

Health Consultation

**ZEUNERT QUARRY POND POLYCHLORINATED BIPHENYL SITE
CITY OF CEDARBURG, OZAUKEE COUNTY, WISCONSIN**

APRIL 11, 2005

**U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333**

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CITY OF CEDARBURG, OZAUKEE COUNTY, WISCONSIN

Prepared by:

Wisconsin Department of Health and Family Services
Under Cooperative Agreement with the
U.S. Department of Health and Human Services
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Summary

The Wisconsin Department of Health and Family Services, Division of Public Health (DPH) was asked, by the United States Environmental Protection Agency (EPA), for assistance in assessing public health hazards associated with polychlorinated biphenyl (PCB) –contaminated sediments in Cedar Creek, and specifically in a hydrogeologically connected quarry pond in Cedarburg, Ozaukee County, Wisconsin. There is a public health hazard from eating fish from the pond. Physical contact with PCB-contaminated sediments in both Zeunert Pond and the Wilshire Drive storm water basin is a public health hazard, based on comparison of available environmental information to health-based guidelines.

There is an indeterminate health hazard from contact with shoreline soil and sediment in the pond. Although the available information shows high concentrations of PCB in some parts of the pond sediment, more information is needed about PCB concentrations in sediment and shoreline soils. Signs around the pond are needed to ensure the public is adequately informed of the chemical hazards present.

Background and Statement of Issues

Cedar Creek and other water bodies around Cedarburg, Wisconsin have been the focus of sediment quality studies involving historical polychlorinated biphenyl (PCB) release from local metal casting operations. Several stages of remediation have already been undertaken on Cedar Creek. Associated with the work on Cedar Creek, other waterways and water handling systems in the area have been investigated for the presence of PCBs. One of the waterways in which PCBs have been found is Zeunert Quarry Pond, which is included in the Wisconsin Department of Natural Resources (WDNR) fish consumption advisory. The pond is a six-acre, 10 feet deep former rock quarry and current seepage pond located within Herman Zeunert Park in Cedarburg, a city of 11,000. The land around the pond consists of park parcels on the northeast and southwest sides, private residences around the southeast, and fenced private property around the northwest side. The southwest portion of the park includes a ballpark and play structures; the northeast part of the park is green space. The park is located within city limits in a residential neighborhood.

A second area of concern revealed by the current PCB study is the storm water basin located in the residential neighborhood near quarry pond, at Park Lane and Wilshire Drive and adjacent to the wastewater treatment plant.

This report reviews the current environmental investigation at Quarry Pond and the Wilshire storm water basin. This public health consultation focuses on the following public health issues (a separate document will address health issues specific to Cedar Creek):

- Potential for exposure to PCBs through eating contaminated fish.
- Potential for exposure to PCBs through direct contact with contaminated sediments.

Discussion

DHFS site visit. DHFS toured the Zeunert Quarry Pond Park and the nearby storm water basin on April 19 2004, along with staff from U.S. EPA, WDNR, Ozaukee County Health Department, and the City of Cedarburg public works director and parks director. A significant finding of the visit was that the pond water level is down about 3 feet below normal, revealing about 20-30 feet of gently sloped shoreline around most of the pond perimeter. This exposed pond bottom is a firm surface, with very little vegetation, of silt and fist-sized limestone rocks. PCBs were found in all samples taken recently from Zeunert Quarry Pond (Foth & Van Dyke 2004) indicating that PCBs are dispersed over the entire pond bottom. These data suggest that the recently exposed bottom sediments comprising the shoreline are also PCB-contaminated, although these shoreline soils were not sampled in the Foth & Van Dyke 2004 study. What we do know is that walking, fishing, and stone skipping, or any other activities along this shoreline would bring people into direct contact with these soils. Further environmental sampling is needed to better assess the risk of contact with these soils. There were no other people at the park at the time of our chilly weekday visit, but the well-maintained ball park, park building, and play structures adjacent to the pond suggests frequent visitors. The parks director reports observing people fishing in the park. DHFS also visited a nearby storm water basin, which has been sampled for PCBs. The basin is located in a residential neighborhood with no restrictions to access, and has been engineered with natural-style landscaping, including a convoluted perimeter, walkways, and marsh plants.

As of June 2004, recent heavy rains have reversed the low water conditions at Zeunert Quarry Pond. The current water level extends to the vegetated areas surrounding the park. It is not known if this will affect the distribution of sediment PCBs. However, the current water conditions do not change the recommendations made below, and it is expected that bottom sediments will be periodically revealed due to fluctuating water levels in the pond.

Consuming fish from Zeunert Pond is a human health hazard. There is a recognized hazard of consuming fish from Zeunert Quarry Pond. The WDNR (2003) fish consumption guide advises the public not to eat any fish species from Quarry Pond. The pond was stocked with rainbow trout, sunfish, and largemouth bass from 1985 until PCBs were detected in 1990. Following the first detection of PCBs in Zeunert Pond, fish consumption warning signs were placed at the pond, and at accessible areas of Cedar Creek. These signs are no longer present at the park. Due to the accessibility, high concentration of PCBs, and former fish stocking activity in this pond, it can be reasonably assumed that Zeunert Pond is a recreational destination associated with several pathways of exposure.

Fish data. Fish were last sampled by the WDNR in March 1991. Pending further investigation of PCBs in fish tissues, the “do not eat” advisory for fish from Zeunert Quarry Pond should remain in effect. The *Great Lakes sport fish consumption advisory* (Andersen *et al.* 1993) recommends no consumption of fish fillets with PCB content above above 1.9 milligrams per kilogram (mg/kg). The U.S. Food and Drug Administration (FDA) has set a residue limit of 2 mg/kg for PCBs in fish to protect from harmful health effects including developmental defects and increased risk of cancer.

Other FDA required limits include 0.2 parts of PCBs per million parts (ppm) in infant and junior foods, 0.3 ppm in eggs, 1.5 ppm in milk and other dairy products (fat basis), and 3 ppm in poultry and red meat (ATSDR 2000). PCBs found in fish from Zeunert Quarry Pond (Table 1) ranged from 0.27 mg/kg in rainbow trout to 7.7 mg/kg in a smallmouth bass specimen.

Table 1. Polychlorinated biphenyl (PCB) concentration of skin-on fillet fish tissue sampled from ZEUNERT POND, 1991.¹

Collection date	Sample type	Number of Fish	Avg Length (in)	Avg Weight (kg)	PCB in tissue (mg/kg)
3/29/91	Rainbow Trout	1	8.4	0.09	<0.2
3/29/91	Rainbow Trout	1	9.7	0.17	<0.2
3/29/91	Rainbow Trout	2	10.7	0.38	<0.2
3/29/91	Rainbow Trout	1	11	0.25	<0.2
3/29/91	Rainbow Trout	1	10.6	0.24	0.29
3/29/91	Rainbow Trout	2	11.1	0.23	0.27
3/29/91	Pumpkinseed	3	5.9	0.07	0.97
3/29/91	Bluegill	4	5.6	0.06	1.7
3/29/91	Black Bullhead	1	6.6	0.06	1.0
3/29/91	Black Crappie	1	9.1	0.21	<0.2
3/29/91	Yellow Perch	5	6.7	0.05	2.0
3/29/91	Smallmouth Bass	1	14.8	0.78	7.7
3/29/91	Walleye	1	16.7	0.77	1.2
3/29/91	Northern Pike	1	14.1	0.29	0.5
3/29/91	White Sucker	5	17.4	1.02	5.1

¹Data from the Wisconsin Department of Natural Resources Fish Contaminant Database (1970-2003).

PCBs in fish tissue exceeded the EPA risk-based concentration (1.6 micrograms per kilogram: EPA 2004) for lifetime exposure for all of the pan fish, game fish, and rough fish tested. Based on this information, the pond was listed "do not eat" for all species in the 2003 WDNR fish consumption guide. Nonetheless, new fish tissue data would provide a more reliable estimate of the current risk from consuming fish from this pond.

Estimate of exposure to PCBs in Zeunert Quarry Pond. Although the concentration of PCBs in fish and sediment in the pond advises against fish consumption or contact with sediment, the evidence for actual exposure is unconfirmed. In a survey of 31 homes in the

surrounding neighborhood (Appendix II), most people (71%) were aware of the fish consumption advisory. However, 26% fished the pond, 65% had observed others fishing the pond, and one person reported eating fish from the pond. Some people had anecdotes of others consuming fish from the pond. If a woman of reproductive age were to eat a meal of fish from the pond once each month, an argument for elevated risk to her future offspring could be made. This is based on her consumption of PCBs at a rate nearly 400-fold greater than the oral reference dose (RfD) of 0.0027 micrograms PCB per kilogram body weight per day ($\mu\text{g}/\text{kg}/\text{day}$) (Appendix I.; Tilson *et al.* 1990, in Anderson *et al.* 1993). Although the reference dose is expressed as a daily exposure, a single half-pound meal of Smallmouth Bass containing the highest PCB concentration reported from Zeunert Pond, if eaten once every thirty years, would arithmetically (though not metabolically) equal that daily exposure. This particular reference dose is a rate of chronic PCB exposure proposed to impair visual recognition memory (a developmental endpoint) in infants exposed *in utero* and through mother's milk.

Contact with the pond shoreline is an indeterminate health hazard. Physical contact with PCB-contaminated shoreline, bank soils, and shoreline sediments is an indeterminate health hazard. Although the available information shows PCB concentrations in some parts of the pond sediment as high as 11,000 ppm, more information is needed about PCB concentrations in sediments now exposed as shoreline soils to confirm this hazard. The risk from contact with contaminated soils is considerably lower than that associated with fish consumption from the pond, but great enough to warrant advising against contact with sediments, and possible shoreline soils, prior to remediation. The Agency for Toxic Substances and Disease Registry (ATSDR 2004) Cancer Risk Evaluation Guide (CREG) for a one-in-one million excess cancer risk is 400 parts per billion (ppb). The U.S. EPA cancer risk-based concentration (RBC) for lifetime exposure to PCBs is 320 ppb. However, the PCB concentration in the accessible shoreline has been incompletely assessed. Currently, the limited data do not adequately characterize exposure point concentrations or rule out this potential hazard. Of the sediment data reported, approximately eight sample points are close enough to the current shoreline to provide some indication of unknown PCB concentrations in recently exposed shoreline soils. Shallow samples at locations near the present shoreline range from 850 to 12,000 ppb, and suggest that currently exposed shoreline is contaminated. Soil sampling and analysis is needed to confirm this. Greater concentrations of PCBs, ranging from 12,000 to 140,000 ppb, were seen in shallow sediments in the center of the pond, distributed in a rough gradient from the north end of the pond. The highest PCB concentrations reported were found in sediments taken from 22-28" below surface. Several of these samples exceeded 1,300,000 ppb total PCBs, with the maximum being 11,000,000 ppb.

Contaminated soils in the storm water basin are also a potential health hazard. PCBs (specifically Arochlor 1248) reported in three surficial soil/sediment samples from around the basin are 50, 520, and 150 ppm. Evidence of a stormwater link between Zeunert Pond and the basin is under investigation. The basin does not support consumable fish, but probably supports frogs and aquatic invertebrates. These are attractive to children, and the basin is freely accessible to visitors. Although it is unlikely that humans eat any animals from this basin, it can be assumed that children exploring the basin will come in contact with contaminated soils. In the exposure assessment conducted by the Ozaukee County Health Department and DHFS, none of the 31 people questioned admitted contact with soil or sediment at the storm water basin, but 3 people

had seen others at the basin. The U.S. Environmental Protection Agency has published a risk-based concentration of 0.32 ppm, based on a prediction of increased cancer risk from a lifetime of incidental consumption of soil exceeding that concentration (EPA 2004). Although the frequency with which people contact these contaminated soils is unknown, the storm water basin is clearly designed to encourage visitation, and contact with PCBs at sediment concentrations more than 1600-fold greater than the EPA risk-based concentration has risk.

Toxicology of PCBs. PCBs are a group of structurally similar molecules that are chemically stable, highly soluble in oil, and are insoluble in water. This means that PCBs last for decades in the environment, tend to accumulate in body fats, and accumulate in the food chain (ATSDR 2000). In the environment, PCBs are found mostly adsorbed to sediments and soil rather than in water. PCBs have various effects on the body that are related to physiological development, regulation of the cell cycle, and tumorigenesis. Several population-level studies have linked prenatal and perinatal exposure to PCBs to low birth weight and learning problems. Some forms of PCBs are suspected human carcinogens. Due to the widespread dispersion and chemical stability of PCBs in the environment, some exposure (mostly through food) is unavoidable. Avoidable exposure, such as that presented by eating fish from Zeunert Quarry Pond, should be prevented.

Child Health Considerations

Children are most sensitive to many of the health effects associated with PCB exposure. Eating contaminated fish either by small children or by their pregnant mothers is considered to be the most important exposure pathway for the child development related health effects. Direct contact with PCB-contaminated sediments, while constituting a much lower level of exposure, is another route of exposure to these chemicals. Because the pond banks is attractive to exploration, fishing, and wading by children of all ages, a realistic potential exists for contact with contaminated sediments in Zeunert Quarry Pond. Public education directed at parents, along with access restrictions and posted warnings, should be considered to help prevent exposure.

Conclusions

- Eating fish from Zeunert Quarry Pond is a public health hazard, particularly for women in their childbearing years and young children.
- Physical contact with PCB-contaminated sediments in both Zeunert Pond and the Wilshire Drive storm water basin is a public health hazard, based on comparison of available environmental information to health-based guidelines.
- Physical contact with shoreline soils around Zeunert Pond is an indeterminate public health hazard. Although the available information shows PCB concentrations in some parts of the pond sediment as high as 11,000 ppm, more information is needed about PCB concentrations in sediments now exposed as shoreline soils to confirm this hazard.

Recommendations

- Pending further investigation of PCBs in fish tissues, the “do not eat” advisory for fish from Quarry Pond should remain in effect.

- The community should be made more aware of the fish consumption advisory. Steps to increase awareness should include the posting of advisory signs at the pond. Some initial inquiry into the community should be made to assess the awareness of the advisory and whether fish from the pond are being consumed, and whether more effort is needed to increase awareness.
- Contact should be avoided with bottom sediments in most of the pond, particularly on the pond's north end.
- Shoreline and bank areas, particularly around high-traffic areas within Zeunert Park, should be investigated in more detail for the presence of PCBs and associated hazards from contact with soil.
- Contact should be avoided with bottom sediments in the storm water basin.

Public Health Action Plan

- The public will be provided notice, by DHFS and the Ozaukee County Health Department, that fish from the pond are unsuitable for consumption. This message is already included in the WDNR fish consumption guide.
- Signs warning against sediment contact via wading have been placed in the park and at the storm water basin by the Ozaukee County Health Department and DHFS.
- Secure fencing already present around private land on the north end of the pond will serve to restrict access to the portions of the shoreline where PCB concentrations are highest.
- Contaminated sediments in Quarry Pond will be assessed, removed, and treated. The responsible party will undertake this remediation, under the regulation of the U.S. EPA and the WDNR.

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Appendix I. Estimate of exposure to PCBs from consuming fish from Zeunert Quarry Pond.

1. PCB exposure imparting risk to developing fetus (Tilson *et al.* 1990):

Reference dose (RfD) of 0.0027 $\mu\text{g PCB/kg body wt/day}$.

2. Equivalent whole-body exposure to 60kg woman:

$$(0.0027 \mu\text{g PCB/kg body wt/day})(60 \text{ kg}) = 0.16 \mu\text{g PCB/day}$$

3. Fish consumption: typical one-half pound Smallmouth Bass fish meal, once per month. Equivalent to consuming 0.008 kg fish/day.
4. Maximum PCB found in Zeunert Pond Smallmouth Bass: 7.7 mg PCB/kg fish fillet.
5. PCB dose from consuming Zeunert Pond Smallmouth Bass:

$$(7.7 \text{ mg PCB/kg fish})(0.008 \text{ kg fish/day}) = 0.062 \text{ mg PCB/day}$$

6. **Chronic dose to 60 kg female:**

$$(0.062 \text{ mg PCB/day})/60\text{kg} = \mathbf{1.0 \mu\text{g PCB/kg body wt/day}}$$

This is 370-fold greater than Tilson's reference dose.

Reference: Tilson HA, Jacobson JL, Rogan WJ. 1990. Polychlorinated biphenyls and the developing nervous system: cross-species comparisons. *Neurotoxicol. Teratol.* 12: 239-248.

Appendix II. Zeunert Park Exposure Assessment. City of Cedarburg, Ozaukee County, Wisconsin. A survey of recreational use of Zeunert Quarry Pond by residents of Cedarburg, Wisconsin. August 11, 2004

Background and purpose.

On June 14, 2004, the Ozaukee County, Wisconsin Health Department formally requested the assistance of the Wisconsin Department of Health and Family Services (DHFS) in evaluating neighborhood awareness concerning the existing fish advisory and the extent to which the public has contact with the fish, and sediments of the pond, and Wilshire storm water retention basin.

Health agencies were unclear about the level of public awareness about contamination at Zeunert Park and the fish consumption advisory for the pond and retention basin. The Ozaukee County Health Department requested DHFS assistance in assessing possible PCB exposures among the residents near the pond and retention basin. A survey was used to gauge understanding of the advisory, frequency of contact with the sites, the frequency of fishing and fish consumption, and to identify the best methods to communicate health advisories about Zeunert Park to the public.

Door-to-door interviews of 31 residences were conducted by the Ozaukee County Health Department and DHFS on June 24, 2004. Staff from the Wisconsin Division of Public Health worked with staff of the Ozaukee County Health Department to develop and administer a door to door survey (Attachment 1). A sample size of thirty residents was selected as sufficient to provide confidence in survey findings. The neighborhood around the park was divided into four quadrants and a local and state health official would select a street in their appointed quadrant to begin. Residents surveyed were randomly chosen. Information regarding the survey effort was provided to the community via a press release and subsequent newspaper story that ran in the *Cedarburg News Graphic* on June 24, 2004.

Survey results.

The following statements were drawn from the survey responses in Table 1:

- Most residents are familiar with and use Zeunert Park.
- Most residents either fish in the pond or see others fish there, and the majority are aware of the existing fish advisory.
- Only one resident reported eating the fish.
- Most residents were familiar with the Wilshire retention basin.
- A few residents observed kids playing near the retention basin.
- A number of Wilshire residents raised concerns over the potential for contamination in their yards as they reported the existence of a drainage ditch prior to the installation of underground pipes.

Table 1. Results of Door to Door Survey in neighborhood Surrounding Zeunert Quarry Pond Park and Wilshire Drive Retention Basin, June 24, 2004.

Question	Results
1. Do you use Zeunert Park?	Yes: 71% No: 29%
2. How often do you use it?	Weekly: 42% Monthly: 19% Annually: 13%
3. Do you fish there?	Yes: 26% No: 68%
4. Do you eat the fish?	Yes: 3% No: 90%
5. Are you aware of the fish advisory?	Yes: 71% No: 29%
6. How did you hear about it?	Newspaper: 55% TV: Radio: Other: 22%
7. Do you ever see anyone fishing or playing at the park?	Yes: 65% No: 39%
8. Are you familiar with the Wilshire retention pond?	Yes: 71% No: 29%
9. Do you ever see anyone fishing or playing at the retention pond?	Yes: 10% No: 90%
10. How would you like to be kept informed about the site:	Newspaper: 65% Mail: 13% Email: TV: Radio:

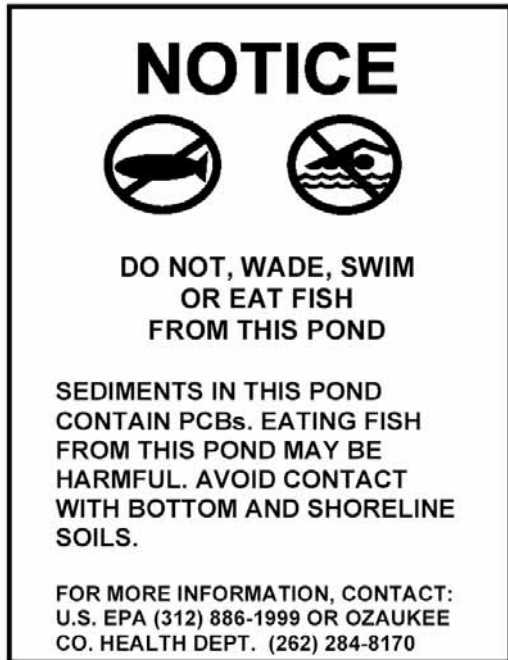
Conclusions of survey.

Of the residents DHFS contacted who live near Zeunert Park, most (71%) visit the park and were aware of a fish consumption advisory for fish in the Zuenert Quarry Pond and Wilshire retention basin. However, people continue to regularly play or fish at the pond or retention basin, and one person reported eating fish from the pond. This confirms that some people are exposed to PCBs from the pond and retention basin.

Recommendations for Risk Communication

- Further outreach is necessary to educate and address concerns of the Wilshire neighborhood regarding contamination in the Wilshire retention basin.
- Warning signs recently posted at Zeunert Park (figure 1) should be maintained to educate people about contamination the pond and retention basin.

Figure 1. Sign to Be Posted Around Pond and Retention Basin



05/10/04

Attachment 1. Survey Tool, Herman A. Zeunert Quarry Pond Park, Cedarburg WI. June 24, 2004

Questions:	Address (# & Street)						
Do you use Zeunert Park?	Y N	Y N	Y N	Y N	Y N	Y N	Y N
How often do you use it?	Weekly Monthly Annually	Weekly Monthly Annually	Weekly Monthly Annually	Weekly Monthly Annually	Weekly Monthly Annually	Weekly Monthly Annually	Weekly Monthly Annually
Do you fish there?	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Do you eat the fish?	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Are you aware of the fish advisory?	Y N	Y N	Y N	Y N	Y N	Y N	Y N
How did you hear about it?	Newspaper TV Radio Other	Newspaper TV Radio Other	Newspaper TV Radio Other	Newspaper TV Radio Other	Newspaper TV Radio Other	Newspaper TV Radio Other	Newspaper TV Radio Other
Do you ever see anyone fishing or playing at the retention pond?	Y N	Y N	Y N	Y N	Y N	Y N	Y N

The park pond has been under a fish advisory since 1990. Recent testing has shown that levels of PCBs in the sediments are high and that PCBs were also detected in a retention pond on the other side of Hamilton, by the treatment plant at Park and Wilshire.

Are you familiar with the retention pond?	Y N	Y N	Y N	Y N	Y N	Y N	Y N
Do you ever see anyone fishing or playing at the retention pond?	Y N	Y N	Y N	Y N	Y N	Y N	Y N
How would you like to be kept informed about the site?	Newspaper Mail email TV Radio Phone #:	Newspaper Mail email TV Radio Phone #:	Newspaper Mail email TV Radio Phone #:	Newspaper Mail email TV Radio Phone #:	Newspaper Mail email TV Radio Phone #:	Newspaper Mail email TV Radio Phone #:	Newspaper Mail email TV Radio Phone #:
Comments:							

While not likely a short-term hazard, we want people to limit contact with the sediments and will be posting signs shortly. Here's some information, if you have any questions, please feel free to call.

Certification

This public health consultation for the Zeunert Quarry Pond Polychlorinated Biphenyl Site was prepared by the Wisconsin Department of Health and Family Services under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the Public Health Consultation was begun. Editorial review was completed by the Cooperative Agreement partner.

Technical Project Officer, CAT, SPAB, DHAC

The Division of Health Assessment and Consultation, ATSDR, has reviewed this Public Health Consultation and concurs with the findings.

Team Lead, CAT, SPAB, DHAC, ATSDR