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Chlordane Contamination Study of the Cedar River, Cedar Rapids, Iowa Spring-Summer 1985

Report No. 86-3

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Prepared for the Iowa Department of Water, Air and Waste Management by the University of Iowa Hygienic Laboratory.

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ABSTRACT

Data from a routine fish tissue monitoring program in Iowa indicated fish in the Cedar Rapids area contained levels of chlordane in excess of the FDA action level. As a result, a chlordane study of the Cedar River was conducted. During the spring and summer of 1985 samples of water, sediment and fish were analyzed for the presence of the persistent insecticide chlordane. The samples were obtained from the Cedar River near Cedar Rapids and Cedar Lake, located within Cedar Rapids. Results of the study indicate:

The average concentration of chlordane present in the edible portion of channel catfish in the Cedar River was lower than the the FDA action level of 300 ppb. Of the 25 Cedar River catfish fillets analyzed individually, two contained chlordane in excess of the FDA action level. There was a significant difference in the chlordane concentrations of fish collected in spring as compared to late summer at the sampling site above Cedar Rapids but not below. No significant difference was observed in the chlordane levels of fish collected upstream of Cedar Rapids as compared to downstream. Low levels of chlordane were found in sediment samples from the Cedar River and two tributaries.

Channel catfish fillets collected in May and August from Cedar Lake contained chlordane in concentrations exceeding the FDA action level. No seasonal difference in chlordane concentration was observed for the Cedar Lake channel catfish. Carp and quillback fillets from Cedar Lake also contained chlordane in excess of 300 ppb. In addition, chlordane was present in fillets from largemouth bass and bullhead. Cedar Lake sediment samples contained substantially more chlordane than found in Cedar River sediments.

Chlordane was found in water samples collected from a foundation drain, sanitary sewer and influent to the Cedar Rapids Pollution Control Plant. The foundation drain data indicate one potential source of the chlordane may be from house foundations treated with chlordane for termite control.

INTRODUCTION

Since 1977, the state of Iowa has participated in a Regional Ambient Fish Tissue Monitoring Program (RAFTMP) sponsored by the Environmental Protection Agency's (EPA) regional office in Kansas City, Kansas. Each year during August and September, fish samples are collected by the Iowa Conservation Commission from preselected sites throughout Iowa and sent to the EPA laboratory in Kansas City for analysis of priority pollutants and other toxic compounds. Upon completion of the analyses, the Iowa Department of Water, Air and Waste Management (IDWAWM) is provided with a report discussing the findings. In 1982, the RAFTMP report (1) indicated carp (Cyprinus carpio) collected from the Cedar River near Cedar Rapids contained the pesticide chlordane at levels exceeding the Food and Drug Administration (FDA) action level of 300 parts per billion (ppb). Action levels are designed to protect humans from toxic residues in foods (2). Chlordane is a broad spectrum persistent insecticide, acutely toxic to freshwater fish and suspected of being a human carcinogen. The 1982 sample analyzed was a composite of several whole carp (total body). The FDA action level for chlordane applies only to the edible portion (fillet) of fish. Follow-up sampling in the Cedar Rapids area was conducted in 1983 and 1984 using channel catfish (Ictalurus punctatus) as the indicator fish and analyzing only the fillets. Two composite catfish samples and one white bass (Morone chrysops) sample collected in 1983 and 1984 downstream of Cedar Rapids exceeded the FDA chlordane action level (380 ppb, 630 ppb and 320 ppb respectively) while upstream samples were below the limit (2, 3). Based on these results, a study of the Cedar River was proposed to be conducted during spring and late summer 1985 in an effort to define the extent of contamination. The objectives of the study were to:

1. confirm that chlordane is contaminating the edible portion of channel catfish in the Cedar River near Cedar Rapids at levels higher than the Food and Drug Administration action level;
2. identify the area of contamination;
3. determine if spring and summer chlordane concentrations in fish differ; and
4. attempt to identify the source(s) of chlordane and the pathways to the river.

FIELD AND LABORATORY METHODOLOGY

A comprehensive Work/Quality Assurance Project Plan for the chlordane study was developed by personnel from the University Hygienic Laboratory (UHL) and IDWAWM. The Work/QA project plan was used as a planning and resource document for the study. A brief discussion of the field and laboratory activities is discussed below. The complete field and laboratory procedures may be found in the Quality Assurance Workplan - Chlordane Contamination Study of Cedar River, Cedar Rapids, Iowa (4). Quality Assurance for field and laboratory activities was followed as determined in the Work/QA plan. All data in this report meet the quality assurance objectives specified in the Work/QA plan. Copies of the plan are available from the IDWAWM or the UHL.

The monitoring area included nine collection sites with three sample matrices (fish, sediment and water) being investigated. The study reach extended from just upstream of the Cedar Rapids metropolitan area to the confluence of the Cedar River with the Iowa River in Louisa County, approximately 70 miles downstream (Figures 1 and 2). The Cedar River main stem sites were selected to confirm chlordane contamination and determine the extent of the affected area. The tributaries and lake locations were used in an attempt to evaluate sources and pathways. The location of all stream and

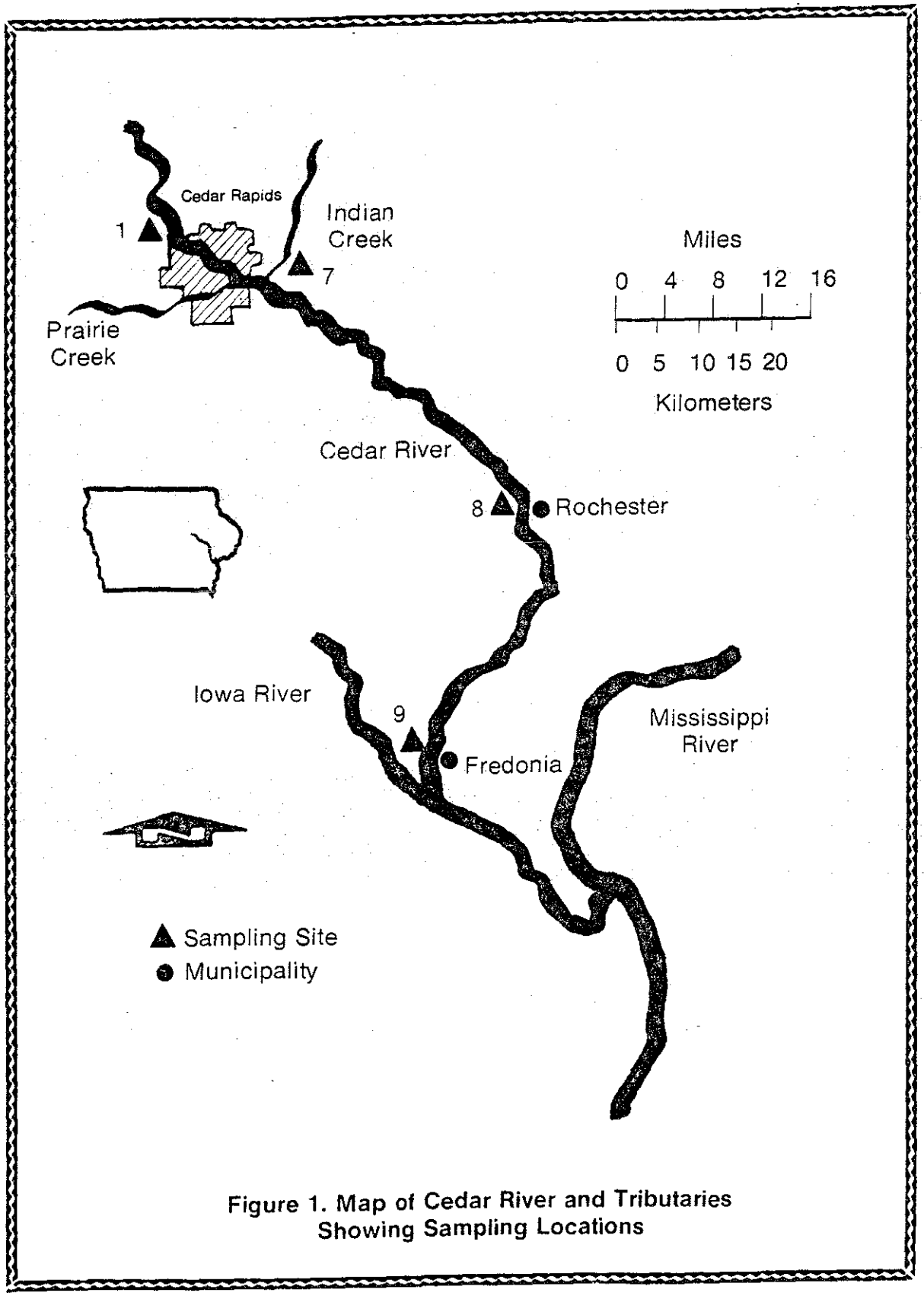


Figure 1. Map of Cedar River and Tributaries Showing Sampling Locations

UHL /graphics

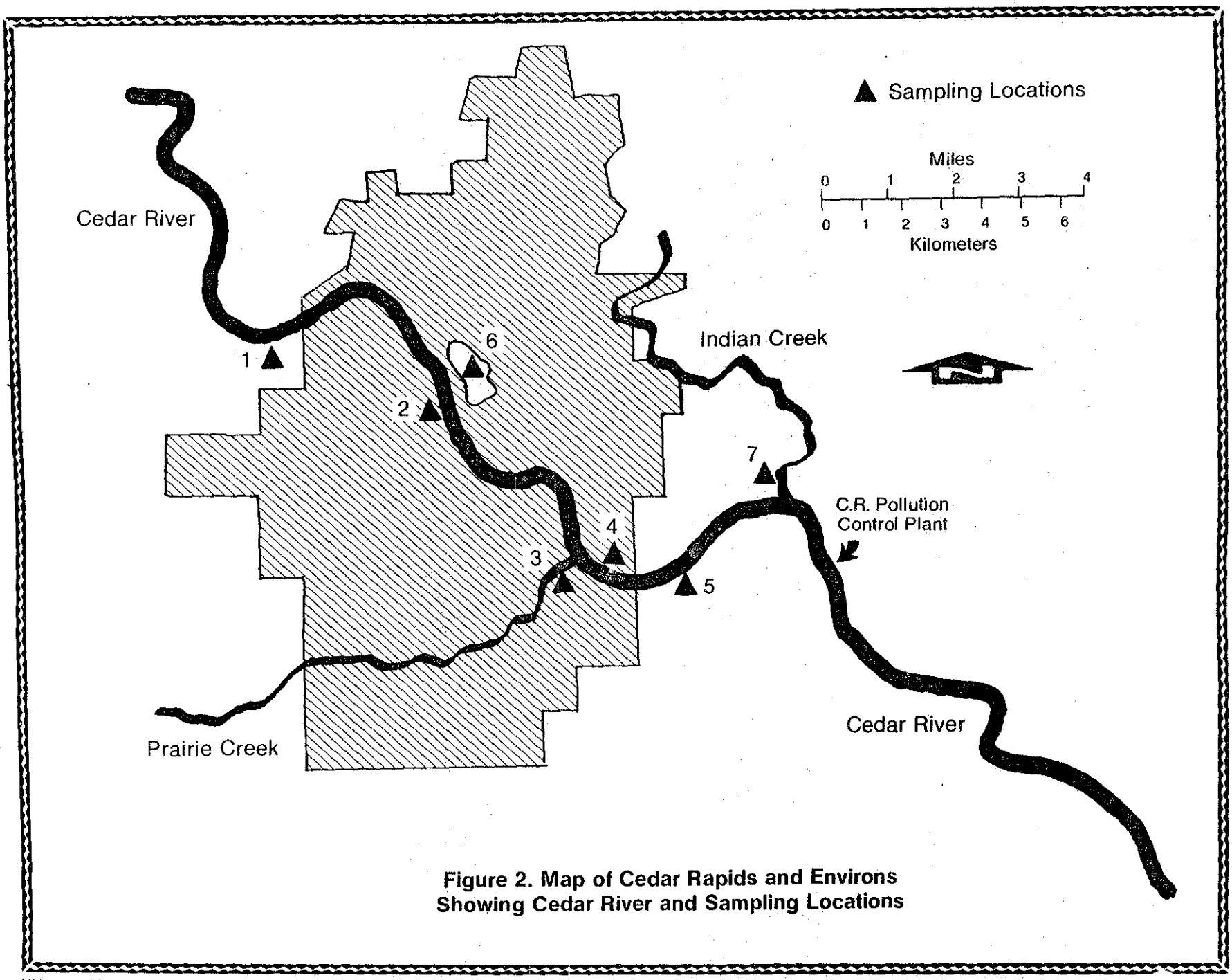


Figure 2. Map of Cedar Rapids and Environs Showing Cedar River and Sampling Locations

UHL/graphics

lake sampling sites may be found in Table 1.

Three types of samples were collected during the study: fish, sediment and water from suspected chlordane sources. All samples were analyzed for the presence of chlordane. From additional chlordane information provided by EPA officials (telephone communication with Bruce Littell - EPA Region 7, Kansas City, Kansas) the analysis of oxychlordane, a metabolite of chlordane, was included in the study. According to Littell, "oxychlordane has been shown to be up to twenty times more toxic than its parent compound and should be evaluated if chlordane is expected to be present".

Fish samples were collected the week of 20 May and 26 August from Sites 1, 5, 6, 8 and 9. Channel catfish were chosen for analysis because they are primarily bottom feeders and likely to be exposed to chlordane present in the sediments, they have a relatively high oil content which can allow catfish to bioaccumulate chlordane in higher amounts than other sport fish, and they are found statewide. Channel catfish 12 to 15 inches in length were collected, filleted and analyzed. This particular size was selected because the fish would be at least two to three years old which would allow time for exposure and bioaccumulation, and are a size desired by fisherman. (Note: All references to "fish" from this point on will mean channel catfish of 12 to 15 inch length except where noted.)

To better define the variability of chlordane concentrations in fish at monitoring Sites 1 and 5 (Seminole Valley Park and just downstream of the low head dam respectively), channel catfish were collected, filleted and analyzed individually. At each of the other sites (Site 6, 8 and 9), when possible, five fish were collected, filleted, ground, and blended together to form a composite sample.

Sediment samples were collected at eight locations (all sites except Site 1) during the week of 20 May and at five locations (Sites 2, 3, 4, 6 and

Table 1

Chlordane Study Stream and Lake Sampling Locations
Spring and Summer, 1985

Site	Location
Site 1 - Cedar River	Seminole Valley Park R8W, T83N, Section 13
Site 2 - Cedar River	Railroad trestle over river, R7W, T83N, Section 21
Site 3 - Prairie Creek	C Street Bridge, R7W, T83N, Section 34
Site 4 - Cedar River	Chicago and Northwestern trestle, R7W, T82N, Section 2
Site 5 - Cedar River	Downstream of low head dam, R7W, T82N, Section 2
Site 6 - Cedar Lake	R7W, T83N, Section 16/21
Site 7 - Indian Creek	R6W, T83N, Section 30
Site 8 - Cedar River	Near Rochester, R3W, T79N, Section 12
Site 9 - Cedar River	Near Fredonia, R4W, T75N, Section 17/20

7) the week of 26 August. Because chlordane has an affinity to attach to soil particles, the river sediments were considered a potential source of chlordane available for uptake by the fish. Sediment samples were obtained using a ponar dredge. A minimum of three samples were collected along a transect across the stream or river. Cedar Lake sediment samples were collected at several sites selected at random throughout the lake. For each transect, a representative aliquot of the top 3 inches of the individual sediment samples was composited together and analyzed for chlordane and oxychlordane.

Source sampling was to be conducted during spring and late summer after a significant rainfall in the Cedar Rapids area. Sampling points were selected from information provided by city officials and included the Municipal Pollution Control Plant (PCP) influent and effluent, storm sewers, and foundation drains of houses where chlordane had been applied for termite control. Because of very dry conditions experienced during the summer and early fall, the source sampling was not performed until 30 September and 11 October, 1985. The sampling locations for the source monitoring are listed in Table 2.

RESULTS AND DISCUSSION

The results of the chlordane study will be presented by collection periods and the type of sample collected. All data collected during the study may be found in the Appendix.

Spring

Sediment Analyses - During late May, composite sediment samples from 8 locations were collected and analyzed for chlordane and oxychlordane concentrations. It should be noted that all the Cedar River sites and the Indian Creek sediment samples were composed primarily of sand. Prairie Creek (Site 3) and Cedar Lake (Site 6) sediments were black, mucky and much higher

Table 2

Chlordane Source Sampling Sites
September and October, 1985

Location	Sampling Point	Potential Source
McCloud Run at Shaver Road bridge	Storm sewer	Residential/Agricultural drainage
Mound Farm Drive N.E. and Staub Court N.E.	Storm sewer	Residential drainage
Prairie Drive N.E. 35th Street N.E.	Storm sewer	Elmcrest Golf Course drainage
Teresa Drive S.W. and 26th Avenue Drive S.W.	Sanitary sewer	Foundation drainage from homes treated with chlordane
Yellow Pine Drive N.E.	Basement sump	Individual foundation drainage
Cedar Rapids Pollution Control Plant	Plant influent Plant effluent	City-wide drainage/ waste water

in organic matter than the sand samples. Results indicated (Table 3) there was not any detectable chlordane (<50 ppb) or oxychlordane (<5 ppb) in any of the sediment samples.

Table 3

Chlordane in Sediment
May 1985

(concentrations in parts per billion or μg/kg)

Location	Chlordane Concentration	Oxychlordane Concentration
Site 2 - Cedar River	<50	<5
Site 3 - Prairie Creek	<50	<5
Site 4 - Cedar River	<50	<5
Site 5 - Cedar River	<50	<5
Site 6 - Cedar Lake	<50	<5
Site 7 - Indian Creek	<50	<5
Site 8 - Cedar River	<50	<5
Site 9 - Cedar River	<50	<5

The state of Illinois has analyzed sediment samples for chlordane from statewide locations for several years. Using lower detection limits, their results from 97 sediment samples showed 35 contained greater than 5 ppb chlordane and only 2 exceeded 50 ppb (5). As a result of the Illinois information, it was determined more elaborate, non-routine sample clean-up would be performed on the late summer sediment samples which would allow the detection limit for chlordane to be lowered to 5 ppb.

Fish Analyses - The analytical results for the spring fish samples are displayed in Table 4.

Figure 3 graphically represents the results from Site 1 (upstream from Cedar Rapids) and Site 5 (downstream from Cedar Rapids). None of the six fish upstream exceeded the FDA action level of 300 ppb and only one of the seven fish downstream exceeded (340 ppb) the FDA limit. The average chlordane

TABLE 4
Chlordane in Channel Catfish
from Cedar River Sites and Cedar Lake
Collected 21 and 22 May 1985

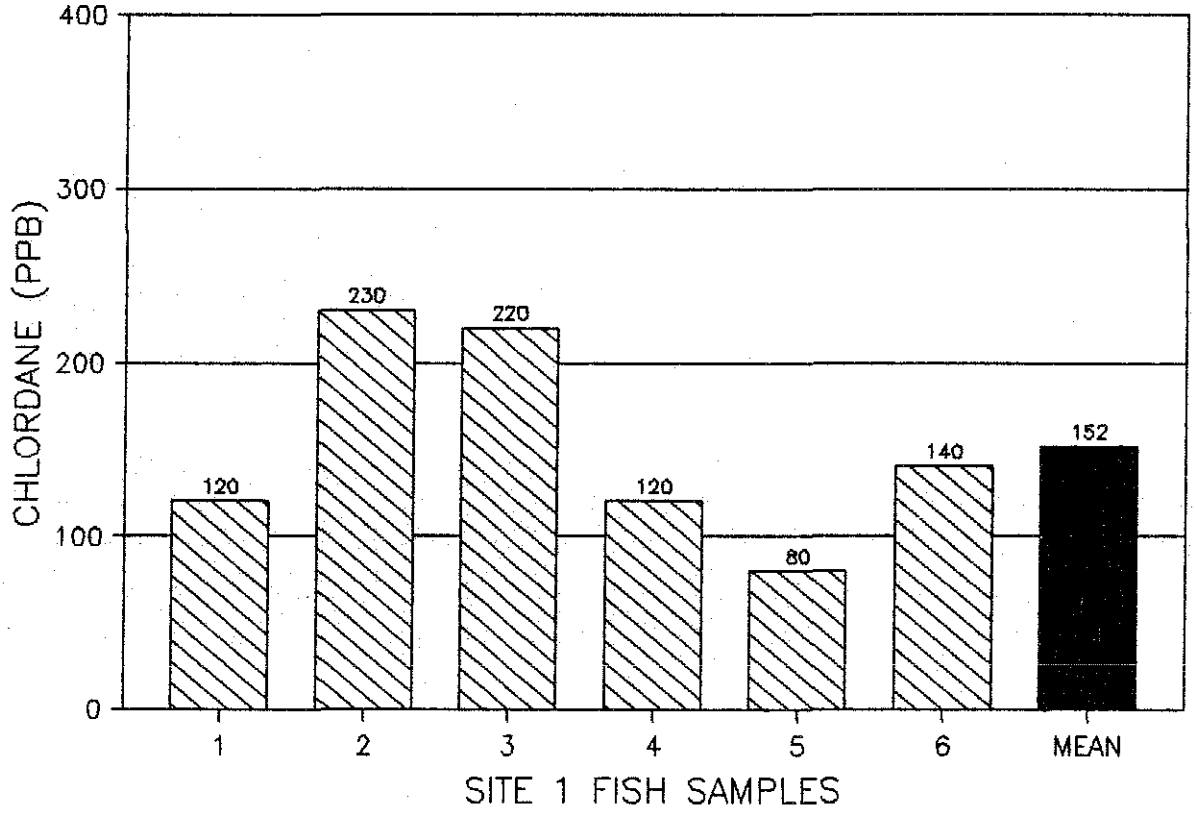
(concentrations in parts per billion or µg/kg)

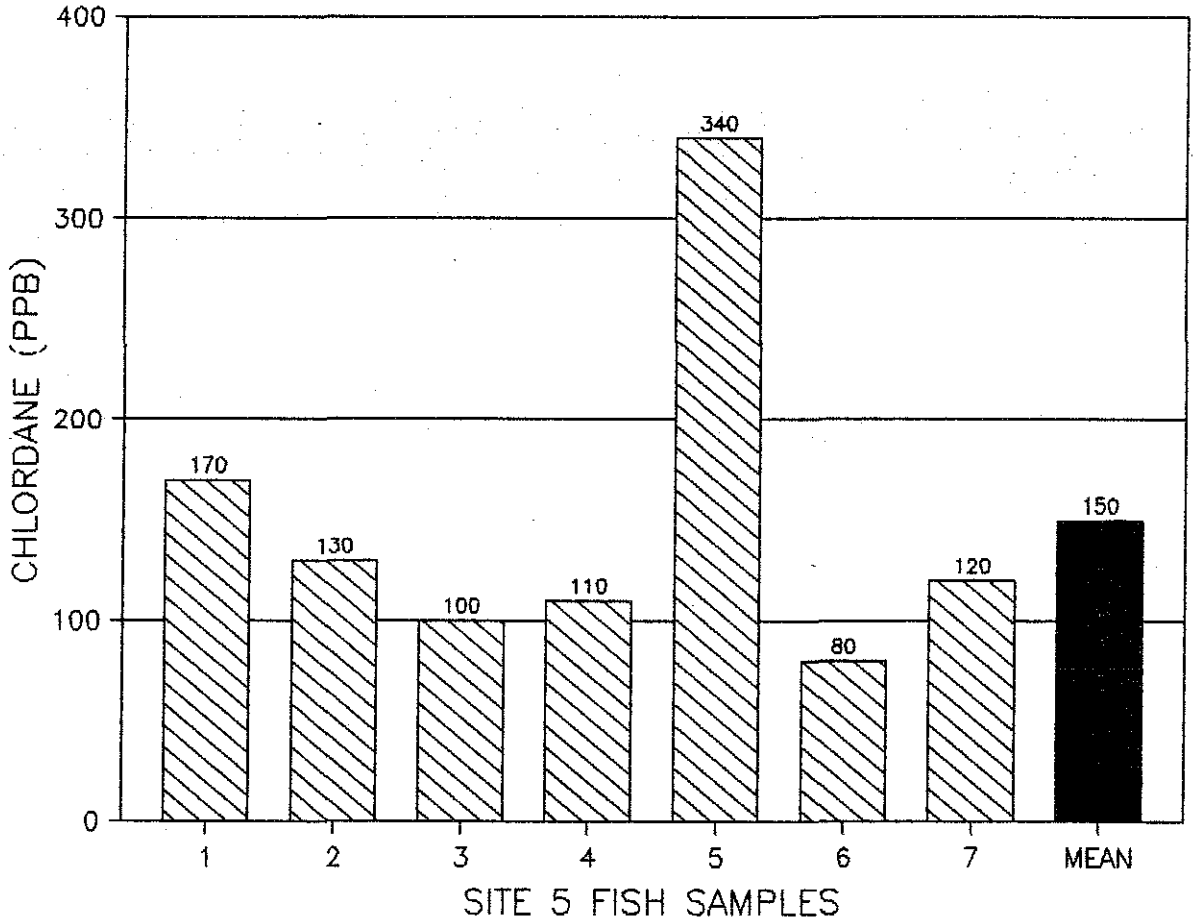
Site 1	Length (Inches)	Chlordane	Oxychlordane	% Oil
Fish 1	15.5	120	10	1.9
Fish 2	14	230	20	4.2
Fish 3	15	220	10	4.0
Fish 4	13.5	120	10	5.0
Fish 5	15.25	80	<10	1.6
Fish 6	13	140	<10	3.4
Average and Standard Deviation	14.4 ±0.4	152 ±27		3.4 ±0.7
Site 5				
Fish 1	14.5	170	<10	3.4
Fish 2	14	130	<10	2.1
Fish 3	13.75	100	10	1.4
Fish 4	13.25	110	10	1.1
Fish 5	13.5	340	<10	5.9
Fish 6	14	80	<10	0.5
Fish 7	13	120	<10	2.0
Average and Standard Deviation	13.7 ±0.3	150 ±61		2.3 ±1.2
Site 6 - Cedar Lake				
Composite[1]	13.5	1000*	20*	5.9*
		900*	20*	6.2*
Site 8				
Composite[1]	13.8	130	10	3.3
Composite[1]	16.8	230	10	4.8
Site 9				
Composite[1]	13.8	200	20	2.9

1 Composite consisted of five fish - length is average length
* Duplicate sample analysis

FIG.3 CEDAR RIVER CHLORDANE IN FISH

MAY,1985





concentration in the catfish fillets was almost identical for Sites 1 and 5 (152 and 150 ppb respectively). Figure 4 reflects the average and composite chlordane level in fish collected at all the Cedar River sites and Cedar Lake (CL). (Average used in this report means the arithmetic sum of each individual analysis divided by the total number of analyses; a composite sample is a number of fish processed together and analyzed once.) Average and composite chlordane values for all the Cedar River sites were less than the FDA action level of 300 ppb. Interestingly, the composite of larger channel catfish (8B) at Site 8 had a higher chlordane level than the smaller fish (8A). This is not suprising since the larger fish would be expected to, and did, have a higher oil content, hence the ability to bioaccumulate more chlordane.

The composite channel catfish sample from Cedar Lake (CL) was more than three times (950 ppb - average of duplicate analysis) the FDA action level. These results indicate channel catfish in Cedar Lake during the spring sampling contained much higher concentrations of chlordane than river fish.

Oxychlordane was found in several fish fillets ranging from 10 to 20 ppb. At these low concentrations no definitive statement can be made regarding its presence.

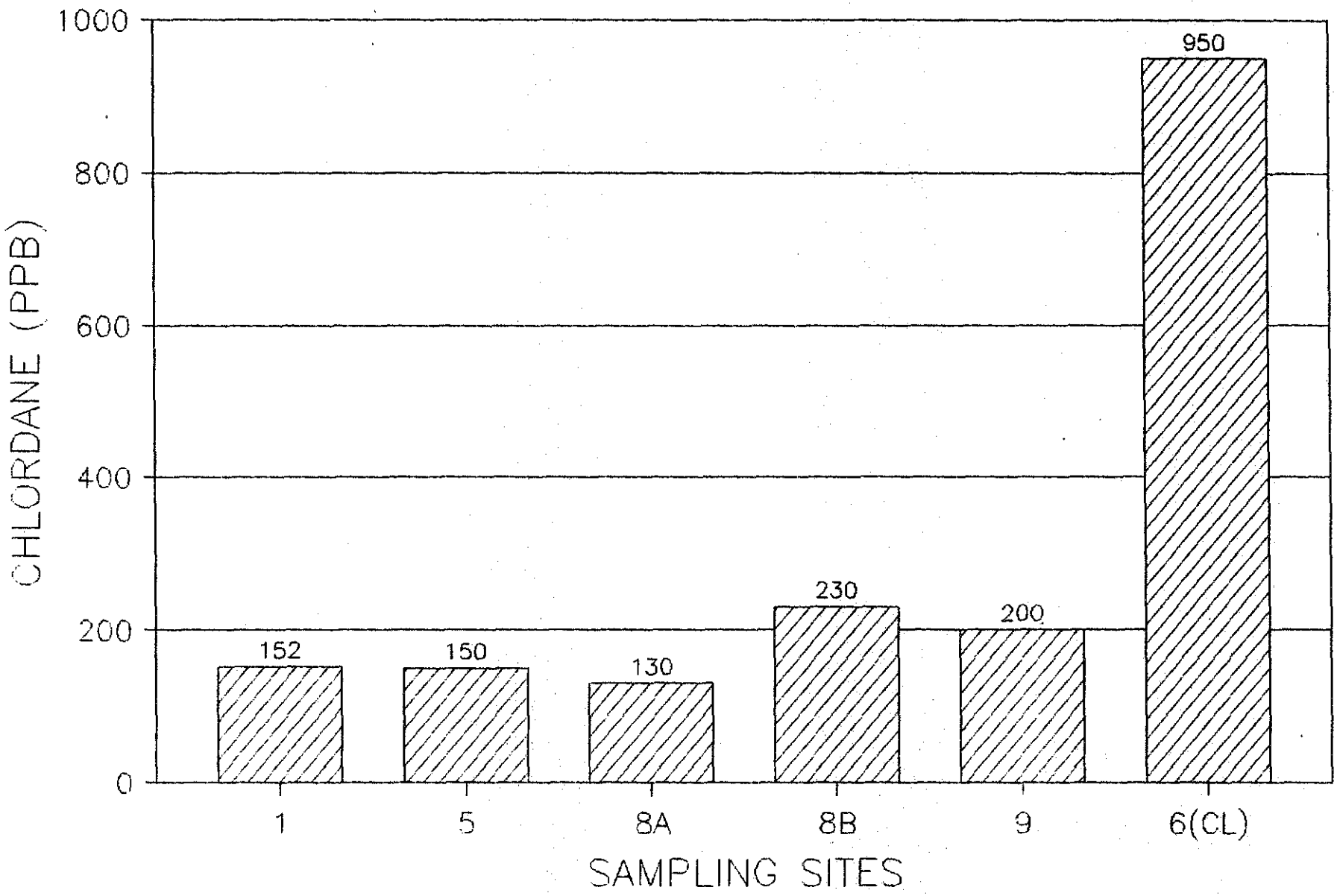
Source Sampling - Lack of adequate rainfall caused the spring source sampling to be postponed.

Late Summer

Based on the results of the spring study, several modifications were made in the late summer follow-up sampling and are discussed in each representative section.

FIG.4 AVERAGE CHLORDANE CONC. IN FISH

CEDAR RIVER MAY,1985



Sediment Analyses - Sediment samples were collected from only five sites during the summer sampling; i.e., Cedar River Sites 2 and 4, Prairie Creek, Indian Creek and Cedar Lake. To better define the sediment load in Cedar Lake, the lake was divided into north and south halves. Several bottom samples (at least four) were collected from each half and composited together resulting in a north sediment sample and a south sediment sample. River and creek sites were collected in the same manner as the spring samples. The results of the chlordane analysis of the sediment samples are listed in Table 5.

Table 5
Chlordane in Sediment from Cedar River
August 1985

(conenctrations in parts per billion or µg/kg)

Location	Chlordane Concentration	Oxychlordane Concentration
Site 2 - Cedar River	6	<0.5
Site 3 - Prairie Creek	17	<0.5
Site 4 - Cedar River	<5	<0.5
Site 6 - Cedar Lake (North)	170	<0.5
Cedar Lake (South)	460	<0.5
Site 7 - Indian Creek	16	<0.5

At the lower detection limit, chlordane was present in all the sediment samples except for Site 4 (in the pool above the lowhead dam). The two creeks contained higher levels of chlordane than the Cedar River samples and may indicate a chlordane pathway to the river. Cedar Lake chlordane values were 10 to 27 times greater than those found in the creeks. The large difference between the north and south transect samples indicates the possibility of a major source of chlordane on the south side. At the levels of chlordane found in the Cedar Lake sediments, fish bioaccumulation is highly probable and explains the elevated fish chlordane concentrations found in the spring study. The difference in the presence of chlordane in the sediments from spring to

late summer may be an artifact of the sampling procedure. During both sediment samplings, collection sites were randomnly selected throughout the lake. If the chlordane is not uniformly distributed, and it appears it is not, the spring sampling may have missed the areas of high chlordane concentration. Chlordane could have been introduced into Cedar Lake between May and August in rainfall runoff. However, the lack of rainfall during that time period does not support that hypothesis.

Fish Analyses - Except for Cedar Lake, late summer fish sample collection was the same as the Spring study. To better evaluate the total fish population in Cedar Lake, several species of fish were collected and analyzed. The results of the summer channel catfish analyses are shown in Table 6 and Figures 5, 6, and 7.

The concentration of chlordane in channel catfish found at Site 1 (upstream of Cedar Rapids) ranged from 27 ppb to 130 ppb with an average concentration for the six fish of 67 ppb. The average chlordane levels in the August fish (67 ppb) was less than half the May average of 152 ppb. To determine if the May and August chlordane levels at Site 1 were significantly different, the average and standard deviations for each have been plotted in Figure 6. The non-overlapping of standard deviations indicates there was a significant difference between the May and August chlordane levels at Site 1. The average percent oil content was similar for both samplings (3.4% $\pm$0.1 for May and 4.5% $\pm$0.8 for August) indicating that factors other than liquid content may be responsible for the difference in the values.

Channel catfish downstream of Cedar Rapids (Site 5) had chlordane values ranging from 57 ppb to 307 ppb with only one fish exceeding the FDA action level of 300 ppb. Although the late summer average chlordane concentration for the six fish at Site 5 was 134 ppb, twice the August chlordane average

TABLE 6
Chlordane in Channel Catfish
from Cedar River Sites and Cedar Lake
Collected 27 August 1985

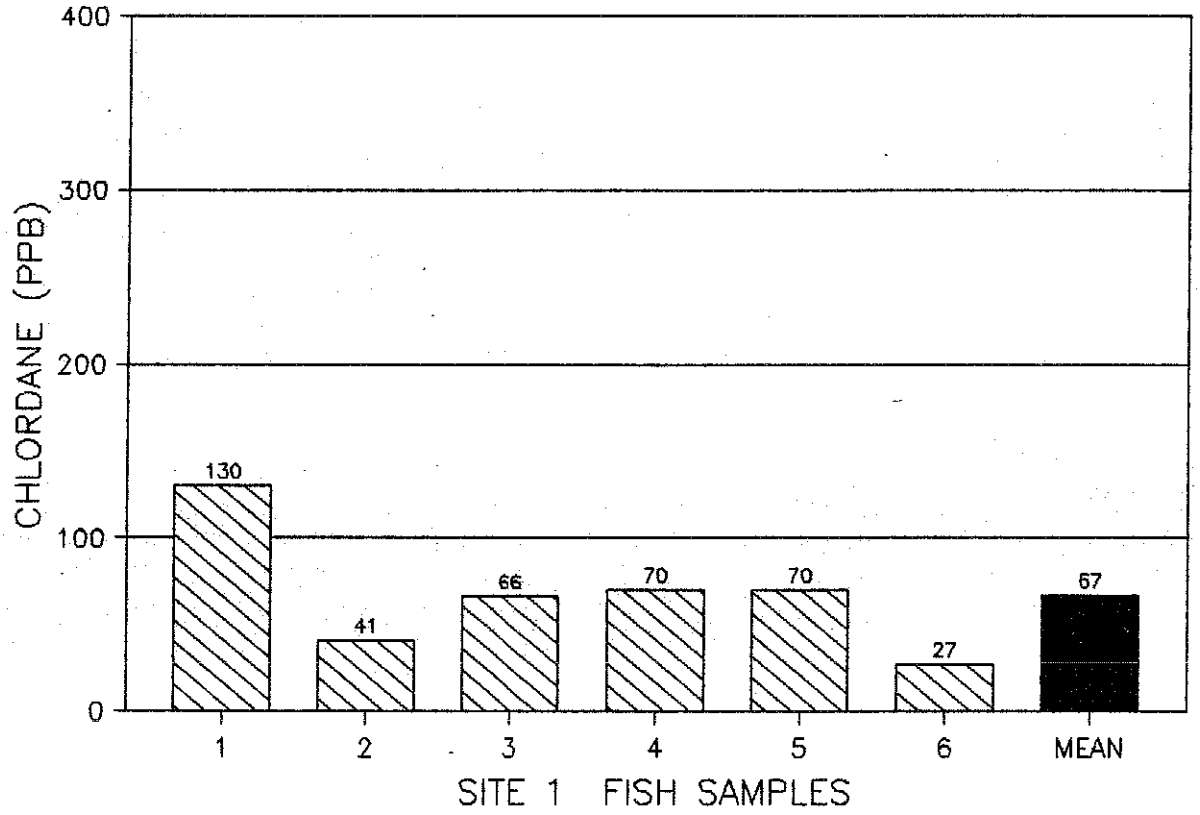
(concentrations in parts per billion or µg/kg)

Site 1	Length (Inches)	Chlordane	Oxychlordane	% Oil
Fish 1	15.2	130	<10	4.6
Fish 2	13.7	41	<10	2.7
Fish 3	14.5	66	<10	6.3
Fish 4	15	70	<10	5.1
Fish 5	14.7	70	<10	6.1
Fish 6	14.5	27	<10	2.5
Average and Standard Deviation	14.6 ±0.3	67 ±25		4.5 ±0.8
Site 5				
Fish 1	14.7	71	<10	2.5
Fish 2	14.5	57	<10	1.4
Fish 3	15	180	<10	2.6
Fish 4	13.5	307	<10	13
Fish 5	14	59	<10	0.92
Fish 6	15.5	130	<10	2.4
Average and Standard Deviation	14.5 ± 0.4	134 ± 56		3.8 ± 3.1
Site 6 - Cedar Lake				
Fish 1	15.5	1200	<20	3.1
Fish 2	14	920	<10	4.0
Fish 3	16	870	<10	2.0
Average and Standard Deviation	15.2 ±0.5	1000 ±60		3.3 ±0.5
Site 8				
Composite[1]	15.4	79	<10	0.82
Composite[1]	17.4	140	<10	3.9
Site 9				
Composite[1]	14.2	180	<10	4.7

1 Composite consisted of five fish - length is average length

FIG.5 CEDAR RIVER CHLORDANE IN FISH

AUGUST, 1985



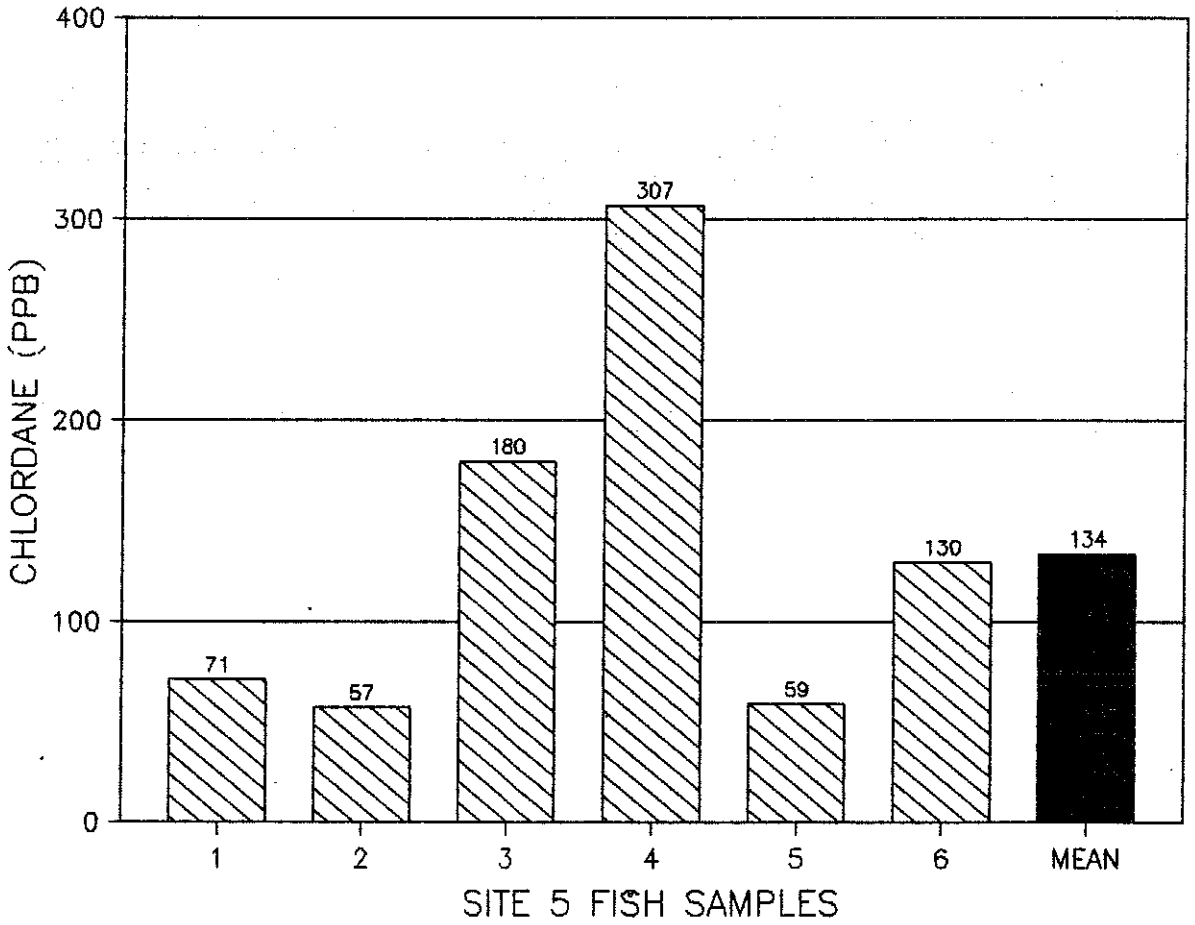


FIG.6 CHLORDANE CONC. IN FISH (AVE. & 1 SD)

MAY & AUGUST 1985

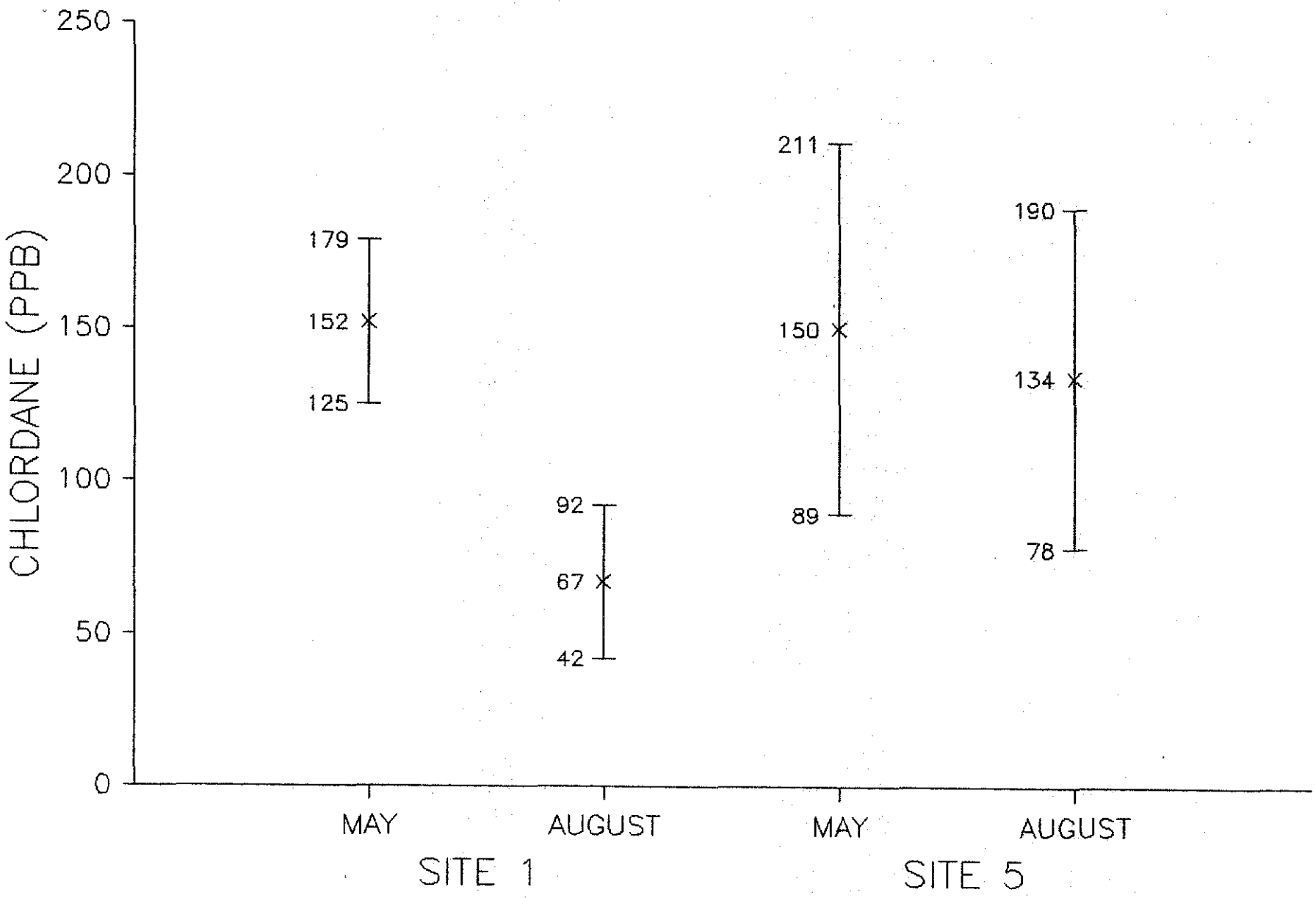
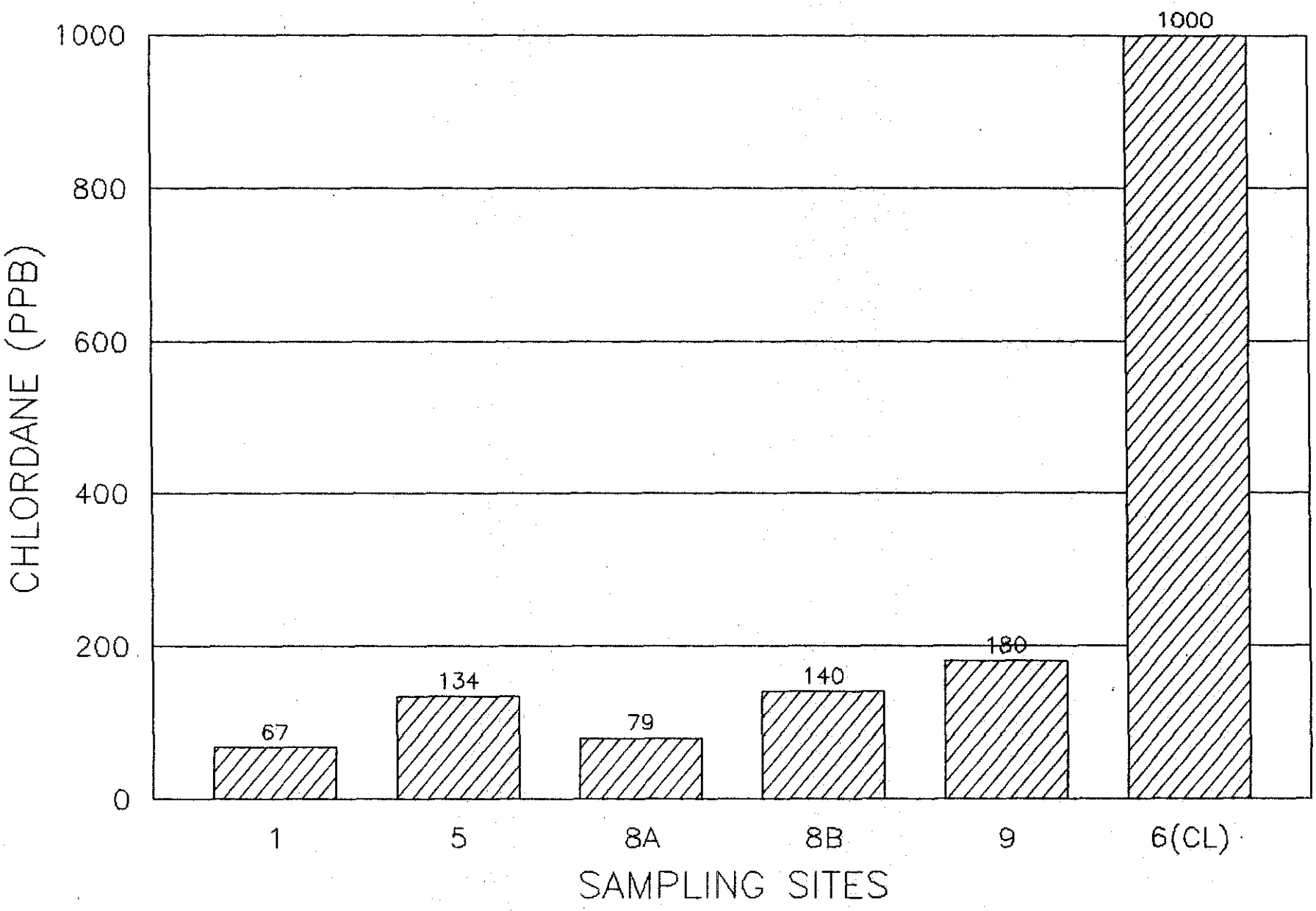


FIG.7 AVERAGE CHLORDANE CONC. IN FISH

CEDAR RIVER AUGUST,1985



found at Site 1, there was no significant difference between Sites 1 and 5 (Figure 6). Compared to the May average chlordane concentration in fish (150 ppb), the August average chlordane level was lower (134 ppb) but not significantly different (Figure 6). As with Site 1, the percent oil content was similar (2.3% ± 1.2 in May, 3.8% ±3.1 in August) for both sampling events.

Chlordane levels in the two composite catfish samples collected at Site 8 were 70 ppb and 140 ppb. The August chlordane values were substantially lower than the May values (130 ppb and 230 ppb). In both instances the larger fish group had the higher chlordane concentration.

The channel catfish composite sample from Site 9 contained a chlordane concentration of 180 ppb, not much different than the May value of 200 ppb.

The composite sample of three channel catfish from Cedar Lake had a chlordane content of almost 1000 ppb (Figure 7), three times the FDA action level of 300 ppb. Unlike the Cedar River catfish samples, there was essentially no change in the Cedar Lake fish chlordane concentrations between the May and August sampling. To better evaluate the fish contamination in Cedar Lake, several species of fish were collected and analyzed. The results of those analyses are found in Table 7 and Figure 8. The range within each species is relatively narrow, indicating the values are probably representative for that particular species. The quillback (Carpiodes cyprinus) had the highest average chlordane concentration (1330 ppb). The average percent oil content was also high in these fish (8.6% ±0.5). Although quillback are generally not a highly sought after fish, they represent a significant portion of the Cedar Lake fish population both in numbers and biomass. Their feeding habits are similar to channel catfish and they "feed freely on debris in the bottom ooze, plant material and insect larva" (6). Channel catfish, as discussed previously, had the next highest concentration of chlordane, averaging 1000 ppb. The average chlordane concentration was 480

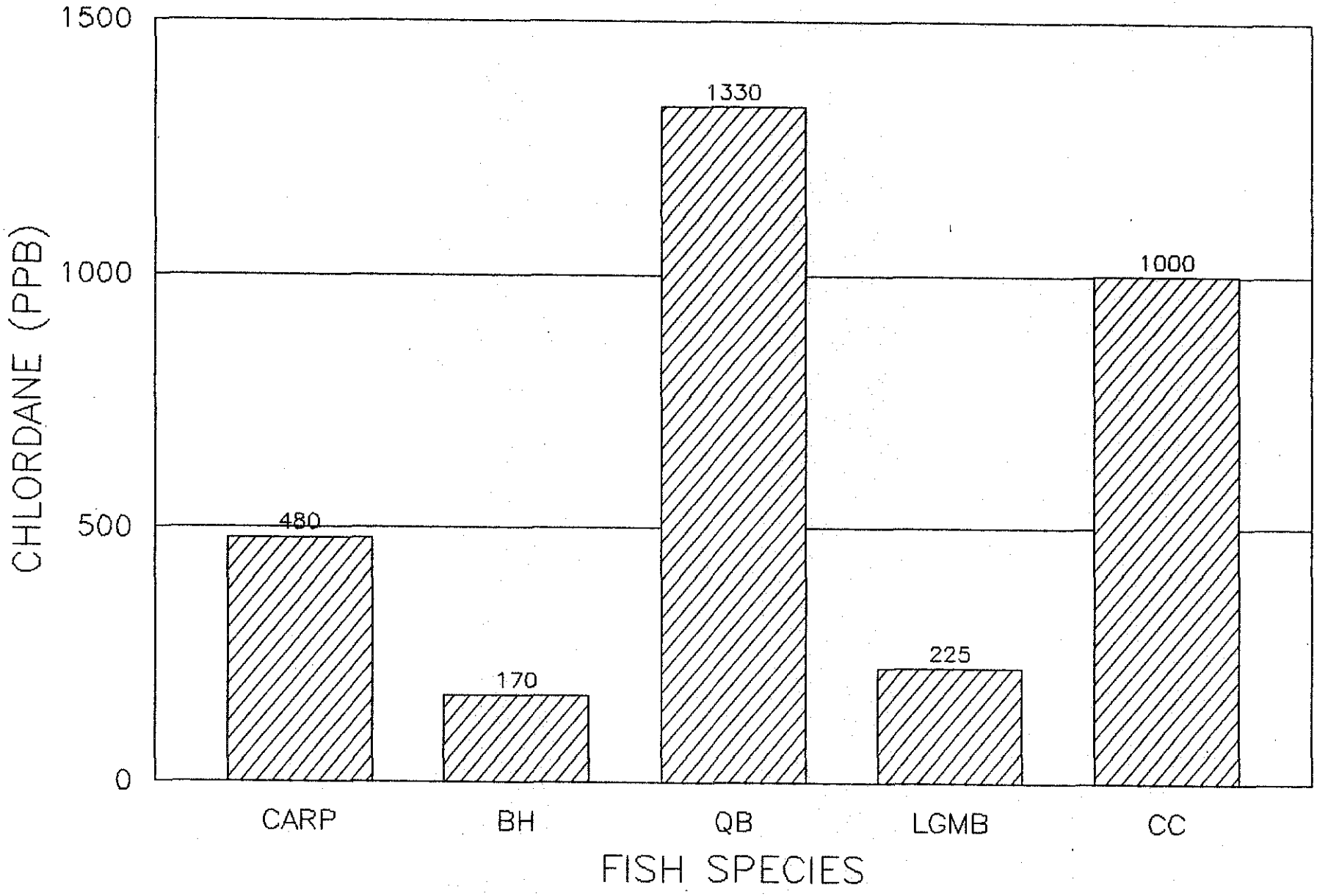
TABLE 7
Chlordane in Various Fish Species from Cedar Lake
August, 1985

(concentrations in parts per billion or ug/kg)

Species	Length (Inches)	Chlordane	Oxychlordane	% Oil
Carp 1	18.7	450	<10	1.6
Carp 2	17.5	470	<10	1.2
Carp 3	14	530	<10	2.4
Average and Standard Deviation	16.7 ±0.9	480 ±20		1.7 ±0.3
Bullhead (BH)	11.5	170	10	1.8
Quillback (QB)1	17	1600	<20	8.9
Quillback (QB)2	16	1100	<20	7.3
Quillback (QB)3	17	1300	<20	9.5
Average and Standard Deviation	16.7 ±0.2	1330 ±129		8.6 ±0.5
Largemouth Bass (LGMB)1	14.5	180	<10	0.45
Largemouth Bass (LGMB)2	14.7	270	<10	0.35
Average	14.6	225		0.40
Channel Catfish (CC)1	15.5	1200	<20	3.1
Channel Catfish (CC)2	14	920	<10	4.0
Channel Catfish (CC) 3	16	870	<10	2.0
Average and Standard Deviation	15.2 ±0.5	1000 ±60		3.0 ±0.5

FIG.8 AVERAGE CHLORDANE CONC. IN FISH

CEDAR LAKE AUGUST,1985



ppb for carp and 225 ppb for largemouth bass (Micropterus salmoides). One black bullhead (Ictalurus melas) contained 170 ppb of chlordane. Except for the largemouth bass, the feeding habits of all the fish analyzed are similar, and they are most probably accumulating chlordane from the lake sediment. Fish are important in the diet of adult bass and often constitute as much as 60 percent or more of the total volume (6). The largemouth bass in Cedar Lake may have been contaminated with chlordane from consuming the forage fish in the lake.

Source Sampling - Chlordane source sampling was conducted in the Cedar Rapids area on two occasions in response to rainfall/runoff conditions. The six sampling sites included: storm sewer discharges, house foundation drainage, and Cedar Rapids Pollution Control Plant (PCP) influent and effluent (Table 2). The McCloud Run drainage ditch represented residential storm sewer discharge with an agricultural runoff contribution. According to local officials, a portion of McCloud Run flows into Cedar Lake. Residential and golf course storm sewer sites were used to reflect the possible contribution of chlordane from lawn and garden insect control practices. A sanitary sewer was sampled in the vicinity of Teresa Drive S.W. to investigate foundation drainage of several homes treated with chlordane for termite control. To evaluate the application of chlordane around the foundation of a single residence, a basement sump well was sampled (Yellow Pine Drive). Twenty-four hour composite sampling of the Cedar Rapids Pollution Control Plant (PCP) influent and final effluent provided information on unknown chlordane sources from throughout the Cedar Rapids area enroute to the Cedar River. Source sampling was conducted on 30 September and 1 October 1985 and 10-11 October 1985.

Results of source sampling for both dates are given in Table 8.

Table 8
Chlordane Concentrations in Source Samples
Fall 1985

(concentrations in parts per billion or µg/kg)

Location	30 September	11 October	24 October
McCloud Run	<0.1	<0.1	Not Collected
Mount Farm Drive N.E.	<0.1	<0.1	Not Collected
Elm Crest Country Club	<0.1	<0.1	Not Collected
Teresa and 26th	2.5	4.7	Not Collected
Yellow Pine Drive N.E.	Not Collected	Not Collected	180
Cedar Rapids PCP Influent*	0.18	0.18	Not Collected
Cedar Rapids PCP Effluent*	<0.1	<0.1	Not Collected

*24 hour composite

Reportable chlordane values were obtained from three of the seven source sites sampled. Both samples collected from the sanitary sewer at Teresa and 26th had measurable amounts of chlordane present. The values are relatively low, yet consistent, for both sampling events. This location was selected because it was on the upstream end of a sanitary sewer serving a cluster of several houses with foundation drainage to the sewer. The houses were constructed before a city code was established restricting foundation drainage to sanitary sewers; according to city officials, several of the houses had been treated for termite control. The chlordane found at Teresa and 26th most probably originated from the foundations of the treated houses. On 30 September and 11 October the residence on Yellow Pine Drive was not sampled because there was no water in the sump. The sample collected at Yellow Pine Drive on 24 October contained a chlordane concentration of 180 ppb. The foundation around the house was treated for termite control using chlordane approximately 4 years ago and is most probably the source of chlordane found in the sump water. The influent to the pollution control plant also had reportable values for both sampling days. Although very low (0.18 ppb), the values indicate chlordane may frequently be present in the plant influent. No

detectable chlordane was found in the Cedar Rapids PCP effluent. This may be a result of the treatment process removing the chlordane, or the chlordane concentration may be below detectable levels. The prolonged spring and summer dry weather followed by scattered moderate rainfall may not have provided the most representative data for assessing potential sources.

Most of the source water samples were also analyzed for total suspended solids. Several pesticides have been known to attach to particulate matter in water. Total suspended solids analysis provides an indication of the particulate matter in a water sample. By comparing the total suspended solids and chlordane concenterations of several water samples using linear regression it is possible to determine if a relationship exists between the two. A linear regression analysis was performed on the source water samples using total suspended solids and chlordane concentration as the variables. The linear correlation coefficient (r) was 0.4022 indicating there was a poor relationship between the variables (an r value of 1 indicates a perfect correlation while r = 0 implies no relationship).

INTERLABORATORY QUALITY CONTROL

As part of the chlordane study's quality assurance, fish samples were analyzed by the University Hygienic Laboratory (UHL) and the Iowa Department of Agriculture-State Chemical Laboratory (IDA-SCL). Four fish samples from the spring study and three fish samples from the summer study were analyzed. Results of the spring analyses are listed below. The summer data had not been received as of the writing of this report.

Sample Number	Chlordane (ppb) UHL Result	IDA-SCL Result
503896	950*	720
503897	130	130
503898	230	130
504257	200	100

*Average of duplicate analysis

Because of the complexities inherent in the chlordane analysis, variability was expected. The analytical chemists from both laboratories indicated the results were within the expected range of interlaboratory variation for this type of analysis in fish samples.

SUMMARY AND CONCLUSIONS

During the spring and summer of 1985 samples of water, sediment and fish were anlayzed for the presence of the persistent insecticide chlordane. The samples were obtained from the Cedar River near Cedar Rapids and Cedar Lake, located within Cedar Rapids. Results of the study indicate:

The average concentration of chlordane present in the edible portion of channel catfish in the Cedar River was lower than the FDA action level of 300 ppb. Of the 25 Cedar River catfish fillets analyzed individually, two contained chlordane in excess of the FDA action level. There was a significant difference in the chlordane concentrations of fish collected in spring as compared to late summer at the sampling site above Cedar Rapids but not below. No significant difference was observed in the chlordane levels of fish collected upstream of Cedar Rapids as compared to downstream. Low levels of chlordane were found in sediment samples from the Cedar River and two tributaries.

Channel catfish fillets collected in May and August from Cedar Lake contained chlordane in concentrations exceeding the FDA action level. No seasonal difference in chlordane concentration was observed for the Cedar Lake

channel catfish. Carp and quillback fillets from Cedar Lake also contained chlordane in excess of 300 ppb. In addition, chlordane was present in fillets from largemough bass and bullhead. Cedar Lake sediment samples collected in late summer contained substantially more chlordane than found in Cedar River sediments.

Chlordane was found in water samples collected from a foundation drain, sanitary sewer and influent to the Cedar Rapids Pollution Control Plant. The foundation drain data indicate one potential source of the chlordane may be from house foundations treated with chlordane for termite control.

LITERATURE CITED

1. U.S. Environmental Protection Agency. 1983. Report of the analysis of fishes collected during 1982 from the basic water monitoring program sites in Iowa. Environmental Monitoring and Compliance Branch, Region VII. Kansas City, Kansas.

2. U.S. Environmental Protection Agency. 1984. Report of the analysis of the fillets of fishes collected in 1984 from the RAFT monitoring program follow-up sites in Iowa. Environmental Monitoring and Compliance Branch, Region VII. Kansas City, Kansas.

3. U.S. Environmental Protection Agency. 1985. Report of the analysis of fishes collected during 1984 from the basic water monitoring program sites in Iowa. Environmental Monitoring and Compliance Branch, Region VII. Kansas City, Kansas.

4. Iowa Department of Water, Air and Waste Management. 1985. Quality assurance workplan - chlordane contamination study of Cedar River, Cedar Rapids, Iowa. Des Moines, Iowa.

5. Kelly, M.H. and R.L. Hite. 1984. Evaluation of Illinois stream sediment data:1974-1980. Illinois Environmental Protection Agency. Springfield, Illinois.

6. Harlan, J.R. and E.B. Speaker. 1969. Iowa fish and fishing. 4th Edition. State of Iowa, Des Moines, Iowa.

APPENDIX

University Hygienic Laboratory
Pesticide Section
Oak[illegible]le Hall
Iow[illegible]City, Iowa 52242

Chlordane Analysis
concentrations in parts per billion (µg/kg)

Limnology - Sediments

Lab No.	Date Collected		Source	Chlordane Concentration	oxy-chlordane
503877	5-23-85		Cedar River Site No. 2	<50 ppb	<5 ppb
503878	5-23-85		Prairie Creek Site No. 3	<50 ppb	<5 ppb
503879	5-23-85		Cedar River Site No. 4	<50 ppb	<5 ppb
503880	5-23-85		Cedar Lake Site No. 6	<50 ppb	<5 ppb
503881	5-23-85		Indian Creek Site No. 7	<50 ppb	<5 ppb
503882	5-23-85		Cedar River Site No. 8	<50 ppb	<5 ppb
503942	5-28-85		Cedar River Site No. 9	<50 ppb	<5 ppb
504184	6-04-85		Cedar River Hwy 30 Bridge	<50 ppb	<5 ppb

Analyst: T. Outhouse
Verified:
Date Reported: 6-26-85
Date Revised: 9-16-85

34/p503877-84

TABLE A

Size of Channel Catfish Comprising Composite
Collected in May and August, 1985

May 1985

Location	Length (Inches)
Site 6	12.25, 12.25, 15, 12, 16
Site 8 - #1	13.75, 13.25, 15, 14.25, 12.5
Site 8 - #2	17, 17.25, 16, 16.5, 17
Site 9	12.5, 15.5, 14, 14, 13.25

August 1985

Site 8 - #1	16.75, 16.5, 17.5, 18.25, 17.25
Site 8 - #2	16, 15, 16, 14.25, 15.5
Site 9	15, 14, 14, 13, 14.75

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Iowa City, Iowa 52242

PESTICIDE ANALYSIS
Concentration in Parts per Billion (micrograms/kg)

IDWAWM - Fish Samples

Lab No.	Date Collected	Location	Chlordane	Oxychlordane	% Oil		
503883	5-22-85	Site 1 Fish 1	120	10	1.9		
503884	5-22-85	Site 1 Fish 2	230	20	4.2		
503885	5-22-85	Site 1 Fish 3	220	10	4.0		
503886	5-22-85	Site 1 Fish 4	120	10	5.0		
503887	5-22-85	Site 1 Fish 5	80	<10	1.6		
503888	5-22-85	Site 1 Fish 6	140	<10	3.4		
503889	5-21-85	Site 5 Fish 1	170	<10	3.4		
503890	5-21-85	Site 5 Fish 2	130	<10	2.1		
503891	5-21-85	Site 5 Fish 3	100	10	1.4		

Analyst: D. Larabee-Zierath
Verified:
Date Reported: 6-28-85

E34/p503883-91

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PESTICIDE ANALYSIS
Concentration in Parts per Billion (micrograms/kg)

IDWAWM - Fish Samples

Lab No.	Date Collected	Location	Chlordane	Oxychlordane	% Oil		
503892	5-21-85	Site 5 Fish 4	110	10	1.1		
503893	5-21-85	Site 5 Fish 5	340	<10	5.9		
503894	5-21-85	Site 5 Fish 6	80	<10	0.5		
503895	5-21-85	Site 5 Fish 7	120	<10	2.0		
503896	5-21-85	Site 6 Composite	1000	20	5.9		
503896	5-21-85	Duplicate 503896	900	20	6.2		
503897	5-22-85	Site 8 A 12.5-15 inch Composite	130	<10	3.3		
503898	5-22-85	Site 8 B 16-17 inch Composite	230	<10	4.8		
504257	5-24 and 5-30-85	Site 9 Composite	200	20	2.9		

Analyst: D. Larabee-Zierath
Verified:
Date Reported: 6-28-85

IOWA DEPARTMENT OF AGRICULTURE

State Chemical Laboratory
Wallace Bldg., E. 9th and Grand
Des Moines, Iowa 50319

REPORT OF ANALYSIS

Lab. No. X-174-85 thru X-177-85
Sample No. I.C. Hygienic Laboratory
Date Collected
Date Received 07/03/85
Investigator

Collection Site Information (Name, Address & Telephone)

Samples received from
I.C. Hygienic Laboratory

Name, Address & Telephone of Applicator

Description of Sample

4 - samples/fish

Results of Analysis

LAB. NO.	Sample Number	COMPOUNDS	PPM
X-174-85	503896	Chlordane	.72 ppm
		Oxychlordane	.012 ppm
X-175-85	503897	Chlordane	.13 ppm
		Oxychlordane	.006 ppm
X-176-85	503898	Chlordane	.13 ppm
		Oxychlordane	.011 ppm
X-177-85	504257	Chlordane	.10 ppm
		Oxychlordane	.007 ppm

METHOD OF ANALYSIS: PAM I, Sect. 211.13f, # 2.

(No. of Determinations - 15 per sample)

ANALYST: Roger Bishop RB

Signature of Lab. Supervisor D. [illegible]

Date 8/19 [illegible]

SAMPLE RECORD COPY

University Hygienic Laboratory
Pesticide Section
Oak[illegible]le Hall
Iow[illegible]City, Iowa 52242

Chlordane Analysis
concentrations in parts per billion (µg/L)

Limnology - Water

Lab No.	Date Collected		Source	Chlordane Concentration	
504322	6-07-85		Water Pollution Control Plant Influent - Blank	<0.1 ppb	
504323	6-07-85		Water Pollution Control Plant Effluent - Blank	<0.1 ppb	

Analyst: T. Outhouse
Verified: [signature]
Date Reported: 6-26-85

:34/p504322

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Oakdale Hall
Iowa City, Iowa 52242

PESTICIDE ANALYSIS
Concentration in Parts per Billion (micrograms/L)

Lab No.	Date Collected	Location	Chlordane	Oxychlordane				
506821	8-27-85	Cedar River Cedar Rapids Site No. 2	6	<0.5				
506822	8-27-85	Cedar Lake Cedar Rapids South Sediment Sample	460	<0.5				
506823	8-27-85	Cedar Lake Cedar Rapids North Sediment Sample	170	<0.5				
506824	8-28-85	Praire Creek Sediment Site No. 3	17	<0.5				
506825	8-28-85	Cedar River Sediment Site No. 4	<5	<0.5				
506826	8-28-85	Indian Creek Sediment Site No. 7	16	<0.5				

Analyst: D. Larabee-Zierath
Verified:
Date Reported: 10-22-85

F58/p506821-26

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Iowa City, Iowa 52242

FISH SAMPLES
PESTICIDE ANALYSIS
Concentration in Parts per Billion (micrograms/Kg)

Lab No.	Date Collected	Location	Species	No. in Sample	Ave. Length Inches		Chlordane	Oxy-chlordane				% Oil
506795	8-27-85	Site #1 Cedar R. #1	C.C.		15.2		130	<10				4.6
506796	8-27-85	Site #1 Cedar R. #2	C.C.		13.7		41	<10				2.7
506797	8-27-85	Site #1 Cedar R. #3	C.C.		14.5		66	<10				6.3
506798	8-27-85	Site #1 Cedar R. #4	C.C.		15		70	<10				5.1
506799	8-27-85	Site #1 Cedar R. #5	C.C.		14.7		70	<10				6.1
506800	8-27-85	Site #1 Cedar R. #6	C.C.		14.5		27	<10				2.5
506801	8-27-85	Site #5 Cedar R. #1	C.C.		14.7		71	<10				2.5
506802	8-27-85	Site #5 Cedar R. #2	C.C.		14.5		57	<10				1.4
506803	8-27-85	Site #5 Cedar R. #3	C.C.		15		180	<10				2.6
506804	8-27-85	Site #5 Cedar R. #4	C.C.		13.5		307	<10				13
506805	8-27-85	Site #5 Cedar R. #5	C.C.		14		59	<10				0.92

Analyst: D. Larabee-Zierath/W. Patton
Verified:
Date Reported: 12-03-85

G68/p506795-05

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FISH SAMPLES
PESTICIDE ANALYSIS
Concentration in Parts per Billion (micrograms/Kg)

Lab No.	Date Collected	Location	Species	No. in Sample	Ave. length Inches		Chlordane	Oxy-chlordane				% Oil
506806	8-27-85	Site #5 Cedar R. #6	C.C.		15.5		130	<10				2.4
506807	8-27-85	Site #6 Cedar Lk. #1	Carp		18.7		450	<10				1.6
506808	8-27-85	Site #6 Cedar Lk. #2	Carp		17.5		470	<10				1.2
506809	8-27-85	Site #6 Cedar Lk. #3	Carp		14		530	<10				2.4
Duplicate 506809	8-27-85	Site #6 Duplicate Cedar Lk. #3	Carp		14		770	<10				4.8
506810	8-27-85	Site #6 Cedar Lk. #4	Bull Head		11.5		170	<10				1.8
506811	8-27-85	Site #6 Cedar Lk. #5	Quillback Carp-sucker		17		1600	<20				8.9
506812	8-27-85	Site #6 Cedar Lk. #6	Quillback Carp-sucker		16		1100	<20				7.3
506813	8-27-85	Site #6 Cedar Lk. #7	Quillback Carp-sucker		17		1300	<20				9.5
506814	8-27-85	Site #6 Cedar Lk. #8	Lg. Mouth Bass		14.5		180	<10				0.45
506815	8-27-85	Site #6 Cedar Lk. #9	Lg. Mouth Bass		14.7		270	<10				0.35

Analyst: D. Larabee-Zierath/W. Patton
Verified:
Date Reported: 12-03-85

G68/p506806-15

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FISH SAMPLES
PESTICIDE ANALYSIS
Concentration in Parts per Billion (micrograms/Kg)

Lab No.	Date Collected	Location	Species	No. in Sample	Ave. length Inches		Chlordane	Oxy-chlordane				% Oil
506816	8-27-85	Site #6 Cedar Lk. #10	C.C.		15.5		1200	<20				3.1
506817	8-27-85	Site #6 Cedar Lk. #11	C.C.		14		920	<10				4.0
506818	8-27-85	Site #6 Cedar Lk. #12	C.C.		16		870	<10				2.0
506819	8-27-85	Site #8 B Cedar River Comp. # 1	C.C.	5 large	17.4		140	<10				3.9
506820	8-27-85	Site #8 A Cedar River Comp. # 2	C.C.	5 small	15.4		79	<10				0.82
506976	9-05-85	Fredonia Site #9 Comp. Cedar River	C.C.		14.2		180	<10				4.7

Analyst: D. Karabee-Ziera
Verified:
Date Reported: 12-03-85

G68/p506816-20

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PESTICIDE ANALYSIS
Concentration in Parts per Billion (micrograms/L)

Lab No.	Date Collected	Location	Bottle No.	Chlordane	Oxychlordane	Total Suspended Solids (mg/L)	
507728	9-30-85	Manhole at Mount Farm Dr. and Staub Ct.	P2	<0.1	<0.01	7	
507729	9-30-85	McCloud Run to Cedar Lake at Shaver Rd. Bridge	P3	<0.1	<0.01	6	
507730	9-30-85	McCloud Run to Cedar Lake at Shaver Rd. Bridge	P4	<0.1	<0.01	8	
507731	9-30-85	Foundation drain sampling sewer	P5	2.5	<0.01	36	
507736	9-30-85	Drainage from Elm Crest Country Club	P1	<0.1	<0.01	5	

mg/L = milligrams per liter

Analyst: D. Larabee-Zierath
Verified:
Date Reported: 10-28-85

F58/~507728etc

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PESTICIDE ANALYSIS
Concentration in Parts per Billion (micrograms/L)

Lab No.	Date Collected	Location	Chlordane	Oxychlordane	Total Suspended Solids (mg/L)			
507733	10-01-85	Cedar Rapids Raw Influent P-8	0.18	<0.01	120			
507734	10-01-85	Cedar Rapids Final Effluent Post Chlorination P-10	<0.1	<0.01	18			
507735	10-01-85	Cedar Rapids Final Effluent Post Chlorination P-9	<0.1	<0.01	25			

mg/L = milligrams per liter

Analyst: D. Larabee-Zierath, W. Patton
Verified:
Date Reported: 11-15-85

G63/p507733-35

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PESTICIDE ANALYSIS
Concentration in Parts per Billion (micrograms/L)

Lab No.	Date Collected	Location	Chlordane	Oxychlordane	Total Suspended Solids (mg/L	
508029	P-200 10-11-85	Cedar Rapids McCloud Run at Shaver Rd. Bridge	<0.1	<0.01	16	
508029D	P-210 10-11-85	Cedar Rapids McCloud Run at Shaver Rd. Bridge	<0.1	<0.01	7	
508030	P-160 10-11-85	Cedar Rapids Foundation Drainage Teresa and 26th	4.7	<0.01	220	
508031	P-180 10-11-85	Cedar Rapids Elm Crest C.C. Praire and 35th	<0.1	<0.01	<1	
508032	P-190 10-11-85	Cedar Rapids Storm Sewer Staub Ct. and Mound Farm Dr.	<0.1	<0.01	26	
508033	P-170 10-11-85	Cedar Rapids P.C.P. Influent	0.18	<0.01	360	
508034	P-130 10-11-85	Cedar Rapids P.C.P. Effluent Post Chlorination	<0.1	<0.01	26	
508034D	P-150 10-11-85	Cedar Rapids P.C.P. Effluent Post Chlorination	<0.1	<0.01	26	

mg/L = milligrams per liter

Analyst: D. Larabee-Zierath, W. Patton
Verified: [signature]
Date Reported: 11-18-85

G63/p508029-34

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Oakdale Hall
Iowa City, Iowa 52242

PESTICIDE ANALYSIS
Concentration in Parts per Billion (micrograms/L)

Lab No.	Date Collected	Location	Chlordane	Oxychlordane			
508603	10-24-85	Cedar Rapids Basement Sump Well Yellow Pine Dr. N.E.	180	<5			

Analyst: W. Patton
Verified: [signature]
Date Reported: 11-25-85

G64/p508603