ALABAMA POWER COMPANY
BIRMINGHAM, ALABAMA

COOSA – WARRIOR RELICENSING PROJECT

E5 Toxins Issue Report

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1.0 INTRODUCTION

The Alabama Power Company (APC) is currently relicensing nine hydroelectric projects on the Coosa and Warrior Rivers. The relicensing process includes a multi-year cooperative effort between APC and interested stakeholders to address operational, recreational, and ecological concerns associated with hydroelectric project operations. During the initial (scoping) phase of the relicensing process, APC consulted a wide variety of stakeholders, including state and federal resource agencies, non-governmental organizations, and concerned citizens, seeking their input on important relicensing issues. Relicensing stakeholders identified several issues they believe need to be addressed during this relicensing process, including toxin levels within the Coosa and Warrior River hydroelectric projects.

As part of the cooperative process, APC worked with stakeholders to further refine the toxins issue, which is presented in the E5 Toxins Issue Sheet (Appendix A). The primary purpose of this report is to educate stakeholders on the status of toxins and resulting fish advisories within the Coosa and Warrior projects. Specifically, it provides a baseline of information needed to address specific concerns identified in the Issue Sheet, including:

- A summary of how toxins enter into and cycle within the aquatic environment,
- Information on how toxins are regulated and monitored in the Coosa and Warrior Basins,
- A summary of which toxins are of concern within the project boundaries of APC’s Coosa and Warrior developments, and
- A summary of the current fish advisories in effect for these toxins.

Any questions regarding this report should be directed to APC relicensing staff.
2.0 TOXINS IN THE AQUATIC ENVIRONMENT

During the last century, industrial manufacturing processes, farming practices, and common household chores have all benefited from the use of artificial chemicals. However, some of these substances have either accidentally or intentionally been released into the environment, sometimes resulting in toxic impacts. Toxins are generally stable and persistent substances that in some cases can accumulate over time in aquatic and terrestrial species and habitats. In the aquatic environment, toxins often accumulate in sediments where they may be taken up by aquatic plants. Some toxins accumulate at successively higher concentration as they are passed up the food chain from green plants, to small fish and invertebrates, to larger game fish, and may eventually build up to levels that may be toxic to human consumers. This process is known as bioaccumulation. Whether or not a toxin bioaccumulates up the food chain is the primary factor determining the potential for human exposure through fish consumption.
3.0 REGULATION AND MONITORING OF TOXINS IN THE COOSA AND WARRIOR BASINS

Several federal and state agencies, including the U.S. Environmental Protection Agency (EPA), the Alabama Department of Environmental Management (ADEM), the Alabama Department of Public Health (ADPH), and the U.S. Army Corps of Engineers (ACOE) share in the responsibility of regulating or addressing toxins at some level in the Coosa and Warrior River Basins.

The EPA regulates chemicals and toxic substances through specific provisions of the Clean Water Act, Resource Conservation and Recovery Act, the Comprehensive Environmental Response, Compensation and Liability Act, Toxic Substances Control Act, and several other statutes. The EPA also monitors and responds to concerns about environmentally-accessible toxins through its Persistent Bioaccumulative and Toxic (PBT) Chemical Program.

For aquatic systems, the EPA requires that state and local governments protect people from potential risks of eating contaminated fish and shellfish by monitoring their waters and issuing consumption advisories when necessary. In Alabama, this requirement is fulfilled through the state Fish Tissue Monitoring Program (FTMP), which is jointly administered by ADEM and ADPH.

Since toxins accumulate in lake and stream sediments, the dredging of these sediments can influence the movement of toxins in aquatic systems. The ACOE regulates lake and river sediment dredging through their Dredge and Fill Permits under Section 404 of the Clean Water Act. The APC permitting process addresses the requirements associated with dredging.

3.1 Alabama Fish Tissue Monitoring Program (FTMP)

The FTMP was initiated as a cooperative effort between the ADEM, the ADPH, the Alabama Department of Conservation and Natural Resources (ADCNR), and the Tennessee Valley Authority (TVA) to monitor fish tissues throughout the state for toxins posing a risk to human health. As part of the FTMP, several waterbodies are sampled each year based on a predetermined rotation schedule. Water bodies that have been
identified as having elevated concentrations of bioaccumulative fish tissue contaminants, or greater potential for contamination, are more closely monitored. Since most toxins are concentrated in the fatty tissues of fish, field collections occur in the fall of each year when fish are preparing for winter and most pollutants of concern would be expected to be stored at their highest concentrations (ADPH, 2002). Fish tissue samples are screened by ADEM’s Environmental Laboratory for polychlorinated biphenyls (PCBs), arsenic, chlordane, toxaphene, mercury, mirex, DDT, DDD, DDE, dieldrin, dursban, endrin, heptachlor, heptachlorepoxide, endosulfan, hexachlorobenzene, lindane, and certain heavy metals (ADEM, 1998).

At the request of stakeholders, a summarized description (from the ADPH website) of the standard protocol for sampling fish tissues in Alabama has been included in Appendix B of this report.
4.0 FISH CONSUMPTION ADVISORIES

Based on fish toxin levels provided through the FTMP, the ADPH calculates potential risk to human consumers and issues consumption advisories as necessary. Advisories are based on the risk of cancer or other serious illnesses that may result from eating contaminated fish. Risk calculations are generally extremely conservative and highly protective. For example, excess cancer risk is usually expressed as 1 in 100,000 or 1 in 1,000,000 additional cancers over a lifetime of consumption. Advisories for non-cancer causing agents are usually based on chemical levels below which no adverse effects are found in animal studies. The level shown by animal studies to be safe is usually divided by 10 or more to determine a daily level of intake that is likely to be without risk of adverse health affects for humans. Women of childbearing age and children may be particularly vulnerable to the effects of toxic substances. Therefore, some advisories particularly limit consumption by these groups (ADPH, 2002).

According the ADPH, advisories are recommendations designed to aid fishermen in understanding the potential risks associated with eating contaminated fish and do not constitute a ban on fish consumption. Fishermen may legally continue to catch fish from waters for which advisories have been issued and may choose to eat them (ADPH, 2002). Currently, two types of advisories are issued in Alabama:

- A limited-consumption advisory states that women of reproductive age and children less than 15 years old should avoid eating certain fish from a defined area. Other people should limit their consumption of the particular species to one meal per month.
- A no-consumption advisory recommends that everyone should avoid eating certain species of fish from the defined area.

Fish consumption advisories issued by the ADPH are generally updated on an annual basis. The most current advisories for all counties in Alabama are provided in Appendix B of this report. Updates to advisories are available on the ADPH website, located at http://www.adph.org. At the request of stakeholders, information from the ADPH website
detailing how fish consumption advisories are formulated in Alabama is also included in Appendix B of the this report.

An ADPH publication entitled “Get Hooked on Health” is also included in Appendix B. It contains valuable information on cooking, handling, and preparation methods that can help reduce potential exposure to contaminated fish, as well as which species are best to consume to minimize potential risk. Paper copies of “Get Hooked on Health”, as well as current fish advisories, are available by contacting the Risk Assessment and Toxicology Branch of the ADPH at (334) 206-5973 or toll free at (800) 201-8208.
5.0 TOXINS OF CONCERN IN THE COOSA AND WARRIOR BASINS

As part of the Coosa and Warrior relicensing effort, stakeholders have requested that additional information be provided regarding the status of four specific toxins: mercury, dioxins, PCBs, and arsenic (from treated lumber). Because these are bioaccumulative toxins, the primary means of non-occupational human exposure is through consumption of contaminated fish. Extensive fish tissue sampling has been conducted in both the Coosa and Warrior basins by ADEM as part of the FTMP, and as a result, represents the best available measure of whether or not the toxins identified are of concern within the basins. The following sections detail the status of each of the identified toxins based on FTMP sampling efforts and resulting fish consumption advisories. In addition, information requested by stakeholders regarding reservoir stratification / destratification processes and their potential effects on contaminated sediments is also provided.

5.1 Mercury

Mercury is a naturally occurring metal used in the manufacture of a variety of products including batteries, electrical switches, fluorescent lamps, and certain paints (Harte et al., 1991; EPA, 2002c). Mercury can be released to the aquatic environment through the manufacture and disposal of such products, as well as through activities such as mining, smelting, municipal waste incineration, and fossil fuel combustion. The EPA and Agency for Toxic Substances and Disease Registry (ATSDR) Fact Sheets, included in Appendix C, provide additional detailed information regarding cycling and bioaccumulation of mercury in the environment.

Although stakeholders have expressed concern over this toxin, sampling conducted as part of the FTMP in the Coosa and Warrior basins has not indicated elevated levels of mercury. Further, no fish advisories are currently in effect for mercury in either basin (See Appendix B for current consumption advisories). Therefore, mercury is not a specific toxin of concern in the Coosa or Warrior basins.
5.2 Dioxins

Dioxins are a group of several hundred synthetic (man-made) organic compounds that share similar chemical structures and biological characteristics as PCBs (EPA, 2002d). Most are not intentionally produced, but rather are by-products of combustion and several industrial chemical processes. Dioxins primarily enter the environment through incineration of medical, industrial, and municipal wastes (Podoll et al., 1986); production of bleached wood pulp and paper (Fletcher and McCay, 1993); and smelting of metals and chlorine-related manufacturing processes (i.e. herbicides; EPA, 1998). Additional detailed information regarding dioxins in the environment is provided in Appendix D.

Although stakeholders have expressed concern over this toxin, sampling conducted as part of FTMP in the Coosa and Warrior basins has not indicated elevated levels of dioxins. Further, no fish advisories are currently in effect for dioxins in either basin (See Appendix B for current consumption advisories). Therefore, dioxin is not a specific toxin of concern in the Coosa or Warrior basins.

5.3 Arsenic

Arsenic is a naturally occurring element that has historically been released to the environment in unnatural levels through smelting, coal combustion, and use and manufacture of wood preservatives and pesticides (Harte et al., 1991). In recent decades, the use of pressure treated lumber (PTL) has become increasingly common in the Coosa and Warrior reservoirs as it has throughout the country. Pressure Treated Lumber is typically used in shoreline structures such as sea walls, fishing piers, marinas, decks and boat docks, as well as in bank stabilization and erosion protection projects. Additional detailed information for arsenic and arsenic-treated lumber, including information regarding environmental cycling, is included in Appendix E.

Although stakeholders have expressed concern over this toxin, sampling conducted as part of FTMP in the Coosa and Warrior basins has not indicated elevated levels of arsenic. Further, no fish advisories are currently in effect for arsenic in either
basin (See Appendix B for current consumption advisories). Therefore, arsenic is not a specific toxin of concern in the Coosa or Warrior basins.

During review of an earlier version of this report, stakeholders expressed concern over potential exposure to arsenic through direct dermal (skin) contact with PTL and requested that additional information be provided regards the use of painting and sealing of existing PTL structures as a means of minimizing such risk. The Connecticut Agricultural Experiment Station has conducted extensive research on this subject and recommends sealing of wood every two years by painting or sealing with an oil-based stain (CAES 2001). The EPA and ATSDR Fact Sheets included in Appendix E provide additional information regarding ways to minimize arsenic exposure.

It should also be noted that, as of March 17, 2003, the EPA cancelled the federal pesticide registration for Chromated Copper Arsenate (CCA), the arsenic compound used in the manufacture PTL. As a result of this cancellation, CCA products may no longer be used to treat wood intended for most residential uses effective December 30, 2003. Detailed information regarding EPA’s cancellation of CCA are provided in the EPA Topical and Chemical Fact Sheet entitled “Cancellation of Residential Uses of CCA-Treated Wood,” which is included in Appendix E of this report.

5.4 Polychlorinated Biphenyls (PCBs)

Polychlorinated biphenyls are a group of over 200 synthetic organic compounds for which there are no known natural sources (EPA, 2002a). Before production was banned in 1979, PCBs were used extensively in hydraulic and cutting oils, paints, electrical transformers and capacitors, and other products due to their non-corrosive and fire-resistant nature and their electrical and thermal insulating properties. Because they are completely synthetic, any releases to the environment are related to commercial manufacture, use, storage, and disposal of products containing PCBs (EPA, 2002a).

PCBs are very stable, are heavier than water, and exhibit low water solubility, resulting in a tendency to accumulate in lake and river sediments when released to the aquatic environment (EPA, 1999). PCBs are bioaccumulative toxins that concentrate in
tissues of organisms near the top of the aquatic food chain; making consumption of
contaminated predatory fish one of the primary routes of human non-occupational
exposure. The EPA and ATSDR Fact Sheets contained in Appendix F provide additional
detailed information regarding PCBs in the environment and how they impact fish
consumption advisories.

Fish consumption advisories are currently in effect for bioaccumulated PCBs for
eight distinct reaches of the Coosa Basin that are within the project boundaries of APC’s
hydroelectric developments (Table 5-1). However, studies conducted in the basin have
shown that PCB concentrations in fish tissues have been gradually decreasing through the
years (Bayne et al., 1993). There are no fish consumption advisories in effect for the
Warrior Basin.

During review of an earlier version of this report, stakeholders requested that
historical data regarding PCB levels in fish from the Coosa Basin, and in particular
Choccolocco Creek, be included in the report. As a result, an ATSDR report entitled
“Polychlorinated Biphenyls in Fish from Choccolocco Creek” has been included in
Appendix F.
<table>
<thead>
<tr>
<th>Water Body</th>
<th>County</th>
<th>Species</th>
<th>Portion</th>
<th>Pollutant</th>
<th>Advisory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coosa River</td>
<td>Cherokee</td>
<td>Catfish over 1 lb.</td>
<td>Georgia State line to Weiss Dam</td>
<td>PCBs</td>
<td>Limited consumption</td>
</tr>
<tr>
<td>Coosa River</td>
<td>Etowah</td>
<td>Channel catfish</td>
<td>In the Croft Ferry area of the Neely Henry Reservoir (Alabama Power reservoir mile 54)</td>
<td>PCBs</td>
<td>No consumption</td>
</tr>
<tr>
<td>Coosa River</td>
<td>Calhoun; St. Clair; Talladega</td>
<td>Catfish over 1 lb.</td>
<td>Between Neely Henry Dam and Riverside, AL</td>
<td>PCBs</td>
<td>Limited consumption</td>
</tr>
<tr>
<td>Coosa River</td>
<td>St. Clair, Talladega</td>
<td>Striped bass, Catfish over 1 lb. and Crappie</td>
<td>Between Riverside and Vincent including the Logan Martin Reservoir</td>
<td>PCBs</td>
<td>No consumption</td>
</tr>
<tr>
<td>Coosa River</td>
<td>St. Clair, Shelby, Talladega</td>
<td>Spotted or Striped bass, Catfish over 1 lb. and Crappie</td>
<td>Between Logan Martin Dam and the railroad tracks crossing the Coosa River near Vincent, AL</td>
<td>PCBs</td>
<td>No consumption</td>
</tr>
<tr>
<td>Coosa River</td>
<td>Chilton, Coosa, St. Clair, Shelby, Talladega</td>
<td>Striped bass, Crappie, Blue catfish and Spotted bass</td>
<td>Between Logan Martin Dam and Lay Dam</td>
<td>PCBs</td>
<td>No consumption</td>
</tr>
<tr>
<td>Coosa River</td>
<td>St. Clair</td>
<td>Spotted Bass</td>
<td>In upper Lay Reservoir approximately two miles downstream of Logan Martin Dam and one half mile downstream from the Kelly Creek – Coosa River confluence in the vicinity of Ratcliff/Elliot Island</td>
<td>PCBs</td>
<td>Limited consumption</td>
</tr>
<tr>
<td>Choccoloco Creek</td>
<td>Calhoun, Talladega</td>
<td>All species</td>
<td>Entire length of Creek from South of Oxford, downstream to where Choccoloco Creek flows into Logan Martin Lake</td>
<td>PCBs</td>
<td>No consumption</td>
</tr>
</tbody>
</table>
5.4.1 Sources of Contamination

PCB contamination in the Coosa River is believed to be related primarily to two sources: the General Electric (GE) manufacturing plant in Rome, Georgia (which closed in 1997) and the Monsanto (now called Solutia) facility in Anniston, Alabama (Bayne et al., 1993; EPA, 2001; 2002b).

*General Electric*

Prior to closure of the plant in 1977, GE used PCBs in the manufacturing of certain products, resulting in soil and groundwater contamination on some portions of the site (GE, 2003). In addition, stormwater run-off also resulted in contamination of some adjacent properties and watersheds, and likely contributed to the downstream contamination of the Coosa River system. Additionally, PCBs in wastewater discharges from the GE plant settled in the sludge at the Rome wastewater treatment plant. Historically, the city gave the sludge to area residents for use as fertilizer. Subsequently, storm water runoff from agricultural lands to which this sludge was applied resulted in PCB contamination in the watershed (GE, 2003).

*Solutia*

PCBs were first produced at the Anniston site in 1929 by the Swann Chemical Company. In 1935, Monsanto (now called Solutia) acquired the Anniston Plant and continued producing PCBs at the site until the early 1970’s (Solutia 2004). During this time, Monsanto disposed of hazardous and non-hazardous waste at two landfills adjacent to their Anniston Plant (EPA, 2001; 2002b). Based on the operations at the facility, activities occurred which contaminated adjacent properties, creeks, and eventually reaches of the Coosa River downstream. Storm water run-off from the plant site and other non-direct exposures also likely contributed to PCB contamination of the surrounding area.
5.4.2 Remediation Efforts

*General Electric*

GE has committed staff and resources to address environmental issues related to past manufacturing activities at both the plant site and off-site. In addition to providing regular reports to the City of Rome and Floyd County, GE has sponsored and participated in public meetings and hearings to share information about investigation and cleanup activities. Following the discovery of contamination at its Rome plant, the EPA placed GE under a consent order to reduce PCB contaminated runoff from the site (GE, 2003). As part of their response efforts, GE has employed a number of technologies to remove PCBs from the environment or prevent them from moving off-site. In addition, GE actively samples residential and industrial sites adjacent to its plant and has remediated or is planning remediation at several sites. Additional information regarding sampling results and remediation efforts can be found on the *GE Rome, GE Efforts* web page, located at [http://www.ge.com/en/commitment/ehs/rome_news/ehs_rome_sampling.htm](http://www.ge.com/en/commitment/ehs/rome_news/ehs_rome_sampling.htm).

*Solutia*

Local Citizens, EPA, ADEM, and Solutia have taken several actions over the past five years to begin addressing, controlling, reducing, and remediating PCB contamination resulting from the Anniston site. According to Solutia, the two landfills thought to be responsible for the majority of the contamination were capped using state-of-the-art technology in 1997 (Solutia 2003). In addition, Solutia has remediated more than a mile of ditches and more than 300 acres of land, including residential, public, and commercial sites.

Sampling for PCBs has been conducted on more than 8,000 acres of land and more than 40 miles of waterways in the vicinity of the Anniston Plant, including Logan Martin Lake, Choccolocco Creek, and Snow Creek (Solutia, 2003). Information regarding sampling results and remediation effort can be found on the Solutia web page, located at [http://www.solutia.com/pages/anniston/cleanup.asp](http://www.solutia.com/pages/anniston/cleanup.asp).
Solutia’s response activities are governed by the following:

(1) Partial Consent Decree, United States v. Pharmacia Corp. (p/k/a Monsanto Co.) and Solutia, Inc., Civil Action No. CV-02-PT-0749-E (N.D. Ala. October 23, 2002, approved August 4, 2003), - provides for expedited cleanup of residential properties and preparation of a Remedial Investigation and Feasibility Study by Solutia - for additional detailed information, please refer to EPA’s 2002 Anniston Site fact sheet in Appendix G; (2) Class Action Settlement Agreement, Dyer v. Monsanto, Civil Action No. CV-93-250, and Shelter Cove Mgmt. v. Monsanto Co., Civil Action No. CV-94-50PH (St. Clair County Cir. Ct. Ala., June 9, 1999) – provides for compensation to plaintiffs related to PCB contamination and establishment of a $21.0 million remediation fund for PCB investigation and remediation activities related to Lake Logan Martin, Choccolocco Creek, Snow Creek, and tributaries of Snow Creek; and (3) Global Settlement Agreement, Tolbert v. Monsanto, Civil Action No. 01-C-1407-S (N.D. Ala. September 9, 2003) and Abernathy v. Monsanto, Civil Action No. CV-01-832 (Etowah County Cir. Ct., September 9, 2003).

5.5 Lake Stratification and Contaminated Sediments

In the Coosa and Warrior basins, stakeholders have expressed concerns regarding the effects of thermal and chemical stratification (and subsequent destratification) of the reservoirs on movement of sediments and resulting toxin levels within aquatic food chains. Thermal stratification occurs during the summer months when warming of surface waters causes the lake to separate into two distinct layers: a warmer, less dense surface layer (the epilimnion) and a cooler, more dense layer (hypolimnion). Chemical stratification occurs when the hypolimnion becomes oxygen-depleted due to lack of circulation with epilimnion (near the surface) where photosynthesis is taking place. Destratification (or lake turnover) occurs as surface water cools, becomes more dense and eventually mixes with the deeper water.

As discussed above, the only toxins of specific concern in the Coosa and Warrior basins are PCBs and elevated PCB levels only occur within a few sections of APC’s
reservoirs which are all located in the upper Coosa Basin. The reservoirs in the upper Coosa Basin are relatively shallow (with average depths ranging from 11 feet at Weiss to 18 feet at Logan Martin) and they display only weak thermal and chemical stratification. Accordingly, they generate only minimal mixing currents during the destratification process. Movement of sediments in and between these shallow lakes is more likely to occur during periodic flood events. It is important to note that APC can’t control flood events since they are an act of nature.

5.6 Impact on Relicensing

Stakeholders requested that APC identify modifications to hydroelectric project operations that have the potential to control toxin levels and reduce fish advisories. The only toxins of specific concern are PCBs in certain sections of reservoirs in the upper Coosa Basin. PCBs are highly persistent in the environment and their presence at elevated levels in the upper Coosa basin are the result of historical rather than current practices. There are no known modifications to project operations that would help control PCB levels in the Coosa system.
6.0 CONCLUSIONS

- The only toxins of specific concern in the Coosa or Warrior basins are PCBs in reservoirs in the upper Coosa Basin.
- Other toxins, such as mercury, dioxin, and arsenic are not found at elevated levels in the Warrior or Coosa Basins at this time.
- Fish advisories recommending limited or no consumption have been issued for specific portions of the upper Coosa River Basin, including some sections of APC reservoirs, for bioaccumulated PCBs only.
- No fish consumption advisories have ever been issued for the Warrior River or any of its reservoirs.
- The presence of PCBs in the Coosa Basin is a result of historical industrial practices.
- EPA, ADEM, other federal and state agencies and the courts are responsible for determining the appropriate sampling and remediation measures and they are actively working to address the two sources of PCBs in the upper Coosa basin.
- Movement of sediments in the system are primarily associated with periodic flood events beyond human control.
- PCB concentrations in the tissues of Coosa basin fish have been gradually decreasing, and this improvement will presumably continue in the future.
- There are no known modifications to project operations that would reduce PCB or other toxin levels within the Coosa and Warrior basins.
- APC does not release toxins into the Warrior or Coosa Projects nor does it have the regulatory authority to manage toxins released by other parties.

Recommendation to CCRT and WCRT
- APC will assist the Alabama Department of Public Health with their posting of consumption advisories at APC’s public recreation areas in the Coosa Basin.
7.0 INFORMATION SOURCES/LITERATURE CITED


APPENDIX A

E5 – Toxins Issue Sheet
CE 5  Toxins - Effect of toxins (e.g., PCB, mercury, and dioxin) in the Coosa Basin on the aquatic resources of the project study area.

Description of the Issue:

Stakeholders are concerned over the number of fish advisories that exist on the Coosa River system and would like to understand the basis of these fish advisories. They would like APC to educate them on how toxins cycle in the Coosa River system (specifically PCB, mercury, and dioxin) and to identify modifications to project operations that would change the current extent of fish advisories (improve or worsen). Stakeholders are also concerned about the potential localized impact of using treated wood for structures in or near the water to water quality and fish. Stakeholders are also interested in reviewing other activities in the basin to determine what level of impact those programs or activities have on the toxin levels in the river. The goal is to educate stakeholders on toxins and fish advisories and to identify modifications to project operations and other non-APC program activities that could reduce the adverse impacts of identified toxins.

Specific issues or requests identified include:

- How does lake stratification affect bottom sediments in relation to cycling of PCB, mercury, and other toxins?
- Does using treated wood for structures in or near the water affect water quality and fish?
- Can APC operate the system to help control or reduce fish advisories?
- Limit the study area to the project boundary.

Specific questions and suggestions identified include:

- All public access areas should have fish advisory signs posted (where applicable).
- APC should partner with ADEM and the County Health Departments regarding fish advisories on the reservoirs.
APPENDIX B
Current Alabama Fish Consumption Advisories
Summarized ADPH Fish Tissue Sampling Methodology
Summarized ADPH Fish Consumption Advisory Methodology
ADPH “Get Hooked on Health” Publication
<table>
<thead>
<tr>
<th>Water Body</th>
<th>County</th>
<th>Species</th>
<th>Portion</th>
<th>Pollutant</th>
<th>Type Advisory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bay Minette Creek</td>
<td>Baldwin</td>
<td>Largemouth bass</td>
<td>Entire creek</td>
<td>Mercury</td>
<td>No Consumption</td>
</tr>
<tr>
<td>Big Escambia Creek</td>
<td>Escambia</td>
<td>Largemouth Bass</td>
<td>Louisville &amp; Nashville RR Bridge Crossing</td>
<td>Mercury</td>
<td>No Consumption</td>
</tr>
<tr>
<td>Blackwater Creek</td>
<td>Baldwin</td>
<td>Largemouth Bass</td>
<td>Area between mouth of river and railroad bridge crossing SE and between Co. Rd. 4 bridge and AL/FL line</td>
<td>Mercury</td>
<td>No Consumption</td>
</tr>
<tr>
<td>Chickasaw Creek</td>
<td>Mobile</td>
<td>Largemouth bass</td>
<td>Entire creek</td>
<td>Mercury</td>
<td>No Consumption</td>
</tr>
<tr>
<td>Choccolocco Creek</td>
<td>Calhoun</td>
<td>All Species</td>
<td>Entire length of Creek from South of Oxford, downstream to where Choccolocco Creek flows into Logan Martin Lake</td>
<td>PCBs</td>
<td>No Consumption</td>
</tr>
<tr>
<td>Cold Creek Swamp</td>
<td>Mobile</td>
<td>All Species</td>
<td>From confluence of Cold Creek with the Mobile River west through the Swamp</td>
<td>Mercury</td>
<td>No Consumption</td>
</tr>
<tr>
<td>Conecuh River</td>
<td>Escambia</td>
<td>Largemouth Bass</td>
<td>At Pollard Landing approx. 8.6 mi. downstream of paper mill</td>
<td>Mercury</td>
<td>No Consumption</td>
</tr>
<tr>
<td>Coosa River</td>
<td>Cherokee</td>
<td>Catfish over 1 pound</td>
<td>Georgia state line &amp; Weiss Dam</td>
<td>PCBs</td>
<td>Limited Consumption</td>
</tr>
<tr>
<td>Coosa River</td>
<td>Calhoun</td>
<td>Catfish over 1 pound</td>
<td>Between Neely Henry Dam &amp; Riverside, AL</td>
<td>PCBs</td>
<td>Limited Consumption</td>
</tr>
<tr>
<td>Coosa River</td>
<td>St. Clair</td>
<td>Striped bass, catfish</td>
<td>Between Riverside and Vincent, including the Logan Martin Reservoir</td>
<td>PCBs</td>
<td>No Consumption</td>
</tr>
<tr>
<td>Coosa River</td>
<td>St. Clair</td>
<td>Spotted or stripe bass</td>
<td>Between Logan Martin Dam &amp; the railroad tracks crossing the Coosa River near Vincent, AL</td>
<td>PCBs</td>
<td>No Consumption</td>
</tr>
<tr>
<td>Coosa River</td>
<td>Chilton, Coosa, Shelby, St. Clair</td>
<td>Striped bass, Crappie, Blue Catfish, Spotted bass</td>
<td>Between Logan Martin Dam &amp; Lay Dam</td>
<td>PCBs</td>
<td>No Consumption</td>
</tr>
<tr>
<td>Coosa River</td>
<td>St. Clair</td>
<td>Spotted bass</td>
<td>In upper Lay Reservoir approximately two miles downstream of Logan Martin Dam and one half mile downstream from the Kelly Creek - Coosa River confluence in the vicinity of Ratcliff/Elliot Island</td>
<td>PCBs</td>
<td>Limited Consumption</td>
</tr>
<tr>
<td>Coosa River</td>
<td>Etowah</td>
<td>Channel catfish</td>
<td>In the Croft Ferry area of Neely Henry Reservoir (Alabama Power Reservoir Mile 54)</td>
<td>PCBs</td>
<td>No Consumption</td>
</tr>
<tr>
<td>Escatawpa River</td>
<td>Mobile</td>
<td>Largemouth Bass</td>
<td>Entire River</td>
<td>Mercury</td>
<td>No Consumption</td>
</tr>
<tr>
<td>Fish River</td>
<td>Baldwin</td>
<td>Largemouth bass</td>
<td>Entire river</td>
<td>Mercury</td>
<td>No Consumption</td>
</tr>
<tr>
<td>Fowl River</td>
<td>Mobile</td>
<td>Largemouth bass</td>
<td>Entire river</td>
<td>Mercury</td>
<td>No Consumption</td>
</tr>
<tr>
<td>Gulf Coast</td>
<td>Baldwin</td>
<td>King Mackerel</td>
<td>Entire coast</td>
<td>Mercury</td>
<td>No Consumption</td>
</tr>
<tr>
<td>Gulf Coast</td>
<td>Baldwin</td>
<td>King Mackerel</td>
<td>Entire coast</td>
<td>Mercury</td>
<td>Limited Consumption</td>
</tr>
<tr>
<td>Huntsville Spring Branch &amp; Indian Creek</td>
<td>Madison</td>
<td>Small mouth buffalo, Bigmouth buffalo</td>
<td>From Redstone Arsenal to the Tennessee River</td>
<td>DDT</td>
<td>No Consumption</td>
</tr>
<tr>
<td>Little Escambia Creek</td>
<td>Escambia</td>
<td>Spotted Bass</td>
<td>At U.S. Hwy 31/29 Bridge</td>
<td>Mercury</td>
<td>No Consumption</td>
</tr>
<tr>
<td>Middle River</td>
<td>Mobile</td>
<td>Largemouth Bass</td>
<td>4.5 mi. above confluence w/ Tensaw River</td>
<td>Mercury</td>
<td>No Consumption</td>
</tr>
<tr>
<td>Mobile River</td>
<td>Mobile</td>
<td>Largemouth bass</td>
<td>At and South of the Confluence of Cold Creek</td>
<td>Mercury</td>
<td>Limited Consumption</td>
</tr>
<tr>
<td>Opossum Creek</td>
<td>Jefferson</td>
<td>Largemouth Bass</td>
<td>From the pumping station to the confluence w/ Valley Creek</td>
<td>Mercury</td>
<td>No Consumption</td>
</tr>
<tr>
<td>Styx River</td>
<td>Baldwin</td>
<td>Largemouth Bass</td>
<td>Entire River</td>
<td>Mercury</td>
<td>No Consumption</td>
</tr>
<tr>
<td>Styx River</td>
<td>Baldwin</td>
<td>Channel Catfish</td>
<td>Entire River</td>
<td>Mercury</td>
<td>Limited Consumption</td>
</tr>
<tr>
<td>Tensaw River</td>
<td>Baldwin</td>
<td>Largemouth Bass</td>
<td>Entire river</td>
<td>Mercury</td>
<td>Limited Consumption</td>
</tr>
<tr>
<td>Water Body</td>
<td>County</td>
<td>Species</td>
<td>Portion</td>
<td>Pollutant</td>
<td>Type Advisory</td>
</tr>
<tr>
<td>-------------</td>
<td>----------</td>
<td>----------------------------------</td>
<td>-------------------------------------------------------------------------</td>
<td>------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Three Mile Creek</td>
<td>Mobile</td>
<td>Atlantic croaker</td>
<td>Downstream of railroad trestle down to one mile upstream of confluence with Mobile River</td>
<td>Chlordane 3</td>
<td>No Consumption 1</td>
</tr>
<tr>
<td>Three Mile Creek</td>
<td>Mobile</td>
<td>Striped bass, Speckled trout</td>
<td>Downstream of railroad trestle down to one mile upstream of confluence with Mobile River</td>
<td>Chlordane 3</td>
<td>Limited Consumption 2</td>
</tr>
<tr>
<td>Tombigbee River</td>
<td>Washington</td>
<td>Largemouth bass, Channel catfish</td>
<td>At rivermile 60.5</td>
<td>Mercury 4</td>
<td>No Consumption 1</td>
</tr>
<tr>
<td>Valley Creek</td>
<td>Jefferson</td>
<td>Largemouth Bass</td>
<td>Around the confluence of Opossum Creek</td>
<td>Mercury</td>
<td>No Consumption</td>
</tr>
<tr>
<td>Yellow River</td>
<td>Covington</td>
<td>Largemouth Bass</td>
<td>At Co. Rd. 4 bridge crossing approx. 1.5 mi. upstream of AL/FL line</td>
<td>Mercury</td>
<td>No Consumption</td>
</tr>
</tbody>
</table>
Summarized Protocol for Fish Tissue Sampling

The fish tissue sampling program monitors fish on a rotational basis from 28 major lakes (reservoirs), 28 smaller lake and stream locations, and 20 state lakes managed specifically for fishing by the Alabama Department of Conservation and Natural Resources. Fish are sampled late in the growing season, which in Alabama is from late September through mid to late November. For most species, their lipid content is highest late in the growing season. Since lipids are an important reservoir for organic pollutants, sampling the fish when their lipid content is highest more accurately describes the amount of organic pollutants in the samples.

Certain target species are selected for sampling. The target species are chosen the following criteria. They should be abundant and large enough to provide adequate tissue samples for chemical analysis. The species selected are those commonly consumed in the study area and those of commercial, recreational, or subsistence fishing value. Lastly, the species selected are those that have the potential to bioaccumulate high concentrations of chemical contaminants and have a wide geographic distribution (EPA 823-R-95-007, 1995).

Two distinct ecological groups of finfish (i.e., bottom-feeders and predators) are used as target species. Bottom-feeding species may accumulate high contaminant concentrations from direct physical contact with contaminated sediment and/or by consuming invertebrates and organisms that live in contaminated sediment. Predator species are also good indicators of persistent pollutants. Freshwater target species are the predatory species: largemouth bass, spotted bass, smallmouth bass, black crappie, white crappie, flathead catfish, and the bottom-feeding species: channel catfish, blue catfish, white catfish, common carp, and smallmouth buffalo. These species are sampled for contaminants and our fish advisories are based upon the results.


Source: http://www.adph.org/RISK/fishsmpl.htm
Alabama Waterways

Fish Advisories

General

The State of Alabama has an abundance of clean rivers and lakes. These waters present sport fishermen with great recreation, while providing subsistence fishermen with an abundance of good food. However, fishermen need to understand both the benefits and the risks of their fish consumption practices. This awareness is especially important in areas where fish consumption advisories have been issued.

The benefits of fishing are many. It provides stress-reducing recreational and outdoor activity needed for good health. Fish are high in protein; and low in fat, cholesterol, and calories when prepared properly.

Unfortunately, certain toxic chemicals have been found in some lakes and rivers in Alabama. Some of these chemicals can accumulate in fish. With some of the materials, higher levels of contaminants can be found in older and/or larger fish. When chemical concentrations are elevated in fish, they can pose health risks to people who eat them. Sampling of fish (http://www.adph.org/RISK/fishsmpl.htm) provides the information (levels of contaminants) needed for issuing the advisories.

The advisories (http://www.adph.org/RISK/Alabama Fish Consumption Advisories 03.pdf) are developed to inform fishermen which species of fish in which water bodies may present an elevated health hazard. They also explain the potential health hazards associated with eating certain contaminants. Finally, the advisories tell how to reduce contamination ingestion by changing the way the fish is prepared. The advisories are designed to provide sufficient information to permit individuals to make an informed choice on whether or how a great a risk to take from consuming fish that may be contaminated.
Contaminants in Fish

Fish consumption advisories have been issued for chlordane, DDT, mercury, and polychlorinated biphenyls (PCBs).

Chlordane is a chlorinated hydrocarbon frequently used as a pesticide until it was banned in the late 1980's. Contamination problems presently exist from run off in agricultural land and other areas where it was heavily used.

DDT is another chlorinated hydrocarbon used as a pesticide, especially against mosquitos, during World War II. The United States permitted the commercial use of DDT in 1945. It was a widely used pesticide until it was banned in 1972.

Mercury is a naturally occurring element and is used in a variety of products such as barometers, thermometers, paints, and batteries, although manufacturers are seeking non-mercury alternatives for many of these uses. Manufacturers also use mercury in the production of chlorine, caustic soda, urethane foam, and other products. Such wide use has led to unintentional contamination of the environment. Mercury has also been taken up in growing trees and vegetation. Burning of the materials, either as wood or as coal, can result in the release of mercury into the air. A large source of this exposure route is from industries which burn coal as fuel. Once in the environment, mercury is converted to methyl mercury, which is the chemical form that is most hazardous to human health. In recent years, the government has promulgated regulations to limit or ban the use of mercury in various products and industrial processes.

PCBs constitute a class of compounds previously used in electrical capacitors and transformers and in the pressure treatment of lumber. These uses developed because the chemicals have good dielectric and fire resistance properties. In 1979 the U.S. Environmental Protection Agency (EPA) prohibited all manufacture of PCBs. However, due to the persistence of these materials in the environment, they can be leached into waterbodies from where fish can be exposed.

All of these chemicals tend to persist in the environment. Chlordane, DDT, and PCBs collect in fatty tissue, while mercury collects in muscle tissue of fish. The presence of toxic contaminants in Alabama waters should decrease due to the current regulations which ban or restrict their use. Advisory numbers should decrease as the contaminants work their way out of the waterways.
Advisories (http://www.adph.org/RISK/Alabama Fish Consumption Advisories 03.pdf) are used to help fishermen realize and reduce the potential health risks from eating contaminated fish. When advisories are issued, fishermen can continue to catch fish and may choose to eat them; an advisory is only a recommendation.

Advisories are based on the risk of cancer or other serious illnesses that may result from eating contaminated fish. Regulations are based on the level of a material that produces an effect in laboratory animals; the most sensitive endpoint is selected as the basis for the level of material which may be permitted into the food supply. In other words, if a dose of a material causes cancer, but a lower dose produces birth defects or developmental disabilities in the offspring of an animal fed the material, the regulatory limit would be based on the lower level. A cancer risk is usually described as the number of additional cancers than might be expected over a lifetime of consumption. Therefore, the cancer risk from eating a few fish from the area over a few years is slight. Advisories for non-cancer causing agents are usually based on a level of a chemical below which no adverse health effects are found, as determined in animal studies. The safe level derived from animal studies to be is further divided by 100 or more to determine a daily level of intake that is likely to be without risk of adverse health effects for humans. Women of childbearing age and children may be particularly vulnerable to the effects of toxic substances. Therefore, some advisories particularly limit consumption for these very sensitive groups.

There are two types of advisories (http://www.adph.org/RISK/Alabama Fish Consumption Advisories 03.pdf); both are for specific fish species in defined areas of lakes and streams.

A **limited consumption advisory** states that women of reproductive age and children less than 15 years old should avoid eating certain fish from these areas. Other people should limit their consumption of the particular species to one meal per month. The size of a portion of fish in a meal is proposed to be 8 oz. For a 70kg (154lb) individual.

A **no consumption advisory** recommends that everyone avoid eating the named species of fish in the defined area.
Reducing Consumption Risks

Anglers who fish in an area in which an advisory has been recommended can take actions to reduce risks from contaminants in fish. Chlordane, DDT, and PCBs tend to adsorb to (bind with) sediments. Eating fish that feed on the bottom of lakes and streams (catfish, carp, buffalofish or suckers) should be avoided. However, in waterways contaminated with mercury, fish such as largemouth bass tend to store mercury in the muscle and should be eaten less often.

A second way to limit exposure to contaminants in fish is to keep and eat smaller fish. Ingested contaminants are not easily removed from fish. They tend to be deposited in areas such as the fat, the skin, or muscle tissues. It's nice to bring home big fish, but the longer the exposure time to a chemical, the higher the chemical concentration in the fish tissue. As fish grow older, they tend to develop a higher overall body fat content. The fat is where most of the contaminants of concern are stored. Fish at the higher levels in the food chain (e.g., bass for freshwater species, mackerel or shark for marine species) tend to bioaccumulate contaminants. Because the diets of these more aggressive species are primarily lower fish and crustaceans, these higher fish will consume and deposit in their own tissues those contaminants contained in the fish and crustaceans they eat.

Cutting away most of the fatty tissue when cleaning fish is a third way to limit exposure to toxic chemicals. The skin, belly flap, and the fatty strip along the backbone and lateral line should be removed to reduce the amount of contaminants in the meal.

Cooking methods provide a fourth method for reducing toxic substances in meals composed primarily of fish. Since most of the contaminants are stored in the fat, cook the fish in a manner that allows the juices (high in fat content) to drip away from the meat. Broiling and grilling are excellent ways to do this. Frying fish, and putting them into soups and chowders do not remove the fat, and are not recommended.
Get hooked on HEALTH

FISH – A GREAT NUTRITIONAL CATCH

FIND OUT ABOUT
THE SAFE TYPES OF FISH TO EAT,
THE SAFE WAYS TO PREPARE FISH,
PLUS SPECIAL INFORMATION ON HOW EATING FISH CAN AFFECT PREGNANCY.

Good Health is Catching
in Alabama!
Fish and shellfish are an excellent source of protein, vitamins, and minerals. Many fish are also high in omega-3 fatty acids – which are believed to provide protection from heart disease.

However, fish can become unhealthy to eat based on:

- the length of time they are exposed to harmful substances in their habitat;
- the amount(s) of contaminant(s) in the food they themselves eat;
- and the bacteria and parasites they may contain that are harmful to humans.

You can reduce your risk of health hazards that may be involved in eating fish by knowing how to choose, store, prepare, and cook fish.

---

**FISH NUTRITION**

<table>
<thead>
<tr>
<th>Seafood (4oz. cooked)</th>
<th>calories</th>
<th>protein (gm)</th>
<th>total fat (gm)</th>
<th>saturated fat (g)</th>
<th>cholesterol (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>bass</td>
<td>166</td>
<td>27</td>
<td>5</td>
<td>1</td>
<td>99</td>
</tr>
<tr>
<td>catfish</td>
<td>170</td>
<td>21</td>
<td>9</td>
<td>2</td>
<td>72</td>
</tr>
<tr>
<td>flounder</td>
<td>133</td>
<td>27</td>
<td>2</td>
<td>0.4</td>
<td>77</td>
</tr>
<tr>
<td>ocean perch</td>
<td>137</td>
<td>27</td>
<td>2</td>
<td>0.4</td>
<td>61</td>
</tr>
<tr>
<td>oysters</td>
<td>185</td>
<td>21</td>
<td>5</td>
<td>1</td>
<td>113</td>
</tr>
<tr>
<td>salmon</td>
<td>245</td>
<td>31</td>
<td>12</td>
<td>2</td>
<td>99</td>
</tr>
<tr>
<td>shrimp</td>
<td>95</td>
<td>20</td>
<td>1</td>
<td>0.3</td>
<td>183</td>
</tr>
<tr>
<td>trout</td>
<td>170</td>
<td>26</td>
<td>1</td>
<td>0.3</td>
<td>183</td>
</tr>
<tr>
<td>tuna, packed in water</td>
<td>132</td>
<td>29</td>
<td>1</td>
<td>0.3</td>
<td>33</td>
</tr>
<tr>
<td>whiting</td>
<td>116</td>
<td>24</td>
<td>1.7</td>
<td>0.4</td>
<td>84</td>
</tr>
</tbody>
</table>

Saturated fat, the kind of fat that raises cholesterol levels in people and increases risk of heart disease and stroke, is low in fish and seafood. The cholesterol content of fish is generally similar to that found in lean meat and poultry. Shellfish, while somewhat higher in cholesterol, are low in saturated fat so they are still considered a good choice when eaten in moderation.

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**THE SAFE TYPES OF FISH TO EAT**

Fish may contain different kinds and levels of contaminants based on their location, their length of life, and their feeding habits.

For example, a fish that lives a longer life and is at the top of the food chain will have more time to accumulate more mercury in its body muscle. Fish known as bottom feeders will be more exposed to pesticides and PCBs, because these chemicals run off the land and settle to the bottom of waterbodies. These primarily deposit in the fatty portions of the fish.

Fish bought at a store are usually farm-grown. Farm-grown fish have the least exposure to contaminants, because they are raised in tanks and other carefully controlled areas and are sold as soon as they reach the best size for eating.

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**Women who could become pregnant, who are pregnant, or who are nursing should be aware that contaminants transferred through the uterus or through breast milk can harm the development of their child.**

The following guidelines for pregnant women are from the Environmental Working Group, a Washington, D.C.-based advocacy group.

**Safe for pregnant and nursing women:** farmed trout, farmed catfish, shrimp, fish sticks, summer flounder, wild Pacific salmon, croaker, mid-Atlantic blue crab, haddock.

**Pregnant women should eat no more than one serving per month:** canned tuna, mahi mahi, blue mussels, Eastern oysters, cod, pollock, Great Lakes salmon, wild channel catfish, blue crab from the Gulf of Mexico.

**Any woman considering pregnancy, already pregnant, or nursing should avoid these fish:** shark, swordfish, king mackerel, tilefish, tuna steaks, sea bass, marlin, halibut, pike, walleye, white croaker, largemouth bass, sport fish caught from waterways with fish advisories.
There are three primary contaminants of fish:

**Mercury** is a toxic metal that naturally exists in low levels throughout air, water, soil, rocks, plant, animal, and human life. It also accumulates in fish muscle tissues.

**Health risk:** When mercury is present in food, it can build up in the body and cause damage to the nervous system and kidneys. Women who eat fish containing mercury before or during pregnancy risk causing developmental and/or learning problems in children.

**Risk reduction:** Fish that live longer or that eat other fish will contain more mercury than small fish or crayfish. No cooking will reduce mercury levels; eat long-lived fish such as bass or tuna in moderate amounts (two to three times per week in small to medium portions – 3 to 4 ounces). If you are pregnant or nursing, avoid fish that usually contain high mercury levels or that are on the fish advisory list.

**PCBs** (polychlorinated biphenyls) are chemicals that were created for use in electrical transformers, cutting oils and hydraulic fluids, and carbonless paper. While banned in the U.S. in 1979, they have remained in the soil and tend to accumulate in the sediment at the bottom of lakes and streams when they reach water.

**Health risk:** High levels of PCBs have been linked to problems with learning and short-term memory. PCBs can accumulate in breast milk, and it is important that nursing women eat a variety of animal foods in moderation to avoid consumption of high rates of PCBs.

**Risk reduction:** All animal fat is a source of storage for PCBs, and so intake of fish fat and other animal fats should be reduced (see section on how to prepare fish and safe amounts to eat). Bottom feeders such as catfish, carp, buffalo fish, and sucker tend to have a higher level of PCBs.

**Pesticides** found in fish in Alabama are mainly chlordane and DDT. These have either been dumped into the ground or the water or have run off the land where they have been used into the water.

**Health risk:** Chlordane can cause nervous system and liver damage as well as cancer in experimental animals. DDT damages the liver and can harm reproductive, developmental, and nervous systems. Exposure to pesticides can damage a child's development.

**Risk reduction:** Chlordane and DDT accumulate in the fatty tissues of fish, so reduce intake of the fatty parts of fish.

The Alabama Department of Public Health issues fish consumption advisories to help people decide whether or not to eat a specific fish from a specific Alabama waterbody.

**Fish consumption advisories:**

- Have no regulatory impact and are not laws to say you cannot eat the fish; they only help you make a decision about eating fish caught in some Alabama waters.
- Are based on an examination of the level of contaminants in the fish by the Alabama Department of Environmental Management. Because there are 77,000 miles of rivers and streams in Alabama, ADEM can only do representative samplings. ADEM personnel collect at least six fish of each species from various watershed basins every five years. These fish are analyzed for 21 different materials that are known to be harmful when eaten and stored in various human body parts such as muscle, fat, and organs where they may damage either development or function.
- Are issued by the Alabama Department of Public Health after a review of the information provided by the ADEM samples. The Health Department issues two types of advisories:
  - A **limited consumption advisory** states that women of reproductive age and children less than 15 years of age should avoid eating certain types of fish from specific waterbodies. Other people should limit consumption to one meal per month.
  - A **no consumption advisory** recommends that everyone should avoid eating certain species of fish in the defined area.
- Are updated annually in the spring and whenever any important changes are found.
- Are available by calling 1-800-201-8208 or on the Health Department website at www.adph.org

Continued on reverse.
THE SAFE WAYS TO PREPARE FISH

Follow these simple guidelines when preparing fish and other kinds of seafood:

Keep fish cold until ready to cook. Fish must be kept on ice or in the refrigerator to prevent spoiling. Store fish in the refrigerator within two hours after cooking or serving.

Eat only thoroughly cooked fish. Uncooked fish may contain viruses and parasites that can make you sick.

Eat only the fillet portions of fish. Contaminants that may come from the environment can accumulate in fatty tissues, especially when fish are large. Remove and discard the skin, guts, and liver. Filleting removes fat that is located in the belly flaps and along the lateral line of the back.

Use low-fat cooking methods like broiling, grilling, poaching, and steaming. Let juices drain away from the fish as much as possible. Frying or adding butter and other rich sauces during or after preparation takes away the heart health benefits of eating fish and adds many calories.

CALL 1-800-201-8208 OR VISIT OUR WEBSITE: www.adph.org

LOCATION OF FAT IN FISH

- Belly flaps
- Nape
- Sections closest to head
- Dark red portions
- Lateral line
- Just under skin

Fat – Remove the fatty dark meat along the entire length of the filet

Remove all fat along the back

Remove all skin

Remove guts

Remove the belly

Part closest of head

Tail portions leanest

Belly flaps

Nape

Fillet

Nape

Part closest of head

Locations in fish

Fat – Remove the fatty dark meat along the entire length of the filet
APPENDIX C
ATSDR Mercury Fact Sheet
EPA Mercury Impacts on Fish Advisories Fact Sheet
This fact sheet answers the most frequently asked health questions (FAQs) about mercury. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It’s important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

**HIGHLIGHTS:** Exposure to mercury occurs from breathing contaminated air, ingesting contaminated water and food, and having dental and medical treatments. Mercury, at high levels, may damage the brain, kidneys, and developing fetus. This chemical has been found in at least 714 of 1,467 National Priorities List sites identified by the Environmental Protection Agency.

**What is mercury?**

(Pronounced mûr’kya-rê)

Mercury is a naturally occurring metal which has several forms. The metallic mercury is a shiny, silver-white, odorless liquid. If heated, it is a colorless, odorless gas.

Mercury combines with other elements, such as chlorine, sulfur, or oxygen, to form inorganic mercury compounds or “salts,” which are usually white powders or crystals. Mercury also combines with carbon to make organic mercury compounds. The most common one, methylmercury, is produced mainly by microscopic organisms in the water and soil. More mercury in the environment can increase the amounts of methylmercury that these small organisms make.

Metallic mercury is used to produce chlorine gas and caustic soda, and is also used in thermometers, dental fillings, and batteries. Mercury salts are sometimes used in skin lightening creams and as antiseptic creams and ointments.

**What happens to mercury when it enters the environment?**

- Inorganic mercury (metallic mercury and inorganic mercury compounds) enters the air from mining ore deposits, burning coal and waste, and from manufacturing plants.
- It enters the water or soil from natural deposits, disposal of wastes, and volcanic activity.
- Methylmercury may be formed in water and soil by small organisms called bacteria.
- Methylmercury builds up in the tissues of fish. Larger and older fish tend to have the highest levels of mercury.

**How might I be exposed to mercury?**

- Eating fish or shellfish contaminated with methylmercury.
- Breathing vapors in air from spills, incinerators, and industries that burn mercury-containing fuels.
- Release of mercury from dental work and medical treatments.
- Breathing contaminated workplace air or skin contact during use in the workplace (dental, health services, chemical, and other industries that use mercury).
- Practicing rituals that include mercury.

**How can mercury affect my health?**

The nervous system is very sensitive to all forms of mercury. Methylmercury and metallic mercury vapors are more harmful than other forms, because more mercury in these forms reaches the brain. Exposure to high levels of metallic, inorganic, or organic mercury can permanently damage the brain, kidneys, and developing fetus. Effects on brain functioning may result in irritability, shyness, tremors, changes in vision or hearing, and memory problems.

Short-term exposure to high levels of metallic mercury vapors may cause effects including lung damage, nausea,
vomiting, diarrhea, increases in blood pressure or heart rate, skin rashes, and eye irritation.

How likely is mercury to cause cancer?
There are inadequate human cancer data available for all forms of mercury. Mercuric chloride has caused increases in several types of tumors in rats and mice, and methylmercury has caused kidney tumors in male mice. The EPA has determined that mercuric chloride and methylmercury are possible human carcinogens.

How can mercury affect children?
Very young children are more sensitive to mercury than adults. Mercury in the mother’s body passes to the fetus and may accumulate there. It can also pass to a nursing infant through breast milk. However, the benefits of breast feeding may be greater than the possible adverse effects of mercury in breast milk.

Mercury’s harmful effects that may be passed from the mother to the fetus include brain damage, mental retardation, incoordination, blindness, seizures, and inability to speak. Children poisoned by mercury may develop problems of their nervous and digestive systems, and kidney damage.

How can families reduce the risk of exposure to mercury?
Carefully handle and dispose of products that contain mercury, such as thermometers or fluorescent light bulbs. Do not vacuum up spilled mercury, because it will vaporize and increase exposure. If a large amount of mercury has been spilled, contact your health department. Teach children not to play with shiny, silver liquids.

Properly dispose of older medicines that contain mercury. Keep all mercury-containing medicines away from children.

Pregnant women and children should keep away from rooms where liquid mercury has been used.

Learn about wildlife and fish advisories in your area from your public health or natural resources department.

Is there a medical test to show whether I’ve been exposed to mercury?
Tests are available to measure mercury levels in the body. Blood or urine samples are used to test for exposure to metallic mercury and to inorganic forms of mercury. Mercury in whole blood or in scalp hair is measured to determine exposure to methylmercury. Your doctor can take samples and send them to a testing laboratory.

Has the federal government made recommendations to protect human health?
The EPA has set a limit of 2 parts of mercury per billion parts of drinking water (2 ppb).

The Food and Drug Administration (FDA) has set a maximum permissible level of 1 part of methylmercury in a million parts of seafood (1 ppm).

The Occupational Safety and Health Administration (OSHA) has set limits of 0.1 milligram of organic mercury per cubic meter of workplace air (0.1 mg/m$^3$) and 0.05 mg/m$^3$ of metallic mercury vapor for 8-hour shifts and 40-hour work weeks.

References
Mercury Update: Impact on Fish Advisories

Mercury is distributed throughout the environment from both natural sources and human activities. Methylmercury is the main form of organic mercury found in the environment and is the form that accumulates in both fish and human tissues. Several instances of methylmercury poisoning through consumption of contaminated food have occurred; these resulted in central nervous system effects such as impairment of vision, motor in-coordination, loss of feeling, and, at high doses, seizures, very severe neurological impairment, and death. Methylmercury has also been shown to be a developmental toxicant, causing subtle to severe neurological effects. EPA considers there is sufficient evidence for methylmercury to be considered a developmental toxicant, and to be of concern for potential human germ cell mutagenicity. As of December 2000, 41 states have issued 2,242 fish advisories for mercury. These advisories inform the public that concentrations of mercury have been found in local fish at levels of public health concern. State advisories recommend either limiting or avoiding consumption of certain fish from specific waterbodies or, in some cases, from specific waterbody types (e.g., all freshwater lakes or rivers).

The purpose of this fact sheet is to summarize current information on sources, fate and transport, occurrence in human tissues, range of concentrations in fish tissue, fish advisories, fish consumption limits, toxicity, and regulations for mercury. The fact sheets also illustrate how this information may be used for developing fish consumption advisories. An electronic version of this fact sheet and fact sheets for dioxins/furans, PCBs, and toxaphene are available at http://www.epa.gov/OST/fish. Future revisions will be posted on the web as they become available.

Sources of Mercury in the Environment

Mercury is found in the environment in the metallic form and in different inorganic and organic forms. Most of the mercury in the atmosphere is elemental mercury vapor and inorganic mercury; most of the mercury in water, soil, plants, and animals is inorganic and organic mercury (primarily methylmercury).

Mercury occurs naturally and is distributed throughout the environment by both natural processes and human activities. Solid waste incineration and fossil fuel combustion facilities contribute approximately 87% of the emissions of mercury in the United States. Other sources of mercury releases to the air include mining and smelting, industrial processes involving the use of mercury such as chlor-alkali production facilities and production of cement.

Mercury is released to surface waters from naturally occurring mercury in rocks and soils and from industrial activities, including pulp and paper mills, leather tanning, electroplating, and chemical manufacturing. Wastewater treatment facilities may also release mercury to water. An indirect source of mercury to surface waters is mercury in the air; it is deposited from rain and other processes directly to water surfaces and to soils. Mercury also may be mobilized from sediments if disturbed (e.g., flooding, dredging).

Sources of mercury in soil include direct application of fertilizers and fungicides and disposal of solid waste, including batteries and thermometers, to landfills. The disposal of municipal incinerator ash in landfills and the application of sewage sludge to crop land result in increased levels of mercury in soil. Mercury in air may also be deposited in soil and sediments.

Fate and Transport of Mercury

The global cycling of mercury is a complex process. Mercury evaporates from soils and surface waters to the atmosphere, is redeposited on land and surface water, and then is absorbed by soil or sediments. After redeposition on land and water, mercury is commonly volatilized back to the atmosphere as a gas or as adherents to particulates.

Mercury exists in a number of inorganic and organic forms in water. Methylmercury, the most common organic form of mercury, quickly enters the aquatic food chain. In most adult fish, 90% to 100% of the
mercury is methylmercury. Methylmercury is found primarily in the fish muscle (fillets) bound to proteins. Skinning and trimming the fish does not significantly reduce the mercury concentration in the fillet, nor is it removed by cooking processes. Because moisture is lost during cooking, the concentration of mercury after cooking is actually higher than it is in the fresh uncooked fish.

Once released into the environment, inorganic mercury is converted to organic mercury (methylmercury) which is the primary form that accumulates in fish and shellfish. Methylmercury biomagnifies up the food chain as it is passed from a lower food chain level to a subsequently higher food chain level through consumption of prey organisms or predators. Fish at the top of the aquatic food chain, such as pike, bass, shark and swordfish, bioaccumulate methylmercury approximately 1 to 10 million times greater than dissolved methylmercury concentrations found in surrounding waters.

In 1984 and 1985, the U.S. Fish and Wildlife Service collected 315 composite samples of whole fish from 109 stations nationwide as part of the National Contaminant Biomonitoring Program (NCBP). The maximum, geometric mean, and 85th percentile concentrations for mercury were 0.37, 0.10, and 0.17 ppm (wet weight), respectively. An analysis of mercury levels in tissues of bottom-feeding and predatory fish using the data from the NCBP study showed that the mean mercury tissue concentration of 0.12 ± 0.08 ppm in predatory fish species (e.g., trout, walleye, largemouth bass) was significantly higher than the mean tissue concentration of 0.08 ± 0.06 ppm in bottom feeders (e.g., carp, white sucker, and channel catfish).

Mercury, the only metal analyzed as part of EPA’s 1987 National Study of Chemical Residues in Fish (NSCRF), was detected at 92% of 374 sites surveyed. Maximum, arithmetic mean, and median concentrations in fish tissue were 1.77, 0.26, and 0.17 ppm (wet weight), respectively. Mean mercury concentrations in bottom feeders (whole body samples) were generally lower than concentrations for predator fish (fillet samples) (see Table 1). Most of the higher tissue concentrations of mercury were detected in freshwater fish samples collected in the Northeast.

In 1998, the northeast states and eastern Canadian provinces issued their own mercury study, including a comprehensive analysis of mercury concentrations in a variety of freshwater sportfish collected from the late 1980s to 1996. Top level predatory fish such as walleye, chain pickerel, and large and smallmouth bass were typically found to exhibit the highest concentrations, with mean tissue residues greater than 0.5 ppm and maximum residues exceeding 2 ppm. One largemouth bass sample was found to contain 8.94 ppm of mercury, while a smallmouth bass sampled contained 5 ppm. Table 2 summarizes the range and the mean concentrations found in eight species of sportfish sampled.

Table 3 provides national ranges and mean concentrations for several species of freshwater fish collected by states from the late 1980s to early 2001. 43 states have provided EPA with 90,000 records of chemical contaminant fish tissue data. These data are available in the online National Listing of Fish and Wildlife Advisories (U.S. EPA 2001b) at www.epa.gov/ost/fish.

Table 1. Mean Mercury Concentrations in Freshwater Fisha

<table>
<thead>
<tr>
<th>Species</th>
<th>Mean concentration (ppm)b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottom Feeders</td>
<td></td>
</tr>
<tr>
<td>Carp</td>
<td>0.11</td>
</tr>
<tr>
<td>White sucker</td>
<td>0.11</td>
</tr>
<tr>
<td>Channel catfish</td>
<td>0.09</td>
</tr>
<tr>
<td>Predator Fish</td>
<td></td>
</tr>
<tr>
<td>Largemouth bass</td>
<td>0.46</td>
</tr>
<tr>
<td>Smallmouth bass</td>
<td>0.34</td>
</tr>
<tr>
<td>Walleye</td>
<td>0.52</td>
</tr>
<tr>
<td>Brown trout</td>
<td>0.14</td>
</tr>
</tbody>
</table>

aEPA National Study of Chemical Residues in Fish 1987;
bConcentrations are reported on wet weight basis
Source: Bahnick et al., 1994.

Table 2. Mercury Concentrations for Selected Fish Species in the Northeast

<table>
<thead>
<tr>
<th>Species</th>
<th>Mean concentration* (ppm)</th>
<th>Minimum-maximum range* (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Because of the higher cost of methylmercury analysis, EPA recommends that total mercury rather than methylmercury concentrations be determined in state fish contaminant monitoring programs. EPA also recommends that the assumption be made that all mercury is present as methylmercury in order to be most protective of human health.

**Potential Sources of Exposure and Occurrence in Human Tissues**

Potential sources of human exposure to mercury include food contaminated with mercury, inhalation of mercury vapors in ambient air, and exposure to mercury through dental and medical treatments. Dietary intake is by far the dominant source of exposure to mercury for the general population. Fish and other seafood products are the main source of methylmercury in the diet; studies have shown that methylmercury concentrations in fish and shellfish are approximately 1,000 to 10,000 times greater than in other foods, including cereals, potatoes, vegetables, fruits, meats, poultry, eggs, and milk.

Individuals who may be exposed to higher than average levels of methylmercury include recreational and subsistence fishers who routinely consume large amounts of locally caught fish and subsistence hunters who routinely consume the meat and organ tissues of marine mammals.

Analytical methods are available to measure mercury in blood, urine, tissue, hair, and breast milk.

**Fish Advisories**

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### Table 3. Mercury Concentrations for Selected Fish Species in the U.S.

<table>
<thead>
<tr>
<th>Species</th>
<th>Mean concentration* (ppm)</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Largemouth bass</td>
<td>0.52</td>
<td>0.0005 - 8.94</td>
</tr>
<tr>
<td>Smallmouth bass</td>
<td>0.32</td>
<td>0.005 - 3.34</td>
</tr>
<tr>
<td>Yellow perch</td>
<td>0.25</td>
<td>0.005 - 2.14</td>
</tr>
<tr>
<td>Eastern chain pickerel</td>
<td>0.61</td>
<td>0.014 - 2.81</td>
</tr>
<tr>
<td>Lake trout</td>
<td>0.27</td>
<td>0.005 - 2</td>
</tr>
<tr>
<td>Walleye</td>
<td>0.43</td>
<td>0.005 - 16</td>
</tr>
<tr>
<td>Northern Pike</td>
<td>0.36</td>
<td>0.005 - 4.4</td>
</tr>
</tbody>
</table>

* Concentrations are reported on a wet weight basis.

*Source: NLEWA, 2000.*
The states have primary responsibility for protecting their residents from the health risks of consuming contaminated noncommercially caught fish. They do this by issuing consumption advisories for the general population, including recreational and subsistence fishers, as well as for sensitive subpopulations (such as pregnant women/fetus, nursing mothers and their infants, and children). These advisories inform the public that high concentrations of chemical contaminants, such as mercury, have been found in local fish. The advisories recommend either limiting or avoiding consumption of certain fish from specific waterbodies or, in some cases, from specific waterbody types (such as lakes or rivers).

As of December 2000, mercury was the chemical contaminant responsible, at least in part, for the issuance of 2,242 fish consumption advisories by 41 states. Almost 79% of all advisories issued in the United States are at least partly due to mercury contamination in fish and shellfish. Advisories for mercury have increased steadily, by 149% from 899 advisories in 1993 to 2,242 advisories in 2000. The number of states that have issued mercury advisories also has risen steadily from 27 states in 1993 to 41 states in 2000. Advisories for mercury increased nearly 8% from 1999 (2,073 advisories) to 2000 (2,242 advisories).

Thirteen states have issued statewide advisories for mercury in their freshwater lakes and/or rivers: Connecticut, Kentucky, Indiana, Maine, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, North Carolina, Ohio, Vermont and Wisconsin. Another nine states (Alabama, Florida, Georgia, Louisiana, Maine, Mississippi, North Carolina, and Texas) have statewide mercury advisories in effect for their coastal marine waters. Figure 1 shows the total number of fish advisories for mercury in each state in 2000 (U.S. EPA, 2001a).

**Fish Consumption Limits**—EPA indicated in the *Mercury Study Report to Congress* (U.S. EPA, 1997) that the typical U.S. consumer was not in danger of consuming harmful levels of methylmercury from fish and was not advised to limit fish consumption on the basis of mercury content. This advice is appropriate for typical consumers who eat less than 10 grams of fish and shellfish per day with mercury concentrations averaging between 0.1 and 0.15 ppm. At these rates of fish intake, methylmercury exposures are considerably less than the reference dose (RfD) of 1 x 10^-4 mg/kg-d. However, eating more fish than is typical or eating fish that are more contaminated, can increase the risk to a developing fetus.

Two groups of women of childbearing age are of concern: (1) those who eat more than 10 grams of fish a day and (2) those who eat fish with higher methylmercury levels. Ten grams of fish is a little over one-quarter cup of tuna per week or about one fish sandwich per week. Based on diet surveys, 10% of women of childbearing age eat five times or more fish than does the average consumer. If the fish have average mercury concentrations of 0.1 to 0.15 ppm, the women’s mercury exposures range from near or slightly over the RfD to about twice the RfD.

The second group of women of concern are those who eat fish with higher mercury concentrations (e.g., 0.5 ppm and higher). Examples of fish with above average mercury levels are king mackerel, various bass species, pike, swordfish, and shark. Even women eating average amounts of fish (i.e., <10 g/d) have mercury exposures near the RfD, if the mercury concentration is 0.5 ppm. If women eat these fish species and their average fish intake is between 40 and 70 grams/day (or about a quarter cup per day), their mercury exposures would range from three to six times the RfD. Consumers who eat fish with 1 ppm mercury (e.g., swordfish and shark) at the level of 40 to 70 g/d have intakes that range from 6 to nearly 12 times the RfD.

Some women of childbearing age in certain ethnic groups (Asians, Pacific Islanders, and Native Americans) eat much more fish than the general population. Because of the higher amounts of fish in their diets, women in these ethnic groups need to be aware of the level of mercury in the fish they eat.

The RfD is not a “bright line” between safety and toxicity; however, there is progressively greater concern about the likelihood of adverse effects above this level. Consequently, people are advised to consume fish in moderate amounts and be aware of the amount of mercury in the fish they eat.

For some populations, such as pregnant women, nursing mothers, and young children, some states have issued either "no consumption" advisories or "restricted consumption" advisories for methylmercury. Additional information on calculating specific limits for these sensitive populations is available in EPA’s Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, Volume 2, Section 3 (U.S. EPA 2000).

Table 4 shows the recommended monthly fish consumption limits for methylmercury in fish for fish consumers based on EPA’s default values for risk assessment parameters. States may select other scientifically defensible values for developing fish...
advisories. Consumption limits have been calculated as the number of allowable fish meals per month based on the ranges of methylmercury in the consumed fish tissue. The following assumptions were used to calculate the consumption limits:

- Consumer adult body weight of 70 kg
- Average fish meal size of 8 oz (0.227 kg)
- Time-averaging period of 1 mo (30.44 d)
- EPA’s reference dose for methylmercury (1x10^-4 mg/kg-d) from EPA’s Water Quality Criterion for the Protection of Human Health: Methylmercury (U.S. EPA, 2001c).

For example, when methylmercury levels in fish tissue are 0.4 ppm, then two 8-oz. (uncooked weight) meals per month can safely be consumed.

### Table 4. Monthly Fish Consumption Limits for Methylmercury

<table>
<thead>
<tr>
<th>Risk-based consumption limit</th>
<th>Noncancer health endpoints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish meals/month</td>
<td>Fish tissue concentrations (ppm, wet weight)</td>
</tr>
<tr>
<td>16</td>
<td>&gt; 0.03–0.06</td>
</tr>
<tr>
<td>12</td>
<td>&gt; 0.06–0.08</td>
</tr>
<tr>
<td>8</td>
<td>&gt; 0.08–0.12</td>
</tr>
<tr>
<td>4</td>
<td>&gt; 0.12–0.24</td>
</tr>
<tr>
<td>3</td>
<td>&gt; 0.24–0.32</td>
</tr>
<tr>
<td>2</td>
<td>&gt; 0.32–0.48</td>
</tr>
<tr>
<td>1</td>
<td>&gt; 0.48–0.97</td>
</tr>
<tr>
<td>0.5</td>
<td>&gt; 0.97–1.9</td>
</tr>
<tr>
<td>None (&lt;0.5)*</td>
<td>&gt; 1.9</td>
</tr>
</tbody>
</table>

* None = No consumption recommended.

NOTE: In cases where >16 meals per month are consumed, refer to EPA’s Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, Volume 2, Section 3 for methods to determine safe consumption limits.

### Toxicity of Mercury

**Pharmacokinetics**—Methylmercury is rapidly and nearly completely absorbed from the gastrointestinal tract; 90% to 100% absorption is estimated. Methylmercury is somewhat lipophilic, allowing it to pass through lipid membranes of cells and facilitating its distribution to all tissues, and it binds readily to proteins. Methylmercury binds to amino acids in fish muscle tissue.

The highest methylmercury levels in humans are generally found in the kidneys. Methylmercury in the body is considered to be relatively stable and is only slowly transformed to form other forms of mercury. Methylmercury readily crosses the placental and blood/brain barriers. Estimates for its half-life in the human body range from 44 to more than 80 days.

Excretion of methylmercury is via the feces, urine, and breast milk. Methylmercury is also distributed to human hair and to the fur and feathers of wildlife; measurement of mercury in hair and these other tissues has served as a useful biomonitor of contamination levels.

**Acute Toxicity**—Acute high-level exposures to methylmercury may result in impaired central nervous system function, kidney damage and failure, gastrointestinal damage, cardiovascular collapse, shock, and death. The estimated lethal dose is 10 to 60 mg/kg.

**Chronic Toxicity**—Both elemental mercury and methylmercury produce a variety of health effects at relatively high exposures. While recent studies indicate that lower dose exposure can have effects on the cardiovascular and immune systems, neurotoxicity is the effect of greatest concern. This is true whether exposure occurs to the developing embryo or fetus during pregnancy or to adults and children. Human exposure to methylmercury has generally been through consumption of contaminated food. Two major episodes of methylmercury poisoning through fish consumption have occurred. The first occurred in the early 1950s among people, fish consuming domestic animals such as cats, and wildlife living near Minamata City on the shores of Minamata Bay, Kyushu, Japan. The source of the methylmercury contamination was effluent from a chemical factory that used mercury as a catalyst and discharged wastes into the bay where it accumulated in fish and shellfish that were a dietary staple of this population. Average fish consumption was reported to be in excess of 300 g/d, 20 times greater than is typical for recreational fishers in the United States. By comparison, about 3% to 5% of U.S. consumers routinely eat 100 grams of fish per day. Among women of childbearing age, 3% routinely eat 100 grams of fish per day.

In 1965, another methylmercury poisoning incident occurred in the area of Niigata, Japan. The signs and symptoms of the disease in Niigata were similar to those of methylmercury poisoning in Minamata.

Methylmercury poisoning also occurred in Iraq following consumption of seed grain that had been treated with a fungicide containing methylmercury. The first outbreak occurred prior to 1960; the second occurred in the early 1970s. In this case, imported
mercury-treated seed grains that arrived after the planting season were ground into flour and baked into bread. Unlike the long-term exposures in Japan, the epidemic of methylmercury poisoning in Iraq was short in duration lasting approximately 6 months. The signs and symptoms of disease in Iraq were predominantly in the nervous system: difficulty with peripheral vision or blindness, sensory disturbances, incoordination, impairment of walking, and slurred speech. Both children and adults were affected. Some infants born to mothers who had consumed methylmercury contaminated grain (particularly during the second trimester of pregnancy) showed nervous system damage even though the mother was only slightly affected or asymptomatic.

Three recent epidemiology studies in the Seychelles Islands, New Zealand, and the Faroe Islands were designed to evaluate childhood development and neurotoxicity in relation to fetal exposures to methylmercury in fish-consuming populations. Prenatal methylmercury exposures in these three populations were within the range of some U.S. population exposures. No adverse effects were reported from the Seychelles Islands study, but children in the Faroe Islands exhibited subtle dose-related deficits at 7 years of age. These effects include abnormalities in memory, attention, and language. In the New Zealand prospective study, children at 4 and 6 years of age exhibited deficiencies in a number of neuropsychological tests.

In addition to the three large epidemiological studies, studies on both adults and children were conducted in the Amazon; Ecuador; French Guiana; Madeira; Mancora, Peru; northern Quebec; and Germany. Effects of methylmercury on the nervous system were reported in all but the Peruvian population.

There has been considerable discussion within the scientific community regarding the level of exposure to methylmercury that is likely to be without an appreciable risk of deleterious health effects during a lifetime. In 1999, the Congress directed EPA to contract with the National Research Council (NRC) of the National Academy of Sciences to evaluate the body of data on the health effects of methylmercury. NRC published their report, Toxicological Effects of Methylmercury, in 2000. EPA generally concurred with the NRC findings and recommendations and used them in determining the EPA RfD for methylmercury. EPA chose to base the RfD on data from the Faroese study. The Seychelles study has no findings of effects associated with methylmercury exposure, and thus is not the best choice for a public health protective risk estimate. While the New Zealand study does show mercury-related effects it relatively small by comparison to the other two.

Benchmark dose analysis was chosen as the most appropriate method of quantifying the dose-effect relationship. This lower 95% limit (BMDL) on a 5% effect level obtained by applying a K power model (K $1) to Faroese dose-response data based on mercury in cord blood. It was found that several endpoints are sensitive measures of methylmercury effects in the Faroese children. The BMDLs and corresponding estimates of ingested methylmercury are within a very small range and cluster around a level of 1 : g/kg bw/day. Rather than choosing a single measure for the RfD critical endpoint, EPA considers that this RfD is based on several scores which are indications of neuropsychological processes related to the ability of a child to learn and process information. An uncertainty factor of 10 was applied. This included a factor of 3 for pharmacokinetic variability and uncertainty; one area of pharmacokinetic uncertainty was introduced with the assumption of equivalent cord blood and maternal blood mercury levels. An additional factor of 3 addressed pharmacokinetic variability and uncertainty. Other areas of concern include inability to quantify possible long-term sequelae for neurotoxic effects, questions as to the possibility of observing adverse impacts (such as cardiovascular effects) below the BMDL, and lack of a two-generation reproductive effects assay.

**Developmental Toxicity**—Data are available on developmental effects in rats, mice, guinea pigs, hamsters, and monkeys. Also, convincing data from a number of human studies (i.e., Minamata, Iraq, New Zealand, and the Faroe Islands) indicate that methylmercury causes subtle to severe neurologic effects depending on dose and individual susceptibility. EPA considers methylmercury to have sufficient human and animal data to be classified as a developmental toxicant.

Methylmercury accumulates in body tissue; consequently, maternal exposure occurring prior to pregnancy can contribute to the overall maternal body burden and result in exposure to the developing fetus. In addition, infants may be exposed to methyl-mercury through breast milk. Therefore, it is advisable to reduce methylmercury exposure to women with childbearing potential to reduce overall body burden.

**Mutagenicity and Reproductive Effects** - Methylmercury appears to be clastogenic but not to be a point mutagen; that is, mercury causes chromosome damage but not small heritable changes in DNA. EPA has classified methylmercury as being of high concern for potential human germ cell mutagenicity. The absence of positive results in a heritable mutagenicity assay keeps methylmercury from
being included under the highest level of concern. The data on mutagenicity are not sufficient, however, to permit estimation of the amount of methylmercury that would cause a measurable mutagenic effect in the human population. There is no two-generation study of reproductive effects, but shorter term studies in rodents, guinea pigs and monkeys have reported observations consistent with reproductive deficits.

Carcinogenicity - Three human studies have been identified that examined the relationship between methylmercury exposure and cancer. There was no persuasive evidence of increased carcinogenicity attributable to methylmercury exposure in any of these studies. Interpretation of these studies was limited by poor study design and incomplete descriptions of methodology and/or results. Experimental animal data suggest that methylmercury may be tumorigenic in animals. Chronic dietary exposures of mice to methylmercury resulted in significant increases in the incidences of kidney tumors in males but not in females. The tumors were seen only at toxic doses of methylmercury. EPA has found methylmercury to have inadequate data in humans and limited evidence in animals.

All of the carcinogenic effects in animals were observed in the presence of profound damage to the kidneys. Tumors may be formed as a consequence of repair in the damaged organs. Evidence points to a mode of action for methylmercury carcinogenicity that operates at high doses certain to produce other types of toxicity in humans. Given the levels of exposure most likely to occur in the U.S. population, even among consumers of large amounts of fish, methylmercury is not likely to present a carcinogenic risk. EPA has not calculated quantitative carcinogenic risk values for methylmercury.

Special Susceptibilities—The developing fetus is thought to be at particular risk of neurotoxic effects from methylmercury exposure. Data on children exposed only after birth are insufficient to determine if this group has increased susceptibility to the adverse central nervous system effects of methylmercury. Children are considered to be at increased risk of methylmercury exposure by virtue of their greater food consumption as a percentage of body weight (mg food/kg body weight) compared to adult exposures. Additional studies indicate that aging populations may be particularly susceptible to effects of mercury exposure.

Interactive Effects—Potassium dichromate and atrazine may increase the toxicity of mercury, although these effects have been noted only with metallic and inorganic mercury. Ethanol increases the toxicity of methylmercury in experimental animals. Vitamins D and E, thiol compounds, selenium, copper, and possibly zinc are antagonistic to the toxic effects of mercury.

Critical Data Gaps—Additional data are needed on the exposure levels at which humans experience subtle, but persistent, adverse neurological effects. Data on immunologic effects and cardiovascular effects are not sufficient for evaluation of low-dose methylmercury toxicity.

<table>
<thead>
<tr>
<th>Summary of EPA Health Benchmarks</th>
</tr>
</thead>
<tbody>
<tr>
<td># Chronic Toxicity—Reference Dose:</td>
</tr>
<tr>
<td>1x10^-4 mg/kg-d (U.S. EPA, 2001)</td>
</tr>
<tr>
<td># Carcinogenicity:Not likely to be human</td>
</tr>
<tr>
<td>carcinogen under conditions of exposure</td>
</tr>
</tbody>
</table>

Figure 1: Mercury Advisories for 2000
# EPA Regulations and Advisories

- **Maximum Contaminant Level** inorganic mercury in drinking water = 0.002 mg/L

- **Toxic Criteria for those States Not Complying with CWA Section 303(c)(2)(B)** - criterion concentration for priority toxic pollutants:
  - Freshwater: maximum = 1.4 : g/L, continuous = 0.77 : g/L
  - Saltwater: maximum = 1.80 : g/L, continuous = 0.94 : g/L
  - Human health consumption of organisms = 0.3 mg/kg methylmercury fish tissue (wet weight).

- **Water Quality Guidance for the Great Lakes System**—protection of aquatic life in ambient water:
  - acute water quality criteria for mercury total recoverable: maximum = 1.694 : g/L
  - chronic water quality criteria for mercury total recoverable: continuous = 0.908 : g/L
  - water quality criteria for protection of human health, drinking water and nondrinking water: maximum = 1.8 x 10⁻³ : g/L
  - water quality criteria for protection of human health (mercury including methylmercury) = 1.3 x 10⁻³ : g/L.

- **Listed as a hazardous air pollutant under Section 112 of the Clean Air Act**

- **Emissions from mercury ore processing facilities and mercury chlor-alkali plants** = 2,300 g maximum/24 h

- **Emissions from sludge incineration plants, sludge drying plants, or a combination of these that process wastewater treatment plant sludge** = 3,200 g maximum/24 h

- **Ban of phenylmercuric acetate as a fungicide in interior and exterior latex paints**

- **Reportable quantities**: Mercury, mercuric cyanide = 1 lb; mercuric nitrate, mercuric sulfate, mercuric thiocyanate, mercurous nitrate, mercury fulminate = 10 lb; phenylmercury acetate = 100 lb.

- **Listed as a hazardous substance**: Mercuric cyanide, mercuric nitrate, mercuric sulfate, mercuric thiocyanate, mercurous nitrate

- **Reporting threshold for Toxic Release Inventory (proposed)** = 10 lb
Sources of Information


For more information about the National Fish and Wildlife Contamination Program, contact:

Jeffrey Bigler
U.S. Environmental Protection Agency
Office of Science and Technology
1200 Pennsylvania Ave NW (4305)
Washington, DC 20460

Bigler.Jeff@epa.gov
202 260-1305
202 260-9830 (fax)

Additional information regarding contaminants in fish and health risks is available from the following Internet site: http://www.epa.gov/ost/fish
APPENDIX D
ATSDR Dioxins Fact Sheet
What are CDDs?

CDDs are a family of 75 chemically related compounds commonly known as chlorinated dioxins. One of these compounds is called 2,3,7,8-TCDD. It is one of the most toxic of the CDDs and is the one most studied.

In the pure form, CDDs are crystals or colorless solids. CDDs enter the environment as mixtures containing a number of individual components. 2,3,7,8-TCDD is odorless and the odors of the other CDDs are not known.

CDDs are not intentionally manufactured by industry except for research purposes. They (mainly 2,3,7,8-TCDD) may be formed during the chlorine bleaching process at pulp and paper mills. CDDs are also formed during chlorination by waste and drinking water treatment plants. They can occur as contaminants in the manufacture of certain organic chemicals. CDDs are released into the air in emissions from municipal solid waste and industrial incinerators.

What happens to CDDs when they enter the environment?

- When released in waste waters, some CDDs are broken down by sunlight, some evaporate to air, but most attach to soil and settle to the bottom sediment in water.
- CDD concentrations may build up in the food chain, resulting in measurable levels in animals.

How might I be exposed to CDDs?

- Eating food, primarily meat, dairy products, and fish, makes up more than 90% of the intake of CDDs for the general population.
- Breathing low levels in air and drinking low levels in water.
- Skin contact with certain pesticides and herbicides.
- Living near an uncontrolled hazardous waste site containing CDDs or incinerators releasing CDDs.
- Working in industries involved in producing certain pesticides containing CDDs as impurities, working at paper and pulp mills, or operating incinerators.

How can CDDs affect my health?

The most noted health effect in people exposed to large amounts of 2,3,7,8-TCDD is chloracne. Chloracne is a severe skin disease with acne-like lesions that occur mainly on the face and upper body. Other skin effects noted in people exposed to high doses of 2,3,7,8-TCDD include skin rashes, dis-
coloration, and excessive body hair. Changes in blood and urine that may indicate liver damage also are seen in people. Exposure to high concentrations of CDDs may induce long-term alterations in glucose metabolism and subtle changes in hormonal levels.

In certain animal species, 2,3,7,8-TCDD is especially harmful and can cause death after a single exposure. Exposure to lower levels can cause a variety of effects in animals, such as weight loss, liver damage, and disruption of the endocrine system. In many species of animals, 2,3,7,8-TCDD weakens the immune system and causes a decrease in the system’s ability to fight bacteria and viruses. In other animal studies, exposure to 2,3,7,8-TCDD has caused reproductive damage and birth defects. Some animal species exposed to CDDs during pregnancy had miscarriages and the offspring of animals exposed to 2,3,7,8-TCDD during pregnancy often had severe birth defects including skeletal deformities, kidney defects, and weakened immune responses.

How likely are CDDs to cause cancer?

Several studies suggest that exposure to 2,3,7,8-TCDD increases the risk of several types of cancer in people. Animal studies have also shown an increased risk of cancer from exposure to 2,3,7,8-TCDD.

The World Health Organization (WHO) has determined that 2,3,7,8-TCDD is a human carcinogen. The Department of Health and Human Services (DHHS) has determined that 2,3,7,8-TCDD may reasonably be anticipated to cause cancer.

How can CDDs affect children?

Very few studies have looked at the effects of CDDs on children. Chloracne has been seen in children exposed to high levels of CDDs. We don't know if CDDs affect the ability of people to have children or if it causes birth defects, but given the effects observed in animal studies, this cannot be ruled out.

How can families reduce the risk of exposure to CDDs?

- Children should avoid playing in soils near uncontrolled hazardous waste sites.
- Discourage children from eating dirt or putting toys or other objects in their mouths.
- Everyone should wash hands frequently if playing or working near uncontrolled hazardous waste sites.
- For new mothers and young children, restrict eating foods from the proximity of uncontrolled sites with known CDDs.

Is there a medical test to show whether I’ve been exposed to CDDs?

Tests are available to measure CDD levels in body fat, blood, and breast milk, but these tests are not routinely available. Most people have low levels of CDDs in their body fat and blood, and levels considerably above these levels indicate past exposure to above-normal levels of 2,3,7,8-TCDD. Although CDDs stay in body fat for a long time, tests cannot be used to determine when exposure occurred.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 0.00003 micrograms of 2,3,7,8-TCDD per liter of drinking water (0.00003 µg/L). Discharges, spills, or accidental releases of 1 pound or more of 2,3,7,8-TCDD must be reported to EPA. The Food and Drug Administration (FDA) recommends against eating fish and shellfish with levels of 2,3,7,8-TCDD greater than 50 parts per trillion (50 ppt).

References

APPENDIX E

ATSDR Arsenic Fact Sheet

EPA CCACancellation Fact Sheet
This fact sheet answers the most frequently asked health questions (FAQs) about arsenic. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It’s important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to higher than average levels of arsenic occurs mostly in the workplace, near hazardous waste sites, or in areas with high natural levels. At high levels, inorganic arsenic can cause death. Exposure to lower levels for a long time can cause a discoloration of the skin and the appearance of small corns or warts. Arsenic has been found at 1,014 of the 1,598 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is arsenic?
Arsenic is a naturally occurring element widely distributed in the earth’s crust. In the environment, arsenic is combined with oxygen, chlorine, and sulfur to form inorganic arsenic compounds. Arsenic in animals and plants combines with carbon and hydrogen to form organic arsenic compounds.

Inorganic arsenic compounds are mainly used to preserve wood. Organic arsenic compounds are used as pesticides, primarily on cotton plants.

How might I be exposed to arsenic?
- Eating food, drinking water, or breathing air containing arsenic.
- Breathing contaminated workplace air.
- Breathing sawdust or burning smoke from wood treated with arsenic.
- Living near uncontrolled hazardous waste sites containing arsenic.
- Living in areas with unusually high natural levels of arsenic in rock.

How can arsenic affect my health?
Breathing high levels of inorganic arsenic can give you a sore throat or irritated lungs. Ingesting high levels of inorganic arsenic can result in death. Lower levels of arsenic can cause nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of “pins and needles” in hands and feet.

Ingesting or breathing low levels of inorganic arsenic for a long time can cause a darkening of the skin and the
Is there a medical test to show whether I’ve been exposed to arsenic?

There are tests to measure the level of arsenic in blood, urine, hair, or fingernails. The urine test is the most reliable test for arsenic exposure within the last few days. Tests on hair and fingernails can measure exposure to high levels or arsenic over the past 6-12 months. These tests can determine if you have been exposed to above-average levels of arsenic. They cannot predict how the arsenic levels in your body will affect your health.

Has the federal government made recommendations to protect human health?

EPA has set limits on the amount of arsenic that industrial sources can release to the environment and has restricted or canceled many uses of arsenic in pesticides. EPA has set a limit of 0.05 parts per million (ppm) for arsenic in drinking water. The EPA arsenic drinking water standard of 0.01 ppm (10 ppb) reported in the ATSDR February 2001 Arsenic ToxFAQs was based on the EPA final rule for arsenic in drinking water, published on January 22, 2001, in the Federal Register. However, the EPA is currently reviewing the science and cost estimate supporting this rule, and, in the interim, has reverted to the previous standard for arsenic. Thus, the current EPA arsenic drinking water standard remains at 0.05 ppm (50 ppb).

The Occupational Safety and Health Administration has set limits of 10 μg arsenic per cubic meter of workplace air (10 μg/m³) for 8 hour shifts and 40 hour work weeks.

References


Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop E-29, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 404-498-0093, ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.
Cancellation of Residential Uses of CCA-Treated Wood

On March 17, EPA granted the cancellation and use termination requests affecting virtually all residential uses of chromated copper arsenate (CCA)-treated wood. These CCA products cannot be used after December 30, 2003, to treat lumber intended for most residential settings, including playstructures, decks, picnic tables, landscaping timbers, residential fencing, patios and walkways/boardwalks. Phase-out of these uses will reduce the potential exposure risk to arsenic, a known human carcinogen, thereby protecting human health, especially children's health and the environment.

Questions & Answers

1. What is chromated copper arsenate?
2. What does the voluntary cancellation/termination of certain uses of CCA mean?
3. Why is the Agency finalizing the CCA cancellation order now?
4. How is CCA used?
5. What precautions should be taken when working with CCA-treated wood?
6. Does arsenic leach from treated wood products into soil? If so, what happens to it?
7. How should I use CCA-treated wood?
8. What is the role of the Consumer Product Safety Commission (CPSC)?
9. What are EPA’s plans for the risk assessments for CCA?
10. What do you advise consumers who have existing CCA structures?
11. Are there alternatives for the terminated uses of CCA?
12. What is the status of allowing the continued use of CCA to treat agricultural fence posts, and permanent wood foundations?
13. Is the process of phasing out CCA by voluntary cancellation/use termination faster than the traditional regulatory process?
14. What are the existing stocks provisions in the final cancellation order?
15. How do I dispose of CCA-treated wood?
1. What is chromated copper arsenate?

Chromated copper arsenate (CCA) is a chemical preservative that protects wood from rotting due to insects and microbial agents. CCA contains arsenic, chromium and copper. CCA has been used to pressure treat lumber used for decks, playground equipment (playsets) and other outdoor uses since the 1940s. Since the 1970s, the majority of the wood used in residential settings is CCA-treated wood.

2. What does the voluntary cancellation/termination of certain uses of CCA mean?

On Tuesday, February 12, 2002, EPA Administrator Christine Whitman announced a voluntary decision by pesticide registrants to move consumer use of treated lumber products away from a variety of uses of pressure-treated wood that contains arsenic, in favor of new alternative wood preservatives, effective December 31, 2003. This transition affects virtually all residential uses of wood treated with CCA, including wood used in play-structures, decks, picnic tables, landscaping timbers, residential fencing, patios and walkways/boardwalks. This action will result in a reduction of virtually all residential uses of CCA-treated wood within less than two years. This voluntary cancellation of certain CCA products and termination of certain uses of other CCA products greatly accelerates the transition to new alternatives, responding to marketplace demands for wood products that do not contain CCA. This transition will substantially reduce the time it could have taken to go through the traditional regulatory process.

3. Why is the Agency finalizing the CCA cancellation order now?

Under FIFRA 6(f), the Agency is required to publish a notice of receipt of the voluntary cancellation/use termination requests and provide for an opportunity for public comments. This notice was published on February 22, 2002, and solicited public comment. The cancellation order being published now includes the Agency's response to comments, and takes action on the majority of the requests to terminate certain uses of CCA. The sale, distribution, and use of CCA pesticide products listed in the notice will only be permitted under the terms, conditions, and labeling set forth in the cancellation order.

4. How is CCA used?

CCA is injected into wood by a process that uses high pressure to saturate wood products with the chemical. CCA is a restricted use product and only people who have received the proper safety training are allowed to use CCA to treat wood products. CCA is intended to protect wood from dry rot, fungi, molds, termites, and other pests that can threaten the integrity of wood products. CCA-treated wood is most commonly used in outdoor settings. Around the home, CCA-treated wood is commonly used for decks, walkways, fences, gazebos, boat docks, and playground equipment. Other common uses of CCA-treated wood include highway noise barriers, sign posts, utility posts, and retaining walls. On February 12, 2002, EPA announced a voluntary decision by pesticide registrants to move consumer use of treated lumber products away from CCA pressure-treated wood, in favor of new alternative wood preservatives. As of December 31, 2003, EPA will not allow the affected CCA products to be used to treat wood intended for most residential settings.
5. What precautions should be taken when working with CCA-treated wood?

Excessive exposure to inorganic arsenic may be hazardous to your health. Certain activities can facilitate the release of inorganic arsenic, so people working with CCA-treated wood should take a number of precautions, as follows:

- Saw, sand, and machine CCA-treated wood outdoors. Wear a dust mask, goggles, and gloves.
- Clean up all sawdust, scraps, and other construction debris thoroughly and dispose of in the trash (i.e., municipal solid waste). Do not compost or mulch sawdust or remnants from CCA-treated wood.
- Do not burn CCA-treated wood, as toxic chemicals may be released as part of the smoke and ashes.
- After working with the wood, wash all exposed areas of your body, especially the hands, thoroughly with soap and water before eating, drinking, toileting, or using tobacco products.
- Wash your work clothes separately from other household clothing before wearing them again.

These precautions will reduce your exposure from inhaling or ingesting sawdust, protect your eyes from flying particles, and prevent exposure to toxic smoke and ash. For more suggestions on avoiding unnecessary exposure to CCA, the Agency has identified some Common Sense Tips. Before working with CCA-treated wood, always consult the Consumer Safety Information Sheet, which is also available in hard copy at 1-800-282-0600.

6. Does arsenic leach from treated wood products into soil? If so, what happens to it?

Published results of scientific studies suggest that arsenic, over time, slowly leaches from CCA-treated wood products. The amount and rate at which arsenic leaches, however, varies considerably depending on numerous factors, such as local climate, acidity of rain and soil, age of the wood product, and how much CCA was applied. Some chemicals may also be dislodged from the surface of the wood upon contact with the skin.

7. How should I use CCA-treated wood?

CCA-treated wood is used in a variety of outdoor structures. Many people have used CCA-treated wood for fences, posts, decks, and gazebos. It should not be used where routine contact with food or animal feed can occur. Do not use CCA-treated wood for cutting boards, counter tops, bee hives, compost, mulch, or structures or containers for storing human food or animal feed. Furthermore, since some animals like to eat wood, CCA-treated wood should not be used where animals can chew on the treated wood. Also, do not use where treated wood may come into direct or indirect contact with drinking water, except for uses involving incidental contact with docks or bridges. On February 12, 2002, EPA announced a voluntary decision by pesticide registrants to move consumer use of treated lumber products away from CCA pressure-treated wood effective December 31, 2003, in favor of new alternative wood preservatives. After December 30, 2003, EPA will not allow the affected CCA products to be used to treat wood intended for most residential settings.
8. What is the role of the Consumer Product Safety Commission (CPSC)?

In June 2001, CPSC docketed a petition by the Environmental Working Group (EWG) and the Healthy Building Network (HBN) to enact a ban of CCA-treated wood for use in playground equipment. The staff's report that was developed in response to the petition was presented to the Commissioners for their review. The Commission held a public meeting (3/17-18/03) to discuss the staff report and other related information. After the Public Meeting, the Commissioners will vote to grant, deny or defer the petition (which asks the CPSC to initiate a regulatory procedure).

9. What are EPA's plans for the risk assessments for CCA?

EPA plans include two Preliminary Risk Assessments (PRAs) for CCA. The first one, the Occupational and Environmental Risk Assessment, has been completed. It has been released to CCA manufacturers for error correction only, and will be made available to the public in the spring of 2003.

The children's risk assessment is on a different track, and there are a number of difficult science issues on which the Agency will continue to focus regarding CCA. The Agency expects a variety of new data on the exposure to CCA in residential settings. These data will substantially strengthen the confidence in the risk assessment. We are expecting the PRA (Residential) focusing on children's risk from exposure to CCA from decks and playstructures to be completed in late 2003, when it will be reviewed by the Science Advisory Panel (SAP), and it will be publicly available on EPA's docket and website. We expect it to be completed in 2004.

10. What do you advise consumers who have existing CCA structures?

EPA does not believe there is any reason to remove or replace CCA-treated structures, including decks or playground equipment. EPA is not recommending that existing structures or surrounding soils be removed or replaced. While the available data are limited, studies suggest that applying certain penetrating coatings, for example, oil-based semitransparent stains, on a regular basis, can reduce CCA exposure. In selecting a finish, consumers should be aware that, in some cases, "film-forming" or non-penetrating stains (latex semitransparent, latex opaque, and oil-based opaque stains) on outdoor surfaces such as decks and fences are not recommended, as subsequent peeling and flaking may ultimately have an impact on durability as well as exposure to the preservatives in the wood. As always, parents should manage risks to their children, and follow several measures, including:

- Always wash hands thoroughly after contact with any wood, especially prior to eating and drinking; and,
- Ensure that food does not come into direct contact with any treated wood.

Consumers should follow the recommendations in the updated Consumer Awareness Program, including the same precautions that workers should take: wear gloves when handling wood, wear goggles and dust-mask when sawing and sanding, always wash hands before eating, and never burn CCA-treated wood. The Consumer Awareness Program is an education program conducted by the American Wood Preservers Institute at retail institutions to inform construction workers and others of measures needed to protect them from potential occupational exposure to CCA.
11. Are there alternatives for the terminated uses of CCA?

There are a number of non-arsenic containing preservatives that have been registered by EPA to pressure-treat wood for consumer applications (e.g., ammoniacal copper quat, ACQ, and copper boron azole, CBA). Some wood treated with these preservatives is already available at retail outlets such as home improvement stores. In addition, playground equipment made of other non-arsenic containing components is also available (e.g., woods such as cedar and redwood and non-wood alternatives such as metals and plastics). Consumers may also wish to consider the new generation wood preservative products, such as ACQ and CBA. During reregistration review, EPA will determine the availability of alternatives to the remaining uses of CCA.

12. What is the status of allowing the continued use of CCA to treat agricultural fence posts, and permanent wood foundations?

In light of comments received, EPA is deferring any action with respect to requests to terminate CCA use on agricultural fence posts and also on permanent wood foundations at this time. Fence posts for agricultural uses may continue to be treated with CCA. Specifically, fence posts treated according to AWPA Standard C16 are for agricultural purposes only. This particular type of fence post is used by many farmers and ranchers for barbed and other wire fencing. The distribution channels, aesthetics, size, round shape, and random diameter of that type of fence post effectively limit its use for specific agricultural purposes, and make it inappropriate for residential applications. The Agency has determined, based on available information and field investigations, that agricultural fence posts are not sold in the residential market. On the other hand, wood treated for fence posts according to AWPA Standard C5 is sold at the retail level for residential fencing and can be used for other residential applications as well. Therefore, fence posts intended for residential fencing in accordance with the C5 standard cannot be treated with CCA after December 30, 2003. The Agency will review use of CCA to treat agricultural fence posts, as well as permanent wood foundations, through its reregistration process. We believe this temporary deferral for these two uses maintains the principle to phase out CCA for residential uses.

13. Is the process of phasing out CCA by voluntary cancellation/use termination faster than the traditional regulatory process?

This action is much faster than the traditional regulatory process, potentially cutting the time in half. The Agency is expediting the risk assessment process so we can better understand any potential risks to children. If at any time we have information that shows an unacceptable risk to children or others is caused by CCA-treated wood, we will take steps immediately to notify the public and reduce any risks to the public.

The Agency found that allowing the voluntary cancellation of most residential uses of CCA and phasing CCA out of the residential marketplace over the next nine months was the most expedient way to minimize risk to consumers. While EPA recognizes that the transition to alternative chemicals may pose significant challenges to some stakeholders, including wood treaters who have to convert their plants to alternative chemicals, in their requests for cancellation/use termination the registrants indicated that this time period was adequate. Therefore, EPA did not extend the effective date beyond December 31, 2003.
14. **What are the existing stocks provisions in the final cancellation order?**

With respect to cancelled registrations, the registrants have until May 16, 2003 (60 calendar days from the effective date of the cancellation order) to sell or distribute or use the products affected by the order. Sale, distribution, or use by persons other than the registrant may continue until supplies are exhausted, provided any sale, distribution, or use is in accordance with the existing label of that product. Regarding registrations amended to delete terminated uses, the registrants have until May 16, 2003 (60 calendar days from the effective date of the cancellation order) to use previous (unamended) labels, to allow a sufficient period of time for an orderly transition to the amended labels without disrupting supply and availability of product. Sale, distribution, or use by persons other than the registrant may continue until supplies are exhausted.

15. **How do I dispose of CCA-treated wood?**

CCA-treated wood is classified as non-hazardous waste under the Federal Resource Conservation and Recovery Act (RCRA), and disposal of CCA-treated wood is addressed via the Consumer Awareness Program (CAP). The CAP is a voluntary program established in 1986 (and later updated in 2001) by the registrants of CCA products, to protect consumers by providing them with information on the proper handling, use and disposal of CCA-treated wood. Under this program, instructions on the proper handling, use and disposal of CCA-treated wood are disseminated to consumers upon purchasing CCA-treated wood products via the Consumer Safety Information Sheets (CSIS) and/or end tag labeling applied to the wood product itself. CCA-treated wood should never be burned in open fires, stoves, fireplaces, or residential boilers. Additional information regarding the CAP, handling, use and disposal of CCA-treated wood can be obtained from the Agency's Web site at: www.epa.gov/pesticides/factsheets/chemicals/1file.htm. You can also contact your state or local solid waste management offices to receive instructions on how to dispose of CCA-treated wood.

View the graphical version of this page at:
http://www.epa.gov/pesticides/factsheets/chemicals/residential_use_cancellation.htm
APPENDIX F

ATSDR PCBs Fact Sheet

EPA PCB Impacts on Fish Advisories Fact Sheet

ATSDR Health Consultation: PCBs in Fish from Choccolocco Creek
POLYCHLORINATED BIPHENYLS

February 2001

This fact sheet answers the most frequently asked health questions (FAQs) about polychlorinated biphenyls. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It’s important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Polychlorinated biphenyls (PCBs) are a mixture of individual chemicals which are no longer produced in the United States, but are still found in the environment. Health effects that have been associated with exposure to PCBs include acne-like skin conditions in adults and neurobehavioral and immunological changes in children. PCBs are known to cause cancer in animals. PCBs have been found in at least 500 of the 1,598 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are polychlorinated biphenyls?
Polychlorinated biphenyls are mixtures of up to 209 individual chlorinated compounds (known as congeners). There are no known natural sources of PCBs. PCBs are either oily liquids or solids that are colorless to light yellow. Some PCBs can exist as a vapor in air. PCBs have no known smell or taste. Many commercial PCB mixtures are known in the U.S. by the trade name Aroclor.

PCBs have been used as coolants and lubricants in transformers, capacitors, and other electrical equipment because they don’t burn easily and are good insulators. The manufacture of PCBs was stopped in the U.S. in 1977 because of evidence they build up in the environment and can cause harmful health effects. Products made before 1977 that may contain PCBs include old fluorescent lighting fixtures and electrical devices containing PCB capacitors, and old microscope and hydraulic oils.

What happens to PCBs when they enter the environment?
- PCBs entered the air, water, and soil during their manufacture, use, and disposal; from accidental spills and leaks during their transport; and from leaks or fires in products containing PCBs.
- PCBs can still be released to the environment from hazardous waste sites; illegal or improper disposal of industrial wastes and consumer products; leaks from old electrical transformers containing PCBs; and burning of some wastes in incinerators.
- PCBs do not readily break down in the environment and thus may remain there for very long periods of time. PCBs can travel long distances in the air and be deposited in areas far away from where they were released. In water, a small amount of PCBs may remain dissolved, but most stick to organic particles and bottom sediments. PCBs also bind strongly to soil.
- PCBs are taken up by small organisms and fish in water. They are also taken up by other animals that eat these aquatic animals as food. PCBs accumulate in fish and marine mammals, reaching levels that may be many thousands of times higher than in water.

How might I be exposed to PCBs?
- Using old fluorescent lighting fixtures and electrical devices and appliances, such as television sets and refrigerators, that were made 30 or more years ago. These items may leak small amounts of PCBs into the air when they get hot during operation, and could be a source of skin exposure.
- Eating contaminated food. The main dietary sources of PCBs are fish (especially sportfish caught in contaminated lakes or rivers), meat, and dairy products.
- Breathing air near hazardous waste sites and drinking contaminated well water.
- In the workplace during repair and maintenance of PCB transformers; accidents, fires or spills involving transformers, fluorescent lights, and other old electrical devices; and disposal of PCB materials.

How can PCBs affect my health?
The most commonly observed health effects in people exposed to large amounts of PCBs are skin conditions such as acne and rashes. Studies in exposed workers have shown changes in blood and urine that may indicate liver damage. PCB exposures in the general population are not likely to result in skin and liver effects. Most of the studies of health effects of PCBs in the general population examined children of mothers who were exposed to PCBs.

Animals that ate food containing large amounts of PCBs for short periods of time had mild liver damage and some died. Animals that ate smaller amounts of PCBs in food over several weeks or months developed various kinds of health effects, including anemia; acne-like skin conditions; and liver, stomach, and thyroid gland injuries. Other effects
of PCBs in animals include changes in the immune system, behavioral alterations, and impaired reproduction. PCBs are not known to cause birth defects.

How likely are PCBs to cause cancer?

Few studies of workers indicate that PCBs were associated with certain kinds of cancer in humans, such as cancer of the liver and biliary tract. Rats that ate food containing high levels of PCBs for two years developed liver cancer. The Department of Health and Human Services (DHHS) has concluded that PCBs may reasonably be anticipated to be carcinogens. The EPA and the International Agency for Research on Cancer (IARC) have determined that PCBs are probably carcinogenic to humans.

How can PCBs affect children?

Women who were exposed to relatively high levels of PCBs in the workplace or ate large amounts of fish contaminated with PCBs had babies that weighed slightly less than babies from women who did not have these exposures. Babies born to women who ate PCB-contaminated fish also showed abnormal responses in tests of infant behavior. Some of these behaviors, such as problems with motor skills and a decrease in short-term memory, lasted for several years. Other studies suggest that the immune system was affected in children born to and nursed by mothers exposed to increased levels of PCBs. These are no reports of structural birth defects caused by exposure to PCBs or of health effects of PCBs in older children. The most likely way infants will be exposed to PCBs is from breast milk. Transplacental transfers of PCBs were also reported. In most cases, the benefits of breast-feeding outweigh any risks from exposure to PCBs in mother’s milk.

How can families reduce the risk of exposure to PCBs?

- You and your children may be exposed to PCBs by eating fish or wildlife caught from contaminated locations. Certain states, Native American tribes, and U.S. territories have issued advisories to warn people about PCB-contaminated fish and fish-eating wildlife. You can reduce your family’s exposure to PCBs by obeying these advisories.
- Children should be told not play with old appliances, electrical equipment, or transformers, since they may contain PCBs.
- Children should be discouraged from playing in the dirt near hazardous waste sites and in areas where there was a transformer fire. Children should also be discouraged from eating dirt and putting dirty hands, toys or other objects in their mouths, and should wash hands frequently.
- If you are exposed to PCBs in the workplace it is possible to carry them home on your clothes, body, or tools. If this is the case, you should shower and change clothing before leaving work, and your work clothes should be kept separate from other clothes and laundered separately.

Is there a medical test to show whether I’ve been exposed to PCBs?

Tests exist to measure levels of PCBs in your blood, body fat, and breast milk, but these are not routinely conducted. Most people normally have low levels of PCBs in their body because nearly everyone has been environmentally exposed to PCBs. The tests can show if your PCB levels are elevated, which would indicate past exposure to above-normal levels of PCBs, but cannot determine when or how long you were exposed or whether you will develop health effects.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 0.0005 milligrams of PCBs per liter of drinking water (0.0005 mg/L). Discharges, spills or accidental releases of 1 pound or more of PCBs into the environment must be reported to the EPA. The Food and Drug Administration (FDA) requires that infant foods, eggs, milk and other dairy products, fish and shellfish, poultry and red meat contain no more than 0.2-3 parts of PCBs per million parts (0.2-3 ppm) of food. Many states have established fish and wildlife consumption advisories for PCBs.

References

Polychlorinated Biphenyls (PCBs) Update: Impact on Fish Advisories

PCBs are a group of synthetic organic chemicals that contain 209 possible individual chlorinated biphenyl compounds. These chemically related compounds are called congeners and vary in their physical and chemical properties and toxicity. There are no known natural sources of PCBs. Although banned in the United States from further production in 1979, PCBs are distributed widely in the environment because of their persistence and widespread use. PCB mixtures found in the environment are different from the commercially produced PCB mixtures (known as Aroclors in the United States) because of differences in chemical properties, persistence, and bioaccumulation among the different congeners. The most common analytical method used to detect PCBs in the environment is based on Aroclor analysis; however, congener-specific methods have been developed and currently are being tested. PCB exposure is associated with a wide array of adverse health effects in experimental animals. Experimental animal studies have shown toxic effects to the liver, gastrointestinal system, blood, skin, endocrine system, immune system, nervous system, and reproductive system. In addition, developmental effects and liver cancer have been reported. Skin rashes and a severe form of acne have been documented in humans; however, other effects of PCB exposure in humans are not well understood. EPA has classified PCBs as probable human carcinogens (Group B2). As of 1998, 37 states have issued 679 fish advisories for PCBs. These advisories inform the public that high concentrations of PCBs have been found in local fish at levels of public health concern. State advisories recommend either limiting or avoiding consumption of certain fish from specific waterbodies or, in some cases, from specific waterbody types (e.g., all freshwater lakes or rivers).

Sources of PCBs in the Environment

There are no known natural sources of PCBs; therefore, all sources of PCBs are related to commercial manufacture, use, storage, and disposal. Manufacture of PCBs was banned in the United States in 1979. However, PCB-containing materials still in service at the time of the ban were not required to be removed from use, and, therefore, some are still in use. For example, the life expectancy of electrical transformers that contain PCBs is 30 years or more.

Currently, the major source of PCBs is environmental reservoirs from past releases. PCBs have been detected in soil, surface water, air, sediment, plants, and animal tissue in all regions of the earth. PCBs are highly persistent in the environment with reported half-lives in soil and sediment ranging from months to years. Because PCBs have very low solubility in water and low volatility, most PCBs are contained in sediments that serve as environmental reservoirs from which PCBs may continue to be released over a long period of time. PCBs may be mobilized from sediments if disturbed (e.g., flooding, dredging).

Volatilization from land and surface water is also an important source for the global distribution of PCBs and is discussed below.

Fate and Transport of PCBs

The global cycling of PCBs results from their evaporation from soils and surface waters to the atmosphere and their redeposition back to land and surface water. Adsorption to sediments and volatilization are the primary loss mechanisms from surface water.

PCBs are highly lipophilic (fat soluble) and are rapidly accumulated by aquatic organisms and bioaccumulated through the aquatic food chain. Concentrations of PCBs in aquatic organisms may be 2,000 to more than a million times higher than the concentrations found in the surrounding waters, with species at the top of the food chain having the highest concentrations. Bioaccumulation factors vary among the congeners and generally increase with chlorine content from the trichlorobiphenyls up through the hexachlorobiphenyls and then generally...
decrease with higher chlorine content (hepta- and octa-chlorobiphenyls).

PCBs have been included in several major fish contaminant monitoring programs. A summary of the National Contaminant Biomonitoring Program (NCBP) data conducted by the U.S. Fish and Wildlife Service, from 1976 through 1984, indicated a significant downward trend in the geometric mean concentration in whole fish samples of total PCBs (from 0.89 ppm in 1976 to 0.39 ppm in 1984); however, PCB residues in fish tissue remain widespread, being detected at 91% of the sites monitored in 1984. Maximum total PCB tissue residue concentrations (wet weight) during this same period also declined, from 70.6 ppm in 1976 to 6.7 ppm in 1984. Coinciding declines in tissue residue concentrations of three Aroclors (1248, 1254, and 1260) were also observed. An analysis of the 1984-1985 data from the NCBP study showed there was no significant difference in residues in bottom feeding and predatory fish for Aroclor 1248 and 1254; however, there were significantly higher concentrations of Aroclor 1260 in predator species as compared to bottom feeders. Mean tissue concentrations of Aroclor 1248, 1254, and 1260 were 0.06 ± 0.32 0.21 ± 0.39, and 0.14 ± 0.24 ppm, respectively, for bottom feeders (e.g., carp, white suckers, and channel catfish) and 0.08 ± 0.31, 0.35 ± 0.69, and 0.23 ± 0.38 ppm, respectively, for predator species (e.g., rainbow, brown, brook, and lake trout, largemouth bass, and walleye).

Total PCBs also were detected at 91% of 374 sites surveyed in EPA’s National Study of Chemical Residues in Fish (NSCRF). Maximum, arithmetic mean, and median total PCB concentrations reported were 124, 1.89, and 0.209 ppm (wet weight), respectively. As is shown in Table 1, the tri-, tetra-, penta-, hexa-, and heptachlorobiphenyls were detected in fish tissue samples at >50% of the sites. Mean tissue concentrations were highest for the tetra- and pentachlorobiphenyls with concentrations of 0.696 and 0.565 ppm, respectively. The median fish tissue concentrations were highest for the hexa-followed by the pentachlorobiphenyls with concentrations of 0.077 and 0.072 ppm, respectively.

### Table 1. Summary of PCBs Detected in Fish Tissue* as Part of the National Study of Chemical Residues in Fish† (1986-1989)

<table>
<thead>
<tr>
<th>Congener Group</th>
<th>% of sites where detected</th>
<th>Maximum</th>
<th>Mean</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monochlorobiphenyl</td>
<td>13.8</td>
<td>0.235</td>
<td>0.001</td>
<td>ND</td>
</tr>
<tr>
<td>Dichlorobiphenyl</td>
<td>30.7</td>
<td>5.072</td>
<td>0.021</td>
<td>ND</td>
</tr>
<tr>
<td>Trichlorobiphenyl</td>
<td>57.5</td>
<td>18.344</td>
<td>0.150</td>
<td>0.002</td>
</tr>
<tr>
<td>Tetrachlorobiphenyl</td>
<td>72.4</td>
<td>60.764</td>
<td>0.696</td>
<td>0.023</td>
</tr>
<tr>
<td>Pentachlorobiphenyl</td>
<td>86.7</td>
<td>29.578</td>
<td>0.565</td>
<td>0.072</td>
</tr>
<tr>
<td>Hexachlorobiphenyl</td>
<td>88.7</td>
<td>8.862</td>
<td>0.356</td>
<td>0.077</td>
</tr>
<tr>
<td>Heptachlorobiphenyl</td>
<td>69.1</td>
<td>1.850</td>
<td>0.097</td>
<td>0.017</td>
</tr>
<tr>
<td>Octachlorobiphenyl</td>
<td>34.8</td>
<td>0.593</td>
<td>0.017</td>
<td>ND</td>
</tr>
<tr>
<td>Nonachlorobiphenyl</td>
<td>9.7</td>
<td>0.413</td>
<td>0.003</td>
<td>ND</td>
</tr>
<tr>
<td>Decachlorobiphenyl</td>
<td>3.3</td>
<td>0.038</td>
<td>0.001</td>
<td>0.003</td>
</tr>
<tr>
<td>Total PCBs*</td>
<td>91.4</td>
<td>-----</td>
<td>1.898</td>
<td>0.209</td>
</tr>
</tbody>
</table>

* Total PCBs refers to the sum of the concentrations of compounds with 1 to 10 chlorines.
† Concentrations are reported on a wet weight basis.
§ Species included freshwater, estuarine, and marine finfish; and a small number of marine shellfish.

### Potential Sources of Exposure and Occurrence in Human Tissues

Exposure to PCBs is predominantly through the diet, and especially from fish and seafood products. Red meat, poultry, eggs, and dairy products also may be important dietary sources of PCBs. Individuals in the general population who may be exposed to higher than average levels of PCBs include recreational and subsistence fishers who routinely consume large amounts of locally caught fish, subsistence hunters who routinely consume the meat and organ tissues of marine mammals, and persons who live near hazardous waste sites contaminated with PCBs.
Analytical methods are available to measure PCBs in blood, tissue, breast milk, and environmental media. However, currently there are no standard methods for analyzing for PCB congeners. There is a standard method for Aroclor analysis, but PCBs in environmental samples and human tissues are not adequately characterized as Aroclors. In the absence of peer-reviewed analytical methods for congener specific chemical analysis of fish tissue, EPA's Office of Water recommends the continued use of total Aroclor chemical analysis of fish tissue when conducting human health risk assessment for PCBs. Recently, new risk assessment methods for the PCB congeners have been published and peer-reviewed. However, the analytical methods for congener analysis have not been verified or peer reviewed. When standard methods for congener analysis have been verified and peer reviewed, the Office of Water will reevaluate the use of these methods because of their increased accuracy and precision over Aroclor analysis.

**Fish Advisories**

The states have primary responsibility for protecting their residents from the health risks of consuming contaminated noncommercially caught fish. They do this by issuing consumption advisories for the general population, including recreational and subsistence fishers, as well as sensitive subpopulations (such as pregnant women/fetus, nursing mothers, and children). These advisories inform the public that high concentrations of chemical contaminants, such as PCBs, have been found in local fish. The advisories recommend either limiting or avoiding consumption of certain fish from specific waterbodies or, in some cases, from specific waterbody types (e.g., freshwater lakes or rivers).

As of December 1998, PCBs were the chemical contaminants responsible, at least in part, for the issuance of 679 fish consumption advisories by 37 states, including the District of Columbia and the U.S. Territory of American Samoa (see Figure 1). Almost 27% of all advisories issued in the United States are

![Figure 1. 1998 Fish Advisories for PCBs.](image-url)
a result of PCB contamination in fish and shellfish. The number of advisories for PCBs is second only to that for mercury advisories. Advisories for PCBs have increased 112% from 319 advisories in 1993 to 679 advisories in 1998. The number of states that have issued PCB advisories increased only slightly from 31 to 35 states from 1993 to 1994 and then declined to 34 states for 1995 and 1996. In 1997 and 1998, the number of states issuing advisories rose to 36 and 37, respectively. Advisories for PCBs increased nearly 15% from 1997 (588 advisories) to 1998 (679 advisories). Three states (Indiana, New York, and the District of Columbia) have issued statewide advisories for PCBs in their freshwater lakes and/or rivers. Another 6 states—Connecticut, Massachusetts, New Jersey, New Hampshire, New York, and Rhode Island—have statewide PCB advisories in effect for their coastal marine waters. To date, 79% of the 679 PCB advisories in effect have been issued by the following 10 states; Indiana (125), Michigan (104) Minnesota (83), Wisconsin (54), New York (47), Ohio (37), Georgia (25). Pennsylvania (22), Nebraska (22), and Massachusetts (20). General recommendations regarding food preparation, such as trimming the fat and skimming the fish prior to cooking, also may be included in the general advisory information. Lipophilic chemicals, such as PCBs, accumulate mainly in fatty tissues (belly flap, lateral line, subcutaneous and dorsal fat, dark muscle, gills, eye, brain, and internal organs). Therefore, removal of internal organs and skin and trimming the fat before cooking will decrease exposure. In addition, various cooking procedures can also reduce the amount of PCBs consumed (see Appendix section "Dose Modification Due to Food Preparation and Cooking" of EPA’s Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, Volume 2).

**Fish Consumption Limits**—Table 2 shows the recommended monthly fish consumption limits for PCBs for fish consumers based on EPA’s default values for risk assessment parameters. Consumption limits have been calculated as the number of allowable fish meals per month, based on the ranges of PCBs in the consumed fish tissue. The following assumptions were used to calculate the consumption limits:

- Consumer adult body weight of 72 kg
- Average fish meal size of 8 oz (0.227 kg)
- Time-averaging period of 1 month (30.44 days)
- EPA's reference dose for PCBs (2 × 10^-5 mg/kg-d) from EPA’s Integrated Risk Information System (U.S. EPA, 1999)
- EPA's cancer slope factor for PCBs (2 per mg/kg-d) from EPA’s Integrated Risk Information System (U.S. EPA, 1999c)
- Maximum acceptable cancer risk level (10^-6 over a 70-year lifetime)

For example, when PCB levels in fish tissue are 0.05 ppm, then three 8-oz. meals per month (based on the noncancer health endpoint—EPA’s reference dose) or a half of an 8-oz. meal per month (based on the cancer health endpoint—EPA’s cancer slope factor) can safely be consumed. EPA recommends using the more conservative of the two limits, for PCBs, this is the consumption limit based on the cancer endpoint.

### Table 2. Monthly Fish Consumption Limits for PCBs

<table>
<thead>
<tr>
<th>Risk-Based Consumption Limit</th>
<th>Noncancer Health Endpoints</th>
<th>Cancer Health Endpoints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish Meals/Month</td>
<td>Fish Tissue Concentrations (ppm, wet weight)</td>
<td>Fish Tissue Concentrations (ppm, wet weight)</td>
</tr>
<tr>
<td>16</td>
<td>&gt;0.006 - 0.012</td>
<td>&gt;0.0015 - 0.003</td>
</tr>
<tr>
<td>12</td>
<td>&gt;0.012 - 0.016</td>
<td>&gt;0.003 - 0.004</td>
</tr>
<tr>
<td>8</td>
<td>&gt;0.016 - 0.024</td>
<td>&gt;0.004 - 0.006</td>
</tr>
<tr>
<td>4</td>
<td>&gt;0.024 - 0.048</td>
<td>&gt;0.006 - 0.012</td>
</tr>
<tr>
<td>3</td>
<td>&gt;0.048 - 0.064</td>
<td>&gt;0.012 - 0.016</td>
</tr>
<tr>
<td>2</td>
<td>&gt;0.064 - 0.097</td>
<td>&gt;0.016 - 0.024</td>
</tr>
<tr>
<td>1</td>
<td>&gt;0.097 - 0.19</td>
<td>&gt;0.024 - 0.048</td>
</tr>
<tr>
<td>0.5</td>
<td>&gt;0.19 - 0.39</td>
<td>&gt;0.048 - 0.097</td>
</tr>
<tr>
<td>None (&lt;0.5)</td>
<td>&gt;0.39</td>
<td>&gt;0.097</td>
</tr>
</tbody>
</table>

None = No consumption recommended.

NOTE: In cases where >16 meals per month are consumed, refer to EPA’s Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, Volume 2, Section 3 for methods to determine safe consumption limits.

For sensitive populations, such as pregnant women, nursing mothers, and young children, some states have issued either "no consumption" advisories or "restricted consumption" advisories for PCBs. Additional information on calculating specific limits for these sensitive populations is available in EPA’s Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, Volume 2, Section 3.

### Toxicity of PCBs

**Pharmacokinetics**—PCBs are absorbed through the gastrointestinal tract and distributed throughout the body. Studies of individual chlorobiphenyl congeners indicate, in general, that PCBs are readily absorbed, with an oral absorption efficiency of 75% to greater than 90%. Because of their lipophilic nature, PCBs, especially the more highly chlorinated congeners (tetra- through hexachlorobiphenyl), tend to accumulate in lipid-rich tissues. Greater relative amounts of PCBs are usually found in the liver, adipose tissue, skin, and breast milk. It has been shown that absorption by nursing infants of tetra- and higher chlorinated congeners from breast milk ranges from 90% to 100% of the dose. Offspring can also be...
exposed to PCBs through placental transfer. PCBs have also been measured in other body fluids including plasma, follicular fluid, and sperm fluid.

The retention of PCBs in fatty tissues is linked to the degree of chlorination and also to the position of the chlorine atoms in the biphenyl ring. In general, higher chlorinated PCBs persist for longer periods of time. Pharmacokinetic modeling of PCB disposition indicates that PCB movement in the body is a dynamic process, with exchanges between various tissues that depend on fluctuating exposure levels to specific congeners. The result is elimination of congeners that are more easily metabolized and retention of those that resist metabolism. In occupationally-exposed individuals, lower chlorinated congeners had half-lives between 1 and 6 years and higher chlorinated PCBs had half-lives ranging from 8 to 24 years.

PCBs induce mixed function oxidases, and different congeners induce specific forms (isozymes) of the cytochrome P-450 system. Although there has been much research into the mechanisms of PCB toxicity, there is no clear definition of the mechanisms for most congeners. The congeners appear to act by a variety of mechanisms. Some PCB congeners are similar to dioxins and bind to a cytosolic protein, the Ah receptor, which regulates the synthesis of a variety of proteins. The toxicity of these congeners is similar to dioxins. The toxicity of other PCB congeners seems to be unrelated to the Ah receptor. Ultimately, the toxicity of a PCB mixture may depend on the toxicity of the individual congeners and their interactions.

**Acute Toxicity**—Acute high-level exposures of laboratory animals to PCBs have resulted in liver and kidney damage, neurological effects, developmental effects, endocrine effects, hematological effects, and death. LD<sub>50</sub> values for Aroclor mixtures range from about 1,000 mg/kg to more than 4,000 mg/kg. No human deaths have been associated with acute exposure to PCBs.

**Chronic Toxicity**—In animal studies, numerous effects have been documented, including hepatic, gastrointestinal, hematological, dermal, body weight changes, endocrine, immunological, neurological, and reproductive effects. Most of the studies have involved oral exposure. Despite the variety of adverse effects observed in animals exposed to PCBs, overt adverse effects in humans have been difficult to document. This has been attributed to the fact that, in most cases, the dosages tested in animals were considerably higher than those found in occupational exposures and the difficulties with interpreting epidemiological studies. These include multiple confounding factors, uncertain exposure estimates, and statistical limitations. Skin rashes and a persistent and severe form of acne (chloracne) have been reported following exposures to PCBs. Occupational and accidental exposures have indicated that PCBs may affect many organs including the gastrointestinal, respiratory, immune, central nervous, and cardiovascular systems.

**Developmental Toxicity**—PCB mixtures have been shown to cause adverse developmental effects in experimental animals. Some human studies have suggested that PCB exposure may cause adverse effects in children and in developing fetuses while other studies have not shown effects. Reported effects include lower IQ scores, low birth weight, and lower behavior assessment scores. However, study limitations, including lack of control for confounding variables, deficiencies in the general areas of exposure assessment, selection of exposed and control subjects, the comparability of exposed and control samples, and different findings from different studies provide inconclusive evidence that PCBs cause developmental effects in humans.

A study was conducted of pregnancy outcomes in women who had consumed PCB-contaminated fish from Lake Michigan over an average of 16 years (exposure both prior to and during pregnancy). Consumption of contaminated fish and levels of total PCBs in cord serum correlated with lower birth weight, smaller head circumference, and shorter gestational age. Fish consumption was correlated with delayed neuromuscular maturity, and, at 7 months, the children had subnormal visual recognition memory. Children from this cohort were examined at ages 4 and 11. At age 4, cord serum PCB levels were associated with impaired short-term memory. Activity level was inversely related to 4-year serum PCB level and also to maternal milk PCB level. At age 11, prenatal exposure to PCBs was associated with lower full-scale and verbal IQ scores after controlling for potential confounding variables such as socio-economic status. The results from this series of studies were confounded by possible maternal exposure to other chemicals and by the fact that the exposed group, on average, drank more alcohol and caffeine prior to and during pregnancy, weighed more, and took more cold medications during pregnancy than the nonexposed group.

Other relevant studies generally found no significant differences between control groups and exposed groups regarding stillbirths, multiple births, preterm births, congenital anomalies, and low birth weight.

Information on chronic developmental toxicity is available from studies in Rhesus monkeys. Exposure periods ranged from 12 to 72 months. Inflammation of tarsal glands, nail lesions, and gum recession were noted in offspring of monkeys exposed to Aroclor 1254. Adverse neurobehavioral effects were reported following exposure to Aroclor 1016 and Aroclor 1248. Other observed effects include reduction in birth weight and increased infant death for Aroclor 1248.
Exposure via lactation is a significant concern for neonates. Animal studies indicate that lactational exposure may be more significant than prenatal exposure. In monkeys, signs of PCB intoxication were observed in lactationally-exposed offspring, but not in offspring exposed only prenatally.

**PCB Exposure and Development Effects**—The data from some studies in humans suggest that exposure to PCBs may cause developmental effects. However, limitations of these studies diminish the validity of the results. Animal studies indicate that PCBs can cause developmental effects following prenatal or postnatal exposure.

**Mutagenicity**—The majority of mutagenicity assays of PCBs have been negative. However, an increase in the percentage of chromosomal aberrations in peripheral lymphocytes and an increase in the sister chromatid exchange rate were reported in a study of workers manufacturing PCBs for 10 to 25 years. Although workers and controls were matched for smoking and drinking, concurrent exposure to other known human genotoxic chemicals occurred. Another study found an increased incidence of chromatin exchanges in lymphocytes from workers exposed to PCBs in an electric power substation fire compared to unexposed controls. It is possible that toxic chlorinated dioxins and/or furans generated during the fire may have been responsible for the effects.

The weight of evidence from the in vitro and in vivo genotoxicity studies suggests that PCBs are not likely to be genotoxic to humans. However, exposure to PCBs may enhance the genotoxic activity of other chemicals.

**Carcinogenicity**—PCBs are classified by EPA as Group B2—probable human carcinogens. This is based on studies that have found liver tumors in rats exposed to Aroclors 1260, 1254, 1242, and 1016. Evaluation of the animal data indicates that PCBs with 54% chlorine content induces a higher yield of liver tumors in rats than other PCB mixtures.

Human epidemiological studies of PCBs have not yielded conclusive results. There is some suggestive evidence that xenoestrogens, including PCBs, may play a role in breast cancer induction. Some studies have indicated an excess risk of several cancers including: liver, biliary tract, gall bladder, gastrointestinal tract, pancreas, melanoma, and non-Hodgkins’s lymphoma. As with all epidemiological studies, it is very difficult to obtain clear unequivocal results because of the long latency period required for cancer induction and the multiple confounders arising from concurrent exposures, lifestyle differences, and other factors. The currently available evidence is considered inadequate, but suggestive that PCBs may cause cancer in humans.

**Summary of EPA Health Benchmarks**

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic Toxicity Reference Dose:</td>
<td>2x10^{-5} mg/kg-d (Aroclor 1254) (U.S. EPA, 1999c)</td>
</tr>
<tr>
<td>Carcinogenicity:</td>
<td>1 (central estimate) to 2 (upper bound) per mg/kg-d (U.S. EPA, 1999c)</td>
</tr>
<tr>
<td>Developmental Toxicity:</td>
<td>7x10^{-5} mg/kg-d (Aroclor 1016) (U.S. EPA, 1999c)</td>
</tr>
</tbody>
</table>

**Special Susceptibilities**—There is evidence that embryos, fetuses, and neonates are more susceptible to PCBs due to their under-developed enzymatic systems, which may lead to increased accumulation in the body. Breast-fed infants may have an increased risk because of bioconcentration of PCBs in breast milk and high intake rates relative to body weights. In addition, there is evidence that a steroid present in human milk inhibits glucuronyl transferase activity which could in turn, inhibit glucuronidation and excretion of PCB metabolites. Other individuals with potentially greater risk include those with liver and blood diseases or those with syndromes associated with impairment to the metabolic systems that help eliminate PCBs from the body.

**Interactive Effects**—PCBs induce microsomal enzymes; therefore, the effects of exposure to PCBs or other compounds depend on the role of oxidative metabolism. For example, preexposure to PCBs may enhance the liver toxicity of some chemicals (trichloroethylene, mirex, kepone, carbon tetrachloride, tetrachloroethylene) but decrease the liver toxicity of 1,1-dichloroethylene. Other interactive effects include increased metabolism and excretion of pentobarbital, increased genotoxicity of numerous carcinogens, increased duodenal ulcerogenic activity of acrylonitrile, and increased kidney toxicity of trichloroethylene.

**Critical Data Gaps**—The following studies could help to fill in some of the key data gaps for PCBs: congener-specific PCB levels in human tissues; epidemiological studies of population living near PCB contaminated sites and occupational settings where exposure to PCBs still occurs; reproductive studies in humans and animals including fertility studies in males of a sensitive species; developmental and neurodevelopmental studies; immunotoxicity studies in humans and animals; neurotoxicity studies in humans with high PCB body burdens and in animals; chronic studies to determine the most sensitive
animal target organ and species; and comparative toxicity of Aroclors and bioaccumulated PCBs.

**EPA Regulations and Advisories**

- Maximum Contaminant Level in drinking water = 0.0005 mg/L
- Water Quality Criteria:
  - Continuous chronic criteria (freshwater) = 0.014 µg/L
  - Continuous chronic criteria (saltwater) = 0.03 µg/L
  - Human health = 0.00017 µg/L
- Listed as a hazardous air pollutant under Section 112 of the Clean Air Act
- Reportable quantity = 1 lb
- Listed as a hazardous substance

**Sources of Information**


Delaware Department of Natural Resources and Environmental Control. 1999. Chemical Contaminants in Finfish from the Chesapeake and Delaware Canal and Implications for Human Risk. Delaware Department of Water Resources, March 31.


U.S. Environmental Protection Agency. IRIS (Integrated Risk Information System) for Aroclor 1254. 1999c. National Center for Environmental Assessment, Office of Research and Development. Cincinnati, OH.


For more information about the National Fish and Wildlife Contamination program, contact:

Mr. Jeffrey Bigler
U.S. Environmental Protection Agency
Office of Science and Technology
401 M St. S.W. (4305)
Washington, DC 20460

Bigler.Jeff@epa.gov
202 260-1305
202 260-9830 (fax)

The 1998 update of the database *National Listing of Fish and Wildlife Advisories* is available for downloading from the following Internet site:
http://www.epa.gov/OST
Health Consultation

Public Comment Release

Polychlorinated Biphenyls in Fish from Choccolocco Creek

ANNISTON PCB SITE (MONSANTO COMPANY)
ANNISTON, CALHOUN COUNTY, ALABAMA

EPA FACILITY ID: ALD000400123

JANUARY 15, 2004

Comment Period End Date: March 1, 2004

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
Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR 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.

The Public Comment Period is an opportunity for the general public to comment on Agency findings or proposed activities for this written consultation. The purposes of the comment period are to 1) provide the public, particularly the community associated with a site, the opportunity to comment on the public health findings, 2) evaluate whether the community health concerns have been adequately addressed, and 3) provide ATSDR with additional information. There will be a time period for written comments, which will run until March 1, 2004. Please address correspondence to the Chief, Program Evaluation, Records, and Information Services Branch, Division of Health Assessment and Consultation, Agency for Toxic Substances and Disease Registry, Anniston PCB Site (Monsanto Company), 1600 Clifton Road, NE (E60), Atlanta, Georgia 30333.

The conclusions and recommendations presented in this health consultation are the result of site specific analyses and are not to be cited or quoted for other evaluations or health consultations.

You May Contact ATSDR TOLL FREE at
1-888-42ATSDR
or
HEALTH CONSULTATION

PUBLIC COMMENT RELEASE

Polychlorinated Biphenyls in Fish from Choctolocco Creek

ANNISTON PCB SITE (MONSANTO COMPANY)
ANNISTON, CALHOUN COUNTY, ALABAMA

EPA FACILITY ID: ALD000400123

Prepared by:
Exposure Investigation and Consultation Branch
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry
Background and Statement of Issue

Anniston-area community members have posed questions and voiced concerns regarding polychlorinated biphenyl (PCB) levels in fish taken from waters that received historical releases of PCBs. In this health consultation, the Agency for Toxic Substances and Disease Registry (ATSDR) evaluates recent data describing PCB levels in fish from Choccolocco Creek, a primary surface water drainage in the area of Anniston and Oxford, Alabama. This document assesses whether consumption of fish taken from Choccolocco Creek poses a public health hazard.

Choccolocco Creek is located in the Coosa River Basin in Talladega, Calhoun, and Cleburne counties in east-central Alabama. It is the primary watershed draining the Anniston/Oxford, AL area (see Figure 1). PCBs entered Choccolocco Creek through Snow Creek, a tributary that received PCB releases from the production facility located in west Anniston. Snow Creek runs south from the vicinity of the former PCB manufacturing plant, through Anniston and Oxford (a distance of approximately five miles), and empties into Choccolocco Creek, which runs a westerly course through approximately 20 miles of rural property to its confluence with Lake Logan Martin (Figure 1).

Eating PCB-contaminated fish contributes to the levels of PCBs in humans [2, 3]. In the past, PCB contaminants in fish from Choccolocco Creek have been addressed by the Alabama Department of Environmental Management (ADEM) and the Alabama Department of Public Health (ADPH). Findings from these investigations, including fish sampling and analyses, resulted in initial fish consumption advisories for Choccolocco Creek. The initial “no consumption” advisories were issued in 1993. A similar advisory was re-issued for Choccolocco Creek in the spring of 2002; it recommends no consumption of any fish caught in the creek [1].

ADPH and other State agencies have posted signs that inform anglers of the fish consumption advisories at several access points along Choccolocco Creek. Further information on the fish consumption advisories is available at the ADPH Web site (www.adph.org/risk/ and follow links for fish and fish consumption). In addition, various fish consumption advisories resulting from PCB levels in fish tissues have been issued for nearby Lake Logan Martin and the Coosa River (See Appendix A for the fish consumption advisories issued by ADPH).

The data evaluated for this health consultation were compiled for Solutia Inc. by Blasland, Bouck, and Lee, Inc. [4]. The fish considered for the assessments were collected in 2001 by ADEM and by a contractor hired by Solutia Inc. Various fish species were taken at four different sampling locations on Choccolocco Creek (Figure 1). ADEM and the Solutia Inc. contractor each collected separate samples at one of the sample locations.
The data considered for this health consultation are from these collection activities and from data development as described below:

Various species of fish were collected at each of four collection sites on Choccolocco Creek (Figure 1). The species were largemouth bass, striped bass, spotted bass, channel catfish, blue catfish, black crappie, and freshwater drum.

Only data from “adult” fish collected in 2001 were considered in this health consultation.

At one site (Figure 1; Station 35), both ADEM and the Solutia Inc. contactor collected separate samples. Those separate collection efforts netted different species, and the data developed from those fish were treated as two different samples.

Data from three to ten individuals of a given species, collected at the different sampling sites, were used to estimate PCB concentration in fish fillets (Table 1). The average PCB levels for the same species, taken from different collection sites, are evaluated as a range of PCB levels that could be consumed when eating a given species taken from Choccolocco Creek.

The skin-off fillet samples were analyzed by gas chromatography, following EPA SW-846 method 8082 [5], and PCB concentrations were reported as parts per million (ppm) on a wet-weight basis.

**Results and Discussion**

Ingestion of PCB-contaminated fish is the exposure pathway considered for this health consultation. It is acknowledged that other exposures, such as occupational exposures, ingestion of contaminated soil, or inhalation of contaminated air and dust, can contribute to the total exposure of an individual. Several of these exposure pathways have been addressed or are currently under investigation by ATSDR (Appendix B).

The specific data reviewed for this health consultation describe fish collected in 2001; they represent the most recent data on the local fish. The historical record shows that in most PCB-contaminated areas, PCB levels in fish tissues are declining [2]. The available data for Choccolocco Creek is consistent with findings from other sites [2, 4]. Because PCB levels in fish have declined over the past decades, the most recent data provide the best estimate for assessing current exposures from eating PCB-contaminated fish.

**Exposure Assessment**

Numerous reports have shown that blood PCB levels increase with increased consumption of PCB-contaminated fish [reviewed in 2]. This health consultation assesses the exposures from eating contaminated fish by providing answers to two primary questions:
1) What are the levels of PCBs in the fish that are eaten?

2) How many of the contaminated fish are eaten?

(Note that other factors are also associated with hazard evaluations for eating contaminated fish and issuing fish consumption advisories. These other factors include consideration of cooking methods, size of the fish eaten, and body weight of the individual eating the fish. (See Appendix A for discussions of methods to reduce exposures from eating PCB-contaminated fish.)

1) **What are the levels of PCBs in the fish that are eaten?** Summary statistics describing the PCB concentrations in fish collected from Choccolocco Creek are provided in Table 1 (This table is constructed from the complete data set that is presented in reference 4.) Fish species from the four different sampling locations along Choccolocco Creek (see Figure 1) contained average PCB levels (based on wet weight) as follows:

Channel catfish had average PCB levels that ranged from 1.26 to 8.87 ppm;

Largemouth bass had average PCB levels that ranged from 0.35 to 1.55 ppm;

Black crappie had average PCB levels that ranged from 1.32 to 1.8 ppm;

Spotted bass had average PCB levels that ranged from 0.32 to 2.37 ppm;

Striped bass (caught at only one collection site) had an average PCB level of 1.09 ppm;

Freshwater drum (caught at only one collection site) had an average PCB level of 2.73 ppm; and

Blue catfish (caught at only one collection site) had an average PCB level of 4.22 ppm.

Catfish (either Blue or Channel) had the highest average PCB concentrations in three of the four collection sites, and largemouth bass had the lowest average PCB levels in three of the four collection sites (Table 1).

2) **How many of the contaminated fish are eaten?** Studies have shown that the amount of PCB-contaminated fish consumed will vary greatly among individuals and different groups of people (demographic groups) [6, 7]. As a group, anglers are at increased risk of exposure because of consumption rates that are usually higher than those of the general public.
A random telephone survey, conducted in the State of Alabama in 1991 by ADPH, found that 24.5% of persons responding both ate freshwater fish and had gone fishing at least once in the previous year [6]. Within the broad category of “all Alabama anglers”, some groups tend to eat more freshwater fish than others. For example, the survey revealed that black anglers with low incomes and anglers over 50 years of age eat an average of 60 grams/day (g/day) and 76 g/day, respectively, of freshwater fish caught in Alabama [7].

These estimates compare with an average of 43.1 g/day for all anglers in the same study [7]. A national fish consumption survey (using data from 1989-1991) found that for all persons eating freshwater fish from all sources, fish consumption was estimated at approximately 4.7 g/day [8].

**Comparisons of Locally Caught Fish with Guidance Provided by the US Food and Drug Administration**

The hazard associated with eating PCB-contaminated fish from Choccolocco Creek is evaluated on the basis of a comparison with established guidance for fish that are known to be contaminated with PCBs. The ADPH “no consumption” advisory for all species of fish in Choccolocco Creek is based on PCB levels in fish that exceed the US Food and Drug Administration (FDA) tolerance level of 2 ppm [1]. Of the fish considered in this health consultation, eight of the 20 samples collected (different fish species from the different collection sites; also see Table 1) had average PCB levels that exceeded the FDA tolerance level of 2 ppm.

**Assessment of Eating Locally Caught Fish**

ATSDR considers the data reviewed to provide reasonable estimates of the PCB levels in the fish from Choccolocco Creek. The reviewed data describing PCB levels in the locally caught fish indicate that many of the fish examined have an average PCB level that exceeds the FDA tolerance level (2 ppm). In addition, compared to national estimates for consumption of locally caught fish, Alabamians are more likely to eat the fish they catch. The combination of elevated PCB levels in the local fish and eating more of the fish that anglers catch represents a public health hazard. Therefore, ATSDR has determined that the PCB-contaminated fish in Choccolocco Creek represent a public health hazard. ATSDR concurs with ADPH, which has made a similar assessment, and ATSDR supports ADPH’s issuance of “no consumption” advisories for Choccolocco Creek [1].

**Additional Considerations**

An earlier report has described PCBs in the sediments of both Choccolocco Creek and Snow Creek [5]. While ATSDR does not know of any data describing PCBs in the aquatic animals of Snow Creek, given the presence of contaminated sediments in Snow Creek, it is reasonable to suspect that the PCBs in the sediment of Snow Creek can contribute to the body burdens of the animals living in the creek. Recent findings from a different PCB-contaminated waterway support those suspicions [9]. Snow Creek is a
small stream that is unlikely to contain many “eating-sized” fish. However, ATSDR has received reports of adults and children fishing in Snow Creek. Given the likelihood that PCBs have contaminated fish in Snow Creek, ATSDR recommends, in accordance with prudent public health practice, that persons not eat fish taken from Snow Creek. A similar rationale indicates that it is also reasonable to restrict consumption of other aquatic animals, such as frogs and turtles, taken from both Choccolocco Creek and Snow Creek.

The highest average levels of PCBs found in the fish sampled were in catfish. The two highest individual fish PCB levels of all the fish evaluated were catfish, collected at two different sampling locations, with PCB levels of 19.7 and 20.6 ppm. In addition, four individual fish had PCB levels above 10 ppm, and all four were catfish. Because catfish are “sought-after” fish for Alabama anglers [6, 7], PCB-contaminated catfish could contribute to higher exposures for anglers who specifically fish for catfish and eat the fish they catch. Educational efforts to raise awareness of the fish consumption advisories in the Choccolocco Creek area should include information describing the higher PCB levels found in the locally caught catfish.

The current fish consumption advisories recommend no consumption of fish downstream of the confluence of Snow Creek and Choccolocco Creek. However, it should be recognized that the fish move freely in streams and do not recognize the geographic limits described in the consumption advisories. Note that in the fish collected upstream of the Snow Creek confluence (see “Station 10” on Figure 1), several individual fish had PCB levels that exceeded the FDA tolerance limit of 2 ppm. Moreover a catfish collected above the confluence of Snow Creek and Choccolocco Creek (see “Station 10” on Figure 1) had the highest PCB level at that collection site. Therefore, area anglers should be aware that at least some fish caught above the Snow Creek confluence may have elevated levels of PCBs.
Conclusions

1) Consumption of fish taken from Choccolocco Creek presents a public health hazard.

2) The current “no-consumption” advisories for fish from Choccolocco Creek are warranted.

3) In addition to fish, other aquatic animals from Choccolocco Creek and Snow Creek, may also contain elevated levels of PCBs, and if consumed could contribute to PCB exposures.

Recommendations

1) Continue the “no-consumption” recommendations for Choccolocco Creek.

2) Extend the “no-consumption” advisories to include all aquatic animals from Choccolocco Creek and Snow Creek.

Public Health Action Plan

1) ATSDR will discuss with the involved agencies how to better educate area anglers about the fish consumption advisories. Some demographic groups of Alabama anglers exhibit consumption patterns that place them at a higher risk level, and these groups should be the target of such educational efforts. In addition, educational efforts should raise the local awareness of the PCB levels in catfish.

2) ATSDR will initiate discussions with ADPH and ADEM concerning extending the no-consumption recommendations to include Snow Creek and other edible species.
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References


Appendix A

Alabama Fish Consumption Advisories and Information for Reducing Exposures Associated with Fish Consumption
Note: Appendix A (Pages 12-19) has been left blank intentionally, as it included the same documents as Appendix B of this report.
Appendix B

Recent Documents Related to Investigations in Anniston, AL
Recent Documents Related to Investigations in Anniston, AL

ATSDR Documents

Polychlorinated Biphenyls, Dioxins, and Pesticides in Soil, Blood, and Air from Anniston, Alabama  (Health Consultation)

(Released as “Final” document in July, 2003)

Assessment of Four Activities Addressing Childhood Blood Lead Levels In Anniston, Alabama.

(Released as a “Final” document on June 26, 2003.)

Anniston PCB Air Sampling  (Health Consultation)

(Released as a “Draft for Public Comment” on January 17, 2003)

ATSDR Childhood Blood Lead Screening Project

(Released as a “Final” document in February of 2002)

Exposure Investigation Report (Monsanto Company)

(Released as a “Final” document in October 2001.)

Exploring Opportunities for PCB Related Health Studies. Report from ATSDR’s Expert Panel

(Released as a “Final” Document in Spring 2002)

Evaluation of Lead in Residential Surface Soil from Anniston, Alabama (Health Consultation)

(Released as a “Final” document on January 8, 2001.)

Evaluation of Lead in the Surface Soil at the Oxford Lake Softball Complex (Health Consultation)

(Released as a “Final” document on January 22, 2001.)

Toxicological Profile for Polychlorinated Biphenyls (Update), November, 2000
Alabama Department of Public Health Documents

Health consultation. Monsanto Company, Anniston, Calhoun County, Alabama.

(Released as a "Final" document in January 1996)

Cobbtown/Sweet Valley Community PCB Exposure Investigation (Health Consultation)

(Released as a "Final" document in June 1996)

Monsanto/Solutia, Inc. (Public Health Assessment)

(Released as a "Final" document in May 2001)
Table 1. Total PCB Concentrations in Fish Tissue of Various Species Collected from Choccolocco Creek.

<table>
<thead>
<tr>
<th>Sample Location</th>
<th>Source</th>
<th>Species</th>
<th>sample size</th>
<th>range min</th>
<th>range max</th>
<th>average</th>
<th>SD</th>
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<td>CHOC 10</td>
<td>ADEM</td>
<td>Channel Catfish</td>
<td>6</td>
<td>0.025</td>
<td>3.87</td>
<td>1.26</td>
<td>1.57</td>
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<td></td>
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<td>0.5</td>
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<td></td>
<td>Spotted Bass</td>
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<td>2.91</td>
<td>1.95</td>
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<td>Black Crappie</td>
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<td>6.64</td>
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<td>Blue Catfish</td>
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<td>1.14</td>
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<td>20.6</td>
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<td></td>
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<td>Freshwater Drum</td>
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<td>7.7</td>
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<td>0.55</td>
<td>2.09</td>
<td>1.38</td>
<td>0.61</td>
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</tbody>
</table>

1 Data represent PCB concentrations (ppm) for wet weight, skin-off fillets from adult fish. "Qualified" data were used as the value provided (Table developed from: Fish Data Compendium for Choccolocco Creek and Lake Logan Martin: 1989-2001. Contractors report for Solutia, Inc, by Blasland, Bouck, and Lee, Inc. June 2002.). "Range" presents minimum (min) and maximum (max) values for the species collected at the given collections sites; "average" is the mean of all values for a given species and "SD" is the standard deviation of the mean.

2 Sample locations illustrated in Figure 1.

3 ADEM = Alabama Department of Environmental Management; Contractor = personnel under contract with Solutia Inc.
APPENDIX G
EPA Anniston PCB Site Fact Sheet
U. S. ENVIRONMENTAL PROTECTION AGENCY
SUPERFUND FACT SHEET

Update on Long-Term Response Activities - No. 1

ANNISTON PCB SITE

Anniston, Calhoun County, Alabama

June 30, 2003

Brief Background:
The Anniston PCB Site consists of the Solutia Inc. (formerly Monsanto) plant site in West Anniston and areas around and downstream of the Solutia plant where soil and creek sediments are contaminated with polychlorinated biphenyls (PCBs). PCBs were manufactured at the plant from 1929 to 1971. For more information on the Site background, please refer to the Overview Fact Sheet for the Anniston PCB Superfund Site. Copies are available at the EPA’s Anniston Project Office, 1514 West 10th Street, Anniston, AL.

Time-Critical Removal Action:
In 2000, EPA’s Removal Branch negotiated an Administrative Order on Consent (AOC) with Solutia Inc. (amended in 2001) for cleanup of any residential properties, located in zones near the plant or creeks, with surface soil contamination over 10 parts per million (ppm) PCBs. Work under the AOC is ongoing. The status of the work is as follows:

• 28 residential properties have been found with PCB surface soil contamination exceeding 10 ppm.

• 15 of those properties have been cleaned up or are in the process of being cleaned up.

• Access has not been granted at the remaining 13 properties.

• The design of the removal action needed for the 11th Street Ditch is complete. Access from the adjacent railroad has been requested, but not yet granted.

• Solutia completed a sampling effort initiated by EPA on the West 9th Street creek. This stream also flows into Snow Creek.

Attend the Public Meeting

When: Tuesday, July 15, 2003
From 6:30pm - 8:30pm

Where: Carver Community Center
720 West 14th Street
Anniston, AL 36201

Why: You are invited to a meeting sponsored by EPA to hear about the Status of PCB cleanup activities in Anniston, Alabama. At the meeting you will be able to ask questions.
Consent Decree:
EPA negotiated a **Consent Decree (CD)** with Solutia to address long-term cleanup efforts in Anniston. When the agreement becomes effective, it will incorporate the following agreements: continuation of the Time-Critical Removal AOC (described above); a **Non-Time Critical (NTC) Removal** AOC (to establish cleanup requirements for residential properties with surface soil contamination less than 10 ppm PCBs); and a **Remedial Investigation and Feasibility Study (RI/FS) AOC** (to address the entire site). The status of the CD, NTC Removal, and RI/FS follows:

- The CD was lodged in Federal Court on March 25, 2002.

- A 60-day comment period was held and over 370 separate letters and one petition commenting on the lodged decree were received.

- EPA renegotiated and revised the CD to incorporate many of the comments.

- On October 23, 2002, the government made a motion to enter the revised decree with the court.

- Two hearings have been held regarding entry of the CD.

- EPA is currently awaiting entry of the CD.

Non-Time Critical Removal Action:

- Solutia has submitted a **Draft Engineering Evaluation and Cost Analysis (EE/CA) Report** as required in the CD.

- EPA has circulated the Draft EE/CA Report for technical review and comments.

- When the EE/CA Report is finalized, it will be made available to the public.

- The EE/CA Report will include a proposed removal action for residential soils.

- A 30 day public comment period will be held and advertised in local newspapers.

- EPA will finalize the residential cleanup requirements of the NTC Removal Action in an **Action Memorandum** after consideration and response to public comments.

RI/FS:

- Solutia submitted a Draft Phase I Conceptual Site Model as required in the CD. The Phase I Conceptual Site Model was intended to summarize existing data prior to establishing a work plan and field sampling plan for the RI/FS.

- EPA circulated the Draft Phase I Conceptual Site Model Report for technical review and comments.

- Solutia revised the Phase I Conceptual Site Model and resubmitted it to EPA.

- EPA is reviewing the revised report.

- Once EPA ensures that existing data is clearly identified in the report, plans to fill data gaps will be prepared.

EPA Project Office:
In May, EPA relocated its Anniston Office from Noble Street to 1514 W. 10th Street, Anniston, AL 36201, for all PCB related oversight activities and general community relations activities.

A separate location for the community outreach center is being established at 26 West 11th Street, Anniston, AL 36201. Additional details will be forthcoming.

Information Repository:

An electronic copy of the Removal Administrative Record for the Anniston PCB Site is located at the Public Library of Anniston-Calhoun County, Main Branch, 108 East 10th Street, Anniston, Alabama 36201. The telephone number for the library is (256) 237-8501 and the hours of operation are Monday - Friday from 9am-6:30pm, Saturday from 9am-4pm, and Sunday from 1pm-5pm.

A paper copy of the Removal Administrative Record for the Anniston PCB Site is located at the Public Library of Anniston-Calhoun County, Carver Branch, 722 West 14th Street, Anniston, Alabama 36201. The telephone number for the library is (256) 237-7271 and the hours of operation are Monday - Friday from 9 am - 5 pm, and Saturday from 9 am -12 pm.

As the Remedial Administrative Record is established, it will also be located at the Public Library of Anniston-Calhoun County. Solutia is working to establish an additional information repository adjacent to EPA’s Project Office at 1514 W. 10th Street, Anniston, AL. As documents are finalized as part of the CD, they will be added to the repositories for public review.

Community Advisory Group:

In accordance with the CD, Solutia will form a Community Advisory Group (CAG). A CAG is made up of representatives of diverse community interests. Its purpose is to provide a public forum for community members to present and discuss their needs and concerns related to the Superfund decision-making process.

In the next few months, Solutia will submit a Community Advisory Group Plan (CAGP) to EPA. The plan will describe how the CAG will be formed. It will also identify resources for ongoing operation of the CAG during the response action activities conducted under the CD. Meetings of the CAG will be open to the public.
Technical Assistance Plan:

In accordance with the CD, Solutia will submit a Technical Assistance Plan (TAP) to EPA, for providing and administering funds to qualified citizen groups to hire technical advisors, independent from Solutia, to help interpret and comment on Site-related documents developed under the CD.

The TAP will include an application process and eligibility criteria for awarding and administering the funds.

Eligible citizen groups must be:

- a representative group of individuals potentially affected by the Site;
- incorporated as a nonprofit organization for the purposes of the Site or otherwise established as a charitable organization that operates within the geographical range of the Site and is already incorporated as a nonprofit organization; and
- able to demonstrate its capability to adequately and responsibly manage any funds awarded.

Ineligible citizen groups include:

- parties potentially responsible for contamination at the Site;
- an academic institution;
- a political subdivision;
- a group whose ability to represent the interest of affected individuals might be limited as a result of receiving paid services from a potentially responsible party; or
- a group established or sustained by government entities, a potentially responsible party, or any ineligible entity.

Funds may be awarded to one qualified group at a time. The TAP will provide for an initial payment of up to $50,000 and may be renewed twice in $50,000 increments, if necessary, to help interpret and comment on Site-related documents through the comment period for the ROD.

Any technical advisor hired by the group must possess the following credentials:

- demonstrated knowledge of hazardous or toxic waste issues by proven work experience in such fields in excess of five years;
- a bachelor of science in a relevant discipline (e.g., biochemistry, toxicology, environmental sciences, engineering);
- ability to translate technical information into terms understandable to lay persons;
- experience in making technical presentations in a public meeting or hearing setting; and
- demonstrated writing skills.

The technical advisor may not be a party to or be associated with an organization that is a party to or a witness in any current or past legal proceeding against Solutia.

To the extent practicable, the TAP recipient should be established by the time the RI/FS Workplan is due to EPA.

Community Involvement Opportunity:

EPA would like to meet with the community to discuss the status of work in Anniston. At the meeting, EPA will briefing discuss the contents of this fact sheet and will then answer questions from the community.

The meeting will be held on July 15, 2003, from 6:30 pm to 8:30 pm. The meeting will be held at the Carver Community Center.
located at 720 West 14th Street, Anniston, AL. The telephone number for the Carver Center is (256)231-7630.

For More Information:

For more information on the Superfund Program, please refer to http://www.epa.gov/superfund/

For more information on the Anniston PCB Site, please refer to http://www.epa.gov/region4/waste/npl/nplal/annpcbal.htm

Persons interested in obtaining additional information are encouraged to contact the EPA Project Office at (256)236-2599. The Project Office is staffed by EPA’s support contractor. For the past three years the office has been staffed by Jennifer Brice. Jennifer (below) will continue to support EPA during the NTC Removal Activities.

EPA’s Community Involvement Coordinator is Stephanie Brown. Stephanie (below) can be reached at the Anniston Office or in the Atlanta Office at (404)562-8450. Her email address is brown.stephaniey@epa.gov

EPA’s Remedial Project Manager is Pam Scully. Pam (below) can be reached at the Anniston Office or in the Atlanta Office at (404)562-8935. Her email address is scully.pam@epa.gov
**Action Memorandum**: A public document describing EPA's rationale for selection of a Superfund (removal) cleanup decision.

**Administrative Record**: Material documenting EPA's selection of cleanup remedies at Superfund sites, usually placed in the information repository near the Site.

**Administrative Order on Consent (AOC)**: A legal agreement signed by EPA and potentially responsible parties (PRPs), through which PRPs will conduct all or part of a cleanup.

**Community Advisory Group**: A committee made up of representatives of diverse community interests. Its purpose is to provide a public forum for community members to present and discuss their needs and concerns related to the Superfund decision-making process.

**Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)**: A Federal law passed in 1980 and modified in 1986 by the Superfund Amendment and Reauthorization Act (SARA); the act created a trust fund, known as Superfund, to investigate and cleanup abandoned or uncontrolled hazardous waste sites.

**Consent Decree (CD)**: A legal document, approved by a judge, that formalizes an agreement reached between EPA and potentially responsible parties (PRPs), through which PRPs will conduct all or part of a cleanup at a Superfund site.

**Engineering Evaluation and Cost Analysis (EECA)**: Study under Superfund short-term cleanup process to analyze removal action alternatives for a site.

**Information Repository**: File of data and documents located near a Superfund Site.

**Non-Time Critical (NTC) Removal**: A short-term response requiring action taken to address releases of hazardous substances; action can start later than 6 months after the determination that a response is necessary.

**parts per million (ppm)**: A way of expressing small concentrations of pollutants in air, water, soil, tissue, food, or other media.

**Polychlorinated Biphenyls (PCBs)**: A group of toxic, persistent chemicals used in transformers and capacitors for insulating purposes and in many other products; no longer manufactured in the U.S.

**Remedial Investigation/Feasibility Study (RI/FS)**: Study under Superfund long-term cleanup process to collect necessary data to determine the type and extent of contamination at NPL sites and examine possible alternatives for reducing risks posed by sites.

**Superfund**: See CERCLA.

**Technical Assistance Plan (TAP)**: Plan submitted to EPA by PRP for providing and administering funds to qualified citizen groups to hire technical advisors, independent from the PRP, at Superfund Alternative Sites.

**Time-Critical Removal Actions**: A short-term response requiring action taken to address releases of hazardous substances; action required within 6 months.
Attend the Public Meeting

When: Tuesday, July 15, 2003
From 6:30pm - 8:30pm

Where: Carver Community Center
720 West 14th Street
Anniston, AL 36201

Why: You are invited to a meeting sponsored by EPA to hear about the Status of PCB cleanup activities in Anniston, Alabama. At the meeting you will be able to ask questions.