Total Maximum Daily Load
For Chlordane
Cedar Lake
Linn County, Iowa

July 2001

Iowa Department of Natural Resources
Water Resources Section

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TMDL for Chlordane
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Waterbody Name:	Cedar Lake
IDNR Waterbody ID:	IA 02-CED-02250-L
Hydrologic Unit Code:	HUC11 0708025340
Location:	Sec. 21, T83N, R7W
Latitude:	41 Deg 59 Min N 5 Sec
Longitude:	91 Deg 39 Min W 40 Sec
Use Designation Class:	General Use
Watershed Area:	3,250 acres
Lake Area:	115 acres
Iowa Basin:	Iowa - Cedar
Receiving Water Body:	Cedar River
Pollutant:	Chlordane
Pollutant Sources:	Urban Non-point source runoff
Impaired Use:	Fish Consumption
1998 303d Priority:	Medium

1. Description of Waterbody and Watershed

Cedar Lake is located adjacent to the Cedar River in Cedar Rapids, IA. The lake is classified by the *Iowa Water Quality Standards* as a General Use water. The primary uses of Cedar Lake are industrial water withdrawal and noncontact recreation. The lake is privately owned by IES Utilities Inc. for Sixth Street Generating Station, and is a slough of the Cedar River, which has been modified for use as a cooling lake for the generating station.

The lake has been leased to the City of Cedar Rapids for use as a city park since November of 1982. The lake and surrounding areas are used by residents for hiking, bicycling, picnicking, fishing, and non-motorized boating.

In addition to cooling water from the generating station, Cedar Lake receives water from urban runoff including storm sewers. Water may also be diverted from McCloud Run (tributary to the Cedar River) into the lake during low level lake conditions. Cedar Lake is relatively shallow, having an average depth of less than 4 feet and a maximum depth of about 11 feet.

The surface area of Cedar Lake is approximately 115 acres. The watershed of Cedar Lake is approximately 3,250 acres, and the landuse is primarily industrial and urban.

The soils in the Cedar Lake watershed are primarily of the Kenyon-Clyde-Floyd association. The topography ranges from nearly level to strongly sloping. The average rainfall for this region is 36.39 inches per year.

2. Pollutant and Source

Chlordane is an organochlorine insecticide. In the mid 1970's, the major use of chlordane in Iowa was for pest control, mostly on termites and for home lawn and garden use. In addition, there were small amounts of chlordane used for agricultural purposes (Eckerman, 4/2000). Between July 1, 1983 and April 14, 1988, the sole use of chlordane was to control subterranean termites (EPA, 1987). For this purpose, chlordane was applied primarily as a liquid that was poured or injected around a building foundation (Wallace, 1991). The source of chlordane to Cedar Lake has been runoff, particularly from urban areas where widespread eradication of termites occurred around homes in the 1970's and 1980's. Concerns over chlordane as a cancer causing agent caused all uses of chlordane to be banned in April, 1988.

Chlordane is very persistent in the environment, yet very insoluble in water. Its soil half-life is four years, and it may persist in soils for as long as 20 years. Volatilization may be the only major route of removal from soils. Chlordane does not chemically degrade (hydrolyze) and is not subject to biodegradation in soils (US DOC, 1989).

Urban runoff may contain elevated levels of chlordane from the uses described earlier. Chlordane attaches to sediments, which allows for transportation to receiving waters where it does not readily degrade. It can exit the water column by adsorbing to sediments or by volatilization (US DOC, 1989). The sediments containing chlordane accumulate in the bed sediments of Cedar Lake, where they are buried, volatize, or bioaccumulate in fish.

All uses of chlordane were banned in April, 1988. No further loading should occur.

3. Applicable Water Quality Standards

Cedar Lake has violated the Anidegradation policy of the *Iowa Water Quality Standards*. As stated in IAC 567-61.2(2)g, the intent of the antidegradation policy is to protect and maintain the existing physical, biological, and chemical integrity of all waters of the state. This policy has been violated in Cedar Lake.

In addition, there are two criteria that must be met for chlordane in Cedar Lake, an acutely toxic level in the water column and the FDA action level for chlordane found in fish tissue. According to the *Iowa Water Quality Standards*, Cedar Lake is classified as a General Use waterbody. General use water quality criteria specify that all Iowa surface waters must be free from substances in concentrations that are acutely toxic to human, animal, or plant life (Iowa, 1996). In addition, the Iowa DNR routinely monitors levels of toxic contaminants (for example, pesticides and metals) in fish from Iowa lakes and rivers to ensure that these levels are below action levels developed by the U.S. Food and Drug Administration. If levels of toxic contaminants exceed FDA action levels, a fish consumption advisory is issued that warns the public of a potential health risk due to long-term (lifetime) consumption of the contaminated fish.

The water column of General Use waters must be free from acutely toxic conditions. For chlordane, this level must not exceed ½ the 96 hr LC_{50} value for the most sensitive species found in that water. In Cedar Lake, this species is the carp (*Cyprinus carpio*), which has an LC_{50} level of 3 ppb. Therefore, the applicable criteria for chlordane in the water column of Cedar Lake would be 1.5 ppb (EPA, 1980). These standards have not been exceeded in Cedar Lake.

The Food and Drug Administration (FDA) has set an action level for chlordane in the edible portion (fillet) of fish. The FDA action level of 300 ppb was developed to provide long term (chronic) health protection. The action level for chlordane was first exceeded in Cedar Lake fish in 1985. The FDA action level has been exceeded in 17 of 25 samples of fish since 1985. A fish consumption advisory was placed on all species of fish caught in Cedar Lake beginning March 1986. This fish consumption advisory is still in effect.

4. Water Quality Conditions

In 1982, the Regional Ambient Fish Tissue (RAFT) monitoring program indicated that carp collected from the Cedar River near Cedar Rapids contained levels of chlordane exceeding the FDA action levels. As a result, the University Hygienic Laboratory conducted a study in 1985 to further sample the Cedar River and other surrounding waters, such as Cedar Lake (Kennedy and Splinter, 1986). This study analyzed for chlordane in water, sediments, and fish tissue. In addition, the Cedar Lake Water Quality Consortium completed analysis for chlordane in water and sediments in 1991 (Johnson, 1992).

Source water samples from a residential sanitary sewer and a residential basement sump pump in the watershed of Cedar Lake exceeded ½ the 96 hr LC50 value for carp (1.5 ppb) in 1985. The sanitary sewer site had sample results of 2.5 ppb and 4.7 ppb. The residential basement sump pump had one result of 180 ppb. This residence had been treated for termites four years prior to sampling. At the same time of this sampling, McCloud Run was also sampled for chlordane and results were below detection

(Kennedy and Splinter, 1986). The Cedar Lake Water Quality Consortium completed analysis for chlordane in the water of Cedar Lake in January 1991. One sample was collected and analyzed as part of the study and chlordane was not detected (Johnson, 1992).

Sediment analysis was conducted in 1985 and again in 1991. Samples collected by University Hygienic Laboratory in 1985 from Cedar Lake (North) and Cedar Lake (South) had sediment chlordane levels of 170 and 460 ppb respectively (Kennedy and Splinter, 1986). Sediment samples analyzed by the Cedar Lake Water Quality Consortium in 1991 had chlordane levels of 600 ppb (Johnson, 1992)

Fish collected in 1985 from Cedar Lake, as part of the University Hygienic Laboratory study, exceeded the FDA action level for chlordane (Kennedy and Splinter, 1986). Fish tissue monitoring has continued every even numbered year beginning in 1986 as part of the RAFT monitoring program. The fish are collected by IDNR fisheries biologists and analysis of the fish tissue is completed by EPA Region VII. The results of the fish tissue analysis are entered into the STORET database by EPA Region VII.

The monitoring data in Table 1 suggests a general decline in chlordane levels in fish tissue over the past 15 years. Chlordane was banned by EPA on April 14, 1988. Prior to this date, it appears there was an increase in the frequency and amount of chlordane used as applicators used up existing stocks. This pattern is supported by the increase of chlordane in fish tissue samples collected from Cedar Lake in the late 1980's and early 1990's (Table 1 and Figure 1). Although chlordane levels were below FDA action levels in samples collected in 1994 and 1996, the consumption advisory remained in effect. Chlordane levels were slightly above the action level of 300 ppb in the 1998 samples.

Chlordane is very insoluble in water, but attaches to sediments which settle in to the substrate. Therefore, catfish and other bottom feeding fish tend to be the best indicators for levels of chlordane. During each sample period, fish tissue samples (fillets) are collected from bottom feeding fish when possible for chlordane analysis.

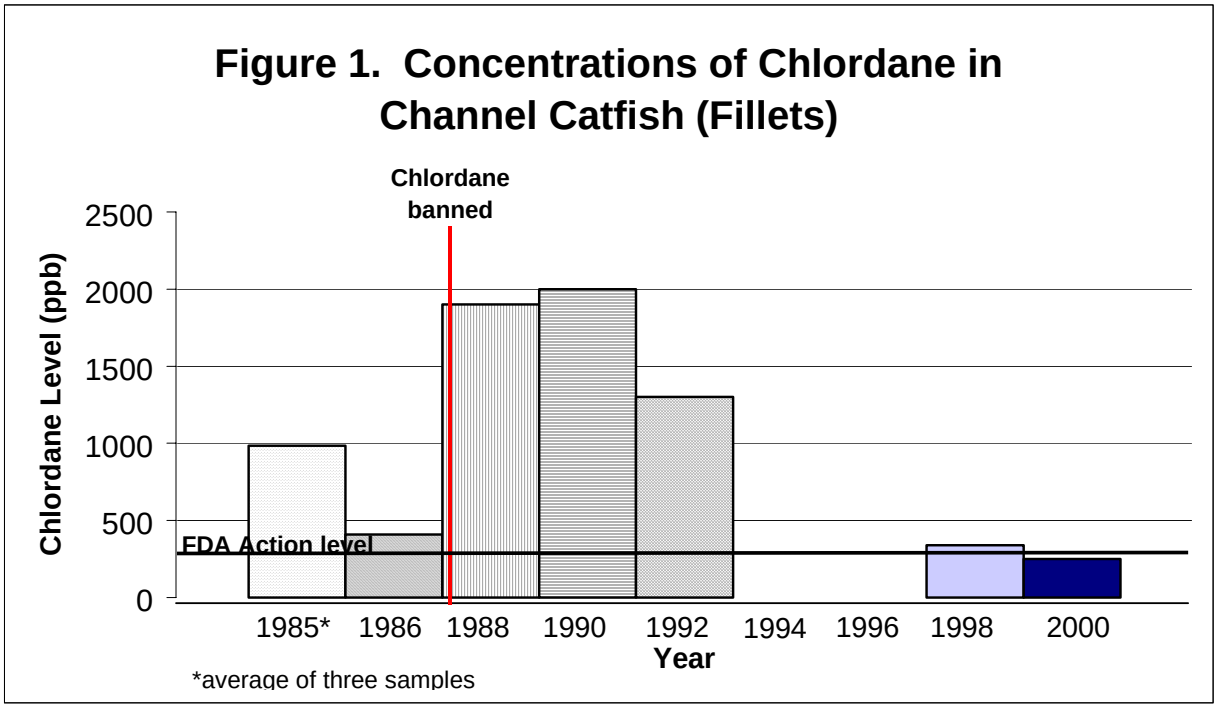
The concentrations of chlordane in fish tissue continues to decline as chlordane is degraded and buried in the bed sediments. This decline is evident by the results of the RAFT channel catfish samples collected in 1990 and 2000. These samples had chlordane concentrations of 2000 and 250 ppb, respectively. Figure 1 shows the levels of chlordane in channel catfish tissues from 1985 to 2000.

Another study of chlordane bioaccumulation in Cedar Lake (St. Clair, 1999) found chlordane present in a variety of species, representing bottom feeding fish as well as top predators. Although this study was able to detect and identify the different contaminants, the concentrations were below a reasonable limit of quantitation.

Table 1. Levels of chlordane found in fish tissue at Cedar Lake.

Sample Month/Year	Species	Sampling Program	Chlordane, Technical, Fillet (ppb)
5/1985	Channel Catfish	UHL	950
8/1985	Carp	UHL	450
8/1985	Carp	UHL	470
8/1985	Carp	UHL	530
8/1985	Bullhead	UHL	170
8/1985	Quillback	UHL	1600
8/1985	Quillback	UHL	1100
8/1985	Quillback	UHL	1300
8/1985	Largemouth Bass	UHL	180
8/1985	Largemouth Bass	UHL	270
8/1985	Channel Catfish	UHL	1200
8/1985	Channel Catfish	UHL	920
8/1985	Channel Catfish	UHL	870
8/1986	River Carpsucker *	RAFT	870
9/1986	Channel Catfish *	RAFT	410
8/1988	Channel Catfish *	RAFT	1900
8/1990	Channel Catfish *	RAFT	2000
1/1991	Channel Catfish*	IES	930**
9/1992	Channel Catfish *	RAFT	1300
8/1994	Carp *	RAFT	280
8/1996	Carp *	RAFT	180
8/1996	Largemouth Bass *	RAFT	76
8/1998	Carp *	RAFT	320
8/1998	Channel Catfish *	RAFT	340
8/2000	Channel Catfish	RAFT	250
8/2000	Carp	RAFT	73

* composite of 3 to 5 fish: ** Cedar Lake Water Quality Consortium sample analyzed for Trans-nonachlor and oxychlordane. Result is the sum of these two components.



5. Desired Endpoint

Cedar Lake is included on the 303(d) list due to the existence of a fish consumption advisory that resulted from high levels of chlordane found in the edible portion of fish. The fish consumption uses of the lake are not supported, and a fish consumption advisory has been in place since 1986. The desired endpoint is to achieve two consecutive samples with all fish tissue chlordane levels below the FDA action level of 300 ppb. Once these samples have been collected, the Linn County Department of Public Health and the Iowa DNR will evaluate whether the advisory should be removed.

6. Pollutant Allocation

6.1 Point Sources

The use of chlordane was banned by EPA in 1988. There will be no discharge of chlordane from point sources in to Cedar Lake. Therefore, the Wasteload Allocation for chlordane established under this TMDL is zero.

6.2 Non-Point Sources

The use of chlordane was banned by EPA in 1988. There will be no further application of chlordane in the watershed, where it might be discharged through runoff conditions and enter Cedar Lake. Therefore, the Load Allocation for chlordane established under this TMDL is zero.

6.3 Margin of Safety

A fish consumption advisory has been in effect for Cedar Lake since March 1986. This advisory could be lifted after one fish tissue sample is below the FDA action level of 300 ppb. To ensure that public health and safety are protected, the fish consumption

advisory will remain in effect until 1) all fish tissue samples collected are below the FDA action level of 300 ppb of chlordane for at least two consecutive monitoring periods, and 2) Linn County Department of Public Health and the IDNR concur that the advisory should be removed.

7. Seasonal Variation

The banning of chlordane by EPA eliminates any future loading of chlordane to Cedar Lake. The wasteload and load allocations are established at zero. There will be no seasonal variation for these allocations.

8. Implementation

The Iowa Department of Natural Resources recognizes that an implementation plan is not a required component of a Total Maximum Daily Load. However, the IDNR offers the following implementation strategy as a guide to improve water quality at Cedar Lake.

Although there is no further application of chlordane in the watershed, it is possible that chlordane may continue to move with sediments through stormwater runoff and be deposited in Cedar Lake. One of the locations that the City of Cedar Rapids monitors stormwater at is on McCloud Run, the main tributary to Cedar Lake. The amount of sediment transported through runoff to Cedar Lake is determined by analyzing the samples for total suspended solids.

The City of Cedar Rapids has a city ordinance requiring controls for erosion on new and redeveloped construction sites. This helps to reduce the amount of sediment delivered to Cedar Lake. In addition, the McCloud Run Watershed Improvement Committee is very active in a large portion of the Cedar Lake watershed. The main focus of this group is to restore the water quality in McCloud Run so that a trout fishery can again be sustained, and provide a variety of recreational opportunities for the general public.

The fish consumption advisory will remain in effect until all fish tissue samples collected are below the FDA action level of 300 ppb of chlordane for at least two consecutive monitoring periods and the Linn County Department of Public Health and IDNR concur that the advisory should be removed. Additional monitoring data will be evaluated as it becomes available and the 303(d) list status of Cedar Lake re-examined.

RAFT monitoring will continue at Cedar Lake once the consumption advisory is lifted at a three year frequency.

9. Public Participation

A public meeting to introduce the TMDL program was held February 1, 2001 at the Coe College Campus in Cedar Rapids. A second public meeting was held to present the Draft TMDL to the public on June 7, 2001 at the Kirkwood Community College Campus. Any comments received will be reviewed and given consideration and, where appropriate, incorporated into the TMDL.

10. References

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