of the study report). Most of the atrazine concentrations exceeding 3 ug/L were reported for samples collected in April, May, and June (during corn planting/early growing periods).

(5) At most locations, the peak observed atrazine concentration appeared to occur during or shortly after the first substantial runoff period following estimated corn planting times after which atrazine concentrations generally gradually decreased to background levels less than 1 ug/L in July or August.

(6) Other than eliminating some surface waters with large watersheds, the procedure for selecting the initial 60 candidate surface waters for sampling was unclear.

ATRAZINE 080803

Page_____ is not included in this copy.

Pages 135 through 139 are not included.

The material not included contains the following type of information:

____ Identity of product inert ingredients.

____ Identity of product impurities.

____ Description of the product manufacturing process.

____ Description of quality control procedures.

____ Identity of the source of product ingredients.

____ Sales or other commercial/financial information.

____ A draft product label.

____ The product confidential statement of formula.

____ Information about a pending registration action.

_X_ FIFRA registration data.

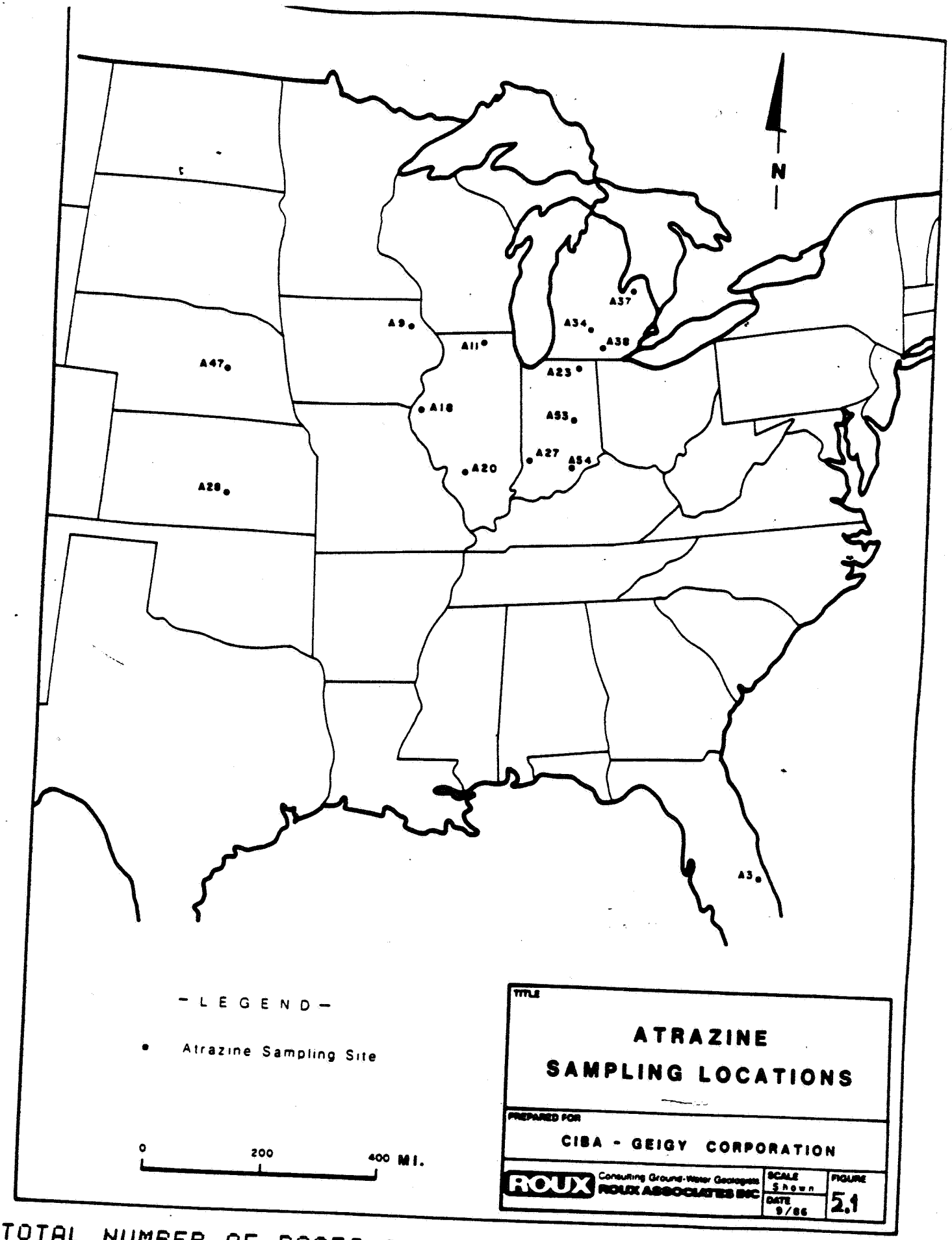
____ The document is a duplicate of page(s) _____.

____ The document is not responsive to the request.

The information not included is generally considered confidential by product registrants. If you have any questions, please contact the individual who prepared the response to your request.

Table 5.4) Atrazine maximum concentrations, arithmetic means, and concentration distributions for 14 locations sampled from 3/86 to 11/87. The concentration distributions of atrazine are computed with respect to its detection limit (0.10 ug/L), 1 ug/L, its MCL (3 ug/L), and 4 times its MCL (12 ug/L). Data from Roux (1988; Ciba-Geigy)

Surface Water	Location	Maximum (ug/L)	3/86-11/87 Ar. Mean (ug/L)	Concentration Distribution C<0.1	0.1<C<1	1<C<3	3<C<12	C>12
W. Palm Canal	Palm Beach, FL	4.20	0.63	8	12	3	1	0
Wapsipinicon R.	Buchanan, IL	2.90	0.87	0	19	5	0	0
Coon Creek	McHenry, IL	2.10	0.50	0	20	4	0	0
La Moine River	Hancock, IL	3.80	0.76	0	20	3	1	0
Little Crooked Cr	Washington, IL	[illegible]	[illegible]	1	7	4	5	7
Pigeon River	LaGrange, IN	2.00	0.51	0	20	4	0	0
Wabash River	Knox, IN	[illegible]	[illegible]	2	6	6	9	1
Ninneschah River	Reno, KS	1.50	0.29	10	12	2	0	0
Deer Creek	Ingham, MI	7.60	0.62	2	21	0	1	0
Pigeon River	Huron, MI	5.20	0.82	2	17	3	2	0
Hog Creek	Hillsdale, MI	2.70	0.61	0	22	2	0	0
Platte River	Hall, NE	2.80	0.52	3	18	3	0	0
Clifty Creek	Barthlomew, IN	[illegible]	[illegible]	1	14	4	3	2
Little Indian Cr.	Floyd, IN	0.76	0.24	9	15	0	0	0
Total Atrazine				38 (11.3%)	223 (66.4%)	43 (12.8%)	22 (6.5%)	10 (3.0%)


N
A37
A34
A38
A9
A11
A47
A23
A18
A53
A27
A54
A20
A28
A3
- L E G E N D -
• Atrazine Sampling Site
0
200
400 MI.
TITLE
ATRAZINE
SAMPLING LOCATIONS
PREPARED FOR
CIBA - GEIGY CORPORATION
ROUX
Consulting Ground-Water Geologists
ROUX ASSOCIATES INC
SCALE
Shown
DATE
9/86
FIGURE
2.1

Spreadsheet 5.1) W. Palm Canal (Palm Beach, FL)

Maximum (ug/L)	3/86-11/87 Ar. Mean (ug/L)	Concentration Distribution C<0.1	0.1<C<1	1<C<3	3<C<12	C>12
4.20	0.63	8	12	3	1	0

Sample Date	Concn. (ug/L)	Concn./ 4 X MCL (12 ug/L)
3/10-17/86	0.72	0.06
3/31-4/8/86	[redacted]	0.35
4/14-22/86	0.76	0.06
4/28-5/6/86	0.34	0.03
5/12-20/86	0.26	0.02
6/3-10/86	0.10	0.01
6/16-21/86	0.10	0.01
7/7-13/86	0.15	0.01
8/4-10/86	0.26	0.02
9/2-9/86	0.10	0.01
9/29-10/10/86	0.10	0.01
11/3-9/86	0.10	0.01
3/2-13/87	2.90	0.24
3/30-4/7/87	1.60	0.13
4/20-26/87	0.37	0.03
4/27-5/4/87	0.16	0.01
5/16-22/87	0.31	0.03
6/1-7/87	0.10	0.01
6/15-21/87	0.10	0.01
7/7-14/87	1.30	0.11
8/3-9/87	0.36	0.03
8/31-9/5/87	0.10	0.01
9/28-10/10/87	0.36	0.03
11/11-18/87	0.15	0.01

Sampling Interval	Arithmetic Mean (ug/L)	Mean/ MCL (3 ug/L)
3/86-11/86	0.60	0.20
3/87-11/87	0.65	0.22

Spreadsheet 5.2) Wapsipinicon River (Buchanan, IL)

Maximum (ug/L)	3/86-11/87 Ar. Mean (ug/L)	Concentration Distribution C<0.1	0.1<C<1	1<C<3	3<C<12	C>12
2.90	0.87	0	19	5	0	0

Sample Date	Concn. (ug/L)	Concn./ 4 X MCL (12 ug/L)
3/10-17/86	0.41	0.03
3/31-4/8/86	0.53	0.04
4/14-22/86	0.31	0.03
4/28-5/6/86	0.45	0.04
5/12-20/86	2.30	0.19
6/3-10/86	2.50	0.21
6/16-21/86	2.90	0.24
7/7-13/86	0.68	0.06
8/4-10/86	2.50	0.21
9/2-9/86	0.11	0.01
9/29-10/10/86	0.99	0.08
11/3-9/86	0.36	0.03
3/2-13/87	0.32	0.03
3/30-4/7/87	0.36	0.03
4/20-26/87	0.36	0.03
4/27-5/4/87	0.45	0.04
5/16-22/87	0.55	0.05
6/1-7/87	1.80	0.15
6/15-21/87	0.65	0.05
7/7-14/87	0.72	0.06
8/3-9/87	0.43	0.04
8/31-9/5/87	0.56	0.05
9/28-10/10/87	0.37	0.03
11/11-18/87	0.30	0.03

Sampling Interval	Arithmetic Mean (ug/L)	Mean/ MCL (3 ug/L)
3/86-11/86	1.17	0.39
3/87-11/87	0.57	0.19

Spreadsheet 5.3) Coon Creek (McHenry, IL)

Maximum (ug/L)	3/86-11/87 Ar. Mean (ug/L)	Concentration Distribution C<0.1	0.1<C<1	1<C<3	3<C<12	C>12
2.10	0.50	0	20	4	0	0

Sample Date	Concn. (ug/L)	Concn./ 4 X MCL (12 ug/L)
3/10-17/86	2.10	0.18
3/31-4/8/86	0.19	0.02
4/14-22/86	0.12	0.01
4/28-5/6/86	0.23	0.02
5/12-20/86	0.51	0.04
6/3-10/86	1.10	0.09
6/16-21/86	1.20	0.10
7/7-13/86	0.50	0.04
8/4-10/86	0.36	0.03
9/2-9/86	0.18	0.02
9/29-10/10/86	0.83	0.07
11/3-9/86	0.19	0.02
3/2-13/87	0.40	0.03
3/30-4/7/87	0.28	0.02
4/20-26/87	0.18	0.02
4/27-5/4/87	0.31	0.03
5/16-22/87	0.24	0.02
6/1-7/87	0.36	0.03
6/15-21/87	0.51	0.04
7/7-14/87	0.38	0.03
8/3-9/87	0.11	0.01
8/31-9/5/87	1.40	0.12
9/28-10/10/87	0.18	0.02
11/11-18/87	0.18	0.02

Sampling Interval	Arithmetic Mean (ug/L)	Mean/ MCL (3 ug/L)
3/86-11/86	0.63	0.21
3/87-11/87	0.38	0.13

Spreadsheet 5.4) La Moine River (Hancock, IL)

Maximum (ug/L)	3/86-11/87 Ar. Mean (ug/L)	Concentration Distribution C<0.1	0.1<C<1	1<C<3	3<C<12	C>12
3.80	0.76	0	20	3	1	0

Sample Date	Concn. (ug/L)	Concn./ 4 X MCL (12 ug/L)
3/10-17/86	0.42	0.04
3/31-4/8/86	0.16	0.01
4/14-22/86	0.16	0.01
4/28-5/6/86	0.35	0.03
5/12-20/86	3.80	0.32
6/3-10/86	1.40	0.12
6/16-21/86	2.30	0.19
7/7-13/86	1.50	0.13
8/4-10/86	0.61	0.05
9/2-9/86	0.25	0.02
9/29-10/10/86	0.80	0.07
11/3-9/86	0.18	0.02
3/2-13/87	0.12	0.01
3/30-4/7/87	0.25	0.02
4/20-26/87	0.30	0.03
4/27-5/4/87	0.84	0.07
5/16-22/87	0.39	0.03
6/1-7/87	0.48	0.04
6/15-21/87	0.88	0.07
7/7-14/87	0.72	0.06
8/3-9/87	0.26	0.02
8/31-9/5/87	0.97	0.08
9/28-10/10/87	0.70	0.06
11/11-18/87	0.29	0.02

Sampling Interval	Arithmetic Mean (ug/L)	Mean/ MCL (3 ug/L)
3/86-11/86	0.99	0.33
3/87-11/87	0.52	0.17

Spreadsheet 5.5) Little Crooked Creek (Washington, IL)

Maximum (ug/L)	3/86-11/87 Ar. Mean (ug/L)	C<0.1	0.1<C<1	1<C<3	3<C<12	C>12
30.50	8.22	1	7	4	5	7

Sample Date	Concn. (ug/L)	Concn./ 4 X MCL (12 ug/L)
3/10-17/86	0.76	0.06
3/31-4/8/86	[illegible]	0.26
4/14-22/86	[illegible]	[illegible]
4/28-5/6/86	2.40	0.20
5/12-20/86	[illegible]	[illegible]
6/3-10/86	[illegible]	[illegible]
6/16-21/86	[illegible]	[illegible]
7/7-13/86	[illegible]	0.51
8/4-10/86	2.10	0.18
9/2-9/86	2.90	0.24
9/29-10/10/86	0.68	0.06
11/3-9/86	[illegible]	0.36
3/2-13/87	0.24	0.02
3/30-4/7/87	1.00	0.08
4/20-26/87	[illegible]	0.30
4/27-5/4/87	2.40	0.20
5/16-22/87	[illegible]	[illegible]
6/1-7/87	[illegible]	[illegible]
6/15-21/87	[illegible]	[illegible]
7/7-14/87	[illegible]	0.29
8/3-9/87	0.10	0.01
8/31-9/5/87	0.64	0.05
9/28-10/10/87	0.56	0.05
11/11-18/87	0.91	0.08

Sampling Interval	Arithmetic Mean (ug/L)	Mean/ MCL (3 ug/L)
3/86-11/86	[illegible]	[illegible]
3/87-11/87	[illegible]	[illegible]

Spreadsheet 5.6) Pigeon River (LaGrange, IN)

Maximum (ug/L)	3/86-11/87 Ar. Mean (ug/L)	Concentration Distribution C<0.1	0.1<C<1	1<C<3	3<C<12	C>12
2.00	0.51	0	20	4	0	0

Sample Date	Concn. (ug/L)	Concn./ 4 X MCL (12 ug/L)
3/10-17/86	0.28	0.02
3/31-4/8/86	0.21	0.02
4/14-22/86	0.12	0.01
4/28-5/6/86	0.11	0.01
5/12-20/86	0.25	0.02
6/3-10/86	1.70	0.14
6/16-21/86	2.00	0.17
7/7-13/86	1.40	0.12
8/4-10/86	1.20	0.10
9/2-9/86	0.94	0.08
9/29-10/10/86	0.75	0.06
11/3-9/86	0.38	0.03
3/2-13/87	0.22	0.02
3/30-4/7/87	0.13	0.01
4/20-26/87	0.26	0.02
4/27-5/4/87	0.18	0.02
5/16-22/87	0.42	0.04
6/1-7/87	0.20	0.02
6/15-21/87	0.23	0.02
7/7-14/87	0.56	0.05
8/3-9/87	0.19	0.02
8/31-9/5	0.19	0.02
9/28-10/10/87	0.17	0.01
11/11-18/87	0.18	0.02

Sampling Interval	Arithmetic Mean (ug/L)	Mean/ MCL (3 ug/L)
3/86-11/86	0.78	0.26
3/87-11/87	0.24	0.08

Spreadsheet 5.7) Wabash River (Knox, IN)

Maximum (ug/L)	3/86-11/87 Ar. Mean (ug/L)	Concentration Distribution C<0.1	0.1<C<1	1<C<3	3<C<12	C>12
14.00	3.28	2	6	6	9	1

Sample Date	Concn. (ug/L)	Concn./ 4 X MCL (12 ug/L)
3/10-17/86	0.52	0.04
3/31-4/8/86	0.10	0.01
4/14-22/86	[illegible]	0.43
4/28-5/6/86	[illegible]	[illegible]
5/12-20/86	[illegible]	[illegible]
6/3-10/86	[illegible]	0.46
6/16-21/86	[illegible]	0.67
7/7-13/86	[illegible]	0.34
8/4-10/86	1.10	0.09
9/2-9/86	0.76	0.06
9/29-10/10/86	1.50	0.13
11/3-9/86	1.60	0.13
3/2-13/87	0.46	0.04
3/30-4/7/87	0.23	0.02
4/20-26/87	0.58	0.05
4/27-5/4/87	0.43	0.04
5/16-22/87	[illegible]	0.29
6/1-7/87	[illegible]	0.75
6/15-21/87	[illegible]	0.28
7/7-14/87	[illegible]	0.27
8/3-9/87	0.10	0.01
8/31-9/5/87	1.10	0.09
9/28-10/10/87	1.40	0.12
11/11-18/87	1.10	0.09

Sampling Interval	Arithmetic Mean (ug/L)	Mean/ MCL (3 ug/L)
3/86-11/86	[illegible]	[illegible]
3/87-11/87	2.04	0.68

Spreadsheet 5.8) Ninneschah River (Reno, KS)

Maximum (ug/L)	3/86-11/87 Ar. Mean (ug/L)	Concentration Distribution C<0.1	0.1<C<1	1<C<3	3<C<12	C>12
1.50	0.29	10	12	2	0	0

Sample Date	Concn. (ug/L)	Concn./ 4 X MCL (12 ug/L)
3/10-17/86	0.10	0.01
3/31-4/8/86	0.14	0.01
4/14-22/86	0.10	0.01
4/28-5/6/86	0.22	0.02
5/12-20/86	0.32	0.03
6/3-10/86	0.20	0.02
6/16-21/86	0.10	0.01
7/7-13/86	1.20	0.10
8/4-10/86	1.50	0.13
9/2-9/86	0.10	0.01
9/29-10/10/86	0.12	0.01
11/3-9/86	0.10	0.01
3/2-13/87	0.10	0.01
3/30-4/7/87	0.31	0.03
4/20-26/87	0.18	0.02
4/27-5/4/87	0.13	0.01
5/16-22/87	0.10	0.01
6/1-7/87	0.24	0.02
6/15-21/87	0.66	0.06
7/7-14/87	0.57	0.05
8/3-9/87	0.10	0.01
8/31-9/5/87	0.10	0.01
9/28-10/10/87	0.16	0.01
11/11-18/87	0.10	0.01

Sampling Interval	Arithmetic Mean (ug/L)	Mean/ MCL (3 ug/L)
3/86-11/86	0.35	0.12
3/87-11/87	0.23	0.08

Spreadsheet 5.9) Deer Creek (Ingham, MI)

Maximum (ug/L)	3/86-11/87 Ar. Mean (ug/L)	Concentration Distribution C<0.1	0.1<C<1	1<C<3	3<C<12	C>12
7.60	0.62	2	21	0	1	0

Sample Date	Concn. (ug/L)	Concn./ 4 X MCL (12 ug/L)
3/10-17/86	0.81	0.07
3/31-4/8/86	0.26	0.02
4/14-22/86	0.27	0.02
4/28-5/6/86	0.42	0.04
5/12-20/86	0.28	0.02
6/3-10/86	0.45	0.04
6/16-21/86	7.60	0.63
7/7-13/86	0.87	0.07
8/4-10/86	0.01	0.00
9/2-9/86	0.14	0.01
9/29-10/10/86	0.83	0.07
11/3-9/86	0.20	0.02
3/2-13/87	0.47	0.04
3/30-4/7/87	0.16	0.01
4/20-26/87	0.18	0.02
4/27-5/4/87	0.27	0.02
5/16-22/87	0.54	0.05
6/1-7/87	0.22	0.02
6/15-21/87	0.22	0.02
7/7-14/87	0.11	0.01
8/3-9/87	0.10	0.01
8/31-9/5/87	0.13	0.01
9/28-10/10/87	0.13	0.01
11/11-18/87	0.13	0.01

Sampling Interval	Arithmetic Mean (ug/L)	A-AMean/ MCL (3 ug/L)
3/86-11/86	1.01	0.34
3/87-11/87	0.22	0.07

Spreadsheet 5.10) Pigeon River (Huron, MI)

Maximum (ug/L)	3/86-11/87 Ar. Mean (ug/L)	Concentration Distribution C<0.1	0.1<C<1	1<C<3	3<C<12	C>12
5.20	0.82	2	17	3	2	0

Sample Date	Concn. (ug/L)	Concn./ 4 X MCL (12 ug/L)
3/10-17/86	1.10	0.09
3/31-4/8/86	0.31	0.03
4/14-22/86	0.25	0.02
4/28-5/6/86	0.15	0.01
5/12-20/86	0.62	0.05
6/3-10/86	1.30	0.11
6/16-21/86	[redacted]	0.40
7/7-13/86	[redacted]	0.43
8/4-10/86	0.43	0.04
9/2-9/86	0.72	0.06
9/29-10/10/86	1.60	0.13
11/3-9/86	0.19	0.02
3/2-13/87	0.94	0.08
3/30-4/7/87	0.22	0.02
4/20-26/87	0.30	0.03
4/27-5/4/87	0.20	0.02
5/16-22/87	0.19	0.02
6/1-7/87	0.20	0.02
6/15-21/87	0.20	0.02
7/7-14/87	0.16	0.01
8/3-9/87	0.16	0.01
8/31-9/5/87	0.10	0.01
9/28-10/10/87	0.22	0.02
11/11-18/87	0.10	0.01

Sampling Interval	Arithmetic Mean (ug/L)	Mean/ MCL (3 ug/L)
3/86-11/86	1.39	0.46
3/87-11/87	0.25	0.08

Spreadsheet 5.11) Hog Creek (Hillsdale, MI)

Maximum (ug/L)	3/86-11/87 Ar. Mean (ug/L)	Concentration Distribution C<0.1	0.1<C<1	1<C<3	3<C<12	C>12
2.70	0.61	0	22	2	0	0

Sample Date	Concn. (ug/L)	Concn./ 4 X MCL (12 ug/L)
3/10-17/86	0.58	0.05
3/31-4/8/86	0.48	0.04
4/14-22/86	0.36	0.03
4/28-5/6/86	0.27	0.02
5/12-20/86	0.31	0.03
6/3-10/86	0.55	0.05
6/16-21/86	2.70	0.23
7/7-13/86	1.40	0.12
8/4-10/86	0.76	0.06
9/2-9/86	0.77	0.06
9/29-10/10/86	1.00	0.08
11/3-9/86	0.60	0.05
3/2-13/87	0.49	0.04
3/30-4/7/87	0.40	0.03
4/20-26/87	0.41	0.03
4/27-5/4/87	0.39	0.03
5/16-22/87	0.70	0.06
6/1-7/87	0.74	0.06
6/15-21/87	0.37	0.03
7/7-14/87	0.49	0.04
8/3-9/87	0.13	0.01
8/31-9/5/87	0.29	0.02
9/28-10/10/87	0.19	0.02
11/11-18/87	0.32	0.03

Sampling Interval	Arithmetic Mean (ug/L)	Mean/ MCL (3 ug/L)
3/86-11/86	0.82	0.27
3/87-11/87	0.41	0.14

Spreadsheet 5.12) Platte River (Hall, NE)

Maximum (ug/L)	3/86-11/87 Ar. Mean (ug/L)	Concentration Distribution C<0.1	0.1<C<1	1<C<3	3<C<12	C>12
2.80	0.52	3	18	3	0	0

Sample Date	Concn. (ug/L)	Concn./ 4 X MCL (12 ug/L)
3/10-17/86	0.21	0.02
3/31-4/8/86	0.16	0.01
4/14-22/86	0.13	0.01
4/28-5/6/86	0.29	0.02
5/12-20/86	2.00	0.17
6/3-10/86	0.97	0.08
6/16-21/86	0.49	0.04
7/7-13/86	0.75	0.06
8/4-10/86	0.57	0.05
9/2-9/86	0.10	0.01
9/29-10/10/86	0.12	0.01
11/3-9/86	0.13	0.01
3/2-13/87	1.20	0.10
3/30-4/7/87	0.11	0.01
4/20-26/87	0.19	0.02
4/27-5/4/87	0.10	0.01
5/16-22/87	0.55	0.05
6/1-7/87	0.35	0.03
6/15-21/87	0.57	0.05
7/7-14/87	2.80	0.23
8/3-9/87	0.10	0.01
8/31-9/5/87	0.22	0.02
9/28-10/10/87	0.19	0.02
11/11-18/87	0.17	0.01

Sampling Interval	Arithmetic Mean (ug/L)	Mean/ MCL (3 ug/L)
3/86-11/86	0.49	0.16
3/87-11/87	0.55	0.18

Spreadsheet 5.13) Clifty Creek (Barthlomew, IN)

Maximum (ug/L)	3/86-11/87 Ar. Mean (ug/L)	Concentration Distribution C<0.1	0.1<C<1	1<C<3	3<C<12	C>12
30.50	3.16	1	14	4	3	2

Sample Date	Concn. (ug/L)	Concn./ 4 X MCL (12 ug/L)
3/10-17/86	0.30	0.03
3/31-4/8/86	0.37	0.03
4/14-22/86	0.53	0.04
4/28-5/6/86	0.53	0.04
5/12-20/86	[illegible]	[illegible]
6/3-10/86	[illegible]	0.70
6/16-21/86	2.59	0.22
7/7-13/86	1.70	0.14
8/4-10/86	0.97	0.08
9/2-9/86	0.84	0.07
9/29-10/10/86	1.20	0.10
11/3-9/86	0.49	0.04
3/2-13/87	0.28	0.02
3/30-4/7/87	0.25	0.02
4/20-26/87	0.33	0.03
4/27-5/4/87	0.44	0.04
5/16-22/87	[illegible]	[illegible]
6/1-7/87	[illegible]	0.48
6/15-21/87	[illegible]	0.30
7/7-14/87	2.40	0.20
8/3-9/87	0.10	0.01
8/31-9/5/87	0.60	0.05
9/28-10/10/87	0.45	0.04
11/11-18/87	0.29	0.02

Sampling Interval	Arithmetic Mean (ug/L)	A-AMean/ MCL (3 ug/L)
3/86-11/86	2.58	0.86
3/87-11/87	[illegible]	[illegible]

Spreadsheet 5.14) Little Indian Creek (Floyd, IN)

Maximum (ug/L)	3/86-11/87 Ar. Mean (ug/L)	Concentration Distribution C<0.1	0.1<C<1	1<C<3	3<C<12	C>12
0.76	0.24	9	15	0	0	0

Sample Date	Concn. (ug/L)	Concn./ 4 X MCL (12 ug/L)
3/10-17/86	0.10	0.01
3/31-4/8/86	0.11	0.01
4/14-22/86	0.10	0.01
4/28-5/6/86	0.13	0.01
5/12-20/86	0.76	0.06
6/3-10/86	0.49	0.04
6/16-21/86	0.36	0.03
7/7-13/86	0.50	0.04
8/4-10/86	0.32	0.03
9/2-9/86	0.17	0.01
9/29-10/10/86	0.10	0.01
11/3-9/86	0.10	0.01
3/2-13/87	0.10	0.01
3/30-4/7/87	0.10	0.01
4/20-26/87	0.10	0.01
4/27-5/4/87	0.11	0.01
5/16-22/87	0.32	0.03
6/1-7/87	0.50	0.04
6/15-21/87	0.35	0.03
7/7-14/87	0.39	0.03
8/3-9/87	0.10	0.01
8/31-9/5/87	0.12	0.01
9/28-10/10/87	0.10	0.01
11/11-18/87	0.12	0.01

Sampling Interval	Arithmetic Mean (ug/L)	Mean/ MCL (3 ug/L)
3/86-11/86	0.27	0.09
3/87-11/87	0.20	0.07

6. STUDY 6: Ross R. and Balu K. 1985. Summary of atrazine surface water monitoring data during 1975-1985. Submitted by CIBA-GEIGY. Appendix A of MRID 410652-05.

6.1) Sampling Locations:

Sampling locations included 11 in the Mississippi River (1 in MO, 2 in AR, 2 in TN, 3 in MS, 3 in LA), 4 in the Missouri River (all in MO), 3 in the Des Moines River (all in IA), 17 in other miscellaneous surface freshwaters (2 in IA, 4 in IL, 3 in AL, 1 in FL, 2 in TX, 2 in KS, 2 in CA, 1 in PA), and over 20 in the Gulf of Mexico (Table 6.1 and Figures 6.1 through 6.4 from Table 2 and Figures through 5 of the study report). Samples were also collected of 2 tap water supplies (Baton Rouge, LA and St. Gabriel, LA).

6.2) Sampling Years:

The report covers surface water samples collected from 1975 through 1985 by Ciba Geigy. The years in which samples were taken varied depending upon the sampling location (Table 6.2 from Table 1 of the study report).

6.3) Sampling Frequency Within Any Given Year:

(1) 1975-1981: Samples were collected weekly during the peak corn planting/growing season of April to August and biweekly to monthly at other times.

(2) 1982-1985: Samples were collected biweekly except at the Vicksburg, MS site where samples were collected weekly.

6.4) Sampling Methodology:

(1) 1975-1981: Permanent sampling sites such as bridges and ferry crossings were used when possible. The locations of sampling sites sampled by boat were marked by identifying or establishing a landmark on the river bank so that subsequent samples could be collected from the same cross section.. For most sampling intervals and locations, ten grab samples were collected at evenly spaced intervals across the width of the stream or river being sampled. The samples were then composited by mixing into a 5 gallon container. Samples were collected at depths of approximately one foot to avoid the inclusion of surface film into the samples. The composite sample was split into 2 one quart samples for shipping to the laboratory.

(2) 1982-1985: River samples were collected from free flowing water near the river bank in metal cans and then shipped to the laboratory. Tap water samples were collected in residences. Sources for the tap water sampled included both well water and river water.

6.5) Shipping/Storage Stability:

(1) 1975-1981: Atrazine was reported to be stable at ambient temperatures in storage stability studies run for up to 28 days. Therefore, samples were not refrigerated during shipping and generally not refrigerated during storage except in rare cases where the elapsed time between sampling and analysis exceeded 28 days.

(2) 1982-1985: Samples were not refrigerated during shipping, but were refrigerated during storage. Information was not provided on the storage stability of refrigerated samples or elapsed times between sampling and analysis.

6.6) Analytical Procedures:

(1) 1975-1981: Water samples were filtered (filter not specified) to remove silt and debris. All samples were analyzed for atrazine; most of the 1975 samples were also analyzed for major degradates of atrazine (Surface Water Appendix Figure 3.5). Atrazine and its major degradates were adsorbed from the water samples by passing the samples through pre-conditioned columns packed with 20-40 mesh XAD-4 resin. Atrazine and major metabolites G-30033, G-28279, and G-28273 were eluted from the columns with diethyl ether. Major metabolite G-34048 was eluted from the columns with methanol. The diethyl ether eluates were either evaporated to low volume or to dryness followed by residue re-dissolving in benzene prior to analysis by GC with a Colson Conductivity Detector in the nitrogen specific mode. Confirmations were performed using a chloride specific detector and/or GC/MS. The methanol eluates were evaporated to dryness and the residues re-dissolved in 0.1 N HCl prior to analysis by TLC. Detection limits were as follows: atrazine (<0.1 ppb), G-30033 (0.1 ppb), G-28279 (0.1 ppb), and G-34048 (0.5 ppb). "Typical" recoveries for atrazine ranged from 85-100%.

(2) 1982-1985: All samples were analyzed only for atrazine. Samples were filtered through one Reeve-Angel and one Whatman 2V filter paper. Atrazine was adsorbed from the water samples by drawing the samples by suction through pre-conditioned C-18 or C-8 Bond-Elut reverse phase cartridges. The adsorption of atrazine to the columns was enhanced by the addition of 50 mL of saturated sodium chloride to each 1000 mL of sample prior to drawing the samples through the columns. Adsorbed atrazine was eluted from each column with 5 X 0.5 mL ethyl acetate. The combined ethyl acetate eluates were evaporated to dryness followed by re-dissolving of the resulting residues in methanol for analysis by isothermal (170°C) GC using a Hall Electrolytic Conductivity detector. Confirmations were performed with the use of both the nitrogen and reductive chloride modes of the detector or by GC/MS.

A "screening level" (presumably the method detection limit) of 0.1 ug/L atrazine based upon a 1 liter sample was reported. Recoveries based upon fortification levels of 0.1, 0.25, and 0. 5 ug/L ranged from 70-90%.

6.6) Results:

The samples were analyzed for atrazine and its major degradates using GC with a Colson conductivity detector. The results of the sample analyses for atrazine and its dégradates (analysis for degradates on 1975 samples only) are presented in Surface Water Appendix Tables 6.1 through 6.41 (from Tables 3 through 41 of the study report). The results are graphically presented by concentration vs. time plots in Surface Water Appendix Figures 6.1 through 6.14.

Under Phase II of the Drinking Water Regulations, water supply systems will be required to collect a minimum of 4 finished water samples a year, one per quarter. A water supply system will be considered out of compliance if the annual mean concentration of a regulated pesticide in the 4 quartely samples exceeds the MCL for the pesticide. If the pesticide concentration exceeds 4 times the MCL in any individual sample, the annual mean will obviously exceed the MCL if only the minimum number of samples is collected (4 per year; 1 per quarter).

Atrazine concentrations were compared to 4 times the MCL. Annual (or the longest available means if sampling was for less than one year) arithmetic mean atrazine concentrations of pesticides (the longest available means) were compared to the MCL.

Maximum atrazine concentrations, overall and annual (or longest available less than annual) arithmetic mean atrazine concentrations, atrazine concentration distributions, ratios of atrazine concentrations to 4 times the MCL, and ratios of annual (or longest available less than annual) arithmetic mean atrazine concentrations to the MCL are presented in EFGWB Spreadsheets 6.1 through 6.41. Atrazine concentrations greater than the MCL (3 ug/L), ratios of atrazine concentration to 4 times the MCL (12 ug/L) greater than 1, and ratios of arithmetic mean atrazine concentrations to the MCL greater than 1.0 are shaded in the spreadsheets.

Maximum atrazine concentrations, overall arithmetic mean atrazine concentrations, and atrazine concentration distributions from the spreadsheets are summarized in Tables 6.3 and 6.4. The concentration distributions of atrazine were computed with respect to its detection limit (0.1 ug/L), 1 ug/L, its MCL (3 ug/L), and 4 times its MCL (12 ug/L).

(1) **1975-1985 Atrazine in Surface Freshwaters:**

(a) 1975-1981: Atrazine was detected at greater than 0.1 ug/L (the detection limit) in 90.3% of the 1407 samples collected during 1975-1981 from 33 locations in 18 surface waters, but 69.4% of the 1269 detects were less than 1 ug/L. Atrazine was detected at greater than 3 ug/L (the MCL) in 5.6% (79/1406) of the samples, and at greater than 12 ug/L in 0.5% (7/1406) of the samples. The overall atrazine concentration distribution for the 1407 samples was as follows :

$C \leq 0.1$ ug/L (9.7%; 137/1406)
0.1 ug/L $< C \leq 1.0$ ug/L (62.7%; 881/1406)
1.0 ug/L $< C \leq 3.0$ ug/L (22.0%; 309/1406)
3.0 ug/L $< C \leq 12$ ug/L (5.1%; 72/1406 over 19 locations)
$C \geq 12$ ug/L (0.5%; 7/1406 over 6 locations)

Peak concentrations exceeding 4 times the MCL (12 ug/L) were 234 ug/L on 10/4/76 and 56 ug/L on 10/18/76 in the Mississippi River 10 miles above Vicksburg; 17.8 ug/L on 6/25/75 in the Mississippi River 10 miles below Helena, AR; 16.7 ug/L on 6/25/75 in the Mississippi River 1 mile above Helena, AR; 14.0 ug/L on 6/9/75 in the Missouri River 10 miles below St. Joseph; 13.59 ug/L on 6/30/75 in the Des Moines River at the Mississippi River confluence; and 13.0 ug/L on 5/27/75 in the Wabash River at the Ohio River confluence. All other atrazine concentrations were < 10 ug/L.

Annual (or longest available less than annual) arithmetic means exceeding the MCL (3 ug/L) were 3.77 ug/L in the Missouri River 10 miles below St. Joseph (19 samples 4/75-12/75), 3.19 ug/L in the Des Moines River at the Miss. Confluence (21 samples 3/75-12/75), and 9.66 ug/L in the Mississippi River 10 miles south of Vicksburg, MS (32 samples 2/76-11/76). The elevated mean in the Mississippi River was due primarily to abnormally high atrazine concentrations (234 and 56 ug/L) in 2 samples collected in October 1976. The magnitude of the concentrations, the fact that the samples were collected in October well after when peak atrazine concentrations are normally observed, and atrazine concentrations < 3 ug/L in all samples other samples collected 3/75-12/79 suggests that the abnormally high atrazine concentrations in the two October 1976 samples did not result from normal agricultural practice.

Annual (or longest available less than annual) arithmetic mean atrazine concentrations less than the MCL, but greater than 2 ug/L were 2.42 ug/L in the Republican River at the Miss. River confluence (18 samples 4/75-2/76) and 2.25 ug/L in the Wabash River at the Ohio River confluence (19 samples 4/75-3/76).

(b) 1982-1985: Atrazine was detected at > 0.1 ug/L (the detection limit) in 89.8% of the 461 samples collected during 1982-1985 from 6 locations in 3 surface waters, but 74.6% of the 414 detects were less than 1 ug/L. Atrazine was detected at greater than 3 ug/L (the MCL) in 6.5% (30/461) of the samples, but at greater than 12 ug/L (4 times the MCL) in only 2 samples. The overall atrazine concentration distribution for the 461 samples was as follows :

C $\leq$ 0.1 ug/L (10.2%; 47/461))
0.1 ug/L < C $\leq$1.0 ug/L (67.0%; 309/461)
1.0 ug/L < C $\leq$ 3.0 ug/L (16.3%; 75/461)
3.0 ug/L < C $\leq$ 12 ug/L (6.1%; 28/461 over 5 locations)
C $\geq$ 12 ug/L (0.4%; 2/461 over 2 locations)

Peak observed atrazine concentrations exceeding 4 times the MCL (12 ug/L) were 28.0 ug/L on 11/16/82 in the Mississippi River 1 mile above Vicksburg and 16.0 ug/L on 7/12/82 in the Mississippi River at Greenville, KS. All other atrazine concentrations were < 10 ug/L.

The highest annual (or longest available less than annual) arithmetic means were 1.60 ug/L in the Missouri River near St. Charles (16 samples 5/52-12/82), 1.76 ug/L in the Mississippi River at Greenville KS (16 samples 5/82-12/82), 1.87 ug/L in the Mississippi River 1 mile above Vicksburg MS (52 samples 1/82-12/82), and 1.80 ug/L in the Mississippi River 8 miles above CIBA GEIGY plant at St. Gabriel LA (19 samples 1/84-12/84).

The Ohio River at the Miss. River confluence, the Missouri River near St. Charles, the Mississippi River 1 mile above Vicksburg, and the Mississippi River 8 miles above the CIBA-GEIGY Plant in St. Gabriel were the only locations sampled both prior to and after January 1982. The arithmetic means and concentration distributions for the pre and post January 1982 samplings were comparable at the first two locations but appear to be somewhat higher for the post January 1982 samplings than for the pre January 1982 samplings at the latter 2 locations. However, the differences are not great, and the number of locations available for comparison is too small to develop conclusions concerning overall trends in atrazine concentrations from 1975-1985.

(2) **Atrazine Degradates in Surface Freshwaters:** Some of the surface freshwater samples collected in 1975 were analyzed for 1 to 4 of the following degradates : 2-hydroxy-4-ethylamino-6-isopropylamino-s-triazine (G-34048 - hydroxylated atrazine), 2-chloro-4-ethylamino-6-amino-s-triazine (G-28279 - deisopropylated atrazine), 2-chloro-4-amino-6-isopropylamino-s-triazine (G30033 - deethylated atrazine), and 2-chloro-4,6-diamino-s-triazine (G28273 -

dealkylated atrazine)(Figure 6.5 from Figure 1 of the study report).

Most of the samples analyzed had atrazine degradate concentrations less than detection limits of 0.5 to 1.0 ug/L. Hydroxylated atrazine was detected at concentrations $\geq$ 1 ug/L in 5 samples ranging from 1.0 to 1.8 ug/L. Deisopropylated atrazine was detected at concentrations $\geq$ 1 ug/L in 4 samples ranging from 1.1 to 2.1 ug/L. Dealkylated atrazine was detected at concentrations $\geq$ 1 ug/L in 2 samples (1.89 and 1.80 ug/L). Deethylated atrazine was not detected at concentrations $\geq$ 1 ug/L in any samples. Atrazine degradate concentrations were typically 2X to > 10X lower than the atrazine concentration, but were occasionally comparable.

(3) 1982-1985 Atrazine in Surface Water Source Tap Water:

Atrazine was detected at greater than 0.1 ug/L (the detection limit) in 70.6% of the 221 samples collected during 1982-1985 from 4 surface water source tap waters. However, 88.5% of the 156 detects were less than 1 ug/L. Atrazine was detected at greater than 3 ug/L (the MCL) in only one sample. The overall atrazine concentration distribution for the 221 samples was as follows :

$C \leq 0.1$ ug/L (29.4%; 65/221)
$0.1 < C \leq 1.0$ ug/L (62.4%; 138/221))
$1.0 < C \leq 3.0$ ug/L (7.7%; 17/221)
$3.0 < C \leq 12$ ug/L (0.6%; 1/221)
$C \geq 12$ ug/L (0.0%; 0/221).

The highest observed peak concentrations reported were 5.10 ug/L on 7/10/84, 5.0 ug/L on 7/25/84, 3.90 ug/L on 6/15/84, and 3.10 ug/L on 7/21/82 all in Missouri River St. Charles, MO tap water. All other tap water concentrations were < 3.0 ug/L.

The arithmetic means over the entire sampling period for the 4 tap water locations were as follows: 0.89 ug/L in the Missouri River source St. Charles tap water (68 samples 7/82-2/85); 0.39 ug/L in the Ohio River source tap water (51 samples 7/82-2/85); 0.14 ug/L in the Miss. River source Baton Rouge tap water (30 samples 2/83-6/85); and 0.12 ug/L in the Sacramento River source tap water (72 samples 5/82-7/85).

Pesticides (such as atrazine) with relatively low soil or sediment/water partition coefficients are frequently reported at concentrations in tap water that are comparable to concentrations reported in the corresponding surface water source. The reason is that most drinking water plants employ only filtration and/or coagulation/flocculation, and chlorination in treatment none of which effectively remove trace organics with low soil/water partition coefficients. The arithmetic means and concentration distributions of atrazine in the Ohio, Missouri, and Sacramento

River source tap waters are comparable to those in their surface water sources (Surface Water Appendix Spreadsheets 3.10, 3.15, and 3.38). The arithmetic means and concentration distribution of atrazine in the Baton Rouge tap water appears to be substantially lower than those generally observed for the lower Mississippi River, but it was unclear from the study report whether the Baton Rouge tap water is derived from groundwater or the Mississippi. In any event, the number of surface water source tap waters sampled is too low to develop conclusions concerning the relative concentrations of atrazine in surface water source tap water versus those in the corresponding surface water source.

(4) **Atrazine Concentrations in the Gulf of Mexico:** Of 48 samples collected in the Gulf of Mexico at the mouth of the Mississippi River from 1975 to 1985, 5 had atrazine concentrations $\geq$ 1 ug/L ranging from 1.2 to 2.5 ug/L. The atrazine concentration distribution for 174 samples collected at 11 locations off Venice, LA in the Gulf of Mexico from 1975 through 1985 was as follows: C $\leq$ 0.1 ug/L (51 samples; 29.3%), 0.1 < C $\leq$ 1.0 ug/L (100 samples; 55.9%), 1.0 < C $\leq$ 5.0 ug/L (17 samples; 9.5%), 5.0 < C $\leq$ 10 ug/L (3 samples; 1.7%), and C > 10 ug/L (1 sample at 56.4 ug/L; 0.6%). The majority of observed atrazine concentrations > 1 ug/L were in samples collected in 1975 and in 1980. Only 2 samples collected from 1981 through 1985 had atrazine concentrations > 1 ug/L.

6.7) Comments:

The QA/QC and other information provided is inadequate to fully assess the accuracy and representativeness of the data for the following reasons:

(1) The results of field and laboratory blank analyses (if any) were not provided.

(2) "Typical" recoveries were reported to range from 85 to 100% for the 1975-1981 samples and 70 to 100% for the 1982-1985 samples, but no recovery data were provided. In addition, it was unclear whether reported recoveries were from de-ionized or river water.

(3) Although recoveries are frequently a function of the level of spiking, no information was provided on the levels of spiking for the 1975-1981 samples, and the highest level of spiking (0.5 ug/L) for the 1982-1985 samples was well below many of the reported concentrations.

(4) No information was provided on the development of calibration curves from standard solutions.

(5) Although storage stability data for unrefrigerated samples over a 28 day period was provided, the maximum time intervals between

sampling and analyses for 1982-1985 samples was not provided.

(6) Samples collected at each sampling time during 1982-1985 were reported to generally be single grab samples collected close to the river banks. Therefore, they were not as representative of the overall river water as the 1975-1981 samples which were generally composited from 10 grab samples collected at equal intervals across the width of the river. None of the samples collected from 1975 to 1985 were time composited such as over 24 hours.

(7) The criteria used for the selection of sampling locations was not provided.

(8) Sampling times were at set intervals and neither dictated nor correlated with rainfall and runoff events.

ATRAZINE 080803

Page_____ is not included in this copy.

Pages 164 through 244 are not included.

The material not included contains the following type of information:

____ Identity of product inert ingredients.

____ Identity of product impurities.

____ Description of the product manufacturing process.

____ Description of quality control procedures.

____ Identity of the source of product ingredients.

____ Sales or other commercial/financial information.

____ A draft product label.

____ The product confidential statement of formula.

____ Information about a pending registration action.

_X_ FIFRA registration data.

____ The document is a duplicate of page(s) _____.

____ The document is not responsive to the request.

The information not included is generally considered confidential by product registrants. If you have any questions, please contact the individual who prepared the response to your request.

STUDY 7: Keck P. 1991. Missouri River Public Water Supplies Association. 1991 Missouri River Monitoring Study. September 19, 1991.

7.1) Sampling Locations:

Samples were collected at 7 locations along the lower Missouri River (Figure 7.1 and Table 7.1 from Figure 1 and Table 1 of the study report). The sampling locations selected bracketed entry points of major tributaries to the lower Missouri River. The sampling locations were all far enough downstream from tributary entrance points to assure mixing within the Missouri River, and were all adjacent to USGS gauging stations.

7.2) Sampling Times:

Samples were collected daily at all 7 sampling locations in May, June, and July 1991.

7.3) Sampling Methodology:

Grab samples were collected. Samples were not stream depth or stream width composited. Samples were refrigerated and shipped weekly to the St. Louis County Water Company Lab.

7.4) Analytical Methodology:

Samples (35 mL) were centrifuged and then extracted with 2 mL pesticide grade hexane. The hexane extracts were analyzed for atrazine, alachlor, and simazine using capillary column GC with a Nitrogen/Phosphorous Detector.

7.5 QA/QC Procedures:

QA/QC procedures included the analysis of one "travel blank" and one spiked sample per weekly sample shipment from each sampling location. In addition, one daily sample collected at each location was split every other week and sent to another lab (the American Water Works Service Company Lab) for comparison. Blank analyses indicated no contamination during shipping, storage, and analysis. Spike recoveries for atrazine (0.70 ug/L spike level) and simazine (0.78 ug/L spike level) averaged 96% and 83%, respectively. Relative percent differences between atrazine concentrations reported by the St. Louis County Water Company Lab and the American Water Works Service Company Lab ranged from 1% to 84% and averaged 28% $\pm$ 22% for 13 split samples.

7.6) Results:

The results of the analyses of individual samples were not reported tabularly, but they are summarized in Table 7.2 (from P.

13 of the study report). The location abbreviations used in Table 7.1 are as follows: SX (Sioux City IA), OM (Omaha NE), SJ (St. Joseph MO), KC (Kansas City MO), LX (Lexington MO), BN (Boonville MO), and SL (Chesterfield MO). The data are presented graphically as a function of time in Figures 7.2 through 7.8 (from Figures 2 through 8 of the study report).

Under Phase II of the Drinking Water Regulations, water supply systems will be required to collect a minimum of 4 finished water samples a year, one per quarter. A water supply system will be considered out of compliance if the annual mean concentration of a regulated pesticide in the 4 quartely samples exceeds the MCL for the pesticide. If the pesticide concentration exceeds 4 times the MCL in any individual sample, the annual mean will obviously exceed the MCL if only the minimum number of samples is collected (4 per year; 1 per quarter).

Concentrations of pesticides were compared to 4 times their MCL (or 4 times their lifetime drinking water HA if a MCL was not available). May-July 1991 Annual arithmetic mean concentrations of pesticides (the longest available means) were compared to their MCLs (or their lifetime drinking water HA if a MCL was not available). Annual means are more appropriate for comparison to the MCLs because of the Phase II regulations, but could not be computed because samples were collected only from May through July of 1991. It should be noted that the ratios of May-July means to MCLs are probably generally somewhat greater than the ratios of annual means to MCLs.

7.6.1 Atrazine

Atrazine was detected (detection limit not provided) in 62.9% of the 589 samples analyzed. Atrazine concentrations greater than the MCL (3 ug/L) were reported in 28.0% (165/589) of the samples analyzed. Arithmetic mean atrazine concentrations ranged from 0.72 ug/L at Omaha NE to 3.22 ug/L at Boonville MO. Boonville was the only sampling location where the arithmetic mean exceeded the MCL (3 ug/L), but 4 other sampling locations had arithmetic means greater than 2 ug/L. Maximum observed atrazine concentrations ranged from 6.71 ug/L at Chesterfield MO to 11.1 ug/L at Kansas City MO. None exceeded 4 times the MCL (12 ug/L).

Percent detections, percent with concentrations greater than the MCL, and arithmetic mean atrazine concentrations were substantially less for the upper most sampling locations (Sioux City IA and Omaha NE) than for the other sampling locations. However, maximum observed atrazine concentrations at Sioux City and Omaha were either comparable to or over 70% of those at the other 5 sampling locations.

7.6.2 Simazine

Simazine was detected (detection limit not provided) in only 2 of the 589 samples analyzed. Both detections were in samples collected from the Kansas City location. The maximum simazine concentration reported (0.48 ug/L) is well below the MCL (1 ug/L).

7.7) Comments:

(1) Average streamflow in the Missouri River was described as near average in May (96% of 1967-1987 average), below average in June (73% of 1967-1987 average), and well below average in July (54% of the 1967-1987 average).

(2) The study author points out that the concentration versus time plots become more complicated from upstream to downstream because of the increasing number of tributaries contributing to the load. At the upper sampling sites (Sioux City and Omaha), atrazine peaks are sharper but fewer (Figures 7.2 and 7.3) than at the lower sampling sites where due to averaging of loadings from increasing numbers of tributaries, peaks are generally broader and lower, but more frequent (Figures 7.4 through 7.8).

(3) The study author estimated total atrazine passing St. Louis in the Missouri River from May through July 1991 to be 1.1×10^5 lbs. The Upper Missouri Basin was estimated to contribute approximately 33% of the flow, but only 8% of the atrazine loading. The Nebraska Platte and 'Western Iowa" drainage areas were estimated to contribute only 26% of the flow, but 50% of the atrazine load. The Grand-Chariton Basin was estimated to contribute only 18% of the flow, but 40% of the atrazine loading.

(4) Cyanazine may have been a better candidate for analysis than simazine since several other studies conducted in the mid-western corn belt have shown cyanazine to generally be much more prevalent and at much higher concentrations than simazine. However, the MCL for simazine (1 ug/L) is substantially lower than the lifetime drinking water HA for cyanazine of 10 ug/L (cyanazine does not have a MCL yet, but the Office of Drinking Water frequently ends up setting the MCL equal to the lifetime drinking water HA).

River Mile	Gaging Station	Rivers	MRPWSA Member	City
	Gavins Point			
		Vermillion		
734		Big Sioux		
731		Floyd		
723.3	Sioux City			
			Sioux City Utilities Dept.	Sioux City, IA
669		Little Sioux		
664		Soldier		
651		Boyer		
626				
619			Omaha Metropolitan Utilities	Omaha, NE
615.9	Omaha		Council Bluffs Waterworks	Council Bluffs, IA
595		Platte		
562.6	Nebraska City			
542		Silver / E&W Nishnabotna		
527.8		Little Nemaha		
507.5		Tarkio		
498	Rulo			
495		Nemaha		
463		Nodaway		
452				
448.2	St. Joseph		Missouri American	St. Joseph, MO
423.5				
397.5			City of Atchison Water Dept.	Atchison, KS
392		Platte(MO.)	Leavenworth Water Dept.	Leavenworth, KS
380				
373.6			Johnson County Water Dist. #1	Shawnee/Mission, KS
370.5			Board of Public Utilies	Kansas City, KS
367.5		Kansas	Water & Pollution Control	Kansas City, MO
366.1	Kansas City			
316				
306.6			U.S. Water	Lexington, MO
293.4	Waverly		Higginsville Municipal Util.	Higginsville, MO
251.7		Grand		
227.9		Chariton		
226.3	Glascow			
197.5				
197.1	Boonville		Boonville Bd. of Public Works	Boonville, MO
147.5		Cedar		
143				
129		Osage	Capital City Water	Jefferson City, MO
103.5		Gasconade		
97.9	Hermann			
37.0				
36.3			St. Louis City Water	St. Louis, MO
20.8			St. Louis County Water(CCP)	St. Louis County, MO
			St. Louis County Water(NCP)	

MAY-JUNE 1991

HERBICIDE CONCENTRATION SUMMARY

Atrazine

Location	Sample Days	Occurrences	Days > 3 ug/l	Average of Samples	Max
SX	84	37	5	0.73	8.36
OM	86	38	6	0.72	7.89
SJ	89	71	29	2.32	10.65
KC	89	56	30	2.15	11.10
LX	74	72	25	2.36	8.20
BN	83	83	40	3.22	7.44
SL	84	84	30	2.61	6.71

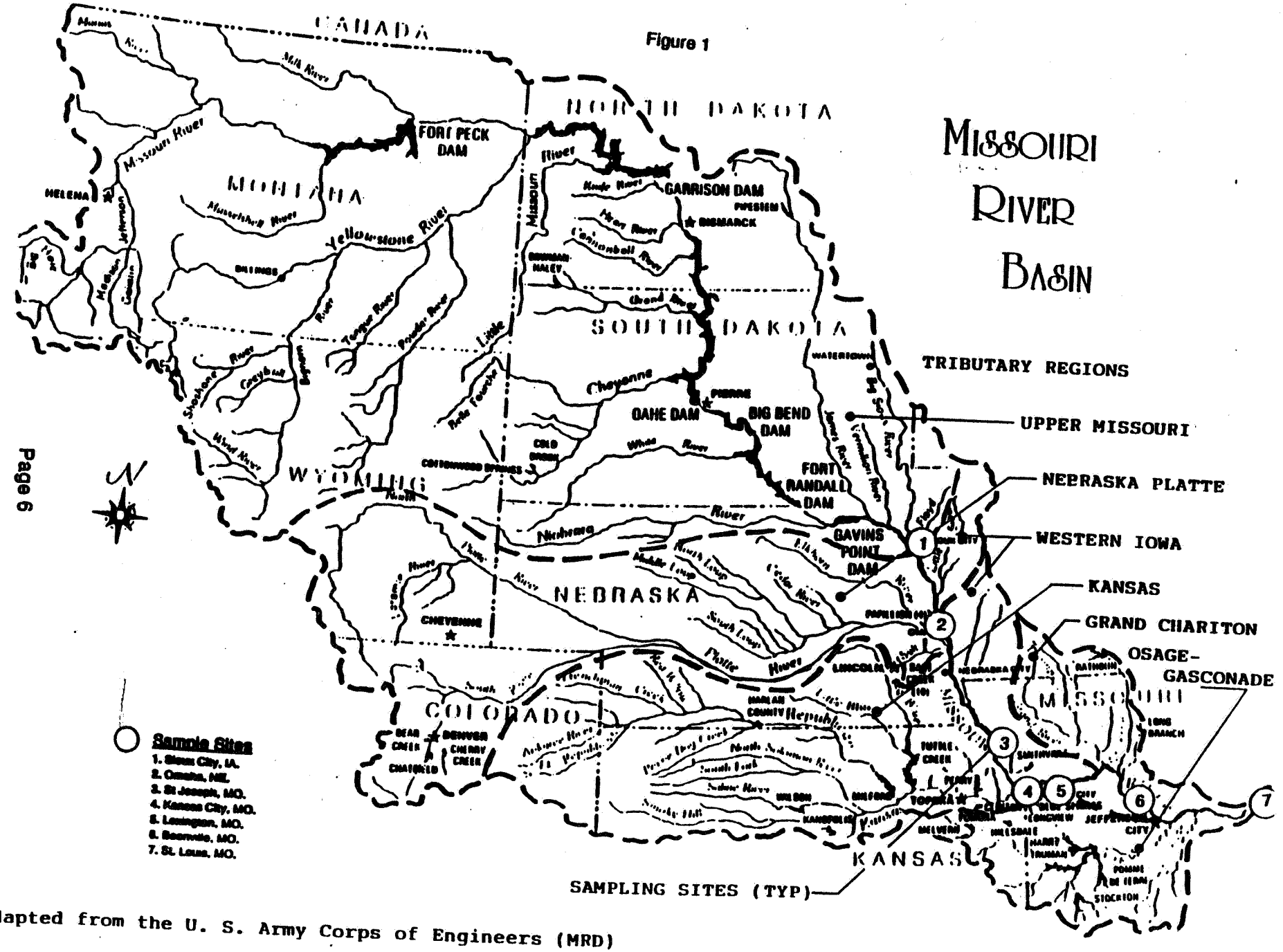
Alachlor

Location	Sample Days	Occurrences	Days > 2 ug/l	Average of Samples	Max
SX	84	2	0	0.03	1.64
OM	86	6	0	0.07	1.21
SJ	89	21	1	0.29	2.94
KC	89	22	4	0.47	14.91
LX	74	16	1	0.20	2.26
BN	83	19	0	0.21	1.49
SL	84	12	0	0.12	1.22

Simazine

Location	Sample Days	Occurrences	Days > 1 ug/l	Average of Samples	Max
SX	84	0	0	0	0
OM	86	0	0	0	0
SJ	89	2	0	0.01	0.48
KC	89	0	0	0	0
LX	74	0	0	0	0
BN	83	0	0	0	0
SL	84	0	0	0	0

Figure 1



Adapted from the U. S. Army Corps of Engineers (MRD)

252

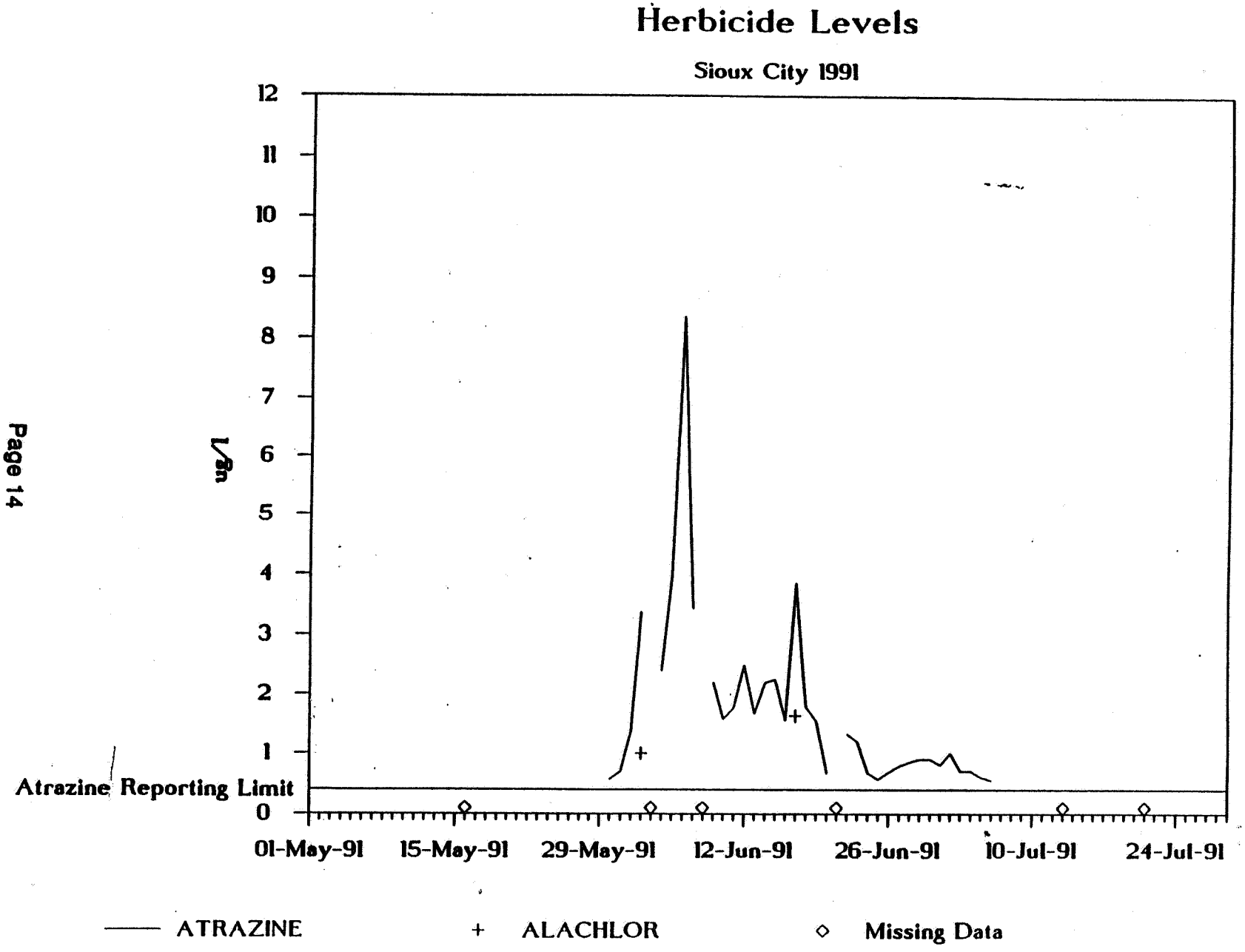

Herbicide Levels
Sioux City 1991
ug/l
12
11
10
9
8
7
6
5
4
3
2
1
0
Atrazine Reporting Limit
01-May-91
15-May-91
29-May-91
12-Jun-91
26-Jun-91
10-Jul-91
24-Jul-91
ATRAZINE
ALACHLOR
Missing Data

Figure 2

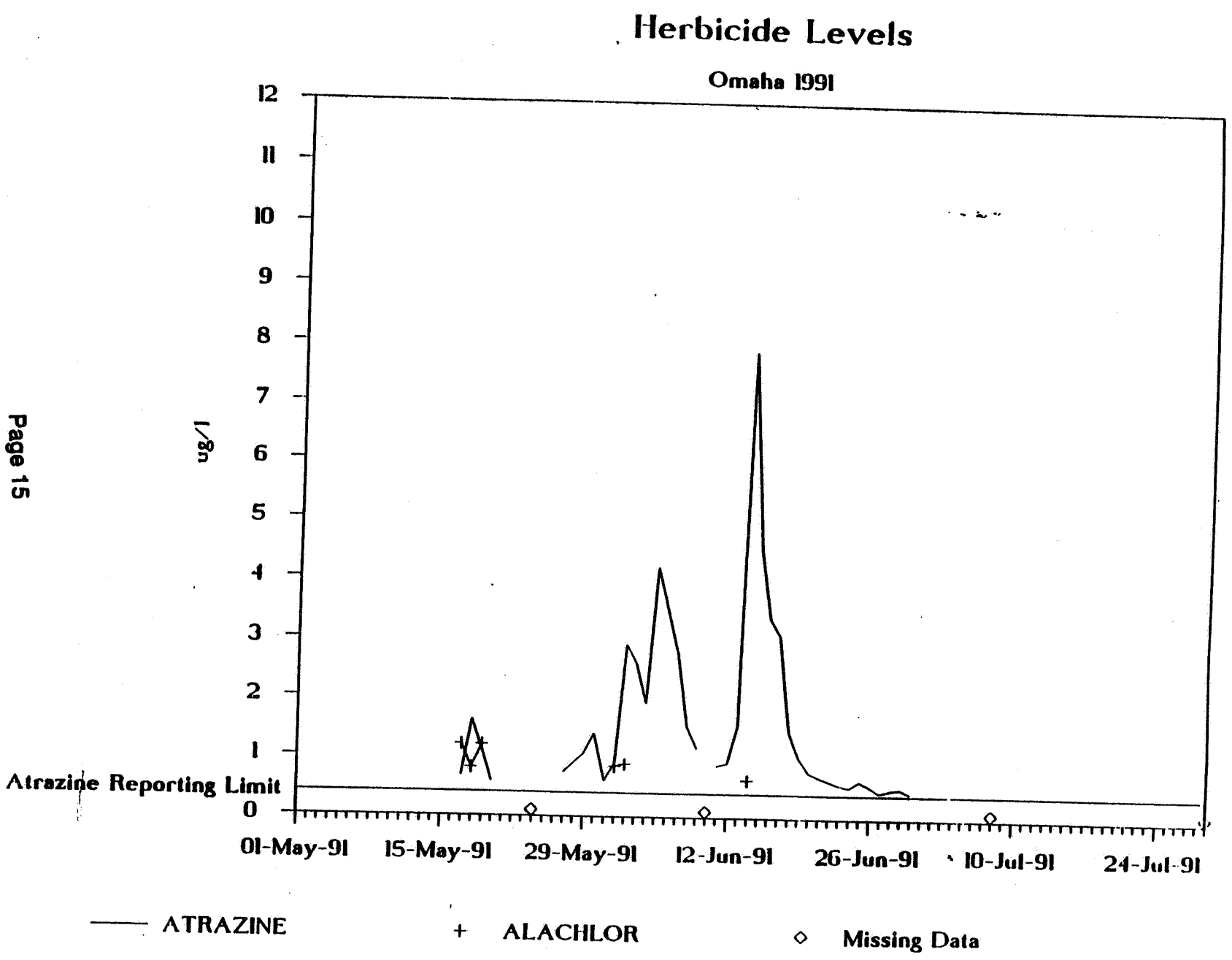

Herbicide Levels
Omaha 1991
ug/l
12
11
10
9
8
7
6
5
4
3
2
1
0
Atrazine Reporting Limit
01-May-91
15-May-91
29-May-91
12-Jun-91
26-Jun-91
10-Jul-91
24-Jul-91
ATRAZINE
ALACHLOR
Missing Data

Figure 3

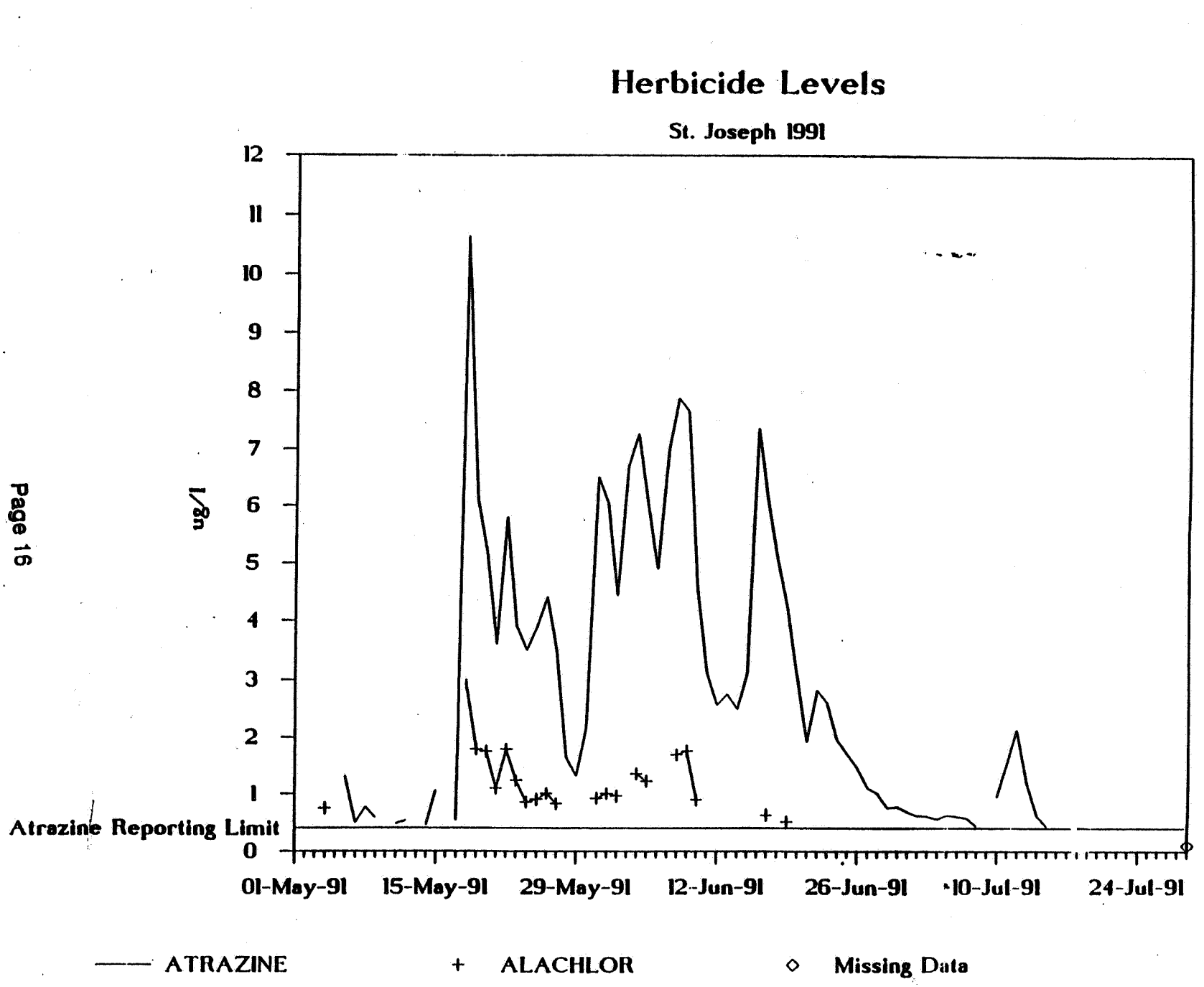

Herbicide Levels
St. Joseph 1991
ug/l
12
11
10
9
8
7
6
5
4
3
2
1
0
Atrazine Reporting Limit
01-May-91
15-May-91
29-May-91
12-Jun-91
26-Jun-91
10-Jul-91
24-Jul-91
ATRAZINE
ALACHLOR
Missing Data

Figure 4

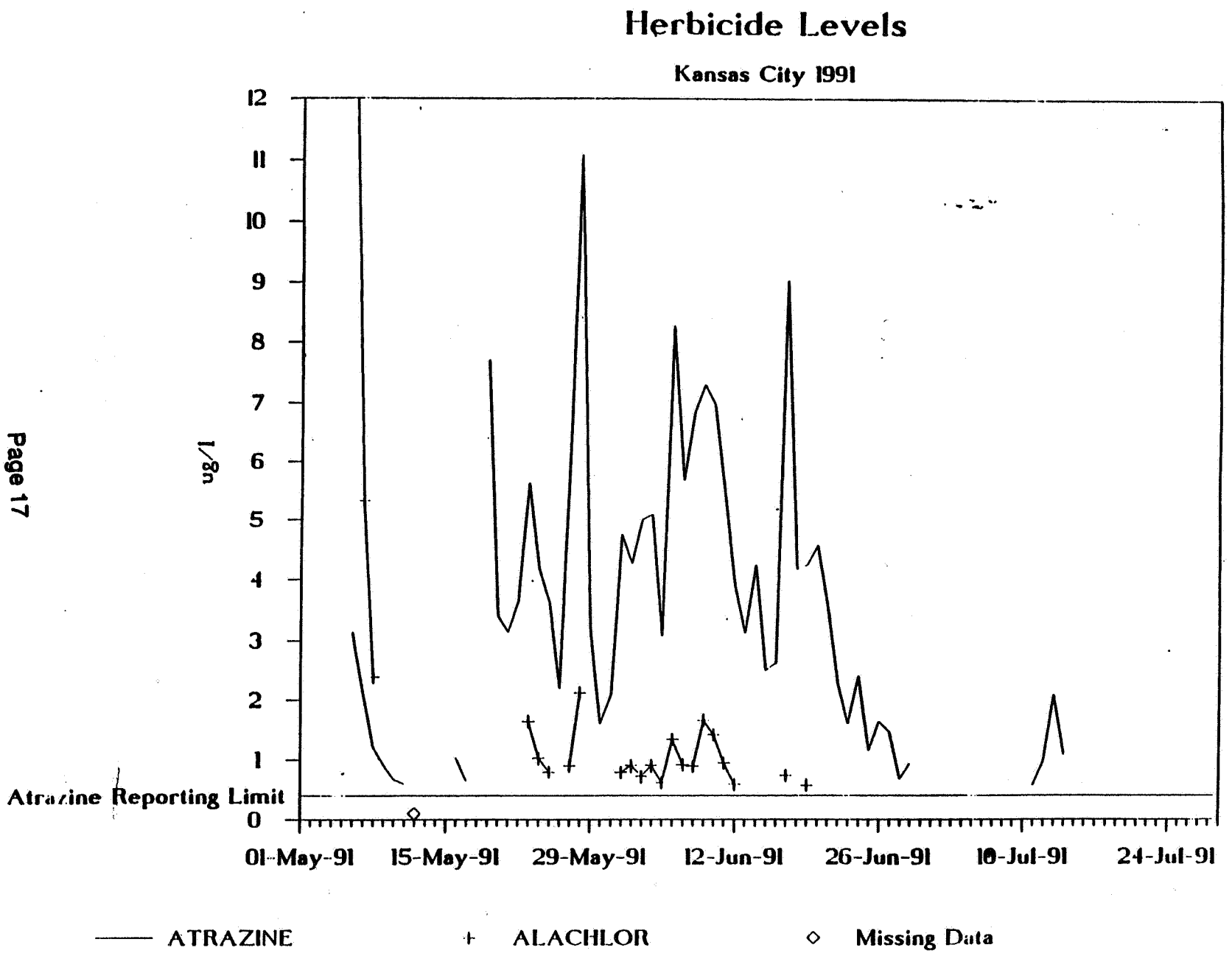

Herbicide Levels
Kansas City 1991
ug/l
12
11
10
9
8
7
6
5
4
3
2
1
0
Atrazine Reporting Limit
01-May-91
15-May-91
29-May-91
12-Jun-91
26-Jun-91
10-Jul-91
24-Jul-91
ATRAZINE
ALACHLOR
Missing Data

Figure 5

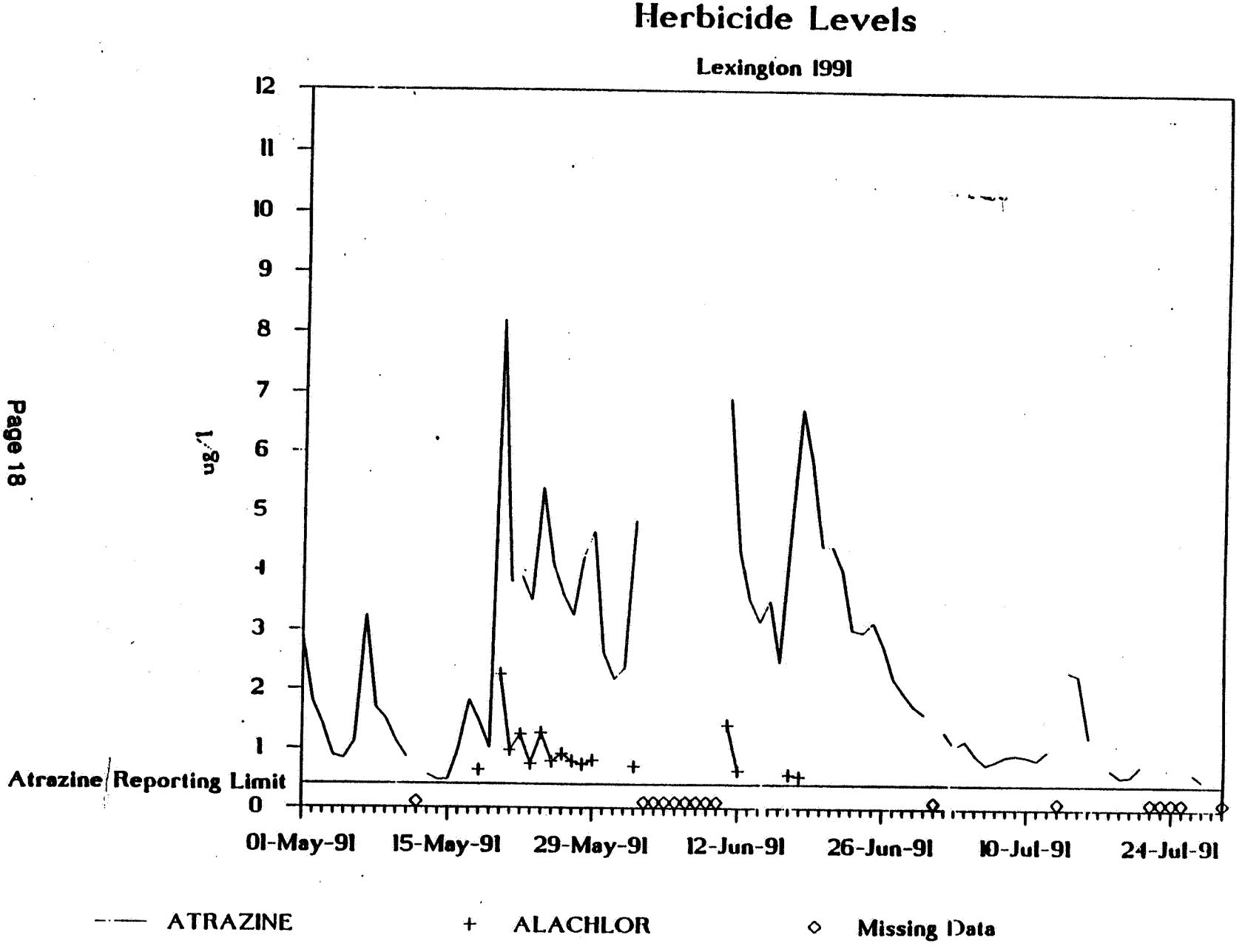

Herbicide Levels
Lexington 1991
ug/l
12
11
10
9
8
7
6
5
4
3
2
1
0
Atrazine Reporting Limit
01-May-91
15-May-91
29-May-91
12-Jun-91
26-Jun-91
10-Jul-91
24-Jul-91
ATRAZINE
ALACHLOR
Missing Data

Figure 6

Herbicide Levels

Boonville 1991

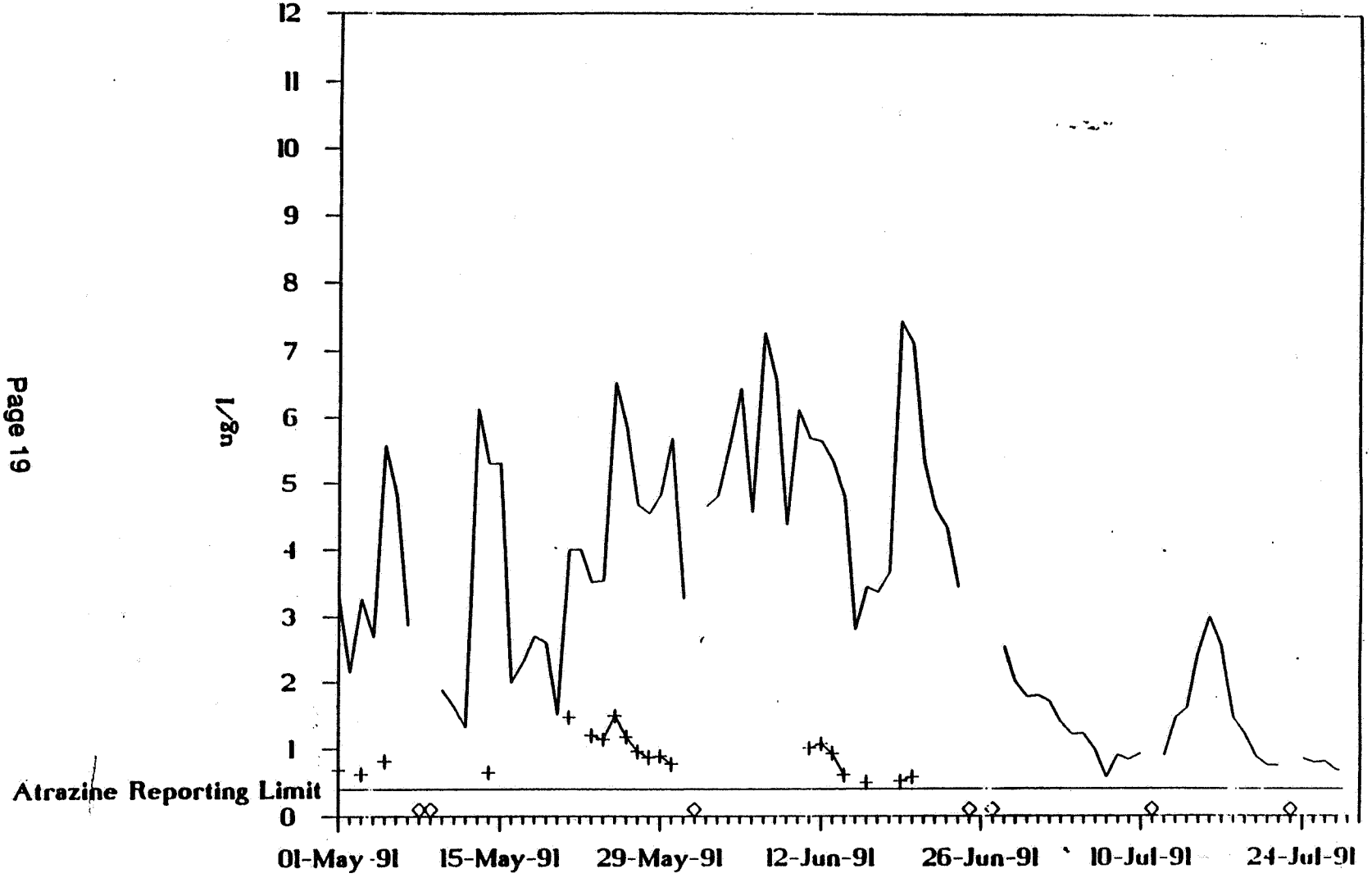


Figure 7

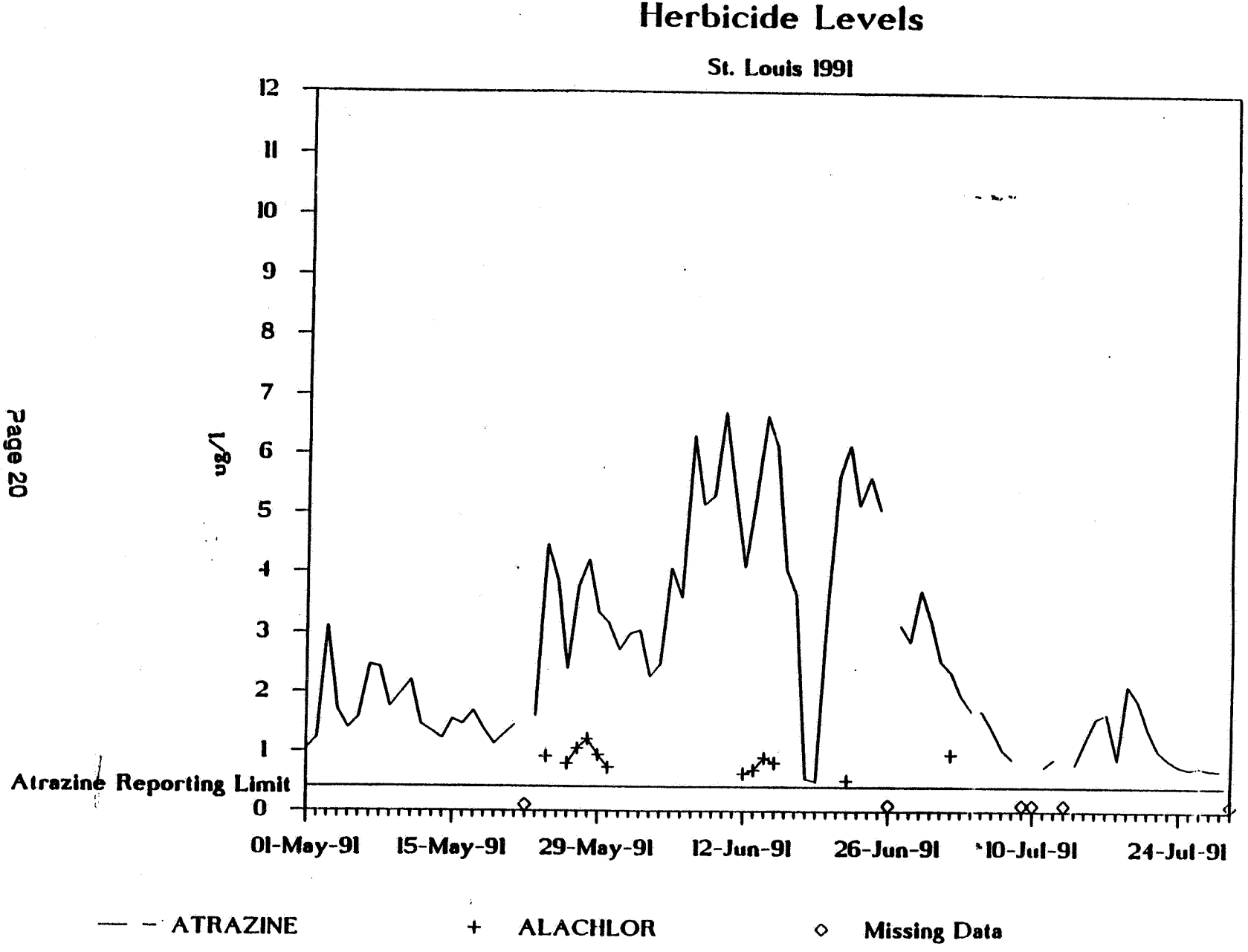

Herbicide Levels
St. Louis 1991
ug/l
12
11
10
9
8
7
6
5
4
3
2
1
0
Atrazine Reporting Limit
01-May-91
15-May-91
29-May-91
12-Jun-91
26-Jun-91
10-Jul-91
24-Jul-91
ATRAZINE
ALACHLOR
Missing Data

Figure 8

8. STUDY 8: Moyer L and Cross J. 1990. Pesticide monitoring: Illinois EPA's summary of results. 1985-1989.

8.1) Sampling Locations:

Samples for pesticide analyses were collected from a 30 station subnetwork of the 208 station Illinois Ambient Water Quality Monitoring Network (Table 8.1 and Figure 8.1 from Table 2 and Figure 2 of the study report). Twenty-six of the 30 stations selected for pesticide monitoring drain predominantly agricultural watersheds and have historically reported high suspended sediment loads (both together indicate high potential for pesticide runoff).

Four of the 30 stations drain predominantly non-agricultural watersheds and were selected to serve as controls. The 4 control stations were in the Des Plaines River, the upper Illinois River, the Big Muddy River, and Lusk Creek.

8.2 Sampling Times:

Samples were collected at each of the 30 stations twice in the spring, twice in the summer, once in the fall, and once in the winter from October 1985 to October 1988. A total of 580 samples were collected under that schedule.

To determine the magnitude and duration of elevated pesticide concentrations during high runoff post-application periods in the spring, additional more intensive sampling was conducted at 2 additional sites. A total of 25 additional samples at another Macoupin Creek site and 15 additional samples at a Spring Creek site were collected from May 1 through May 20, 1989.

8.3) Sampling Methodology:

Depth integrated samplers were used to collect samples at one to ten equal increments across the stream depending upon the stream width (one for streams < 10 feet wide, 3 for streams 10 to 30 feet wide, one per every 10 feet for streams 30 to 100 feet wide, and 10 equal increments for streams > 100 feet wide). Samples collected at different points across a stream were composited in a one-gallon amber glass container.

8.4) Pesticide Selection:

The collected samples were analyzed for 7 herbicides (including the triazines atrazine and cyanazine), 7 insecticides, and one fungicide. The 15 pesticides were selected for monitoring based upon their estimated quantity of use in Illinois and their estimated runoff potential. Physical chemical characteristics, persistence, estimated runoff potential, and estimated leaching potential for the 15 pesticides are listed in Table 8.2 (from Table 3 of the study report).

8.5) Analytical Methodology:

Pesticides were extracted from the aqueous samples with hexane/methylene chloride. Extracts were dried with sodium sulfate and concentrated by evaporation prior to analysis by GC with a flame photometric detector.

8.6) QA/QC Methodology:

No information was provided on QA/QC methodologies.

8.7) Results:

The results of the pesticide analyses of samples collected October 1985 through October 1988 from the 30 sampling locations are presented in Surface Water Appendix Tables 8.1 through 8.30 (from tables in Appendix B of the study report). The results of the pesticide analyses of samples collected May 1 through May 20 from Macoupin Creek and Spring Creek are presented in Surface Water Appendix Tables 8.31 and 8.32 (from tables in Appendix C of the study report). Pesticide concentrations and river discharge versus time for the 2 sites intensely sampled from May 1 through May 20, 1989 (Macoupin Creek and Spring Creek) are presented in Figures 8.2 and 8.3 (from Figures 40 and 41 from the study report).

Under Phase II of the Drinking Water Regulations, water supply systems will be required to collect a minimum of 4 finished water samples a year, one per quarter. A water supply system will be considered out of compliance if the annual mean concentration of a regulated pesticide in the 4 quartely samples exceeds the MCL for the pesticide. If the pesticide concentration exceeds 4 times the MCL in any individual sample, the annual mean will obviously exceed the MCL if only the minimum number of samples is collected (4 per year; 1 per quarter).

Concentrations of pesticides were compared to 4 times their MCL (or 4 times their lifetime drinking water HA if a MCL was not available). Annual (or the longest available if less than annual) arithmetic mean concentrations of pesticides were compared to their MCLs (or their lifetime drinking water HA if a MCL was not available).

Spreadsheets 8.1 through 8.30 contain the following information on atrazine and cyanazine at each location: concentrations, maximum observed concentrations, overall and annual arithmetic mean concentrations, and concentration distributions. Atrazine concentrations exceeding the MCL (3 ug/L), cyanazine concentrations exceeding the lifetime drinking water HA (10 ug/L), ratios exceeding 1 of atrazine concentrations to 4 times the MCL (12 ug/L), ratios exceeding 1 of cyanazine concentrations to 4 times the drinking water HA (40 ug/L), ratios exceeding 1 of annual (or the longest available if less than annual) arithmetic mean

atrazine concentrations to the MCL (3 ug/L), and ratios exceeding 0.5 of April-August arithmetic mean cyanazine to the lifetime drinking water HA (10 ug/L) are shaded in the spreadsheets.

The maximum observed concentrations, overall arithmetic mean concentrations, and concentration distributions of atrazine and cyanazine are summarized for the 30 sampling locations in Tables 8.3 and 8.4. The concentration distribution of atrazine was computed with respect to its detection limit (0.1 ug/L), 1 ug/L, its MCL (3 ug/L), and 4 times its MCL (12 ug/L). The concentration distribution of cyanazine was computed with respect to its detection limit (0.1 ug/L), 1 ug/L, its lifetime drinking water HA (10 ug/L), and 4 times its lifetime drinking water HA (40 ug/L).

8.7.1 Atrazine:

Atrazine was detected (detection limit 0.1 ug/L) in 66.7% of the 575 samples analyzed, but 75.2% of the 441 detects were less than 1 ug/L. Atrazine concentrations exceeded the MCL (3 ug/L) in 7.3% (42/575) of the samples over 17 locations and 4 times the MCL (12 ug/L) in 1.4% (8/575) of the samples over 6 locations. The overall atrazine concentration distribution for samples collected from the 30 sampling locations was as follows:

$C \leq 0.1$ ug/L (23.3%; 134/575)
0.1 ug/L $< C \leq 1.0$ ug/L (57.7%; 332/575)
1 ug/L $< C \leq 3$ ug/L (11.7%; 67/575)
3 ug/L $< C \leq 12$ ug/L (5.9%; 34/575 over 17 locations)
$C \geq 12$ ug/L (1.4%; 8/575 over 6 locations)

Atrazine concentrations exceeding four times the MCL (12 ug/L) were 13.0 ug/L on 6/18/87 in the Little Wabash River, 16.0 ug/L on 6/26/86 in the Spoon River (2 miles W of Wyoming IL), 39.0 ug/L on 5/11/88 and 14.0 ug/L on 6/16/88 in Bay Creek, 19.0 ug/L on 5/12/88 in Bear Creek, 24.0 ug/L on 5/19/87 in the Plum River, and 13.0 ug/L on 5/21/86 and 18.0 ug/L on 5/6/87 in Silver Creek.

Annual (or the longest available if less than annual) arithmetic mean atrazine concentrations exceeding the MCL (3 ug/L) were 5.22 ug/L (1/87-11/87) in the Little Wabash River NE of Louisville IL, 9.33 ug/L (1/88-10/88) in Bay Creek at Nebo IL, 4.40 ug/L (1/88-9/88) in Bear Creek 2.2 miles NE of Marcelline IL, 4.24 ug/L (1/87-10/87) in Plum River at E. Savanna IL, and 4.26 ug/L (1/87-10/87) in Silver Creek 2.2 miles SE of Freeburg IL. Mean atrazine concentrations over the entire October 1985 to October 1988 sampling period for each of the 30 sampling locations are presented in Figure 8.4 (from Figure 10 of the study report).

8.7.2 Cyanazine

Cyanazine was detected (detection limit 0.1 ug/L) in 37.7% of the 575 samples analyzed, but 76.0% of the 217 detects were less than 1 ug/L. Five cyanazine concentrations over 5 locations exceeded the lifetime drinking water HA (10 ug/L). No cyanazine concentrations exceeded 4 times the lifetime drinking water HA (40 ug/L). The overall cyanazine concentration distribution for samples collected from the 6 sampling locations was as follows:

$C \leq 0.1$ ug/L (62.3%; 358/575))
0.1 ug/L $< C \leq$ 1.0 ug/L (28.7%; 165/575)
1 ug/L $< C \leq$ 10 ug/L (8.2%; 47/575)
10 ug/L $< C \leq$ 40 ug/L (0.9%; 5/575))
$C \geq$ 40 ug/L (0.0%; 0/575)

Cyanazine concentrations exceeding the lifetime drinking water HA (10 ug/L) were 11.0 ug/L on 4/16/87 in the Embarass River, 17.0 ug/L on 4/16/87 in the Little Wabash River, 38.0 ug/L on 5/11/88 in Bay Creek, 31.0 ug/L on 5/12/88 in Bear Creek, and 28.0 ug/L on 5/19/87 in the Plum River.

None of the annual (or longest available less than annual) arithmetic mean cyanazine concentrations were greater than the lifetime drinking water HA (10 ug/L). The highest arithmetic mean cyanazine concentrations were 3.51 ug/L (1/87-11/87) in the Little Wabash River, 7.85 ug/L (1/88-10/88) in Bay Creek, 6.04 ug/L (1/88-9/88) in Bear Creek, and 4.71 ug/L (1/87-10/87) in the Plum River. Mean cyanazine concentrations over the entire October 1985 to October 1988 sampling period for each of the 30 sampling locations are presented in Figure 8.5 (from Figure 11 of the study report).

8.8) Comments:

(1) Illinois wide Spring (March-May) arithmetic mean atrazine and cyanazine concentrations were greater than the summer (June-August) means which were much greater than the fall (September-November) and winter (December-February) means for 1986-1988 (Figure 8.6 from Figure 3 of the study report).

(2) Upstream drainage areas for the 30 stations sampled ranged from 42.9 sq. miles to 5150 sq. miles. The 6 highest spring/summer arithmetic mean atrazine concentrations were for stations with upstream drainage areas less than 750 sq. miles (Table 8.5 and Figure 8.7 from Table 16 and Figure 5 of the study report).

(3) The analyses of samples collected from May 1 through May 20 at Macoupin and Spring Creeks yielded somewhat surprising results (Figure 8.2 and 8.3). As expected, peak atrazine concentrations occurred either in conjunction with peak discharges (Spring Creek) or slightly after peak discharge (Macoupin Creek). However, at both locations, a second atrazine peak much greater than the first peak

occurred well after the peak discharge. The study authors postulated that the first atrazine peaks occurring in conjunction with or slightly after peak discharge are primarily due to runoff, while the second atrazine peaks occurring well after peak discharge may be due primarily to tile drainage and/or groundwater discharge. They suggest that at these creeks, the atrazine concentrations associated with runoff are lower than those associated with tile drainage and/or groundwater discharge because of dilution.

Table 8.1 Pesticide Subnetwork Stations

IEPA STATION CODE	STREAM NAME	VERBAL DESCRIPTION
AK 02*	Lusk Creek	Co. Rd. Br., 2.8 mi. SE of Eddyville
ATG 03	M. Fork Saline River	Co. Rd. Br., 2.7 mi. SE of Harrisburg
BE 07	Embarras River	Co. Rd. Br. at N edge of St. Marie
BPJ 07	Salt Fork Vermilion River	Co. Rd. Br., 2.5 mi. N. of St. Joseph
C 19	Little Wabash River	Co. Rd. Br., NE edge of Louisville
D 23*	Illinois River	Marseilles downstream from Nabisco Bld.
DA 06	Macoupin Creek	Rt. 267 Br., 3.5 mi. NW of Kane
DG 01	LaMoine River	U.S. Rt. 24 Br. at Ripley
DG 04	LaMoine River	Rt. 61 Br. at Colmar
DJ 06	Spoon River	Rt. 17 Br., 2 mi. W of Wyoming
DJ 08	Spoon River	Rt. 95, 0.4 mi. NE of Seville
DK 13	Mackinaw River	4 mi. SE of Deer Creek at CO. Rd. Br.
DQ 03	Big Bureau Creek	Rt. 6 Br. near Princeton
DS 07	Vermilion River	Co. Rd. Br., 3 mi. NE of Leonore
E 25	Sangamon River	Rt. 97 Br. near Oakford
E 28	Sangamon River	Co. Rd. Br. (Allerton Park) 4.5 mi. SW of Monticello
EI 02	Salt Creek	Rt. 29 Br., 4 mi. N of Greenview
F 01	Kankakee River	I-55 Br., 3 mi. NW of Wilmington
G 15*	Des Plaines River	Irving Park Rd. Br. at Schiller Park
KCA 01	Bay Creek	Twp. Road Br. at W edge of Nebo
KI 02	Bear Creek	Co. Rd. Br., 2.2 mi. NE of Marcelline
LD 02	Henderson River	Rt. 94 Br., 1 mi. S of Bald Bluff
LF 01	Edwards River	Rt. 17 Br., 2 mi. NE of New Boston
MJ 01	Plum River	U.S. 52 Br. at E edge of Savanna
MN 03	Apple River	U.S. 20 Br., 2 mi. W of Elizabeth
N 11*	Big Muddy River	Rt. 149 Br., 0.7 mi. W of Plumfield
O 08	Kaskaskia River	U.S. Rt. 51 Br. at SE edge of Vandalia
OD 07	Silver Creek	Rt. 460 Br., 2.2 mi. SE of Freeburg
PB 04	Green River	Rt. 82 Br., N.of Geneseo
PH 16	Elkhorn Creek	2 mi. NW of Penrose Co. Rd. Br.

* = "Control"

2. Pesticide Selection

The candidate list of pesticides initially considered for the pesticide subnetwork included a total of 58 herbicides and insecticides (see Appendix A). Criteria utilized in selecting pesticides to be monitoring included:

- quantities used statewide
- potential for offsite movement

- persistence of the pesticide
- solubility of the pesticide
- analytical procedures

Pesticide use surveys conducted in 1978, 1982, and 1985 by the University of Illinois, Urbana were utilized to select those herbicides and insecticides used in highest quantities on a statewide basis (Pike, 1985). A pesticides potential for surface runoff and leaching potential are documented by Wauchope (1987).

Ultimately 15 pesticides were selected for incorporation into the pesticide subnetwork. These 15 pesticides included 7 herbicides, 7 insecticides and one fungicide. Table 3 provides a list of the pesticides selected as well as their potential for offsite movement and other chemical properties used as selection criteria.

Table 8.2 Characteristics of the Herbicides and Organophosphate Insecticides Monitored in the Pesticide Monitoring Subnetwork

Trade Name	Common Name	Type	Soil[1] Sorption Koc (g/ml)	Solubility[2] (mg/l)	Half-Life[3] (Soil Days)	Potential for Offsite Movement[4] Runoff Potential	Leaching Potential
Atrazine	Atrazine	Herbicide	100	33	60	Medium	Large
Bladex	Cyanazine	Herbicide	190	170	14	Medium	Medium
Dual	Metolachlor	Herbicide	200	530	20	Medium	Medium
Lasso	Alachlor	Herbicide	170	240	15	Medium	Medium
Sencore/Lexone	Metribuzin	Herbicide	41	1220	30	Medium	Large
Sutan +	Butylate	Herbicide	126	46	12	Medium	Medium
Treflan	Trifluralin	Herbicide	7000	0.3	60	Large	Small
Counter	Terbufos	Insecticide	3000	5	5	Medium	Small
Dursban/Lorsban	Chloropyrifos	Insecticide	6070	2	30	Large	Small
Dyfonate	Fonofos	Insecticide	532	13	45	Large	Medium
Malathion	Malathion	Insecticide	1800	145	1	Small	Small
Penncap-M	Methyl Parathion	Insecticide	5100	60	5	Medium	Small
Spectracide	Diazinon	Insecticide	500	40	40	Medium	Medium
Thimet	Phorate	Insecticide	2000	22	90	Large	Small
Captan	Captan	Fungicide	196	5	1-12	Not Available	Not Available

[1]The tendency of pesticides to be strongly attached to soil particle surfaces.
[2]The solubility of the pesticide in water at room temperature.
[3]The time required for pesticides in soils to be degraded so that their concentration decreases by one-half.
[4]Source: USDA Soil Conservation Service Standards and Specifications Technical Guide Sections IV and IA.

Table 8.3) Atrazine maximums, arithmetic means, and concentration distributions for surface water samples collected 10/85-10/88 from 30 locations in Illinois. The concentration distributions of atrazine were computed with respect to its detection limit (0.05 ug/L), 1 ug/L, its MCL (3 ug/L), and 4 times its MCL (12 ug/L). Data from Moyer and Cross (1990; Illinois EPA).

Location	Atrazine Maximum (ug/L)	Atrazine Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<	1<C<3	3<C<12	C>12	
Lusk Creek	1.50	0.17	14	4	1	0	0	
Middle F. Saline R.	8.90	1.63	2	11	3	3	0	
Embarass River	7.30	1.35	1	10	5	2	0	
Salt F. Vermillion R.	4.80	0.74	6	10	2	2	0	
Little Wabash River	13.00	2.82	1	10	3	4	1	
Illinois R. (Harbour)	5.30	0.77	5	8	3	1	0	
Maucopin Creek	12.00	1.35	4	12	2	3	0	
Lamoine R. (Ripley)	5.50	0.82	6	13	0	2	0	
Lamoine R. (Colmar)	4.30	0.60	3	14	2	1	0	
Spoon R. (Wyoming)	16.00	1.00	8	12	0	0	1	
Spoon R. (Seville)	3.90	0.60	3	14	1	1	0	
Mackinaw River	1.80	0.32	5	13	1	0	0	
Big Bureau Creek	2.00	0.55	3	13	4	0	0	
Vermillion River	2.40	0.66	3	11	4	0	0	
Sangamon R. (Oakfor)	2.80	0.48	2	11	1	0	0	
Sangamon R. (Montic)	3.80	0.46	7	12	1	1	0	
Salt Creek	2.20	0.35	8	11	1	0	0	
Kankakee River	4.70	0.60	5	11	1	1	0	
Des Plaines River	2.30	0.55	6	8	4	0	0	
Bay Creek	39.00	4.16	2	9	3	4	2	
Bear Creek	19.00	2.42	5	6	5	3	1	
Henderson Creek	3.50	0.59	4	13	3	1	0	
Edwards River	5.30	0.66	4	14	1	1	0	
Plum River	24.00	1.83	4	12	1	1	1	
Apple River	1.90	0.30	8	10	1	0	0	
Big Muddy River	2.30	0.78	4	11	4	0	0	
Kaskaskia River	2.00	0.72	1	13	5	0	0	
Silver Creek	18.00	2.54	2	12	0	3	2	
Green River	2.50	0.47	5	11	3	0	0	
Elkhorn Creek	1.40	0.37	3	13	2	0	0	
Total Atrazine			134 (23.3%)	332 (57.7%)	67 (11.7%)	34 (5.9%)	8 (1.4%)	575

Table 8.4) Cyanazine maximums, arithmetic means, and concentration distributions for surface water samples collected 10/85-10/88 from 30 locations in Illinois. The concentration distributions of cyanazine were computed with respect to its detection limit (0.05 ug/L), 1 ug/L, its lifetime drinkin water HA (10 ug/L), and 4 times its lifetime drinking water HA (40 ug/L). Data are from Moyer and Cross (1990; Illinois EPA).

Location	Cyanazine Maximum (ug/L)	Cyanazine Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40	
Lusk Creek	0.05	0.05	19	0	0	0	0	
Middle F. Saline R.	1.80	0.29	12	5	2	0	0	
Embarass River	11.00	0.75	11	6	0	1	0	
Salt F. Vermillion R.	4.10	0.60	10	7	3	0	0	
Little Wabash River	17.00	1.95	5	8	5	1	0	
Illinois R. (Harbour)	3.60	0.52	10	4	3	0	0	
Maucopin Creek	2.60	0.26	10	10	1	0	0	
Lamoine R. (Ripley)	5.10	0.60	8	10	3	0	0	
Lamoine R. (Colmar)	4.10	0.50	7	10	3	0	0	
Spoon R. (Wyoming)	0.26	0.08	15	6	0	0	0	
Spoon R. (Seville)	2.50	0.25	12	6	1	0	0	
Mackinaw River	1.50	0.14	14	4	1	0	0	
Big Bureau Creek	1.00	0.13	15	5	0	0	0	
Vermillion River	2.30	0.59	10	5	3	0	0	
Sangamon R. (Oakfor)	1.70	0.18	12	1	1	0	0	
Sangamon R. (Montic)	0.45	0.12	13	8	0	0	0	
Salt Creek	5.00	0.30	17	2	1	0	0	
Kankakee River	2.20	0.24	12	5	1	0	0	
Des Plaines River	1.30	0.14	13	4	1	0	0	
Bay Creek	38.00	3.28	6	7	6	1	0	
Bear Creek	31.00	2.32	8	8	3	1	0	
Henderson Creek	2.20	0.25	14	5	2	0	0	
Edwards River	2.20	0.20	12	7	1	0	0	
Plum River	28.00	1.62	14	3	1	1	0	
Apple River	0.30	0.07	17	2	0	0	0	
Big Muddy River	0.22	0.11	13	6	0	0	0	
Kaskaskia River	0.55	0.10	10	9	0	0	0	
Silver Creek	3.50	0.54	13	3	3	0	0	
Green River	1.10	0.16	12	6	1	0	0	
Elkhorn Creek	1.20	0.14	14	3	1	0	0	
Total Cyanazine			358 (62.3%)	165 (28.7%)	47 (8.2%)	5 (0.9%)	0 (0.0%)	575

However, in order to better assess geographic variability, herbicide concentrations were further examined by drainage area. The drainage area represented by the 30 pesticide subnetwork stations range from 42.9 square miles for AK02 to 5,150 square miles for F01 (drainage areas represented by upstream stations are subtracted). Herbicide means during spring/summer seasons (covering the majority of the growing season) for all 3 years of available data were determined for each station (Table 16). Ranges of these means are presented by drainage area in figures 4 to 8.

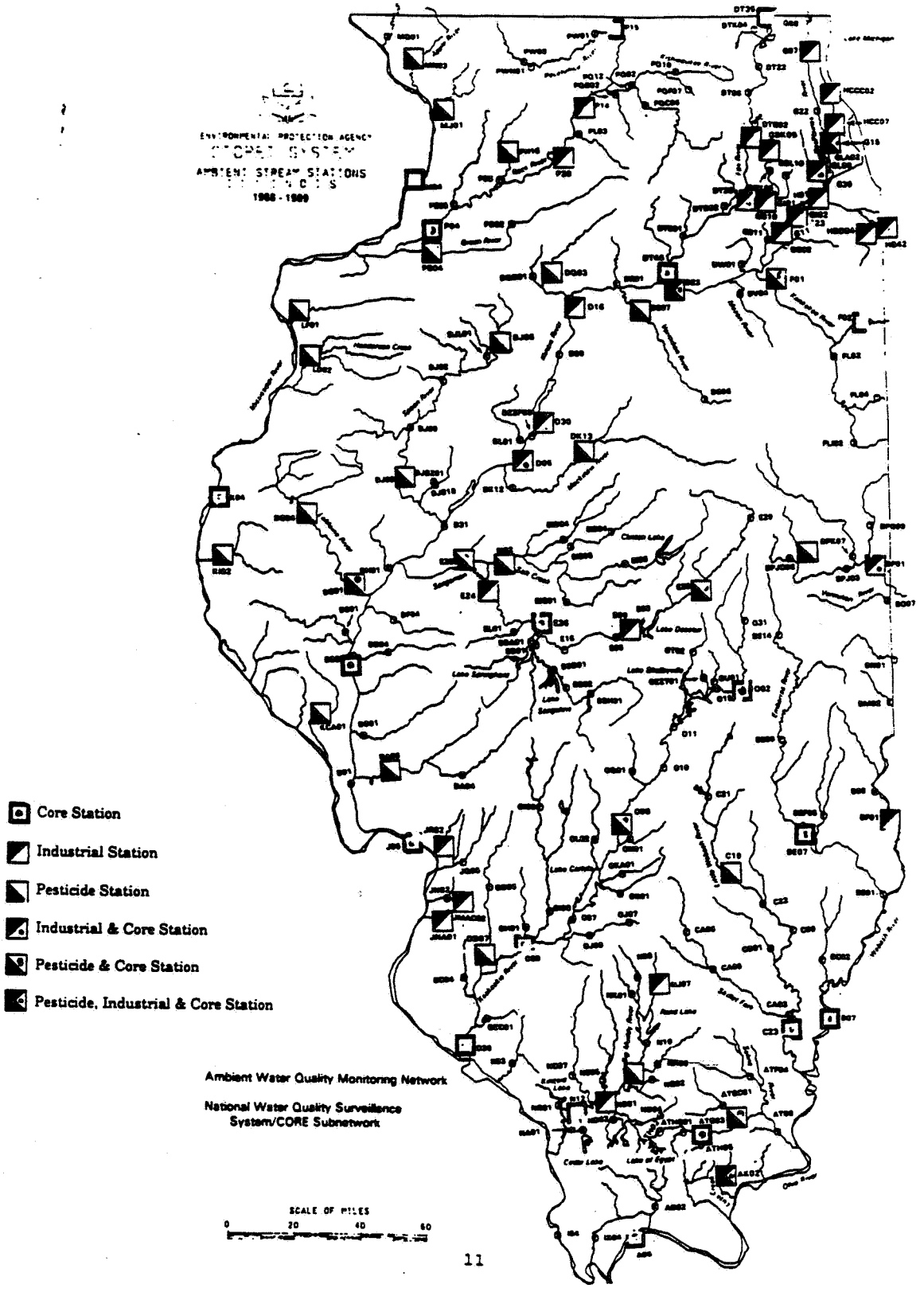
8.5

Table 16. Spring/Summer Mean Herbicide Concentrations (ug/l) by Station

Basin	Station Code	Drainage Area (mi^2)	Alachlor	Atrazine	Cyanazine	Metolachlor	Metribuzin
Ohio	AK02	42.9	.02	.25	.05	.11	.05
	ATG03	233	.96	2.52	.46	.49	.10
Wabash	BE07	1516	.22	1.77	1.10	.36	.07
	BPJ07	134	.34	1.00	.92	.77	.06
	C19	745	.44	4.19	3.03	1.37	.09
Illinois	*D23	2665	.49	1.17	.86	.46	.09
	DA06	868	.30	1.99	.41	.88	.09
	*DG01	638	.46	1.22	.91	.40	.09
	DG04	655	.16	.86	.74	.24	.06
	DJ06	197	.06	1.56	.10	.31	.05
	*DJ08	1439	.08	.88	.35	.44	.05
	DK13	776	.39	.42	.21	.28	.05
	DQ03	196	.18	.72	.17	.40	.05
	DS07	1251	.68	.95	.86	.82	.12
Sangamon	*E25	4520	.08	.68	.25	.28	.05
	E28	573	.11	.36	.14	.39	.07
	EI02	1804	.31	.47	.47	.67	.08
Kankakee	F01	5150	.38	.89	.35	.53	.10
Des Plaines	G15	444	.11	.78	.20	.23	.09
Miss. N. Central	KCA01	161	1.95	6.64	5.41	2.36	.10
	KI02	349	.50	3.85	3.81	.63	.18
	LD02	432	.14	.83	.37	.31	.07
	LF01	445	.50	.91	.28	.29	.10
Miss. North	MJ01	273	.68	2.79	2.76	1.04	.05
	MN03	207	.11	.44	.08	.19	.05
Big Muddy	N11	794	.06	.92	.12	.15	.05
Kaskaskia	O08	1940	.08	.75	.08	.42	.06
	OD07	464	1.03	3.86	.83	2.52	.44
Rock	PB04	1003	.26	.68	.22	.44	.05
	PH16	146	.10	.56	.20	.25	.05

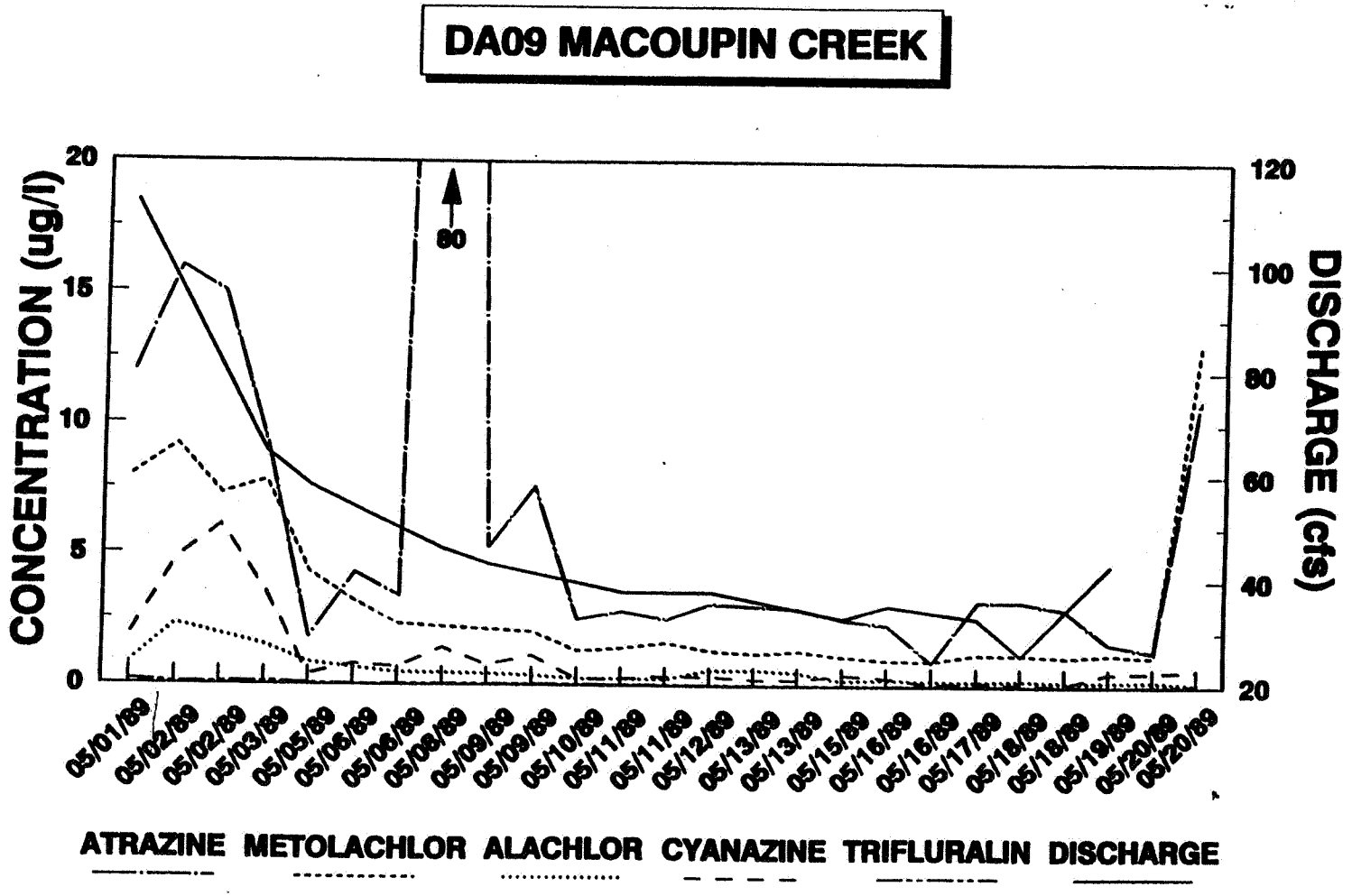
*drainage areas represented by upstream stations are subtracted

Figure 8.1 Ambient Water Quality Monitoring Network Map with Pesticide Subnetwork



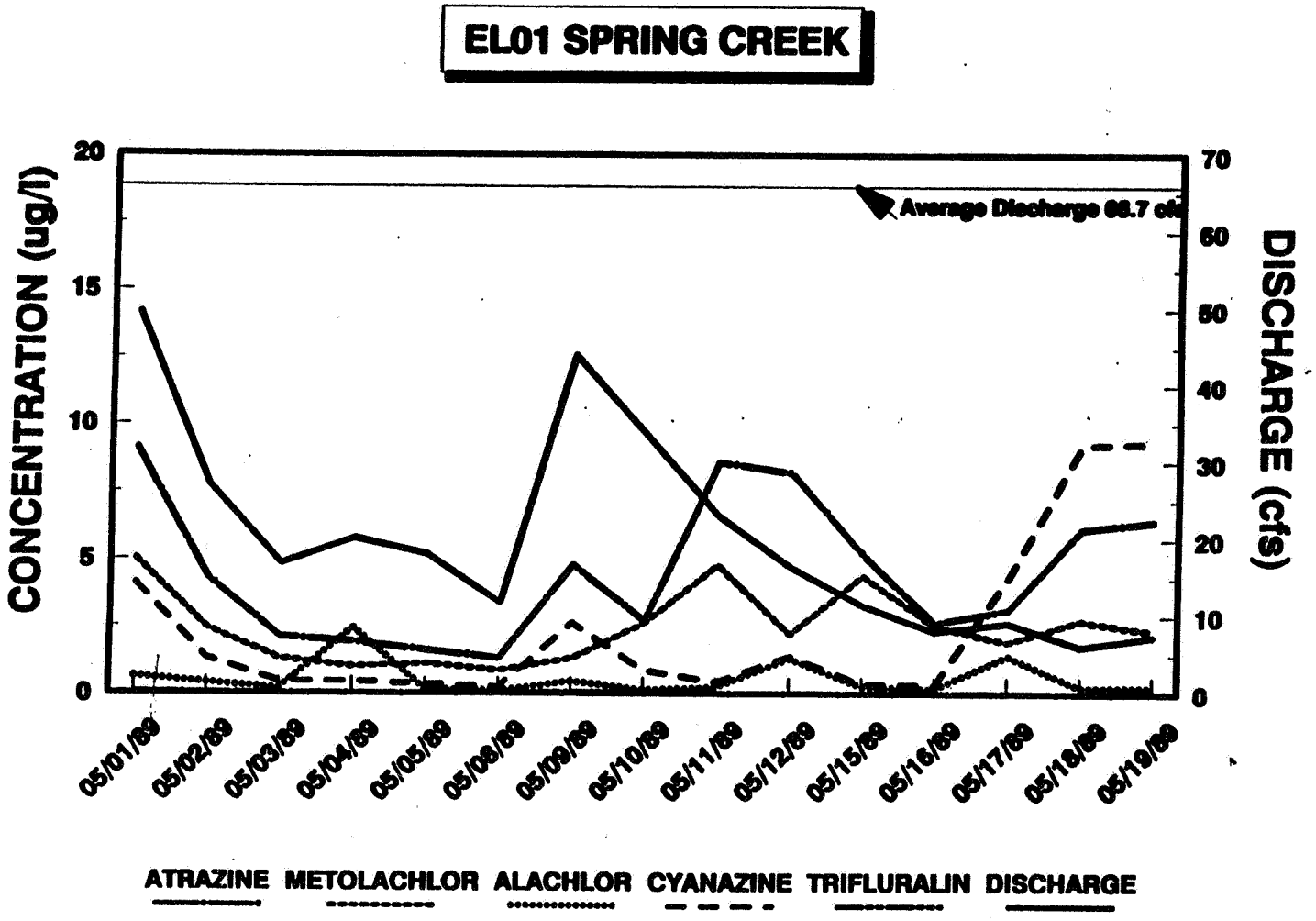
8.2

Figure 40. Hydrograph of Discharge vs. Atrazine for DA09, Macoupin Creek

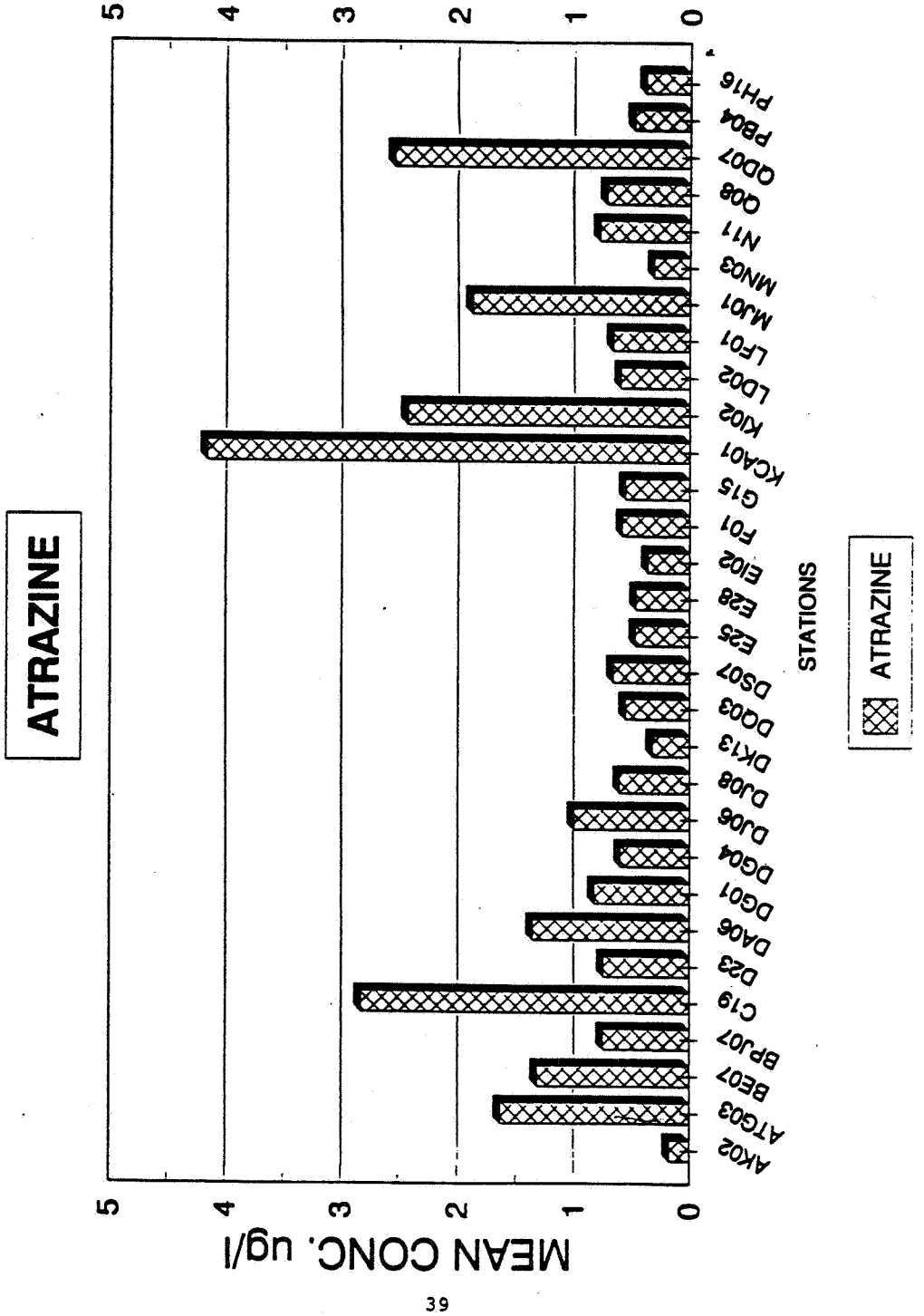


69C

Figure 41. Hydrograph of Discharge vs. Atrazine for EL01, Spring Creek



8.4
Figure 10. Mean concentrations from October 1985 to October 1988 for atrazine for each Pesticide Subnetwork Station



271

8.5

Figure 11. Mean concentrations from October 1985 to October 1988 for cyanazine for each Pesticide Subnetwork Station

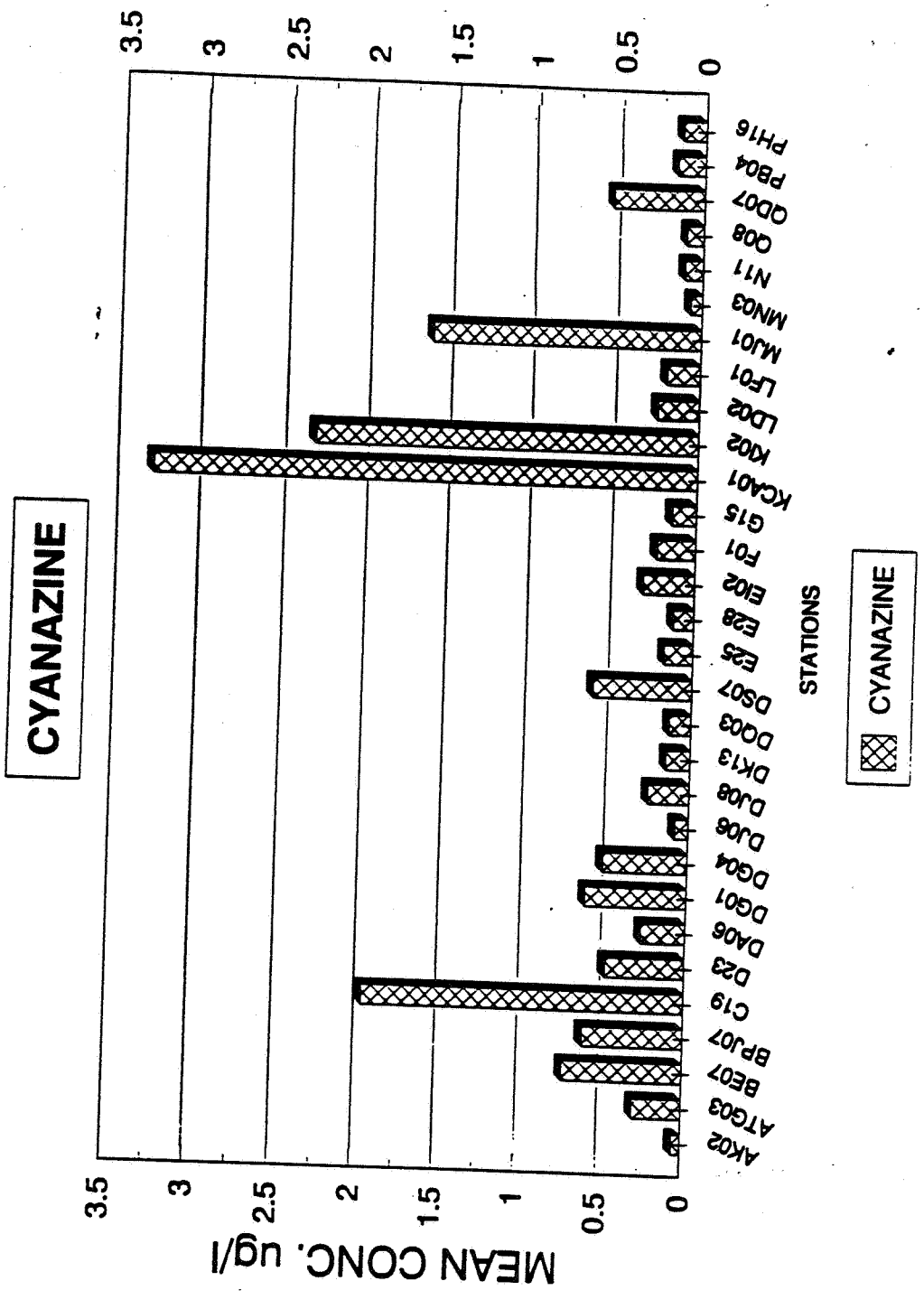
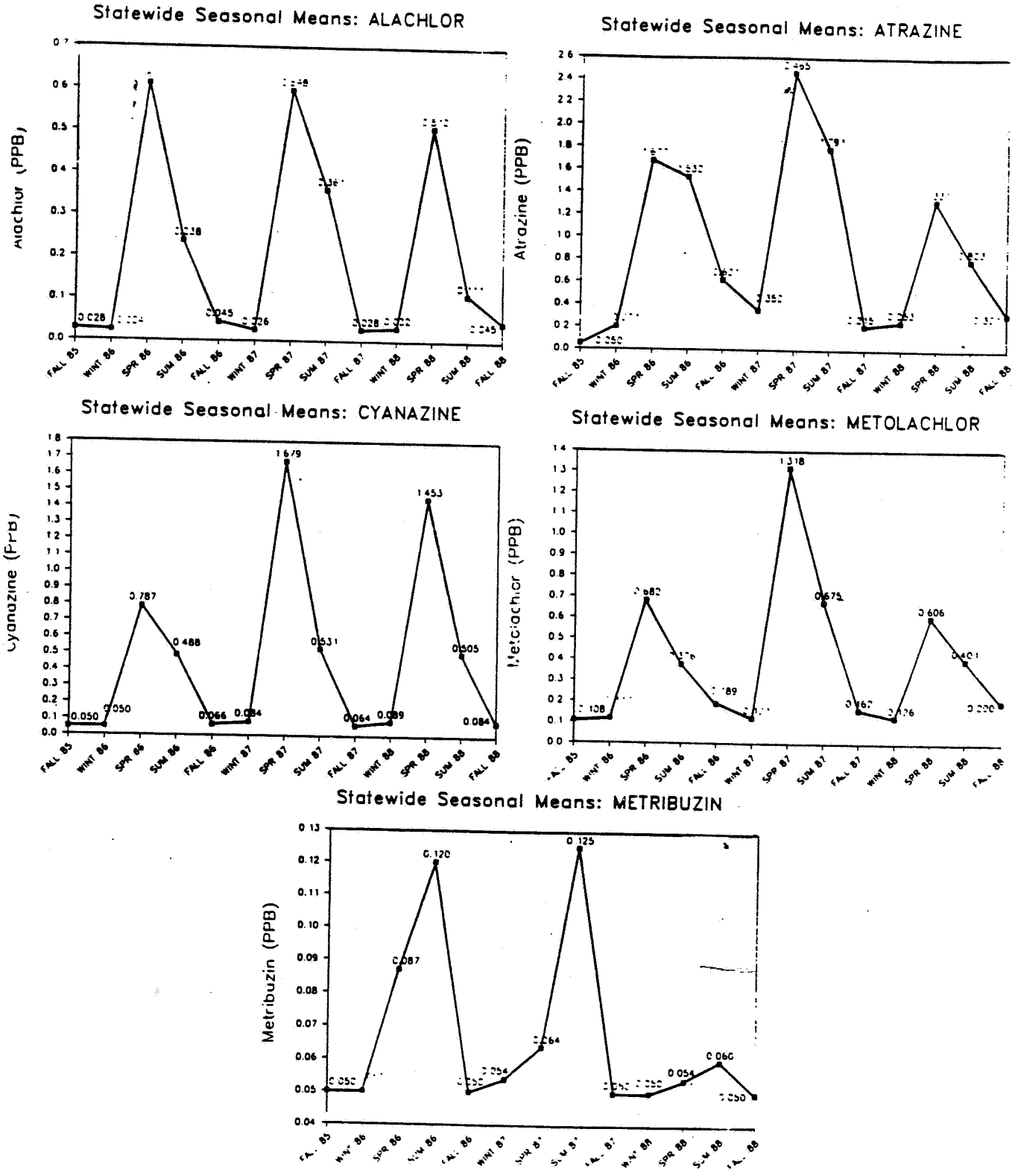
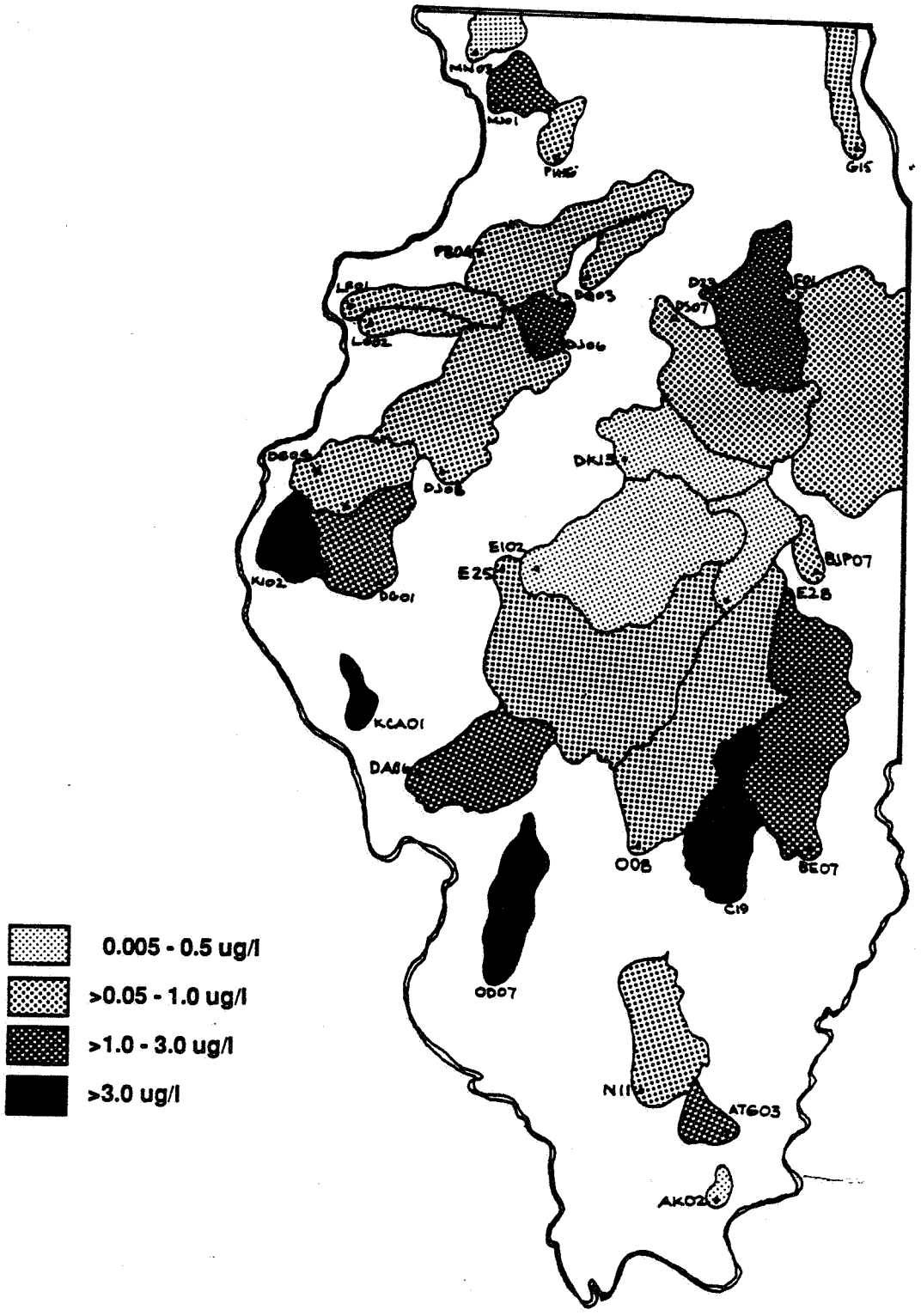


Figure 3 8.6 Statewide Seasonal Means



8.7

Figure 5. Comparison of Spring/Summer Atrazine Means by Drainage Area



274

Spreadsheet 8.1) Lusk Creek (3 miles SE Eddyville, IL)

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
1.50	0.17	14	4	1	0	0

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
0.05	0.05	19	0	0	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
10/24/85	0.05	0.05	0.00	0.00
1/15/86	0.05	0.05	0.00	0.00
4/1/86	0.05	0.05	0.00	0.00
5/29/86	1.50	0.05	0.13	0.00
6/12/86	0.11	0.05	0.01	0.00
8/13/86	0.17	0.05	0.01	0.00
10/16/86	0.05	0.05	0.00	0.00
1/27/87	0.09	0.05	0.01	0.00
4/2/87	0.05	0.05	0.00	0.00
5/5/87	0.05	0.05	0.00	0.00
6/10/87	0.61	0.05	0.05	0.00
7/14/87	0.05	0.05	0.00	0.00
11/3/87	0.05	0.05	0.00	0.00
1/26/88	0.05	0.05	0.00	0.00
4/11/88	0.05	0.05	0.00	0.00
5/31/88	0.05	0.05	0.00	0.00
6/29/88	0.05	0.05	0.00	0.00
9/6/88	0.05	0.05	0.00	0.00
10/19/88	0.05	0.05	0.00	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
10/85-10/86	0.28	0.05	0.09	0.01
1/87-11/87	0.15	0.05	0.05	0.01
1/88-10/88	0.05	0.05	0.02	0.01

Spreadsheet 8.2) Middle Fork Saline River (3 miles SE Harrisburg, IL)

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
8.90	1.63	2	11	3	3	0

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
1.80	0.29	12	5	2	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
10/8/85	0.05	0.05	0.00	0.00
1/15/86	0.05	0.05	0.00	0.00
4/1/86	0.17	0.05	0.01	0.00
5/12/86	[illegible]	1.80	0.74	0.05
6/9/86	[illegible]	0.05	0.38	0.00
8/13/86	0.87	0.05	0.07	0.00
10/16/86	0.77	0.05	0.06	0.00
1/27/87	0.27	0.08	0.02	0.00
4/2/87	1.70	1.00	0.14	0.03
5/5/87	1.70	0.09	0.14	0.00
6/10/87	[illegible]	1.80	0.62	0.05
7/14/87	1.70	0.09	0.14	0.00
10/28/87	0.69	0.05	0.06	0.00
1/26/88	0.49	0.06	0.04	0.00
4/11/88	0.19	0.05	0.02	0.00
5/31/88	0.36	0.05	0.03	0.00
6/29/88	0.16	0.05	0.01	0.00
9/6/88	0.58	0.05	0.05	0.00
10/19/88	0.30	0.05	0.03	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
10/85-10/86	2.20	0.30	0.73	0.03
1/87-10/87	2.24	0.52	0.75	0.05
1/88-10/88	0.35	0.05	0.12	0.01

Spreadsheet 8.3) Embarass River at St.Marie, IIL

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
7.30	1.35	1	10	5	2	0

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
11.00	0.75	11	6	0	1	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
10/29/85	0.05	0.05	0.00	0.00
1/9/86	0.22	0.05	0.02	0.00
4/10/86	1.20	0.29	0.10	0.01
5/28/86	[illegible]	0.50	0.44	0.01
6/25/86	1.40	0.05	0.12	0.00
7/23/86	0.87	0.24	0.07	0.01
10/28/86	1.30	0.05	0.11	0.00
1/22/87	1.30	0.05	0.11	0.00
4/16/87	[illegible]	[illegible]	0.61	0.28
5/27/87	0.77	0.36	0.06	0.01
7/14/87	2.20	0.39	0.18	0.01
8/26/87	0.32	0.05	0.03	0.00
10/14/87	0.34	0.05	0.03	0.00
1/5/88	0.18	0.05	0.02	0.00
5/25/88	0.62	0.15	0.05	0.00
7/12/88	0.44	0.05	0.04	0.00
8/24/88	0.26	0.05	0.02	0.00
10/24/88	0.24	0.05	0.02	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
10/85-10/86	1.48	0.18	0.49	0.02
1/87-10/87	2.04	1.98	0.68	0.20
1/88-10/88	0.35	0.07	0.12	0.01

Spreadsheet 8.4) Salt F. Vermillion R. (north of St. Joseph)

Maximum (ug/L)	10/85-9/88 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
4.80	0.74	6	10	2	2	0

Maximum (ug/L)	10/85-9/88 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
4.10	0.60	10	7	3	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
10/17/85	0.05	0.05	0.00	0.00
1/29/86	0.05	0.05	0.00	0.00
3/26/86	0.07	0.05	0.01	0.00
5/1/86	[illegible]	4.10	0.28	0.10
6/18/86	0.26	0.05	0.02	0.00
7/16/86	0.30	0.06	0.03	0.00
10/8/86	0.49	0.22	0.04	0.01
1/14/87	1.50	0.28	0.13	0.01
3/25/87	0.05	0.27	0.00	0.01
4/29/87	0.12	0.16	0.01	0.00
6/3/87	[illegible]	3.60	0.40	0.09
7/21/87	0.05	0.05	0.00	0.00
9/10/87	0.48	0.05	0.04	0.00
10/27/87	0.05	0.30	0.00	0.01
1/11/88	0.15	0.05	0.01	0.00
3/28/88	0.05	0.05	0.00	0.00
5/16/88	0.28	0.15	0.02	0.00
6/27/88	0.06	0.05	0.01	0.00
8/15/88	2.70	2.40	0.23	0.06
9/19/88	0.08	0.05	0.01	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
10/85-10/86	0.65	0.65	0.22	0.07
1/87-10/87	1.01	1.27	0.34	0.13
1/88-10/88	0.55	0.87	0.18	0.09

Spreadsheet 8.5) Little Wabash R. (NE Louisville, IL)

Maximum (ug/L)	10/85=10/88 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
13.00	2.82	1	10	3	4	1

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
17.00	1.95	5	8	5	1	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
10/29/85	0.05	0.05	0.00	0.00
1/9/86	0.20	0.05	0.02	0.00
4/10/86	1.50	9.00	0.13	0.23
5/28/86	[illegible]	2.50	0.92	0.06
6/25/86	[illegible]	3.00	0.33	0.08
7/23/86	1.60	0.21	0.13	0.01
10/28/86	1.10	0.10	0.09	0.00
1/22/87	0.88	0.05	0.07	0.00
4/16/87	[illegible]	[illegible]	0.76	0.43
5/27/87	7.10	1.40	0.59	0.04
6/18/87	[illegible]	2.20	[illegible]	0.06
8/18/87	0.69	0.10	0.06	0.00
11/10/87	0.53	0.30	0.04	0.01
2/3/88	0.30	0.05	0.03	0.00
4/14/88	0.49	0.06	0.04	0.00
5/12/88	0.24	0.19	0.02	0.00
6/16/88	0.98	0.59	0.08	0.01
8/16/88	0.59	0.06	0.05	0.00
10/13/88	0.17	0.05	0.01	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
10/85-10/86	2.78	2.13	0.93	0.21
1/87-11/87	[illegible]	3.51	[illegible]	0.35
2/88-10/88	0.46	0.17	0.15	0.02

Spreadsheet 8.6) Illinois R. (Marseilles Harbour)

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
5.30	0.77	5	8	3	1	0

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
3.60	0.52	10	4	3	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
10/15/85	0.05	0.05	0.00	0.00
12/16/85	0.05	0.05	0.00	0.00
4/15/86	0.34	0.05	0.03	0.00
5/20/86	1.50	0.88	0.13	0.02
6/3/86	[redacted]	3.60	0.44	0.09
7/30/86	0.62	0.05	0.05	0.00
10/8/86	0.98	0.05	0.08	0.00
1/6/87	0.05	0.05	0.00	0.00
4/14/87	1.40	1.60	0.12	0.04
6/12/87	1.40	0.52	0.12	0.01
11/5/87	0.05	0.05	0.00	0.00
1/14/88	0.05	0.05	0.00	0.00
4/5/88	0.14	0.06	0.01	0.00
5/4/88	0.71	1.70	0.06	0.04
7/5/88	0.10	0.06	0.01	0.00
8/9/88	0.18	0.05	0.02	0.00
10/10/88	0.25	0.05	0.02	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
10/85-10/86	1.26	0.68	0.42	0.07
1/87-11/87	0.73	0.56	0.24	0.06
1/88-10/88	0.24	0.33	0.08	0.03

Spreadsheet 8.7) Macoupin Creek (Rt. 267 3.5 miles NW Kane, IL)

Maximum (ug/L)	11/85-10/88 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
12.00	1.35	4	12	2	3	0

Maximum (ug/L)	11/85-10/88 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
2.60	0.26	10	10	1	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
11/6/85	0.05	0.05	0.00	0.00
2/13/86	0.76	0.05	0.06	0.00
4/2/86	0.05	0.05	0.00	0.00
5/15/86	0.97	0.51	0.08	0.01
6/26/86	[illegible]	0.66	0.26	0.02
8/18/86	0.59	0.14	0.05	0.00
10/30/86	1.90	0.09	0.16	0.00
1/27/87	0.41	0.13	0.03	0.00
4/6/87	0.46	0.11	0.04	0.00
5/6/87	[illegible]	2.60	1.00	0.07
6/25/87	[illegible]	0.47	0.28	0.01
8/11/87	1.50	0.17	0.13	0.00
9/9/87	0.25	0.05	0.02	0.00
11/9/87	0.05	0.05	0.00	0.00
1/21/88	0.97	0.05	0.08	0.00
4/12/88	0.37	0.05	0.03	0.00
5/16/88	0.85	0.09	0.07	0.00
6/21/88	0.25	0.05	0.02	0.00
7/21/88	0.31	0.08	0.03	0.00
9/26/88	0.05	0.05	0.00	0.00
10/31/88	0.06	0.05	0.01	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
11/85-10/86	1.06	0.34	0.35	0.03
1/87-11/87	2.58	0.84	0.86	0.08
1/88-10/88	0.41	0.07	0.14	0.01

Spreadsheet 8.8) Lamoine River (Rt. 24 Ripley, IL)

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
5.50	0.82	6	13	0	2	0

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
5.10	0.60	8	10	3	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
10/21/85	0.05	0.05	0.00	0.00
1/13/86	0.05	0.05	0.00	0.00
3/27/86	0.13	0.05	0.01	0.00
5/13/86	[illegible]	5.10	0.46	0.13
6/19/86	0.56	0.63	0.05	0.02
7/14/86	0.91	0.35	0.08	0.01
10/2/86	0.76	0.19	0.06	0.00
1/8/87	0.05	0.05	0.00	0.00
3/31/87	0.27	0.08	0.02	0.00
4/28/87	0.18	0.12	0.02	0.00
6/10/87	[illegible]	2.50	0.38	0.06
7/16/87	0.85	0.51	0.07	0.01
8/26/87	0.38	0.25	0.03	0.01
10/22/87	0.05	0.05	0.00	0.00
1/7/88	0.42	0.35	0.04	0.01
3/30/88	0.63	0.16	0.05	0.00
5/5/88	0.28	0.42	0.02	0.01
6/2/88	0.77	1.6	0.06	0.04
7/14/88	0.77	0.05	0.06	0.00
9/15/88	0.05	0.05	0.00	0.00
10/28/88	0.05	0.05	0.00	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
10/85-10/86	1.14	0.92	0.38	0.09
1/87-10/87	0.91	0.51	0.30	0.05
1/88-10/88	0.42	0.38	0.14	0.04

Spreadsheet 8.9) Lamoine River (Rt. 61 at Colmar, IL)

Maximum (ug/L)	10/85-9/88 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
4.30	0.60	3	14	2	1	0

Maximum (ug/L)	10/85-9/88 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
4.10	0.50	7	10	3	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
10/22/85	0.05	0.05	0.00	0.00
1/13/86	0.12	0.05	0.01	0.00
3/31/86	0.11	0.05	0.01	0.00
5/14/86	[illegible]	4.10	0.36	0.10
6/19/86	0.28	0.18	0.02	0.00
7/15/86	0.69	0.28	0.06	0.01
10/23/86	0.21	0.05	0.02	0.00
1/12/87	0.05	0.05	0.00	0.00
3/31/87	0.27	0.15	0.02	0.00
4/30/87	0.50	0.33	0.04	0.01
6/10/87	2.00	1.30	0.17	0.03
7/16/87	0.46	0.23	0.04	0.01
8/26/87	0.46	0.29	0.04	0.01
10/26/87	0.05	0.05	0.00	0.00
1/6/88	0.19	0.18	0.02	0.00
3/31/88	0.27	0.10	0.02	0.00
5/9/88	0.45	0.49	0.04	0.01
6/14/88	1.30	2.00	0.11	0.05
7/18/88	0.10	0.11	0.01	0.00
9/28/88	0.08	0.05	0.01	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
10/85-10/86	0.82	0.68	0.27	0.07
1/87-10/87	0.54	0.34	0.18	0.03
1/88-9/88	0.40	0.49	0.13	0.05

Spreadsheet 8.10) Spoon River (Rt. 17 2 miles W Wyoming, IL)

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
16.00	1.00	8	12	0	0	1

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
0.26	0.08	15	6	0	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
10/31/85	0.05	0.05	0.00	0.00
1/29/86	0.05	0.05	0.00	0.00
4/10/86	0.14	0.05	0.01	0.00
5/20/86	0.49	0.05	0.04	0.00
6/26/86	[illegible]	0.05	[illegible]	0.00
7/23/86	0.06	0.05	0.01	0.00
10/7/86	0.28	0.05	0.02	0.00
1/6/87	0.05	0.05	0.00	0.00
3/25/87	0.05	0.05	0.00	0.00
4/22/87	0.56	0.14	0.05	0.00
6/9/87	0.77	0.12	0.06	0.00
7/14/87	0.98	0.26	0.08	0.01
8/25/87	0.62	0.14	0.05	0.00
10/29/87	0.07	0.05	0.01	0.00
1/13/88	0.05	0.05	0.00	0.00
3/22/88	0.05	0.05	0.00	0.00
4/21/88	0.26	0.20	0.02	0.01
6/7/88	0.20	0.07	0.02	0.00
7/12/88	0.07	0.05	0.01	0.00
9/22/88	0.05	0.05	0.00	0.00
10/25/88	0.05	0.05	0.00	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
10/85-10/86	2.44	0.05	0.81	0.01
1/87-10/87	0.44	0.12	0.15	0.01
1/88-10/88	0.10	0.07	0.03	0.01

Spreadsheet 8.11) Spoon River (Rt. 95 0.4 miles NE Seville, IL)

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
3.90	0.60	3	14	1	1	0

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
2.50	0.25	12	6	1	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
10/17/85	0.05	0.05	0.00	0.00
1/15/86	0.29	0.05	0.02	0.00
4/14/86	0.23	0.05	0.02	0.00
6/4/86	[illegible]	2.50	0.33	0.06
7/1/86	0.96	0.37	0.08	0.01
8/19/86	0.20	0.05	0.02	0.00
11/3/86	0.22	0.05	0.02	0.00
3/4/87	0.27	0.05	0.02	0.00
4/9/87	0.05	0.05	0.00	0.00
5/11/87	0.16	0.17	0.01	0.00
6/29/87	1.00	0.25	0.08	0.01
8/13/87	2.60	0.47	0.22	0.01
9/10/87	0.16	0.05	0.01	0.00
10/6/87	0.12	0.05	0.01	0.00
1/4/88	0.07	0.12	0.01	0.00
4/7/88	0.41	0.05	0.03	0.00
7/13/88	0.62	0.18	0.05	0.00
8/25/88	0.10	0.05	0.01	0.00
10/3/88	0.05	0.05	0.00	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
10/85-11/86	0.84	0.45	0.28	0.04
3/87-10/87	0.62	0.16	0.21	0.02
1/88-10/88	0.25	0.09	0.08	0.01

Spreadsheet 8.12) Mackinaw River (4 miles SE Deer Creek, IL)

Maximum (ug/L)	10/85-9/88 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
1.80	0.32	5	13	1	0	0

Maximum (ug/L)	10/85-9/88 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
1.50	0.14	14	4	1	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
10/24/85	0.05	0.05	0.00	0.00
1/14/86	0.14	0.05	0.01	0.00
4/22/86	0.13	0.05	0.01	0.00
5/22/86	0.59	0.14	0.05	0.00
6/19/86	0.20	0.05	0.02	0.00
9/4/86	0.36	0.07	0.03	0.00
10/16/86	0.36	0.05	0.03	0.00
4/9/87	0.05	0.05	0.00	0.00
5/5/87	1.80	1.50	0.15	0.04
7/1/87	1.00	0.25	0.08	0.01
8/11/87	0.21	0.06	0.02	0.00
9/9/87	0.28	0.05	0.02	0.00
11/5/87	0.05	0.05	0.00	0.00
1/13/88	0.05	0.05	0.00	0.00
3/29/88	0.09	0.05	0.01	0.00
5/19/88	0.30	0.05	0.03	0.00
6/27/88	0.21	0.05	0.02	0.00
8/15/88	0.07	0.05	0.01	0.00
9/22/88	0.05	0.05	0.00	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
10/85-11/86	0.26	0.07	0.09	0.01
4/87-11/87	0.57	0.33	0.19	0.03
1/88-9/88	0.13	0.05	0.04	0.01

Spreadsheet 8.13) Big Bureau Creek (Rt. 6 near Princeton, IL)

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
2.00	0.55	3	13	4	0	0

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
1.00	0.13	15	5	0	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
10/16/85	0.05	0.05	0.00	0.00
12/18/85	0.05	0.05	0.00	0.00
4/8/86	0.25	0.05	0.02	0.00
5/20/86	0.71	0.05	0.06	0.00
6/24/86	0.72	0.05	0.06	0.00
7/17/86	0.44	0.05	0.04	0.00
11/10/86	0.24	0.05	0.02	0.00
2/4/87	0.36	0.05	0.03	0.00
4/24/87	2.00	1.00	0.17	0.03
5/12/87	0.40	0.09	0.03	0.00
7/8/87	1.30	0.05	0.11	0.00
8/10/87	0.77	0.22	0.06	0.01
11/4/87	0.05	0.05	0.00	0.00
2/2/88	0.17	0.05	0.01	0.00
4/20/88	0.08	0.05	0.01	0.00
5/24/88	0.42	0.29	0.04	0.01
7/13/88	1.30	0.05	0.11	0.00
8/17/88	0.20	0.05	0.02	0.00
9/20/88	1.20	0.22	0.10	0.01
10/18/88	0.31	0.05	0.03	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
10/85-11/86	0.35	0.05	0.12	0.01
2/87-11/87	0.81	0.24	0.27	0.02
2/88-10/88	0.53	0.11	0.18	0.01

Spreadsheet 8.14) Vermillion River (3 miles NE Leonore, IL)

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
2.40	0.66	3	11	4	0	0

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
2.30	0.59	10	5	3	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
10/16/85	0.05	0.05	0.00	0.00
12/16/85	0.05	0.05	0.00	0.00
4/16/86	0.15	0.05	0.01	0.00
5/16/86	2.40	2.10	0.20	0.05
6/25/86	0.40	0.43	0.03	0.01
8/13/86	0.55	0.05	0.05	0.00
1/26/87	0.07	0.05	0.01	0.00
4/21/87	0.90	0.57	0.08	0.01
5/20/87	1.90	2.30	0.16	0.06
6/25/87	2.30	0.80	0.19	0.02
7/22/87	0.25	0.25	0.02	0.01
10/1/87	0.12	0.05	0.01	0.00
1/27/88	0.15	0.05	0.01	0.00
4/5/88	0.05	0.05	0.00	0.00
6/2/88	2.20	3.30	0.18	0.08
6/29/88	0.15	0.35	0.01	0.01
8/24/88	0.11	0.05	0.01	0.00
10/27/88	0.06	0.05	0.01	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
10/85-8/86	0.60	0.46	0.20	0.05
1/87-10/87	0.92	0.67	0.31	0.07
1/88-10/88	0.45	0.64	0.15	0.06

Spreadsheet 8.15) Sangamon R. (Rt. 97 1.5 miles NW Oakford, IL)

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
2.80	0.48	2	11	1	0	0

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
1.70	0.18	12	1	1	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
10/9/85	0.05	0.05	0.00	0.00
1/8/86	0.05	0.05	0.00	0.00
4/16/86	0.52	0.05	0.04	0.00
7/18/86	0.71	0.05	0.06	0.00
8/27/86	0.40	0.05	0.03	0.00
4/15/87	2.80	1.70	0.23	0.04
6/3/87	0.57	0.19	0.05	0.00
8/27/87	0.14	0.05	0.01	0.00
10/6/87	0.17	0.05	0.01	0.00
1/5/88	0.29	0.05	0.02	0.00
4/13/88	0.07	0.05	0.01	0.00
7/14/88	0.78	0.05	0.07	0.00
8/25/88	0.11	0.05	0.01	0.00
10/3/88	0.08	0.05	0.01	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
10/85-8/86	0.35	0.05	0.12	0.01
4/87-10/87	0.92	0.50	0.31	0.05
1/88-10/88	0.27	0.05	0.09	0.01

Spreadsheet 8.16) Sangamon River (4.5 miles SW Monticello, IL)

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
3.80	0.46	7	12	1	1	0

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
0.45	0.12	13	8	0	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
10/30/85	0.05	0.05	0.00	0.00
1/8/86	0.05	0.05	0.00	0.00
4/1/86	0.05	0.05	0.00	0.00
5/14/86	0.42	0.22	0.04	0.01
6/12/86	1.30	0.41	0.11	0.01
7/10/86	0.29	0.05	0.02	0.00
10/9/86	0.54	0.05	0.05	0.00
1/7/87	0.05	0.05	0.00	0.00
3/19/87	0.06	0.05	0.01	0.00
4/29/87	0.26	0.09	0.02	0.00
6/17/87	0.67	0.06	0.06	0.00
7/22/87	0.26	0.17	0.02	0.00
8/26/87	0.05	0.05	0.00	0.00
10/21/87	0.05	0.05	0.00	0.00
1/6/88	0.07	0.05	0.01	0.00
3/23/88	0.05	0.05	0.00	0.00
5/4/88	0.76	0.05	0.06	0.00
6/15/88	0.08	0.05	0.01	0.00
7/21/88	0.45	0.45	0.04	0.01
9/12/88	[illegible]	0.26	0.32	0.01
10/31/88	0.31	0.21	0.03	0.01

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
10/85-10/86	0.39	0.13	0.13	0.01
1/87-10/87	0.20	0.07	0.07	0.01
1/88-10/88	0.79	0.16	0.26	0.02

Spreadsheet 8.17) Salt Creek (Rt. 29 4 miles north Greenview, IL)

Maximum (ug/L)	10/85-9/88 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
2.20	0.35	8	11	1	0	0

Maximum (ug/L)	10/85-9/88 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
5.00	0.30	17	2	1	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
10/24/85	0.05	0.05	0.00	0.00
1/7/86	0.05	0.05	0.00	0.00
3/26/86	0.05	0.05	0.00	0.00
5/12/86	0.76	0.05	0.06	0.00
6/12/86	0.72	0.05	0.06	0.00
7/10/86	0.34	0.05	0.03	0.00
10/8/86	0.41	0.05	0.03	0.00
1/15/87	0.63	0.07	0.05	0.00
4/2/87	0.05	0.05	0.00	0.00
5/5/87	0.50	0.17	0.04	0.00
6/18/87	0.38	0.05	0.03	0.00
8/6/87	0.13	0.05	0.01	0.00
9/21/87	0.05	0.05	0.00	0.00
11/5/87	0.05	0.05	0.00	0.00
2/9/88	0.10	0.05	0.01	0.00
4/21/88	0.09	0.05	0.01	0.00
5/24/88	2.20	5.00	0.18	0.13
7/11/88	0.05	0.05	0.00	0.00
8/16/88	0.30	0.05	0.03	0.00
9/20/88	0.05	0.05	0.00	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
10/85-10/86	0.34	0.05	0.11	0.01
1/87-11/87	0.26	0.07	0.09	0.01
2/88-9/88	0.47	0.88	0.16	0.09

Spreadsheet 8.18) Kankakee River (I-55 3 miles NW Wilmington, IL)

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
4.70	0.60	5	11	1	1	0

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
2.20	0.24	12	5	1	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
10/16/85	0.05	0.05	0.00	0.00
1/28/86	0.09	0.05	0.01	0.00
4/23/86	0.27	0.08	0.02	0.00
7/3/86	2.10	0.05	0.18	0.00
7/30/86	0.31	0.08	0.03	0.00
10/21/86	0.20	0.05	0.02	0.00
1/5/87	0.05	0.05	0.00	0.00
4/7/87	0.05	0.05	0.00	0.00
5/28/87	4.70	2.20	0.39	0.06
7/9/87	0.71	0.19	0.06	0.00
9/2/87	0.44	0.05	0.04	0.00
10/1/87	0.11	0.05	0.01	0.00
1/27/88	0.05	0.05	0.00	0.00
4/5/88	0.23	0.05	0.02	0.00
6/2/88	1.00	1.00	0.08	0.03
6/29/88	0.14	0.05	0.01	0.00
8/23/88	0.05	0.05	0.00	0.00
10/25/88	0.18	0.16	0.02	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazjne Mean/ Life HA (10 ug/L)
10/85-10/86	0.50	0.06	0.17	0.01
1/87-10/87	1.01	0.43	0.34	0.04
1/11-10/88	0.28	0.23	0.09	0.02

Spreadsheet 8.19) Des Plaines R. (Irving Park Rd. at Schiller Park,IL)

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
2.30	0.55	6	8	4	0	0

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
1.30	0.14	13	4	1	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
10/16/85	0.05	0.05	0.00	0.00
12/16/85	0.05	0.05	0.00	0.00
3/20/86	0.32	0.05	0.03	0.00
6/2/86	2.00	1.30	0.17	0.03
6/13/86	0.74	0.05	0.06	0.00
7/21/86	1.30	0.17	0.11	0.00
10/10/86	0.93	0.05	0.08	0.00
12/30/86	0.05	0.05	0.00	0.00
5/4/87	0.54	0.21	0.05	0.01
6/18/87	1.30	0.08	0.11	0.00
7/13/87	0.59	0.19	0.05	0.00
10/20/87	0.05	0.05	0.00	0.00
1/20/88	0.05	0.05	0.00	0.00
3/22/88	0.08	0.05	0.01	0.00
5/4/88	0.05	0.05	0.00	0.00
6/27/88	0.07	0.05	0.01	0.00
7/14/88	1.60	0.05	0.13	0.00
10/6/88	0.14	0.05	0.01	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
10/85-10/86	0.77	0.25	0.26	0.02
12/86-10/87	0.51	0.12	0.17	0.01
1/88-10/88	0.33	0.05	0.11	0.01

Spreadsheet 8.20) Bay Creek (at Nebo, IL)

Maximum (ug/L)	11/85-9/88 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
39.00	4.16	2	9	3	4	2

Maximum (ug/L)	11/85-9/88 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
38.00	3.28	6	7	6	1	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
11/5/85	0.05	0.05	0.00	0.00
1/16/86	0.23	0.05	0.02	0.00
4/1/86	0.10	0.05	0.01	0.00
5/15/86	[illegible]	3.20	0.32	0.08
6/24/86	[illegible]	5.70	0.53	0.14
7/21/86	0.89	0.47	0.07	0.01
10/29/86	0.31	0.05	0.03	0.00
1/22/87	1.10	0.09	0.09	0.00
4/1/87	0.42	0.14	0.04	0.00
5/4/87	0.66	0.38	0.06	0.01
6/24/87	[illegible]	6.50	0.73	0.16
8/10/87	[illegible]	1.60	0.27	0.04
9/8/87	1.30	0.15	0.11	0.00
10/27/87	0.05	0.05	0.00	0.00
1/14/88	0.20	0.13	0.02	0.00
4/6/88	0.26	0.11	0.02	0.00
5/11/88	[illegible]	[illegible]	3.25	0.95
6/16/88	[illegible]	7.40	1.17	0.19
7/19/88	2.30	1.40	0.19	0.04
9/27/88	0.24	0.05	0.02	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
11/85-10/86	1.67	1.37	0.56	0.14
1/87-10/87	2.22	1.27	0.74	0.13
1/88-10/88	[illegible]	7.85	[illegible]	0.78

Spreadsheet 8.21) Bear Creek (2.2 miles NE Marcelline, IL)

Maximum (ug/L)	10/85-9/88 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
19.00	2.42	5	6	5	3	1

Maximum (ug/L)	10/85-9/88 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
31.00	2.32	8	8	3	1	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
10/30/85	0.05	0.05	0.00	0.00
1/30/86	0.05	0.05	0.00	0.00
4/8/86	1.10	0.85	0.09	0.02
6/3/86	[illegible]	6.20	0.82	0.16
7/2/86	2.10	0.05	0.18	0.00
8/20/86	0.73	0.05	0.06	0.00
11/6/86	0.05	0.05	0.00	0.00
1/28/87	0.25	0.10	0.02	0.00
4/8/87	0.18	0.05	0.02	0.00
5/7/87	0.48	0.43	0.04	0.01
6/29/87	[illegible]	1.70	0.43	0.04
8/12/87	1.20	0.38	0.10	0.01
9/10/87	0.80	0.06	0.07	0.00
11/5/87	0.05	0.05	0.00	0.00
1/20/88	0.93	0.26	0.08	0.01
4/7/88	1.10	0.23	0.09	0.01
5/12/88	[illegible]	[illegible]	[illegible]	0.78
6/20/88	[illegible]	4.00	0.34	0.10
7/20/88	1.20	0.72	0.10	0.02
9/26/88	0.05	0.05	0.00	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
10/85-11/86	1.98	1.04	0.66	0.10
1/87-11/87	1.17	0.40	0.39	0.04
1/88-9/88	[illegible]	6.04	[illegible]	0.60

Spreadsheet 8.22) Henderson Creek (Rt. 94 1 mile south Bald Bluff, IL)

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
3.50	0.59	4	13	3	1	0

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
2.20	0.25	14	5	2	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
10/30/85	0.05	0.05	0.00	0.00
2/25/86	0.31	0.05	0.03	0.00
4/8/86	0.30	0.05	0.03	0.00
5/19/86	1.90	2.20	0.29	0.06
6/25/86	0.63	0.05	0.05	0.00
7/22/86	0.44	0.13	0.04	0.00
10/6/86	0.60	0.05	0.05	0.00
1/5/87	0.05	0.05	0.00	0.00
3/24/87	0.25	0.05	0.02	0.00
4/21/87	1.30	0.08	0.11	0.00
6/8/87	0.90	0.16	0.08	0.00
7/13/87	0.05	0.05	0.00	0.00
8/24/87	1.10	0.09	0.09	0.00
10/28/87	0.13	0.05	0.01	0.00
2/9/88	0.20	0.05	0.02	0.00
3/21/88	0.45	0.12	0.04	0.00
4/20/88	0.07	0.05	0.01	0.00
6/6/88	1.80	1.70	0.15	0.04
7/11/88	0.05	0.05	0.00	0.00
9/21/88	0.13	0.05	0.01	0.00
10/24/88	0.16	0.05	0.01	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
10/85-11/86	0.83	0.37	0.28	0.04
1/87-10/87	0.54	0.08	0.18	0.01
2/88-10/88	0.41	0.30	0.14	0.03

Spreadsheet 8.23) Edwards River (Rt. 17 1 mile NE New Boston, IL)

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
5.30	0.66	4	14	1	1	0

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
2.20	0.20	12	7	1	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
1/28/86	0.11	0.05	0.01	0.00
4/8/86	0.17	0.05	0.01	0.00
5/19/86	[redacted]	2.20	0.44	0.06
6/25/86	0.53	0.05	0.04	0.00
7/22/86	0.53	0.05	0.04	0.00
10/6/86	0.95	0.05	0.08	0.00
1/5/87	0.05	0.05	0.00	0.00
3/24/87	0.13	0.06	0.01	0.00
4/21/87	0.95	0.15	0.08	0.00
6/8/87	1.00	0.20	0.08	0.01
7/13/87	0.76	0.25	0.06	0.01
8/24/87	2.00	0.20	0.17	0.01
10/28/87	0.14	0.05	0.01	0.00
1/12/88	0.14	0.05	0.01	0.00
3/21/88	0.07	0.05	0.01	0.00
4/20/88	0.05	0.05	0.00	0.00
6/6/88	0.07	0.06	0.01	0.00
7/11/88	0.24	0.23	0.02	0.01
9/21/88	0.05	0.05	0.00	0.00
10/24/88	0.05	0.05	0.00	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
1/86-10/86	1.27	0.41	0.42	0.04
1/87-10/87	0.72	0.14	0.24	0.01
1/88-10/88	0.10	0.08	0.03	0.01

Spreadsheet 8.24) Plum River (Rt. 52 E. Savanna, IL)

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
24.00	1.83	4	12	1	1	1

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
28.00	1.62	14	3	1	1	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
10/15/85	0.05	0.05	0.00	0.00
1/7/86	0.05	0.05	0.00	0.00
4/7/86	0.26	0.05	0.02	0.00
5/28/86	[illegible]	1.90	0.33	0.05
6/10/86	0.36	0.05	0.03	0.00
7/23/86	0.28	0.05	0.02	0.00
10/8/86	0.40	0.05	0.03	0.00
1/8/87	0.05	0.05	0.00	0.00
4/14/87	0.41	0.06	0.03	0.00
5/19/87	[illegible]	[illegible]	[illegible]	0.70
6/30/87	0.54	0.07	0.05	0.00
8/4/87	0.36	0.05	0.03	0.00
10/6/87	0.05	0.05	0.00	0.00
1/19/88	0.21	0.05	0.02	0.00
3/29/88	0.15	0.05	0.01	0.00
5/25/88	0.24	0.08	0.02	0.00
6/21/88	0.16	0.05	0.01	0.00
9/13/88	3.00	0.05	0.25	0.00
10/12/88	0.24	0.05	0.02	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
10/85-10/86	0.76	0.31	0.25	0.03
1/87-10/87	[illegible]	4.71	[illegible]	0.47
1/88-10/88	0.67	0.06	0.22	0.01

Spreadsheet 8.25) Apple River (Rt. 20 2 miles W Elizabeth, IL)

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
1.90	0.30	8	10	1	0	0

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
0.30	0.07	17	2	0	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
10/15/85	0.05	0.05	0.00	0.00
1/7/86	0.05	0.05	0.00	0.00
4/7/86	0.30	0.05	0.03	0.00
5/29/86	1.90	0.30	0.16	0.01
6/10/86	0.12	0.05	0.01	0.00
7/23/86	0.22	0.05	0.02	0.00
10/8/86	0.60	0.05	0.05	0.00
1/8/87	0.05	0.05	0.00	0.00
4/14/87	0.72	0.05	0.06	0.00
5/19/87	0.72	0.14	0.06	0.00
6/30/87	0.42	0.05	0.04	0.00
8/4/87	0.22	0.05	0.02	0.00
10/6/87	0.05	0.05	0.00	0.00
1/12/88	0.05	0.05	0.00	0.00
3/29/88	0.06	0.05	0.01	0.00
5/25/88	0.05	0.05	0.00	0.00
6/21/88	0.06	0.05	0.01	0.00
9/13/88	0.05	0.05	0.00	0.00
10/12/88	0.05	0.05	0.00	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
10/85-10/86	0.46	0.09	0.15	0.01
1/87-10/87	0.36	0.07	0.12	0.01
1/88-10/88	0.05	0.05	0.02	0.01

Spreadsheet 8.26) Big Muddy River (Rt. 149 0.7 miles W Plumfield, IL)

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
2.30	0.78	4	11	4	0	0

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
0.22	0.11	13	6	0	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
10/1/85	0.05	0.05	0.00	0.00
1/16/86	1.70	0.05	0.14	0.00
4/8/86	0.71	0.05	0.06	0.00
5/13/86	1.40	0.05	0.12	0.00
7/8/86	0.82	0.05	0.07	0.00
8/12/86	0.96	0.62	0.08	0.02
10/14/86	0.93	0.05	0.08	0.00
1/6/87	0.05	0.05	0.00	0.00
3/24/87	0.05	0.05	0.00	0.00
4/27/87	0.79	0.17	0.07	0.00
6/9/87	2.20	0.13	0.18	0.00
7/13/87	2.30	0.10	0.19	0.00
10/20/87	0.05	0.05	0.00	0.00
1/5/88	0.71	0.22	0.06	0.01
4/18/88	0.34	0.05	0.03	0.00
5/18/88	0.23	0.05	0.02	0.00
6/9/88	0.30	0.05	0.03	0.00
7/20/88	0.99	0.12	0.08	0.00
10/18/88	0.20	0.05	0.02	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
10/85-10/86	0.94	0.13	0.31	0.01
1/87-10/87	0.91	0.09	0.30	0.01
1/88-10/88	0.46	0.09	0.15	0.01

Spreadsheet 8.27) Kaskaskia River (Rt. 40-51 Vandalia,IL)

Maximum (ug/L)	10/85-8/88 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
2.00	0.72	1	13	5	0	0

Maximum (ug/L)	10/85-8/88 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
0.55	0.10	10	9	0	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
10/22/85	0.05	0.05	0.00	0.00
1/14/86	0.68	0.05	0.06	0.00
4/15/86	0.51	0.06	0.04	0.00
5/20/86	2.00	0.12	0.17	0.00
6/11/86	1.60	0.19	0.13	0.00
7/29/86	0.57	0.05	0.05	0.00
10/2/86	1.40	0.09	0.12	0.00
1/15/87	1.30	0.55	0.11	0.01
4/23/87	0.39	0.05	0.03	0.00
6/2/87	0.65	0.08	0.05	0.00
7/7/87	1.40	0.05	0.12	0.00
8/20/87	0.58	0.12	0.05	0.00
9/10/87	0.34	0.05	0.03	0.00
10/6/87	0.27	0.05	0.02	0.00
1/12/88	0.69	0.10	0.06	0.00
3/29/88	0.18	0.05	0.02	0.00
6/2/88	0.30	0.08	0.03	0.00
6/28/88	0.29	0.05	0.02	0.00
8/18/88	0.47	0.05	0.04	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
10/85-10/86	0.97	0.09	0.32	0.01
1/87-10/87	0.70	0.14	0.23	0.01
1/88-8/88	0.39	0.07	0.13	0.01

Spreadsheet 8.28) Silver Creek (Rt. 460 2.2 miles SE Freeburg, IL)

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
18.00	2.54	2	12	0	3	2

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
3.50	0.54	13	3	3	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
10/10/85	0.05	0.05	0.00	0.00
1/21/86	0.31	0.05	0.03	0.00
4/7/86	0.16	0.05	0.01	0.00
5/21/86	[illegible]	0.05	[illegible]	0.00
6/18/86	[illegible]	0.05	0.35	0.00
8/11/86	0.17	0.05	0.01	0.00
10/21/86	0.37	0.05	0.03	0.00
1/13/87	0.88	0.05	0.07	0.00
4/1/87	0.26	0.05	0.02	0.00
5/6/87	[illegible]	3.40	[illegible]	0.09
7/1/87	[illegible]	2.00	0.46	0.05
7/23/87	0.85	0.34	0.07	0.01
10/21/87	0.05	0.05	0.00	0.00
1/6/88	0.06	0.05	0.01	0.00
3/23/88	0.09	0.05	0.01	0.00
5/5/88	0.18	0.18	0.02	0.00
6/6/88	[illegible]	3.50	0.32	0.09
7/11/88	0.16	0.20	0.01	0.01
10/17/88	0.17	0.05	0.01	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
10/85-10/86	2.61	0.05	0.87	0.01
1/87-10/87	[illegible]	0.98	[illegible]	0.10
1/88-10/88	0.74	0.67	0.25	0.07

Spreadsheet 8.29) Green River (Rt. 82 north Geneseo, IL)

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
2.50	0.47	5	11	3	0	0

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
1.10	0.16	12	6	1	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
10/16/85	0.05	0.05	0.00	0.00
12/18/85	0.05	0.05	0.00	0.00
4/16/86	0.20	0.05	0.02	0.00
5/13/86	0.27	0.05	0.02	0.00
6/23/86	0.79	0.05	0.07	0.00
7/16/86	1.30	0.05	0.11	0.00
10/7/86	0.64	0.08	0.05	0.00
1/13/87	0.05	0.05	0.00	0.00
3/24/87	0.09	0.27	0.01	0.01
5/27/87	2.50	0.67	0.21	0.02
7/14/87	0.25	0.05	0.02	0.00
8/10/87	0.43	0.06	0.04	0.00
10/7/87	0.05	0.05	0.00	0.00
1/20/88	0.56	0.22	0.05	0.01
4/14/88	0.17	0.05	0.01	0.00
5/24/88	1.10	1.10	0.09	0.03
7/14/88	0.38	0.05	0.03	0.00
9/21/88	0.05	0.05	0.00	0.00
10/19/88	0.09	0.06	0.01	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
10/85-10/86	0.47	0.05	0.16	0.01
1/87-10/87	0.56	0.19	0.19	0.02
1/88-10/88	0.39	0.26	0.13	0.03

Spreadsheet 8.30) Elkhorn Creek (2 miles NW Penrose, IL)

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.05	0.05<C<1	1<C<3	3<C<12	C>12
1.40	0.37	3	13	2	0	0

Maximum (ug/L)	10/85-10/88 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.05	0.05<C<1	1<C<10	10<C<40	C>40
1.20	0.14	14	3	1	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
10/15/85	0.05	0.05	0.00	0.00
1/6/86	0.05	0.05	0.00	0.00
4/8/86	0.31	0.05	0.03	0.00
5/29/86	1.10	0.26	0.09	0.01
6/10/86	0.18	0.05	0.02	0.00
10/15/86	0.38	0.05	0.03	0.00
1/13/87	0.11	0.05	0.01	0.00
3/24/87	0.17	0.07	0.01	0.00
5/27/87	1.40	0.21	0.12	0.01
7/13/87	0.32	0.05	0.03	0.00
8/11/87	0.46	0.05	0.04	0.00
10/7/87	0.05	0.05	0.00	0.00
1/19/88	0.19	0.05	0.02	0.00
4/12/88	0.14	0.05	0.01	0.00
5/24/88	1.00	1.20	0.08	0.03
7/14/88	0.53	0.05	0.04	0.00
9/22/88	0.12	0.05	0.01	0.00
10/26/88	0.12	0.05	0.01	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
86 Apr.-Aug	0.53	0.12	0.18	0.01
87 Apr.-Aug	0.73	0.10	0.24	0.01
88 Apr.-Aug	0.56	0.43	0.19	0.04

9. STUDY 9: Squillace P and Engberg R. 1988. Surface-water quality of the Cedar River Basin, Iowa-Minnesota, with emphasis on the occurrence and transport of herbicides, May 1984 through November 1985. U.S. Geological Survey Water Resources Investigations Report 88-4060.

9.1) Sampling Locations:

Samples were collected at 6 locations within the Cedar River Basin (5 along the Cedar River and one along the Shell Rock River; Figure 9.1 from Figure 2 of the study report). The Cedar River discharges into the Iowa River with an average discharge of 4800 ft_3/sec. The total drainage area of the Cedar River is 7819 mi^2.

9.2) Sampling Times:

Samples were collected approximately monthly from May 1984 through September 1985 at the Floyd and Cedar Falls sampling locations, and from May 1984 through November 1985 at the other 4 locations.

9.3) Sampling Methodology:

Depth integrated samples were collected at 15-20 equal distant points across the river, and then composited.

9.4) Analytical Methodology:

Two sets of samples were collected. One set was centrifuged for the determination of the dissolved concentrations of herbicides. "Total recoverable" herbicide concentrations consisting of both extractable adsorbed and dissolved herbicides were determined in the sample set not centrifuged.

Herbicides were extracted with 45% methylene chloride/55% hexane and analyzed for 6 herbicides (including the triazines atrazine and cyanazine) using 2 different GC columns. Two different columns were used to confirm identities. The average of the 2 concentrations was reported.

9.5) QA/QC Procedures:

No information was provided on QA/QC procedures.

9.6) Results:

Under Phase II of the Drinking Water Regulations, water supply systems will be required to collect a minimum of 4 finished water samples a year, one per quarter. A water supply system will be considered out of compliance if the annual mean concentration of a regulated pesticide in the 4 quartely samples exceeds the MCL for the pesticide. If the pesticide concentration exceeds 4 times the

MCL in any individual sample, the annual mean will obviously exceed the MCL if only the minimum number of samples is collected (4 per year; 1 per quarter).

Concentrations of pesticides were compared to 4 times their MCL (or 4 times their lifetime drinking water HA if a MCL was not available). Annual (or the longest available if less than annual) arithmetic mean concentrations of pesticides were compared to their MCLs (or their lifetime drinking water HA if a MCL was not available).

The results of the sample analyses for both dissolved and total recoverable herbicides are presented in Surface Water Appendix Tables 9.1 through 9.6 (from Table 2 of the study report). Spreadsheets 9.1 through 9.6 contain the following information on dissolved atrazine and cyanazine at each location: dissolved concentrations, maximum observed concentrations, overall and annual (or the longest available if shorter than annual) arithmetic mean concentrations, and concentration distributions. Atrazine concentrations exceeding the MCL (3 ug/L), cyanazine concentrations exceeding the lifetime drinking water HA (10 ug/L), ratios exceeding 1 of atrazine concentrations to 4 times the MCL (12 ug/L), ratios exceeding 1 of cyanazine concentrations to 4 times the drinking water HA (40 ug/L), ratios exceeding 1 of annual (or the longest available if shorter than annual) arithmetic mean atrazine concentrations to the MCL (3 ug/L), and ratios exceeding 1 of annual (or the longest available if shorter than annual) arithmetic mean cyanazine to the lifetime drinking water HA (10 ug/L) are shaded in the spreadsheets.

The maximum observed concentrations, overall arithmetic mean concentrations, and concentration distributions of dissolved atrazine and cyanazine are summarized for the 6 sampling locations in Table 9.1. The concentration distribution of atrazine was computed with respect to its detection limit (0.1 ug/L), 1 ug/L, its MCL (3 ug/L), and 4 times its MCL (12 ug/L). The concentration distribution of cyanazine was computed with respect to its detection limit (0.1 ug/L), 1 ug/L, its lifetime drinking water HA (10 ug/L), and 4 times its lifetime drinking water HA (40 ug/L).

9.6.1 Atrazine:

Dissolved atrazine was detected in 91.0% of the 100 samples analyzed, but 76.9% of the 91 detects were less than 1 ug/L. Dissolved atrazine concentrations exceeded the MCL (3 ug/L) in 12% (12/100) of the samples over 5 locations and 4 times the MCL (12 ug/L) in 4% (4/100) of the samples over 3 locations. The overall dissolved atrazine concentration distribution for samples collected from the 6 sampling locations was as follows:

$C \leq 0.1$ ug/L (9.0%; 9/100)
0.1 ug/L $< C \leq 1.0$ ug/L (70.0%; 70/100)
1 ug/L $< C \leq 3$ ug/L (9.0%; 9/100)
3 ug/L $< C \leq 12$ ug/L (8.0%, 8/100 over 5 locations)
$C \geq 12$ ug/L (4.0%; 4/100 over 3 locations)

Atrazine concentrations exceeding 4 times the MCL (12 ug/L) were 16.0 ug/L on 6/19/84 in Cedar River near Carville IA, 16.0 ug/L on 6/10/84 and 15.0 ug/L on 6/20/84 in Cedar River at Cedar Falls IA, and 15.0 ug/L on 6/10/84 in Cedar River at Gilbertville IA. All other atrazine concentrations were less than 9 ug/L.

Annual (or the longest available if shorter than annual) arithmetic mean dissolved atrazine concentrations exceeding or approximately equal to the MCL (3 ug/L) were 3.43 ug/L (5/84-12/84) in Cedar River near Carville IA, 3.76 ug/L (5/84-12/84) in Cedar River at Cedar Falls IA, 3.21 ug/L ug/L (5/84-12/84) in Cedar River at Gilbertville IA, and 2.98 ug/L (6/84-12/84) in Cedar River near Bertram IA.

9.6.2 Cyanazine

Dissolved cyanazine was detected in 35.0% of the 100 samples analyzed, but 65.7% of the 35 detects were less than 1 ug/L. No cyanazine concentrations exceeded the lifetime drinking water HA (10 ug/L). The overall dissolved cyanazine concentration distribution for samples collected from the 6 sampling locations was as follows:

$C \leq 0.1$ ug/L (65.0%; 65/100)
0.1 ug/L $< C \leq 1.0$ ug/L (23.0%; 23/100)
1 ug/L $< C \leq 10$ ug/L (12.0%; 12/100)
10 ug/L $< C \leq 40$ ug/L (0.0%, 0/100)
$C \geq 40$ ug/L (0.0%; 0/100)

The highest dissolved cyanazine concentrations reported were 8.0 ug/L on 6/9/84 in Cedar River at Floyd IA, 8.0 ug/L on 6/9/84 and 6.8 ug/l on 6/19/84 in Cedar River near Carville IA, 8.70 ug/L on 6/10/84 and 7.20 ug/L on 6/20/84 in Cedar River at Cedar Falls IA, and 8.10 ug/L on 6/10/84 in Cedar River at Gilbertville IA. All were below the lifetime drinking water HA for cyanazine of 10 ug/L.

The highest annual (or the longest available if shorter than annual) arithmetic mean dissolved cyanazine concentrations were 1.65 ug/L (5/84-12/84) in Cedar River at Floyd IA, 1.95 ug/L (5/84-12/84) in Cedar River near Carville IA, 1.87 ug/L (5/84-12/84) in Cedar River at Cedar Falls IA, 1.72 ug/L (5/84-12/84) in Cedar River at Gilbertville IA, and 1.68 ug/L (6/84-12/84) in Cedar River near Bertram IA. All of the means were far below the lifetime drinking water HA for cyanazine of 10 ug/L.

9.7) Comments:

(1) Dissolved and total recoverable concentrations were comparable (almost always within 20% and generally within less than 10%) for both atrazine and cyanazine. The results show that most of the atrazine and cyanazine in the receiving waters are dissolved even when suspended sediment concentrations are elevated following runoff.

(2) The much lower concentrations of atrazine and cyanazine in the Spring of 1985 compared to the Spring of 1984 is attributed by the study authors to much lower rainfall and runoff during the Spring of 1985 (Figures 9.2 through 9.5 from Figures 14 through 17 of the study report.

(3) An estimated 56-80% of the total annual river discharge (depending upon the location) is contributed by groundwater discharge and tile drainage (unfortunately, estimates of the contributions of groundwater discharge and tile drainage are combined).

(4) The relative contributions of runoff, tile drainage, and groundwater discharge to atrazine and cyanazine loadings is unknown. Runoff is thought to have contributed the most to the high herbicide concentrations reported in the Spring of 1984. However, the study authors believe that significant contributions may have also been made from tile drainage (particularly in the flattest portion of the Cedar River Basin north of Northwood). On an annual basis, groundwater discharge may also contribute significantly to atrazine loading, particularly during drier periods later in the year.

(5) The study authors estimated that approximately 1.5% of the atrazine applied to the Cedar River Drainage Basin ended up being transported into the Cedar River. The average slope of the Cedar River Basin is less than 10%. The study authors point out that is comparable to the 2% loss estimated by Wauchope for soluble wettable powders applied to slopes of less than 10%.

Table 9.8) Atrazine and cyanazine maximums, arithmetic means, and concentration distributions for surface water samples collected 5/84-11/85 from 6 locations in the Cedar River Basin in Iowa. The concentration distributions of atrazine were computed with respect to its detection limit (0.05 ug/L), 1 ug/L, its MCL (3 ug/L), and 4 times its MCL (12 ug/L). The concentration distributions of cyanazine were computed with respect to its detection limit (0.05 ug/L), 1 ug/L, its lifetime drinking water HA (10 ug/L), and 4 times its lifetime drinking water HA (40 ug/L). Data are from Squillace and Engberg (1988; USGS).

Location	Atrazine Maximum (ug/L)	Atrazine Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.1	0.1<C<1	1<C<3	3<C<12	C>12	
Cedar R. (Floyd)	8.80	1.47	0	13	1	2	0	
Cedar R. (Carville)	16.00	1.89	1	12	2	1	1	
Shell Rock River	7.30	0.92	2	12	3	1	0	
Cedar R. (C. Falls)	16.00	2.32	1	11	2	0	2	
Cedar R. (Gilbertvi	8.00	1.85	3	9	1	1	1	
Cedar R. (Bertram)	7.60	1.54	2	13	0	3	0	
Total Atrazine			9	70	9	8	4	100
			(9.0%)	(70.0%)	(9.0%)	(8.0%)	(4.0%)	

Location	Cyanazine Maximum (ug/L)	Cyanazine Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.1	0.1<C<1	1<C<10	10<C<40	C>40	
Cedar R. (Floyd)	8.00	1.05	9	5	2	0	0	
Cedar R. (Carville)	8.00	1.03	10	5	2	0	0	
Shell Rock River	1.80	0.22	14	3	1	0	0	
Cedar R. (C. Falls)	8.70	1.15	10	4	2	0	0	
Cedar R. (Gilbertvi	4.70	0.97	10	3	2	0	0	
Cedar R. (Bertram)	5.30	0.86	12	3	3	0	0	
Total Cyanazine			65	23	12	0	0	100
			(65.0%)	(23.0%)	(12.0%)	(0.0%)	(0.0%)	

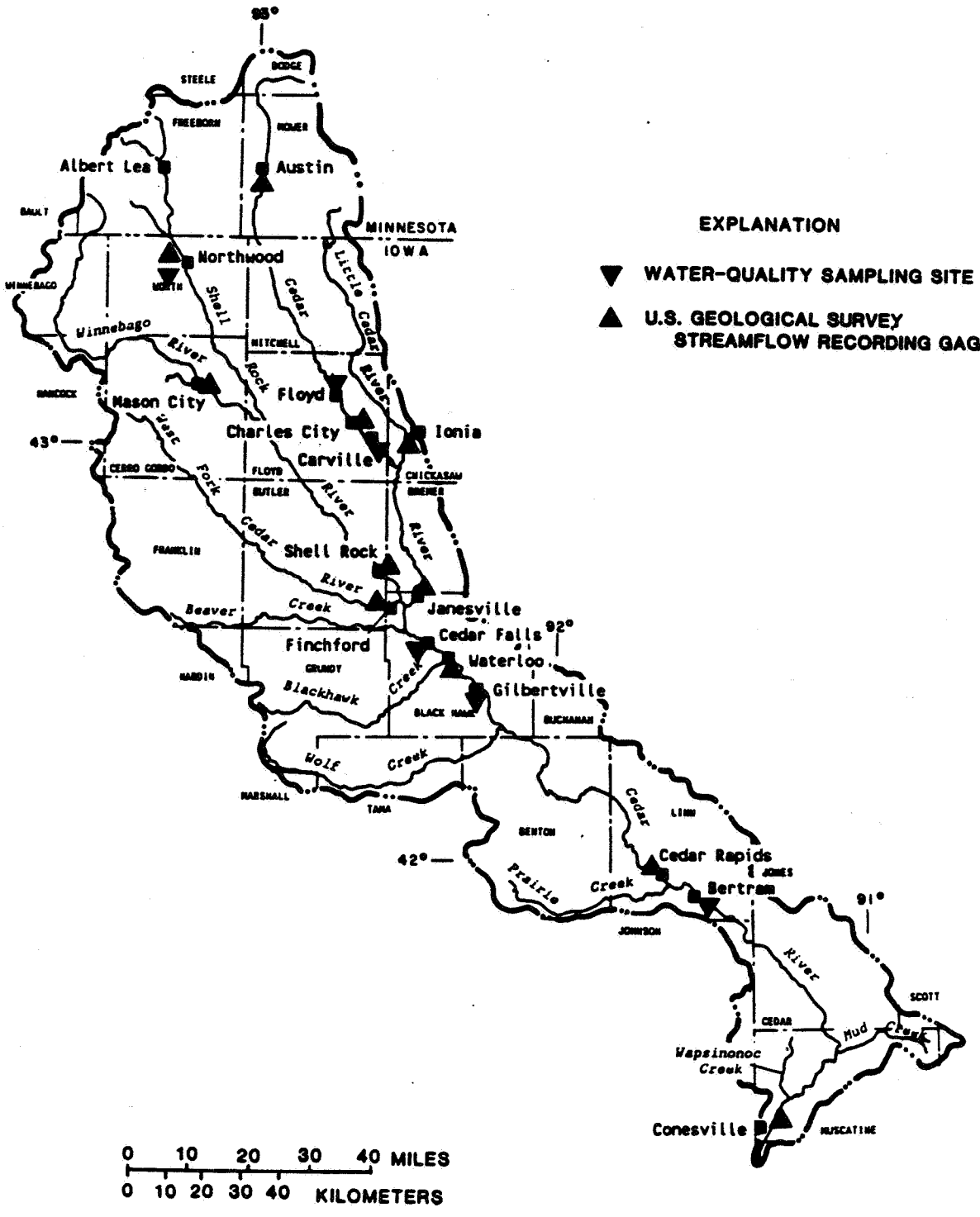


Figure 2.—Location of water-quality sampling sites and U.S. Geological Survey streamflow recording gages.

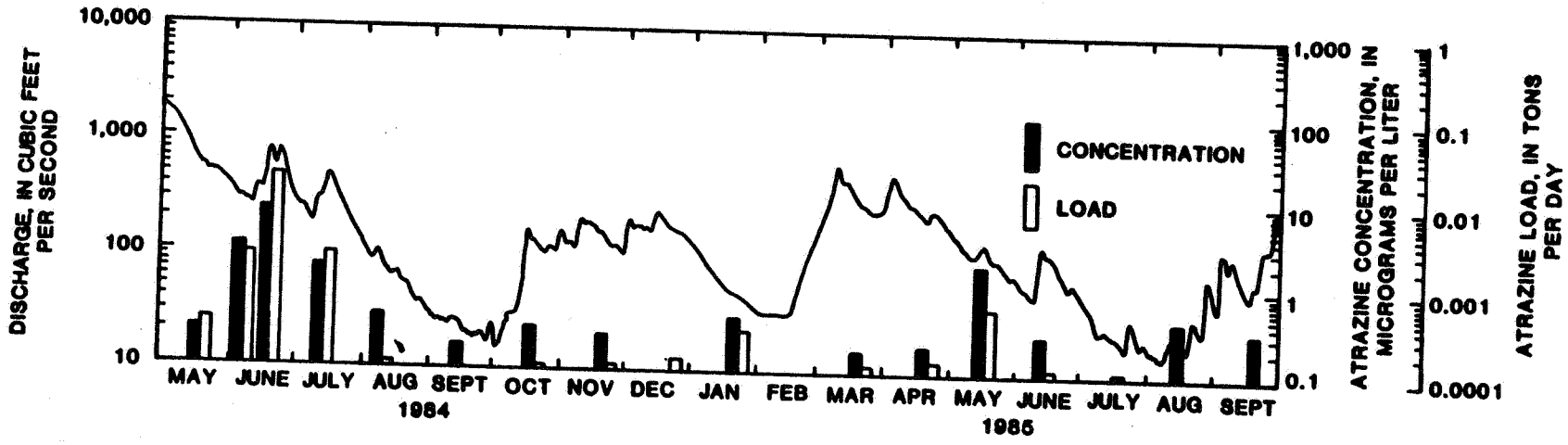


Figure 14.—Hydrograph of the Shell Rock River at Northwood, and total-recoverable concentration and load of atrazine at the sampling site near Northwood, May 1984 through 1985.

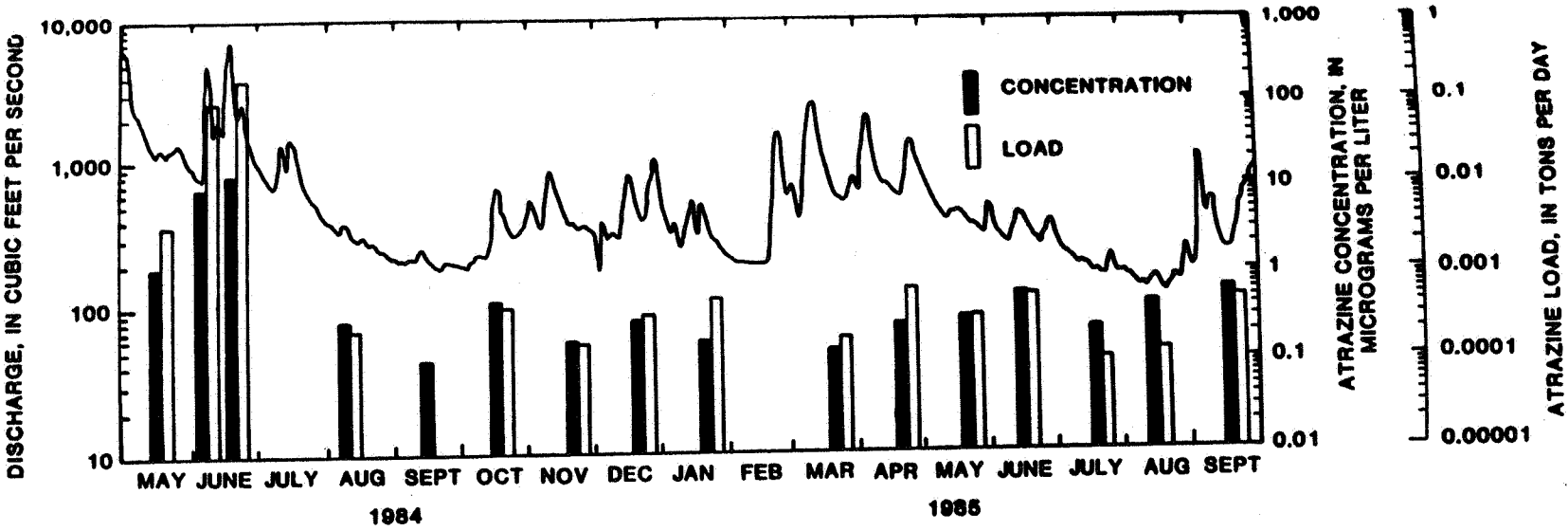


Figure 15.--Hydrograph of the Cedar River at Charles City, and total-recoverable concentration and load of atrazine at the sampling site near Carville, May 1984 through September 1985.

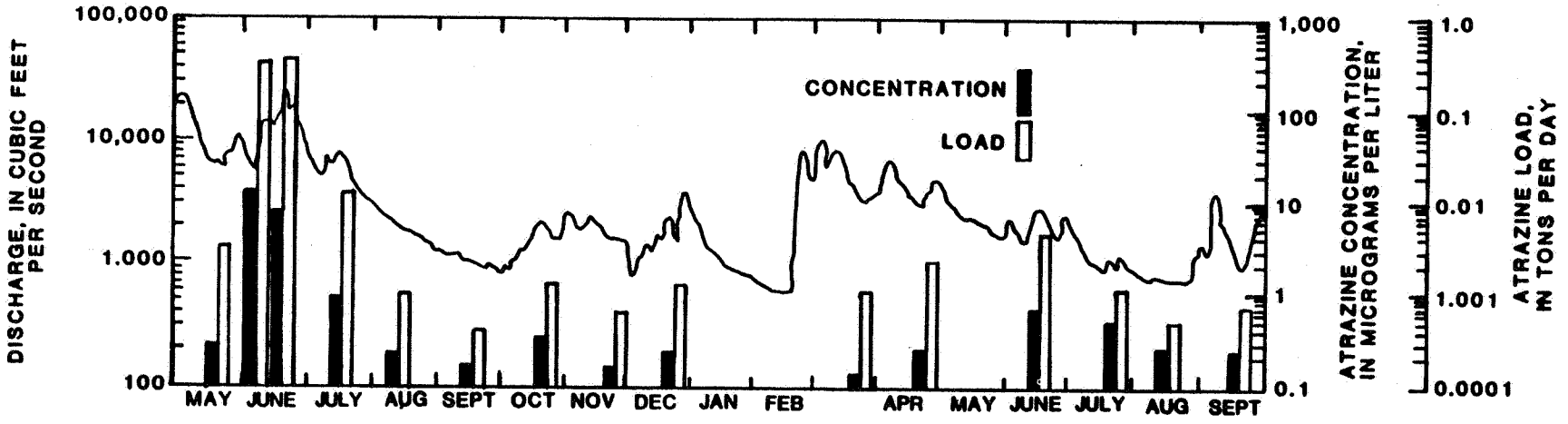


Figure 16.--Hydrograph of the Cedar River at Waterloo, and total-recoverable concentration and load of atrazine at the sampling site in Gilbertville, May 1984 through September 1985.

3/3

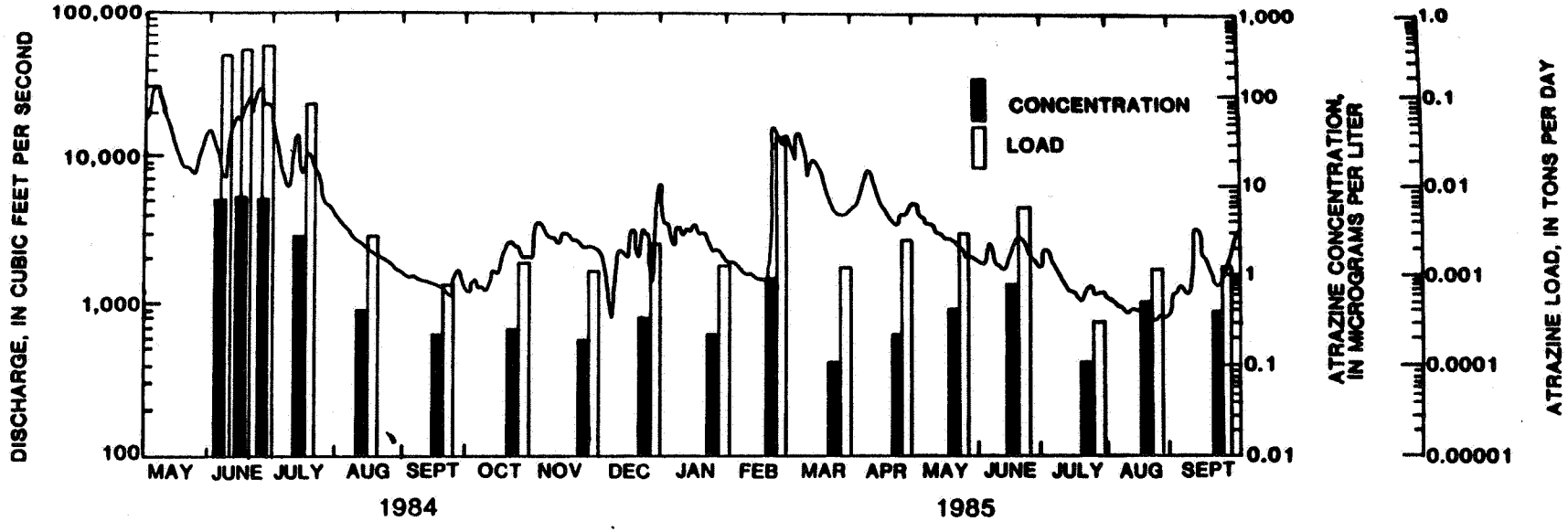


Figure 17.--Hydrograph of the Cedar River at Cedar Rapids, and total-recoverable concentration and load of atrazine at the sampling site near Bertram, May 1984 through September 1985.

Spreadsheet 9.1) Cedar River at Floyd, IA

Maximum (ug/L)	5/84-9/85 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.1	0.1<C<1	1<C<3	3<C<12	C>12
8.80	1.47	0	13	1	2	0

Maximum (ug/L)	5/84-9/85 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.1	0.1<C<1	1<C<10	10<C<40	C>40
8.00	1.05	9	5	2	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
5/22/84	0.65	0.29	0.05	0.01
6/9/84	[illegible]	8.00	0.73	0.20
6/19/84	[illegible]	5.50	0.67	0.14
7/16/84	2.10	0.43	0.18	0.01
8/14/84	0.38	0.10	0.03	0.00
9/19/84	0.13	0.10	0.01	0.00
10/24/84	0.49	0.26	0.04	0.01
11/28/84	0.18	0.10	0.02	0.00
12/27/84	0.22	0.10	0.02	0.00
1/29/85	0.14	0.10	0.01	0.00
3/25/85	0.12	0.10	0.01	0.00
5/20/85	0.45	0.76	0.04	0.02
6/17/85	0.66	0.73	0.06	0.02
7/22/85	0.14	0.10	0.01	0.00
8/19/85	0.33	0.10	0.03	0.00
9/23/85	0.75	0.10	0.06	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
5/84-12/84	2.33	1.65	0.78	0.17
1/85-9/85	0.37	0.28	0.12	0.03

Spreadsheet 9.2) Cedar River near Carville, IA

Maximum (ug/L)	5/84-11/85 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.1	0.1<C<1	1<C<3	3<C<12	C>12
16.00	1.89	1	12	2	1	1

Maximum (ug/L)	5/84-11/85 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.1	0.1<C<1	1<C<10	10<C<40	C>40
8.00	1.03	10	5	2	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
5/22/84	1.40	0.24	0.12	0.01
6/9/84	[illegible]	8.00	0.72	0.20
6/19/84	[illegible]	6.80	1.33	0.17
8/14/84	0.32	0.10	0.03	0.00
9/19/84	0.21	0.10	0.02	0.00
10/24/84	0.61	0.14	0.05	0.00
11/28/84	0.18	0.10	0.02	0.00
12/27/84	0.10	0.10	0.01	0.00
1/29/85	0.17	0.10	0.01	0.00
3/26/85	0.13	0.10	0.01	0.00
5/21/85	0.33	0.54	0.03	0.01
6/18/85	0.64	0.61	0.05	0.02
7/23/85	0.24	0.10	0.02	0.00
8/20/85	0.37	0.10	0.03	0.00
9/24/85	0.65	0.16	0.05	0.00
10/28/85	0.49	0.10	0.04	0.00
11/18/85	1.70	0.10	0.14	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
5/84-12/84	[illegible]	1.95	[illegible]	0.19
1/85-11/85	0.52	0.21	0.17	0.02

Spreadsheet 9.3) Shell Rock River near Northwood, IA

Maximum (ug/L)	5/84-11/85 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.1	0.1<C<1	1<C<3	3<C<12	C>12
7.30	0.92	2	12	3	1	0

Maximum (ug/L)	5/84-11/85 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.1	0.1<C<1	1<C<10	10<C<40	C>40
1.80	0.22	14	3	1	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
5/21/84	0.25	0.10	0.02	0.00
6/9/84	2.50	0.18	0.21	0.00
6/18/84	7.30	1.80	0.61	0.05
7/16/84	1.40	0.30	0.12	0.01
8/13/84	0.55	0.10	0.05	0.00
9/18/84	0.21	0.10	0.02	0.00
10/23/84	0.33	0.10	0.03	0.00
11/27/84	0.24	0.10	0.02	0.00
12/26/84	0.28	0.10	0.02	0.00
1/28/85	0.41	0.10	0.03	0.00
3/25/85	0.18	0.10	0.02	0.00
5/20/85	1.50	0.20	0.13	0.01
6/17/85	0.26	0.10	0.02	0.00
7/22/85	0.10	0.10	0.01	0.00
8/19/85	0.33	0.10	0.03	0.00
9/23/85	0.33	0.10	0.03	0.00
10/28/85	0.10	0.10	0.01	0.00
11/18/85	0.27	0.10	0.02	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
5/84-12/84	1.45	0.32	0.48	0.03
1/85-11/85	0.39	0.11	0.13	0.01

Spreadsheet 9.4) Cedar River at Cedar Falls, IA

Maximum (ug/L)	5/84-9/85 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.1	0.1<C<1	1<C<3	3<C<12	C>12
16.00	2.32	1	11	2	0	2

Maximum (ug/L)	5/84-9/85 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.1	0.1<C<1	1<C<10	10<C<40	C>40
8.70	1.15	10	4	2	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
5/23/84	0.43	0.17	0.04	0.00
6/10/84	[illegible]	8.70	[illegible]	0.22
6/20/84	[illegible]	7.20	[illegible]	0.18
7/17/84	1.30	0.24	0.11	0.01
8/15/84	0.28	0.10	0.02	0.00
9/20/84	0.10	0.10	0.01	0.00
10/24/84	0.30	0.10	0.03	0.00
11/28/84	0.19	0.10	0.02	0.00
12/27/84	0.26	0.10	0.02	0.00
1/30/85	0.16	0.10	0.01	0.00
2/26/85	1.00	0.10	0.08	0.00
3/26/85	0.14	0.10	0.01	0.00
5/21/85	0.26	0.34	0.02	0.01
6/18/85	1.10	0.68	0.09	0.02
7/23/85	0.23	0.10	0.02	0.00
9/24/85	0.30	0.10	0.03	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
5/84-12/84	[illegible]	1.87	[illegible]	0.19
1/85-9/85	0.46	0.22	0.15	0.02

Spreadsheet 9.5) Cedar River at Gilbertville, IA

Maximum (ug/L)	5/84-11/85 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.1	0.1<C<1	1<C<3	3<C<12	C>12
8.00	1.85	3	9	1	1	1

Maximum (ug/L)	5/84-11/85 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.1	0.1<C<1	1<C<10	10<C<40	C>40
4.70	0.97	10	3	2	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
5/23/84	0.49	0.25	0.04	0.01
6/10/84	[illegible]	8.10	[illegible]	0.20
6/20/84	8.00	4.70	0.67	0.12
7/19/84	1.10	0.27	0.09	0.01
8/15/84	0.21	0.10	0.02	0.00
10/25/84	0.39	0.10	0.03	0.00
11/30/84	0.19	0.10	0.02	0.00
12/28/84	0.26	0.10	0.02	0.00
3/26/85	0.15	0.10	0.01	0.00
6/18/85	0.65	0.24	0.05	0.01
7/23/85	0.56	0.10	0.05	0.00
8/20/85	0.38	0.10	0.03	0.00
9/24/85	0.10	0.10	0.01	0.00
10/29/85	0.10	0.10	0.01	0.00
11/19/85	0.10	0.10	0.01	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
5/84-12/84	[illegible]	1.72	[illegible]	0.17
3/85-11/85	0.29	0.12	0.10	0.01

Spreadsheet 9.6) Cedar River near Bertram, IA

Maximum (ug/L)	6/84-11/85 Ar. Mean (ug/L)	Atrazine Concentration Distribution C<0.1	0.1<C<1	1<C<3	3<C<12	C>12
7.60	1.54	2	13	0	3	0

Maximum (ug/L)	6/84-11/85 Ar. Mean (ug/L)	Cyanazine Concentration Distribution C<0.1	0.1<C<1	1<C<10	10<C<40	C>40
5.30	0.86	12	3	3	0	0

Sample Date	Atrazine Concn. (ug/L)	Cyanazine Concn. (ug/L)	Atrazine Concn./ 4 X MCL (12 ug/L)	Cyanazine Concn./ 4 X Life HA (40 ug/L)
6/11/84	7.60	5.30	0.63	0.13
6/14/84	7.56	5.10	0.63	0.13
6/21/84	7.48	2.50	0.62	0.06
8/16/84	0.25	0.10	0.02	0.00
9/21/84	0.29	0.10	0.02	0.00
10/26/84	0.26	0.10	0.02	0.00
11/30/84	0.21	0.10	0.02	0.00
12/28/84	0.31	0.10	0.03	0.00
1/30/85	0.21	0.10	0.02	0.00
2/27/85	0.89	0.10	0.07	0.00
3/27/85	0.13	0.10	0.01	0.00
5/22/85	0.35	0.50	0.03	0.01
6/19/85	0.95	0.49	0.08	0.01
7/24/85	0.10	0.40	0.01	0.01
8/21/85	0.47	0.10	0.04	0.00
9/25/85	0.38	0.10	0.03	0.00
10/29/85	0.10	0.10	0.01	0.00
11/19/85	0.26	0.10	0.02	0.00

Sampling Interval	Atrazine Arithmetic Mean (ug/L)	Cyanazine Arithmetic Mean (ug/L)	Atrazine Mean/ MCL (3 ug/L)	Cyanazine Mean/ Life HA (10 ug/L)
6/84-12/84	2.98	1.68	0.99	0.17
1/85-11/85	0.38	0.21	0.13	0.02

STUDY 10: Roux P. 1989. Summary of atrazine/metolachlor cross-over in the surface-water monitoring program. Completed in February 1988. Performed by Roux Associates and submitted by Ciba Geigy Corp., Greensboro, NC. Laboratory study #CG-02814. Appendix D of 410652-05.

10.1) Surface Waters Sampled:

Surface waters sampled were 3 in Iowa, 2 in Georgia, and one each in Delaware, Louisiana, Michigan, Minnesota, Ohio, and South Dakota (Table 10.1 and Figure 10.1 from Table 1 and Figure 1 of the study report).

10.2) Sampling Times:

Surface water samples were collected monthly in September, October, and November of 1986; monthly in March, July, August, September, October, and November 1987; and bimonthly in April, May, and June 1987. Samples were not collected in December, January, or February.

10.3) Sampling Methodology: No information was provided.

10.4) Analytical and QA/QC Methodologies:

The study author refers readers to a En-Cas Laboratories report entitled "Monitoring of Atrazine in Surface Water" dated 1987 for information on analytical and QA/QC procedures.

10.5) Results:

The results of the sample analyses are presented in Table 10.2 (from Table 3 of the study report). Same page plots of the atrazine concentration, precipitation, and river flow (discharge) vs. time in 1986 and 1987 are given for each sampling location in Surface Water Appendix Figures 10.2 through 10.8 (from Figures 3 through 8 of the study report).

Under Phase II of the Drinking Water Regulations, water supply systems will be required to collect a minimum of 4 finished water samples a year, one per quarter. A water supply system will be considered out of compliance if the annual mean concentration of a regulated pesticide in the 4 quartely samples exceeds the MCL for the pesticide. If the pesticide concentration exceeds 4 times the MCL in any individual sample, the annual mean will obviously exceed the MCL if only the minimum number of samples is collected (4 per year; 1 per quarter).

Concentrations of atrazine were compared to 4 times its MCL. Annual (or the longest available if less than annual) arithmetic mean concentrations of atrazine were compared to its MCL.

The maximum observed concentrations, the concentration distributions, and arithmetic mean concentrations of atrazine for each of the 11 surface waters sampled are presented Spreadsheets 10.1 through 10.11, and are summarized in Table 10.3. The 2 atrazine concentrations exceeding the MCL (3 ug/L) are shaded in the spreadsheets. None of the atrazine concentrations exceeded 4 times the MCL. The concentration distributions of atrazine were computed with respect to its detection limit (0.1 ug/L), 1 ug/L, its MCL (3 ug/L), and 4 times its MCL (12 ug/L).

Atrazine was detected at $\geq$ 0.1 ug/L in 65.7% of the 163 samples collected from the 14 rivers, but 93.5% of the detects were less than 1.0 ug/L. The highest peak concentrations observed were 4.5 ug/L in the Skunk River, IA; 4.5 ug/L in the Bayou Tech River, LA; 2.70 ug/L in Skunk Creek, SD; 1.90 ug/L in the Mad River, OH; 1.80 ug/L in the North River, IA; 1.40 ug/L in the Rum River, MN; and 1.20 ug/L in Strockly Branch, DE. However, those were the only observed concentrations > 1.0 ug/L.

10.6) Comments:

(1) Atrazine is used primarily as a pre-emergent herbicide for corn. It is therefore applied within a few days after planting which occurs between the first part of April and the last part of May in most of the country (Figure 21). However, 4 of the 7 reported concentrations > 1 ug/l were for samples collected in June 1987, 2 were for samples collected in July 1987, and the remaining one was for a sample collected in early August 1987. That suggests that the persistence of atrazine may be sufficient to extend its potential for runoff to several months after its application in some locations.

(2) The study author refers readers to a En-Cas Laboratories report entitled "Monitoring of Atrazine in Surface Water" dated 1987 for information on analytical and QA/QC procedures. However, that report was not included for review. The analytical and QA/QC procedures described in the 1988 En-Cas report entitled "Analysis of Atrazine Residues in Samples from a Surface Water Monitoring Program: Analytical Phase of Roux Associates Project No. CG-02814" appear to be adequate (see DER for 411352-06, study 2). If the same analytical and QA/QC procedures were used in the cross-over study, they are probably adequate. Nevertheless, EFGWB needs to see the actual QA/QC data (field and lab blanks, recoveries, calibration, etc.) to determine the accuracy of the cross-over data.

(3) The study was primarily designed for the determination of metolachlor in rivers within metolachlor use areas. Since atrazine is so widely used, samples collected during the second phase of the study were also analyzed for atrazine. However, atrazine concentrations in samples collected from the 10 known to drain high

metalochlor use areas were generally substantially less than in samples collected in other studies from surface waters known to drain high atrazine use areas.

ATRAZINE 080803

Page_____ is not included in this copy.

Pages 324 through 707 are not included.

The material not included contains the following type of information:

____ Identity of product inert ingredients.

____ Identity of product impurities.

____ Description of the product manufacturing process.

____ Description of quality control procedures.

____ Identity of the source of product ingredients.

____ Sales or other commercial/financial information.

____ A draft product label.

____ The product confidential statement of formula.

____ Information about a pending registration action.

_X_ FIFRA registration data.

____ The document is a duplicate of page(s) _____.

____ The document is not responsive to the request.

The information not included is generally considered confidential by product registrants. If you have any questions, please contact the individual who prepared the response to your request.