

Health Consultation

Public Health Evaluation of Fish Contaminant Data in the
Housatonic River

LAKE ZOAR, LAKE LILLINONAH, WEST CORNWALL,
FALLS VILLAGE AND BULLS BRIDGE IN KENT, CONNECTICUT

Prepared by:
Connecticut Department of Public Health

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U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Community Health Investigations
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

A health consultation is a verbal or written response from ATSDR or ATSDR's Cooperative Agreement Partners to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR or ATSDR's Cooperative Agreement Partner which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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Environmental and Occupational Health Assessment Program
Under a Cooperative Agreement with the
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SUMMARY

INTRODUCTION

The Housatonic River is approximately 149 miles long, beginning in the Berkshire mountains in western Massachusetts and flowing south, through western Connecticut into the Long Island Sound (Appendix A). The General Electric (GE) facility, which produced and handled polychlorinated biphenyls (PCBs) from the 1930s to 1977 in its Pittsfield, Massachusetts facility, caused significant contamination of Housatonic River sediments and fish in the MA portion of the river. PCB-contaminated sediments have been transported into the Connecticut portion of the river over the years. This has resulted in fish becoming contaminated with PCBs to the extent that fish consumption advisories have been in place in several parts of the Housatonic River in Connecticut since 1977. The Connecticut Department of Public Health (CTDPH) reviews new fish tissue data sampled by the Patrick Center of Environmental Research from the Housatonic River biennially and evaluates whether the current fish consumption advisory needs to be modified to protect public health based on the level of PCB contamination. CTDPH has evaluated fish sampling data from 2012 and the results of this evaluation are the focus of this document.

CONCLUSION

CTDPH reached one important conclusion in the health consultation:

CTDPH has concluded that eating five fish species from West Cornwall, Lake Lillinonah, Lake Zoar, Bulls Bridge, and Falls Village over a long period of time could harm people's health if they do not follow the consumption advisory. If community members adhere to the consumption advisory, exposure to PCBs in fish would not be significant enough to cause adverse health effects. CTDPH believes that this consumption advisory is necessary to protect public health while allowing community members to benefit from the nutritional advantages of eating fish.

Basis for Conclusion

Another round of fish tissue data shows that five different fish species from five locations along the Housatonic River continue to have elevated levels of PCBs. CTDPH uses this fish tissue data to issue a general fish consumption advisory for the northern section of the Housatonic River above Derby Dam. The current PCB levels (based on 2012 data) are elevated enough to warrant a continued consumption advisory. Before 2012, there was a general decrease in PCB levels over time, but in some fish species sampled in 2012, there was an increase in PCB levels possibly due to recent weather

related events and remedial work performed on the MA portion of the Housatonic River. CTDPH has decided to maintain the advisory of “do not eat-everyone” for brown trout and northern pike because PCB levels in these species continue to be consistently elevated throughout the Housatonic River and its Lakes. In addition, a consumption advisory on fallfish has been made because of the presence of elevated PCB levels were found in that species along the Housatonic River. Since PCB levels have consistently been elevated in bluegill in the upper part of the Housatonic River (but not the Lakes), the consumption advisory was strengthened to “One meal per month-everyone” in that location.

Next Steps

CTDPH will continue to update its Housatonic River fish consumption advisory in 2014 in response to the 2012 fish sampling data. The advisory will be printed in our annual brochure and distributed to towns and local health departments along the Housatonic River.

FOR MORE
INFORMATION:

If you have concerns about your health, you should contact your health care provider. Please call The CT DPH at (860)-458-FISH (3474) for more information on Connecticut’s fish consumption advisories.

The conclusions and recommendations in this health consultation are based on the data and information made available to the Connecticut Department of Public Health (CTDPH) and the Agency for Toxic Substances and Disease Registry (ATSDR). CTDPH and ATSDR will review additional information when received. The review of additional data could change the conclusions and recommendations listed in this document.

BACKGROUND AND STATEMENT OF ISSUE

The Housatonic River is approximately 149 miles long, beginning in the Berkshire mountains in western Massachusetts and flowing south through western Connecticut into the Long Island Sound (Appendix A). Its major tributaries are the Williams, Green and Konkapot Rivers in Massachusetts, the Tenmile River in New York, and the Blackberry, Hollenbeck, Aspetuck, Candlewood, Shepaug, Pomperaug, Naugatuck, and Still Rivers in Connecticut. It receives the Naugatuck River at Derby, Connecticut, and the Still River south of New Milford, Connecticut. The General Electric (GE) facility, which produced and handled polychlorinated biphenyls (PCBs) from the 1930s to 1977 in its Pittsfield, Massachusetts facility, caused significant contamination of Housatonic River sediments and fish in the Massachusetts portion of the river. PCB-contaminated sediments have been and continue to be transported into the Connecticut portion of the river over the years. This has resulted in fish becoming contaminated with PCBs to the extent that fish consumption advisories have been in place in several parts of the Housatonic River in Connecticut since 1977. The Patrick Center for Environmental Research, The Academy of Natural Sciences of Drexel University samples fish in the Housatonic River for GE on a biennial basis and GE, in turn, reports this information to the Connecticut Department of Public Health (CTDPH) and Connecticut Department of Energy and Environmental Protection (CTDEEP). The sampling locations were chosen in the 1970s and remain in place for the purpose of evaluating temporal trends. CTDPH reviews new fish tissue data sampled by the Philadelphia Academy from the Housatonic River biennially and evaluates whether the current fish consumption advisory needs to be modified to protect public health based on the level of PCB contamination. This sampling program has been in place since 1984 (EPA 2005). CTDPH has evaluated fish sampling data from 2012 and the results of this evaluation are the focus of this document. It is the state of Connecticut's goal to restore the Housatonic River and its Lakes so that in the future fish consumption advisories would not be needed.

Demographics

Since the area surrounding the Housatonic River in Connecticut is very large, the demographics described here include only the towns surrounding the five stations where fish sampling occurred: West Cornwall, Bulls Bridge in Kent, Falls Village, Lake Zoar, and Lake Lillinonah (Appendix A). As seen in Table 1, some of the nearby populations are large because the Lakes are surrounded by several towns. This is a very conservative estimate of a population that may be affected. We expect that only a portion of the population will fish in these five sampling areas along the Housatonic River.

However, the Housatonic River is a popular fishing destination for people across all of Connecticut and even for people from out of state. Therefore, these demographics for local towns do not necessarily reflect the true nature of the people fishing on the river.

Table 1. Demographics for Fish Sampling Locations along the Housatonic River[^]

Sampling Station	Surrounding Towns	Total Population	Area (square miles)
West Cornwall*	Cornwall	1,420	46
Bulls Bridge	Kent	2,979	50
Falls Village*	Canaan	1,234	33
Lake Zoar	Monroe, Oxford, Newtown, Southbury	79,626	194
Lake Lillinonah	Brookfield, Bridgewater, Newtown, Southbury, New Milford, Roxbury	74,428	182

[^]United States Census Bureau 2010

*Indicates a village within a larger town

Health Comparison Values and Fish Tissue Contaminant Levels

In the summer and fall of 2012, thirty brown trout were sampled from West Cornwall and analyzed for PCB content as part of the Housatonic River’s biennial fish monitoring program described previously. In addition, 40 smallmouth bass from the four stations along the Housatonic River (West Cornwall, Bulls Bridge, Lake Zoar, and Lake Lillinonah) were also sampled. Four northern pike samples of three fish composites (12 fish) from four stations (Bulls Bridge, Falls Village, Lake Lillinonah, and Lake Zoar) were also sampled. Lastly, 3 samples of five-fish composites (15 bluegill from Bulls Bridge, Lake Lillinonah, and Lake Zoar) and 10 individual bluegill samples from Falls Village were analyzed as part of a supplemental fish sampling effort. One five fish composite sample of fallfish from West Cornwall was also analyzed as part of the supplemental fish sampling effort. All of the fish fillets (brown trout, northern pike, smallmouth bass, bluegill and fallfish) contained PCB levels that exceeded CTDPH’s Modified Great Lakes Protocol PCB value for fish consumption which is described below (Patrick Center for Environmental Research 2013).

1. Health Comparison Values

In order to set safe levels of PCBs in fish associated with fish consumption advisories, CTDPH uses a modified version of the Protocol for a Uniform Great Lakes Sport Fish Consumption Advisory (GLP) (1993). The risk-based PCB fish concentration cutoffs for different meal frequencies developed in the GLP are listed in Appendix B. The GLP is a framework for setting risk-based fish consumption advisories in the Great Lakes states.

Using the GLP, the Great Lakes Task Force developed a Health Protective Value (HPV) for PCBs of 0.05 µg/kg/day by using a “weight of evidence” approach which considered all of the existing toxicological values and studies (mostly human and monkey). The “weight of evidence” approach differs from a reference dose which typically uses a single critical study. The HPV is a unique value developed specifically for the Great Lakes sport fish advisory process (Great Lakes Sport Fish Advisory Task Force 1993). The development of the HPV was based on some key assumptions: average meal size for a 70 kg adult of one-half pound (227 grams) and a 50% reduction in PCB fish fillet content (skin on, scales off fillet) through trimming and cooking losses of fatty portions of the fish. The goal of the advisory program was to limit PCB exposure to 3.5 µg/day (0.05 µg/kg/day *70 kg = 3.5 µg/kg/day). At this exposure level, cancer risks would not be expected to exceed 1 excess cancer in 10,000 exposed people and non cancer health effects would not be likely. Concerning non-cancer health effects, there are several animal and human studies that resulted in a variety of adverse health effects from exposure to PCBs. The main effects from exposure to PCBs in animals include hepatic, dermal, immunological, and neurobehavioral development. Because the most sensitive effects are immunological and neurobehavioral development, the GLP Task Force tended to weigh more heavily on these studies when developing its HPV (Great Lakes Sport Fish Advisory Task Force 1993).

The ATSDR minimum risk level (MRL) for chronic exposure to PCBs is 0.02 µg/kg/day and less than half of the HPV. Derivation of the ATSDR MRL is based on a Lowest Advise Effect Level (LOAEL) of 0.005 µg/kg/day from one study for immunological effects and divided by an uncertainty factor of 300 for extrapolation from monkeys to humans, and 10 for human variability. As stated previously, development of the HPV is based on a “weight of evidence” approach and considered all toxicological values and studies. Cancer risks estimates for PCBs at the HPV of 0.05 ug/kg/day using the United States Environmental Protection Agency (US EPA) Cancer Slope Factor (CSF) of $(7.7\text{mg/kg/day})^{-1}$ (95% upper bound confidence level estimate) and $(5.5\text{mg/kg/day})^{-1}$ (most likely estimate) are 3.8×10^{-4} and 2.7×10^{-4} respectively. If a population were exposed to PCB levels of 0.05 µg/kg/day (HPV) every day for 70 years (a lifetime), there would be a theoretical excess cancer risk of approximately 2 persons in a population of 10,000. CTDPH considers this theoretical excess cancer risk to be on the upper end of a generally acceptable range (1 in 10,000 to 1 in 1,000,000).

CTDPH’s version of the GLP takes into account detection limit issues and the somewhat greater concern for higher risk individuals (Ginsberg and Toal, 1999). CTDPH currently issues consumption advisories for PCBs levels exceeding 0.1 ppm (parts per million), the point where practical quantification of PCBs in fish becomes certain whereas the GLP recommends consumption advisories at PCBs levels exceeding 0.05 ppm.

High risk individuals include pregnant women, women planning to become pregnant within a year, breastfeeding women, or children under the age of six. Pregnant women or women planning to become pregnant are particularly sensitive because PCBs can be passed through the mother to the unborn fetus and can result in central nervous system (CNS) effects as well as others. Children under the age of six are also particularly vulnerable because they tend to eat more per body weight. In addition, the developing

organs (brain and thyroid gland) of children can sustain permanent damage if exposure to PCBs occurs during critical growth stages. Breastfeeding women are also in the high risk group because PCBs can pass through breast milk and expose young children to PCBs. Low risk individuals include the remaining population. Table 2 gives the details of CTDPH's fish consumption advisory as it relates to PCB levels in fish samples. In addition, CT DPH gives each fish consumption category a reference letter for ease of reference.

Regarding the issue of higher risk individuals, the animal toxicology studies support an HPV that is in the same range for reproductive and other (immunological, dermal) endpoints. This suggests that *in utero* development is no more sensitive to PCBs than endpoints seen in adult animals. However, the evidence of low dose effects in humans is strongest for *in utero effects* (central nervous system development). This creates a somewhat greater concern for pregnant women and women planning pregnancy (Ginsberg and Toal 1999).

Two short term studies in mink and rats also resulted in low dose developmental effects from exposure to PCBs. Therefore, CTDPH believes that there may be a greater sensitivity during *in utero* exposure such that recent exposures that do not involve a cumulative body burden (which is important to adult toxicity) could produce an adverse health effect. This uncertainty over PCBs pharmacokinetics and developmental outcomes supports a prudent avoidance (do not eat) approach for pregnant women for markedly elevated PCB concentrations (e.g. over 1 ppm). CTDPH's recommendation of "do not eat" for high risk groups for PCB levels in fish of 1.1-1.9 ppm differs from the GLP's approach which recommends a "1 meal per 2 months" restriction for fish consumption for all risk groups for PCB levels of 1.1-1.9 ppm (Ginsberg and Toal 1999). In addition, CTDPH's recommendation also differs from the GLP's approach which recommends a "one meal per week" restriction for all risk groups for PCB levels of 0.06-0.20 ppm (Table 2).

Setting limits based on cancer risk less than 1 in 10,000 would lead to severe restrictions on fish consumption overall (local or commercial) due to the widespread occurrence of low levels of PCBs in fish. This would result in the benefit of fish consumption to be lost in the interests of minimizing cancer risks. Given that the number of frequent consumers of locally caught fish in Connecticut may not be large, the theoretical 1 in 10,000 cancer risk is of less concern than if this were a population-wide exposure (Ginsberg and Toal 1999). Therefore, both CTDPH and The Great Lakes Protocol focus on prevention of non-cancer health effects of PCBs.

Table 2. CTDPH's Modified Great Lakes Protocol for Fish Consumption[^]

Restriction Category (Level)	PCB Level (ppm [*])	Consumption Advisory	
		Low Risk [@]	High Risk [#]
A	< 0.1	No Consumption Advice	No Consumption Advice
B	0.1-0.2	One meal per week	One meal per month
C	0.21 - 1.0	One meal per month	One meal per month
D	1.1 - 1.9	One meal every 2 months	Do not eat
E	> 1.9	Do not eat	Do not eat

[^](Ginsberg and Toal, 1999)

^{*}Parts Per Million

[@]Includes all other groups not included in the high risk group

[#]Includes pregnant women, women planning to become pregnant within a year, nursing women, and children under 6 years old

2. Fish Contaminant Levels

The 2012 contaminant data show that average PCB concentrations in all of the fish species from the five Housatonic River sampling locations exceeded the concentration where CTDPH issues a consumption advisory (0.1 ppm). Table 3 gives the average congener-based¹ PCB concentrations in five locations along the Housatonic River in the 5 fish species sampled in 2012.

Smallmouth Bass

The average PCB concentrations for Lake Zoar and Lake Lillinonah in smallmouth bass were 0.75 and 0.59 ppm, respectively, while the average for West Cornwall and Bull's Bridge was almost twice those levels at 1.41 and 1.11 ppm, respectively.

Brown Trout

Brown trout were only sampled at the West Cornwall station. The average PCB concentration in this fish species was 1.79 ppm.

Northern Pike

The average PCB concentrations in northern pike in Falls Village, Bulls Bridge, and Lake Zoar were 3.30, 2.18, and 3.36 ppm, respectively, while the average was lower for Lake Lillinonah at 1.52 ppm.

¹ The congener-based analysis method sums the concentrations of all individual congeners (up to 121) quantitated by the analytical method.

Fallfish

Fallfish were only sampled at the West Cornwall station. The PCB concentration in this five fish composite sample was 0.78 ppm.

Bluegill

The average PCB concentrations in bluegill in Falls Village was 0.72 ppm, while the averages were much lower for Bulls Bridge, Lake Lillinonah, and Lake Zoar at 0.37, 0.27 and 0.13 ppm, respectively, for the same species.

Table 3. PCB Concentrations in Five Species of Fish Caught in Five Locations along the Housatonic River in 2012.

Location	Species	Number of Samples	Total Number of Individuals	Average (Congener*) PCBs (ppm ^) in 2012	Range (Congener Based) PCB (ppm)
West Cornwall	Smallmouth Bass	10	10	1.41	0.74-2.02
Bulls Bridge	Smallmouth Bass	10	10	1.11	0.50-1.67
Lake Lillinonah	Smallmouth Bass	10	10	0.59	0.12-1.78
Lake Zoar	Smallmouth Bass	10	10	0.75	0.26-2.27
West Cornwall	Brown Trout	30	30	1.79	0.47-3.66
Falls Village	Northern Pike	1	3	3.30	--
Bulls Bridge	Northern Pike	1	3	2.18	--
Lake Lillinonah	Northern Pike	1	3	1.52	--
Lake Zoar	Northern Pike	1	3	3.36	--
Bulls Bridge	Bluegill	1	5	0.37	--
Falls Village	Bluegill	10	10	0.72	0.28-1.17
Lake Lillinonah	Bluegill	1	5	0.27	--
Lake Zoar	Bluegill	1	5	0.13	--
West Cornwall	Fallfish	1	5	0.78	--

*The congener-based analysis method sums the concentrations of all individual congeners (up to 121) quantitated by the analytical method.

^Parts per Million

3. Time Trends

It is also informative to evaluate trends in contaminant levels in fish tissue over time. Table 4 gives the trend over time for average PCB contamination in the five locations in 4 of the 5 species of fish sampled. Fallfish is not included in this table because 2012 is the first time it has been sampled in the Housatonic River. Since the 1980s, the average PCB levels have decreased greatly in all of the locations in these 4 fish species sampled (except for northern pike, whose PCB levels were not correlated with size) from a high of

7.25 ppm in West Cornwall in brown trout in 1992 to a low of 0.04 in yellow perch in Lake Lillinonah in 2010. It is important to note, however, that after several years of decreasing levels of PCBs in several fish species, the levels have increased slightly during the latest sampling period (2012), although not significantly.

4. Data Evaluation Issues

In calculating average congener-based PCB concentrations, CTDPH used average concentrations for each species and sampling location rather than 95% upper confidence limits (UCLs). A 95% UCL provides a conservative estimate of the average concentration and is unlikely to underestimate the “true” average. However, there is a tendency to sample larger fish (an intentional bias) in the Housatonic River Sampling Program which is the source of the data used in this health consultation. This provides conservatism because larger fish tend to have higher PCB concentrations. For this reason, CTDPH decided that it was not necessary to calculate 95% UCLs. CTDPH is confident that the average PCB concentrations provide a conservative estimate of the “true” average.

**Table 4. PCB Level History along the Housatonic River in Five Locations
1984- 2012**

Location	Fish Species	Highest Average (Congener Based [#]) PCBs 1984-2008 (ppm [@]) (Year)	Average (Congener Based) PCBs (ppm) (Previous Year Sampled)	Average (Congener Based) PCBs (ppm) in 2012
West Cornwall	Smallmouth Bass	3.77 (1988 [*])	0.93 (2010)	1.41
Bulls Bridge	Smallmouth Bass	2.33 (1988)	0.55 (2010)	1.11
Lake Lillinonah	Smallmouth Bass	1.41 (1992)	0.5 (2010)	0.59
Lake Zoar	Smallmouth Bass	1.13 (1992)	0.96 (2010)	0.75
West Cornwall	Brown Trout	7.25 (1992)	1.34 (2010)	1.79
Falls Village	Northern Pike	10.01 (2004)	6.61 (2010)	3.30
Bulls Bridge	Northern Pike	1.74 (2008)	1.48 (2010)	2.18
Lake Lillinonah	Northern Pike	1.20 (2008)	1.13 (2010)	1.52
Lake Zoar	Northern Pike	1.49 (2008)	0.96 (2010)	3.36
West Cornwall	Fallfish	NPS	NPS [^]	0.78
Bulls Bridge	Bluegill	1.85 (1988)	0.48 (2010)	0.37
Falls Village	Bluegill	0.68 (2000)	1.30 (2010)	0.72
Lake Lillinonah	Bluegill	0.48 (1984)	0.13 (2010)	0.27
Lake Zoar	Bluegill	0.89 (1984)	0.15 (2010)	0.13

[#]The congener-based analysis method sums the concentrations of all individual congeners (up to 121) quantitated by the analytical method.

[@]parts per million

^{*} Results for 1984-1990 were estimated by the Patrick Center for Environmental Research (2009) from aroclor-based data using regressions of the natural logarithm (ln) of the congener-based PCB concentration versus the ln of the aroclor-based PCB concentration of each fish species that were established with data from 1992 and 1994. The aroclor-based analysis method is a measurement of commercial mixtures of PCB compounds. Congener analysis was not performed before 1992.

[^]Not previously Sampled

DISCUSSION

Exposure Pathway Analysis

To determine if community members are exposed to contaminated fish in the Housatonic River and its Lakes, CTDPH evaluated the environmental and human components that lead to human exposure. CTDPH evaluated the fish tissue data and considered how people may be exposed to contaminants in the fish. The only possible complete pathway of exposure is via ingestion (eating the fish). An exposure pathway consists of five elements (ATSDR 2005):

1. A source of contamination;
2. Transport through an environmental medium;
3. A point of exposure;
4. A route of human exposure; and
5. A receptor population.

ATSDR categorizes an exposure pathway as either completed, potential, or eliminated. In a completed pathway, all five elements exist and indicate that exposure to a contaminant has occurred in the past, is occurring, or will occur in the future. In a potential exposure pathway, at least one of the five elements has not been confirmed, but it may exist. Exposure to a contaminant may have occurred in the past, may be occurring, or may occur in the future. An exposure pathway can be eliminated if at least one of the five elements is missing and will never be present (ATSDR 2005).

Environmental data show that fish in the 5 locations sampled along the Housatonic River and its Lakes (Zoar and Lillinonah) are contaminated with PCBs. Individuals who catch and eat fish in these water bodies would likely be exposed to PCBs in the fish. In addition, their families and friends would also be exposed to PCBs if they eat the fish.

Public Health Implications for Adults and Children

When determining the public health implications of exposure to hazardous contaminants, CTDPH considers how people might come into contact with contaminants and compares contaminant concentrations with health protective levels. When contaminant levels are below health-based comparison values, health impacts from exposure to those levels are unlikely. Contaminant levels exceeding comparison values do not indicate that health impacts are likely, but instead warrant further investigation. In this health consultation, CTDPH used a modified Great Lakes Protocol for fish consumption to set a health protective value (HPV) for PCBs in fish as described in the Environmental Contamination section of this document. As stated previously, this modified protocol is a risk-based protocol which takes into account detection limit issues and the somewhat greater concern for higher risk individuals.

Ingestion of five species of fish in the upper part of the Housatonic River and its Lakes which contain elevated levels of PCBs is a completed exposure pathway and is evaluated in this health consultation. Using CTDPH's Modified Great Lakes Protocol for Fish

Consumption, we have classified each fish species according to its appropriate consumption category (restriction level). Table 2 also gives 5 restriction level categories; “A” being the least restrictive and “E” being the most restrictive. CTDPH has concluded that the five fish species from Lake Lillinonah, Lake Zoar, Bulls Bridge, Falls Village, and West Cornwall contain elevated PCB levels where adverse health effects from ingestion of these fish can not be ruled out. Ingestion of these fish represents a public health hazard to individuals who do not follow the consumption advisory. However, if community members adhere to the current consumption advisory, exposure to PCBs in fish would not be significant enough to cause adverse health effects. CTDPH believes that this updated consumption advisory is necessary to protect public health while allowing community members to benefit from the nutritional advantages of eating fish.

Table 5 gives the updated CTDPH fish consumption advisory in response to the 2012 PCB data from the five sampling locations along the Housatonic River and compares it to the previous advisory. It is also important to note that other species, (eel, catfish, and carp) despite not having been sampled for PCBs, have been placed in the Category E advisory for many years to be protective of public health since PCBs are known to bioaccumulate in these species in other Connecticut water bodies.

1. Smallmouth Bass

Environmental data indicate the average PCB levels in smallmouth bass from all 4 stations are above the concentration where CTDPH issues a consumption advisory according to CTDPH’s modified Great Lakes Protocol for fish consumption (Table 2). The average PCB levels in Bulls Bridge (1.11 ppm) Lake Lillinonah (0.59 ppm), and Lake Zoar (0.75 ppm), and West Cornwall (1.41 ppm) are all within the Category C or D restriction level (Table 2). However, in past sampling events, PCB levels have been higher in fish sampled from the upper Housatonic River with levels in the Category E restriction level. Although the levels of PCBs in 2012 in smallmouth bass have dropped low enough to loosen the consumption advisory, the CT DPH advisory of Category C will remain in the Lakes (Lillinonah, Housatonic, and Zoar) on the Housatonic River and the advisory of Category D will remain for the upper part of the Housatonic River because additional sampling is necessary to conclude that the PCB levels in smallmouth bass have stabilized enough to loosen the advisory. In addition, the PCB levels in smallmouth bass have recently increased in this round of sampling possibly due to weather related events and remedial work occurring on the upper part of the Housatonic River near Pittsfield, MA.

In summary, CT DPH has decided to maintain the advisory at the Category C restriction level for the Lakes on the Housatonic River and Category D for the upper part of the Housatonic River for the following reasons:

1. Past fish sampling has indicated moderately high levels of PCB contamination in this river.
2. Further sampling is necessary to show that PCB levels in smallmouth bass are consistently low enough to allow more consumption.

3. 2012 sampling results have indicated an increase in PCB levels that may be due to recent weather related events and ongoing remedial activity in the Pittsfield, MA area of the Housatonic River.

2. Brown Trout

In 2012, brown trout in the West Cornwall station had an average PCB level (1.79 ppm) which is in the Category D restriction level. In addition, the PCB levels in brown trout have recently increased in this round of sampling possibly due recent weather related events and the remedial work now occurring on the upper part of the Housatonic River near Pittsfield, MA.

CTDPH has decided to maintain the advisory of Category E restriction level for the upper portion of the Housatonic River and its Lakes for the following reasons:

1. Past fish sampling has indicated moderately high levels of PCB contamination in this river.
2. Further sampling is necessary to show that PCB levels in brown trout are consistently low enough to allow more consumption.
3. 2012 sampling results have indicated an increase in PCB levels that may be due to recent weather related events and ongoing remedial activity in the Pittsfield, MA area of the Housatonic River.

3. Northern Pike

2012 is the fifth year that PCB levels in northern pike were sampled. While levels from Falls Village, Lake Lillinonah, and Bulls Bridge were within the Category E restriction level, PCB levels in Lake Zoar, are lower and fall within Category D restriction level. Previous sampling results in 2008 and 2010 from all sampling stations indicated high levels of PCBs in northern pike which were in the category D or E restriction level.

In summary, CTDPH has decided to maintain the advisory of Category E restriction level for the following reasons:

1. Past sampling has indicated very high levels of PCBs in northern pike in this river. This relatively high average PCB concentration was due to one fish with very high levels of PCBs (30 ppm) sampled in 2004. CT DPH believes this particular fish does not represent the fish in the Falls Village sampling station, but may have been a fish from the Pittsfield, Mass area. Even so, CT DPH has maintained an advisory based on these high PCB levels of Category E.
2. Five sampling rounds have indicated that PCB levels in northern pike remain generally high and should not be consumed.

3. 2012 sampling results have indicated an increase in PCB levels that may be due to recent weather related events and ongoing remedial activity in the Pittsfield, MA area of the Housatonic River.

4. Bluegill

Environmental data indicate that bluegill levels generally range within the restriction level of Category C to Category B for the Housatonic River and its Lakes. PCB levels in bluegill tend to be higher in stations along the upper Housatonic River (Bulls Bridge and Falls Village) than the Lakes along the Housatonic River. Generally, PCB levels in bluegill in the Housatonic River and its Lakes are lower than other fish sampled in 2012 and previous years and warrant a less strict consumption advisory than other fish sampled (except for fallfish). Bluegill PCB levels have generally decreased steadily over the years and don't seem to be affected by recent weather related events and ongoing remedial work in the Pittsfield area of the Housatonic River.

CTDPH has decided to strengthen the advisory for bluegill on the Housatonic River to Category C and maintain Category B for the Lakes along the Housatonic River for the following reasons:

1. In 2012, PCB levels in bluegill in Lakes Lillinonah and Zoar were low enough to allow limited consumption as seen in previous years and have continued to decrease over the years.
2. While 2012 data indicate that PCB concentrations in bluegill found in the Housatonic River have decreased steadily over the years, they are too high to allow for more consumption.
3. Further sampling is necessary to show that PCB levels in bluegill are low enough to allow more consumption.

5. Fallfish

2012 is the first year that fallfish from the Housatonic River have been sampled. PCB levels in fallfish are high enough to warrant a consumption advisory of Category C for both the Housatonic River and its Lakes for the following reasons:

1. In 2012, PCB levels in fallfish in along the Housatonic River are high enough to warrant limited consumption.
2. Further sampling is necessary in both the Housatonic River to show that PCB levels in fallfish are low enough to allow more consumption.

CTDPH believes that this updated consumption advisory is necessary to protect public health while allowing community members to benefit from the nutritional advantages of eating fish.

Table 5. Updated 2012 Advisory for Five Fish Species in the Housatonic River and its Lakes.

Location	Fish Species	Restriction Category	Consumption Advisory	
			Previous (2013)	Updated (2014)
Housatonic River above Derby Dam [^]	Smallmouth Bass	D	1 Meal per 2 Months /Do Not Eat – High Risk	No Change
	Brown Trout	E	Do Not Eat-Everyone	No Change
	Northern Pike	E	Do Not Eat-Everyone	No Change
	Bluegill	C	1 Meal per week-Low Risk/1 Meal per month-High Risk	1Meal/Month-Everyone
	Fallfish	C	—	1 Meal/Month-Everyone
Lakes Housatonic, Zoar, and Lillinonah	Smallmouth Bass	C	1Meal/Month-Everyone	No Change
	Bluegill	B	1 Meal per week/1 Meal per month-High Risk	No Change
	Fallfish	C	1Meal/Month-Everyone	No Previous Advisory

[^]Includes West Cornwall, Falls Village, and Bulls Bridge sampling locations.

EVALUATION OF COMMUNITY CONCERNS

The following is a list of general concerns that CTDPH has received in recent years through community meetings and inquiries from the public and community leaders:

1. I eat fish often in the Housatonic River. Why have I not gotten sick?

The PCBs present in fish in the Housatonic River are not present at levels that will make you acutely (immediately) sick. They are chronic toxins (i.e. they take a long time to cause an effect). The health effects of concern for PCBs are potential cancers and developmental problems in children/fetuses. PCBs accumulate in your body over time. The more PCB contaminated fish you eat, the greater the PCB levels that will build up in your body. PCB exposure is a particular concern to pregnant women because the exposure their unborn child receives through the mother may be linked with development, behavioral, and learning problems in children.

2. I have eaten lots of fish from the Housatonic River. Is there medicine I can take to get rid of these chemicals?

There is no medicine or other procedure to get rid of the chemicals your body has accumulated from eating fish. The chemicals will very slowly leave your body over time. If you follow the advisory you will decrease your exposure and allow your body the time needed to reduce the levels of the chemicals.

3. Are there areas along the Housatonic River that have less contaminated fish?

The Housatonic River (below Derby Dam) as well as Lakes Lillinonah and Zoar are areas that are less contaminated. You can safely eat a greater amount of fish from these areas.

4. I am concerned that there are not enough signs along the river to alert people to this advisory. In addition, I am concerned that there may be a language barrier preventing people from understanding these signs.

Signs are posted by conservation officers at every access point along the Housatonic River. If you need more signs, contact the CTDEEP, Bureau of Natural Resources, Inland Fisheries Division to request signs. Consumption advisory signs in other languages have been prepared and are posted in areas where these populations are thought to fish. Recently, more signs have been placed in these areas in response to this concern.

CONCLUSIONS

Another round of fish tissue data shows that five different fish species from five locations along the Housatonic River continue to have elevated levels of PCBs. CTDPH uses this fish tissue data to issue a general fish consumption advisory for the northern section of the Housatonic River above Derby Dam. The current PCB levels (based on 2012 data) are elevated enough to warrant a continued consumption advisory. Before 2012, there was a general decrease in PCB levels over time, but in some fish species sampled in 2012, there was an increase in PCB levels possibly as a result of recent weather related events and ongoing remedial work performed on the Massachusetts portion of the Housatonic River. CTDPH has decided to maintain the advisory of “do not eat-everyone” for brown trout and northern pike because PCB levels in these species have continued to be consistently elevated throughout the Housatonic River and its Lakes. In addition, a new consumption advisory on fallfish has been made after the presence of elevated PCB levels were found in that species along the Housatonic River. Since PCB levels have consistently been elevated in bluegill in the upper part of the Housatonic River (but not the Lakes), the consumption advisory was strengthened to “One meal per month-everyone” in that location and the current advisory for bluegill in the Housatonic Lakes of “1 meal/month, high risk, 1 meal/week, low risk” will be maintained.

CTDPH has concluded that eating five fish species from West Cornwall, Lake Lillinonah, Lake Zoar, Bulls Bridge, and Falls Village over a long period of time could harm people’s health if they do not follow the consumption advisory. If community members adhere to the current consumption advisory, exposure to PCBs in fish should not be significant enough to cause adverse health effects. CTDPH believes that this updated consumption advisory is necessary to protect public health while allowing community members to benefit from the nutritional advantages of eating fish.

RECOMMENDATIONS

1. CTDPH recommends that the CTDEEP continue to work with GE and request a biennial PCB fish sampling plan and report for the Housatonic River. CTDPH also recommends that CT DEEP continue to consult and share information with CTDPH throughout this process.
2. CTDPH recommends that the CTDEEP Inland Fisheries Division continue to work with CTDPH to educate fishing populations along the Housatonic River about the consumption advisory.

PUBLIC HEALTH ACTION PLAN

Actions Taken

1. CTDPH along with CTDEEP Inland Fisheries Division have worked together to educate both the general public as well as minority fishing populations along the Housatonic River about the consumption advisory. CTDEEP has posted signs along the river to inform the public about the consumption advisory.
2. As a result of the 2004 sampling results, CTDPH held a “Train the Trainer” session in May 2007 to educate leaders in the Housatonic River community about Connecticut’s fish consumption advisory issues so that they will be able to educate other members of the community.
3. CTDPH added questions to the 2008 CTDEEP CREEL (angler) survey to gain information about the level of knowledge of the fish consumption advisory. Almost all of the anglers surveyed were informed of the fish consumption advisory and only one angler who knew of the advisory chose to ignore it.
4. CTDPH has performed a ‘Train the Trainer’ session on Fish Consumer Advisories in August 2011 for the Hispanic Health Council since an earlier consumer survey indicated that Hispanics have a low knowledge of the advisory.
5. CT DPH, along with CT DEEP has entered into negotiations with GE concerning long term remedial actions for the Housatonic River. One of the final proposed goals of these remedial actions is that PCB levels in fish would be reduced to low enough levels so that consumption advisories would not be necessary to protect public health.

Actions Planned

1. CTDPH and CTDEEP will continue to work together to educate the general public as well as minority subsistence fishing populations along the Housatonic River about the consumption advisory.
2. CTDPH will update its Housatonic River fish consumption advisory in the 2014 in response to the 2012 fish sampling data. The advisory will be printed in our annual brochure, “If I Catch It, Can I Eat It” and distributed to towns and local health departments along the Housatonic River as well as posted on the CTDPH website.
3. CTDPH will continue to evaluate new fish contaminant data and will update its current Housatonic River fish consumption advisory as needed.
4. CTDPH will continue to review its fish sampling protocol periodically and modify it as appropriate.

5. CTDPH will review and update its fish consumption advisory signs as necessary in 2014 as well as ensure that sufficient signage has been posted along Connecticut waterways.

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REPORT PREPARATION

This Health Consultation was prepared by the Connecticut Department of Public Health under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with the approved agency methods, policies, procedures existing at the date of publication. Editorial review was completed by the cooperative agreement partner. ATSDR has reviewed this document and concurs with its findings based on the information presented. ATSDR's approval of this document has been captured in an electronic database, and the approving agency reviewers are listed below.

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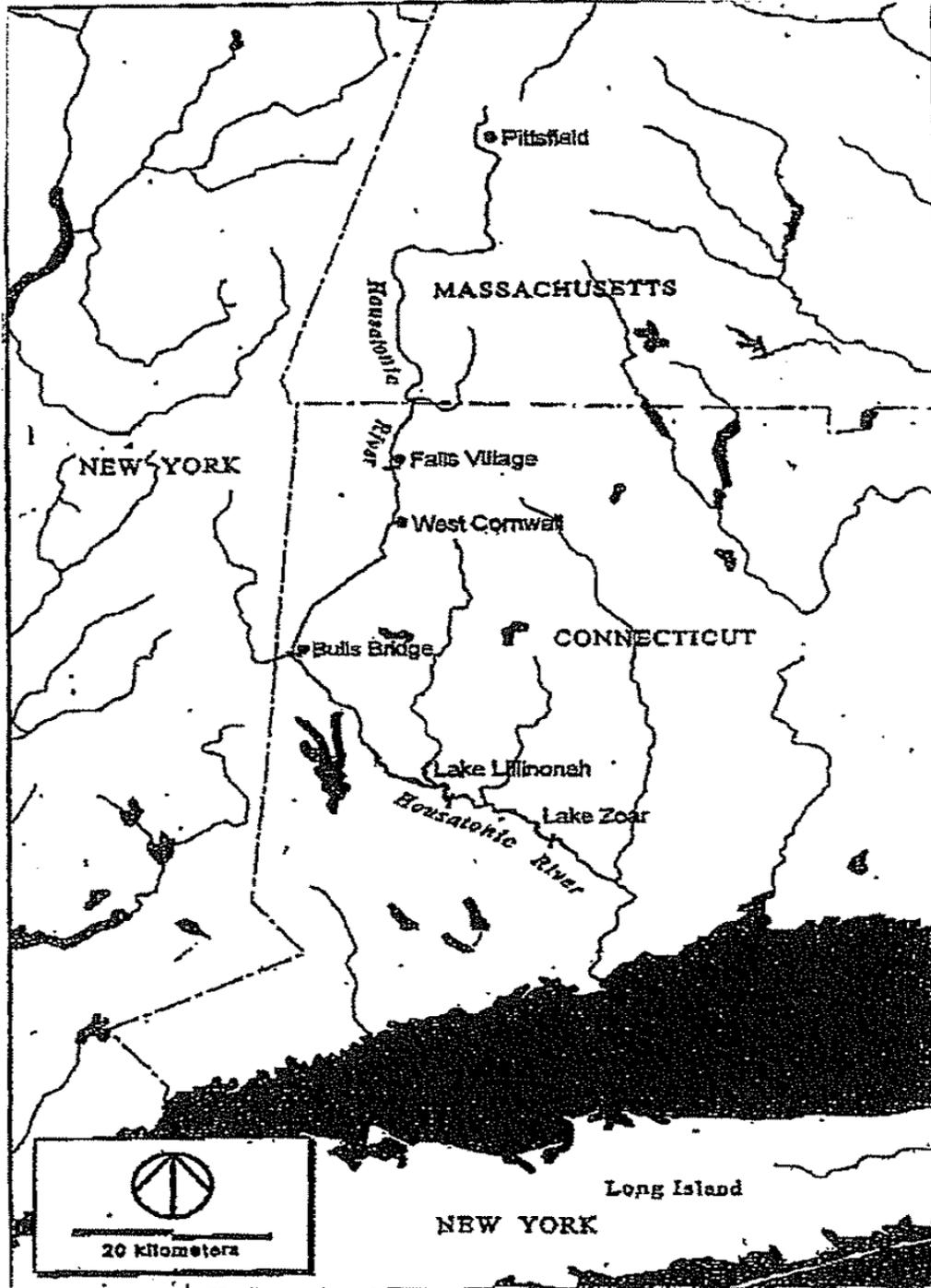
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Appendix A
Map of Sampling Locations along the Housatonic River



Appendix B

Risk Based PCB Fish Concentrations for Different Meal Frequencies Developed in the Great Lakes Protocol

- No advice for consumption for concentrations ≤ 0.05 ppm (assuming 1 meal every 1.6 days or 140 grams fish/day).
- One meal per week for concentrations 0.06 to 0.2 ppm
- One meal per month for concentrations 0.21 to 1.0 ppm
- One meal every other month for concentrations 1.1-1.9 ppm
- No consumption > 1.9 pm