Letter Health Consultation

LAKE SARACEN PCB-CONTAMINATED FISH DATA REVIEW

PINE BLUFF, JEFFERSON COUNTY, ARKANSAS

Prepared by the
Arkansas Department of Health

MAY 3, 2010

Prepared under a Cooperative Agreement with the
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

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LETTER HEALTH CONSULTATION

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Under Cooperative Agreement with the
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Agency for Toxic Substances and Disease Registry

Arkansas Department of Health

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Governor Mike Beebe
Paul K. Halverson, DrPH, FACHE, Director and State Health Officer

April 16, 2010

Mr. Dick Cassat, Chief
Environmental Preservation and Technical Services Division
Arkansas Department of Environmental Quality
5301 Northshore Drive
North Little Rock, AR 72118-5317

Dear Mr. Cassat:

Pursuant to your letter of January 26, 2010, requesting the evaluation of polychlorinated biphenyl (PCB) analysis of fish samples collected from Lake Saracen (previously known as Lake Pine Bluff), the Arkansas Department of Health (ADH) Environmental Epidemiology Section has examined these data for public health interests. PCBs can move from water and sediments into fish through the ingestion of these media. Fish can accumulate much higher concentrations of PCBs than are observed in the water or sediment to which they are exposed, and then people can be exposed to PCBs by eating the contaminated fish. PCBs can cause adverse health effects if people eat food contaminated with high enough concentrations. Therefore, ADH, in cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), has completed this health consultation letter to determine the public's exposure to, and possible adverse health effects from, the consumption of PCB-contaminated fish from Lake Saracen.

Background and Statement of Issues

At the end of January 2010, ADH received a request from the Arkansas Department of Environmental Quality (ADEQ) to evaluate recent Lake Saracen fish data submitted to ADH in order to ascertain the need for an updated PCB fish consumption advisory for the Pine Bluff area [1]. On January 19, 2010, fish samples were collected from Lake Saracen. Several fish of each species were collected, and only the edible portion, or filet, of the fish was analyzed in laboratory testing. Each species was analyzed as a composite sample. The composite samples included: four largemouth bass (15 – 16 inches), three largemouth bass (20 inches), three crappie (11.5 inches), and three buffalo (33 inches), for a total of four composite species-specific samples [1]. The small data set of current samples for each species may be a limitation to this evaluation. However, our knowledge of historical data further supports this evaluation and our conclusions.

After these initial samples were collected, a request from ADEQ and ADH for catfish samples to also be collected from Lake Saracen was processed by the Arkansas Game and Fish Commission (AGFC). On February 25, 2010, AGFC personnel collected channel catfish (18.5 – 23.5 inches) and blue catfish (23 – 28 inches) samples from Lake Saracen, and those laboratory results, provided by ADEQ, were sent to ADH for

analysis on March 15, 2010 [2]. These catfish data were analyzed as individual filet samples rather than composite samples.

In the mid-1980's, this lake was drained, some of the sediment was removed, and all the fish were killed and removed in order to reduce the PCB contamination that had been discovered. According to ADEQ records, the lake was restocked with bass, crappie, and bream, but no bottom feeders. Subsequent to that time, a bass sample was analyzed each year in order to track the PCB concentrations, which were below levels of health concern. An existing advisory for that species was lifted in the mid 1990's. As a result, the fish collection and sampling was continued at random intervals, only as needed or requested.

As speculated in your request letter, the Arkansas River at high levels may have reintroduced the bottom feeder species into Lake Saracen. These fish species have thrived in the lake, as evidenced by the size of the buffalo and catfish found. The bottom feeders, which are more likely to ingest PCB-laden sediment than the water column dwelling fish, would also increase PCB mobility by stirring up sediment still contaminated with PCB [1]. Since PCBs are characteristically resistant to biodegradation and are chemically stable, environmental contamination may be present for a long time. Thus, any present-day PCB contamination found in the buffalo is most likely a residual of the original PCB source from the 1980's. Fish caught and consumed from Lake Saracen have the potential to be contaminated with PCBs that can lead to an increased exposure to people, depending on the type of fish species caught and the amount of that fish species that people end up eating.

Discussion

For a public health hazard to exist, people must be exposed to contamination at levels high enough and for a long enough time to adversely affect their health. Our evaluation of potential public health hazards is based on ATSDR assessment procedures. ADH was requested to examine fish tissue sample results for potential health effects related to eating fish caught from Lake Saracen. However, this study was not designed to examine the lake water or sediment for PCB contamination, nor was it intended to identify the source of the PCB contamination found in the fish. As a result, a single exposure pathway of eating fish caught in Lake Saracen will be discussed.

Typically, the state health screening level for PCB-contaminated fish has followed the Food and Drug Administration (FDA) tolerance level for PCBs in edible fish portions of less than two parts per million (ppm), as stipulated in Federal Regulation 21 CRF 109.30. PCBs are a group of synthetic organic chemicals that contain 209 possible individual chlorinated biphenyl compounds, but due to the lack of sufficient toxicological data, the Environmental Protection Agency (EPA) has not developed quantitative estimates of health risk for these specific compounds. Therefore, the state monitors for total PCB concentrations rather than each PCB mixture (measured as Aroclor 1260 in the data received). The fish data in this investigation will be evaluated in terms of total PCBs for health screening purposes.

In the data of the four composite samples, sent to our office in January 2010, only the composite sample of the buffalo (3.25 ppm) was over the screening level of 2 ppm for PCBs. The other three composite samples of 15-inch largemouth bass (< 0.25 ppm), 20-inch largemouth bass (1.36 ppm), and crappie (< 0.25 ppm) were under the 2 ppm PCB screening value, and considered not harmful to people's health [1]. Therefore, further analysis from this data set was done on the buffalo composite sample data only.

In the data of the catfish samples, sent to our office in March 2010, five channel catfish and six blue catfish were individually analyzed. All five of the channel catfish samples had PCB concentrations lower than the laboratory's reportable detection limit (RDL) of 0.54 ppm. Of the six blue catfish samples, only one sample showed a PCB concentration over the RDL. This one blue catfish sample concentration was reported at 0.72

ppm PCB, which is still well below the FDA screening level of 2 ppm for PCBs [2]. Therefore, no further analysis was needed for the catfish samples collected from Lake Saracen.

Based on the PCB concentration of 3.25 ppm found in the buffalo composite sample, a daily exposure dose was calculated for an adult and a child consuming 2 fish meals per week. Variables used in calculations included: a six-ounce fish meal two times per week for 24 weeks out of the year for either an adult weighing 70 kilograms, or a child weighing 16 kilograms. ADH based this meal size and frequency on anecdotal evidence received from state agency personnel that there are some subsistence fishers who use Lake Saracen as a food source for all fish meals (including buffalo) due to the socioeconomic status of the area.

A bioavailability factor of 0.5 was used, based on a 50% loss of PCBs in fish after fat trimming and cooking methods are taken into account. According to the EPA PCB Fish Advisory Fact Sheet, lipophilic chemicals such as PCBs accumulate mainly in fatty tissues (i.e. belly flap, lateral line, subcutaneous and dorsal fat, dark muscle, gills, eye, brain, and internal organs). Removal of internal organs and skin and trimming the fat before cooking will decrease PCB exposure [3]. Refer to the table below for specific daily exposure dose values for both an adult and child.

Calculation of Buffalo Fish Composite Data from Lake Saracen Collected January 2010

Compound	Concentration (mg/kg)	Receptor	ATSDR MRL (mg/kg/day)	Exposure Dose (mg/kg/day)	Theoretical Lifetime Cancer Risk
Polychlorinated Biphenyls (PCBs)	3.25	Adult	2.00E-05	1.80E-05	3.90E-06
Polychlorinated Biphenyls (PCBs)	3.25	Child	2.00E-05	**7.90E-05**	**1.71E-05**

mg/kg = milligram per kilogram; mg/kg/day = milligram per kilogram per day; ATSDR = Agency for Toxic Substances and Disease Registry; MRL = Minimal Risk Level

ATSDR lists a health effects screening value, or Minimal Risk Level (MRL), of 2.0E-05 (or 0.00002) milligrams per kilogram per day (mg/kg/day) as the daily oral exposure to PCBs that would be expected to not result in adverse health effects to people ingesting this concentration of PCBs daily for one year (a "chronic" exposure) [4]. This value is equal to the EPA chronic oral reference does value (RfD), and is derived from an animal study in which the lowest adverse health effect [or lowest-observed-adverse-effect level (LOAEL)] was observed at a dose of 0.005 mg/kg/day and resulted in adverse immunological effects to adult monkeys [4]. The calculated exposure dose for adults consuming two six-ounce fish meals of buffalo from Lake Saracen per week (six months out of a year) is slightly lower than the MRL [5]. Although this value is just under the MRL, the assumptions made in the calculations may not be applicable for pregnant women or sensitive sub-population adults who may also ingest a PCB-contaminated buffalo fish meal caught from Lake Saracen. The calculated exposure dose for children who consume two six-ounce fish meals of buffalo from Lake Saracen per week (six months out of a year) is higher than the MRL [5].

The ATSDR Toxicological Profile for PCB lists an oral exposure cancer slope factor (CSF) of 2 $(mg/kg/day)^{-1}$ [4]. This CSF is equivalent to the upper-bound value referenced by EPA. This CSF value is used by EPA for evaluation of human food-chain exposures because it provides assurance that risk is not underestimated, and it represents a value for high risk and high persistence PCBs. The estimated exposure time used in all cancer

calculations was 30 years, since PCB is a persistent contaminant that has the possibility of existing in the sediment and fish population of Lake Saracen for at least that amount of time. The calculated theoretical lifetime cancer risk (LCR) for an adult consuming two six-ounce fish meals of buffalo from Lake Saracen per week (six months out of a year) is within the EPA target risk range of 1.0E-06, or 1 person in 1,000,000. This represents only a slight risk of possible cancer effects using this estimate. The calculated theoretical LCR for a child consuming two six-ounce fish meals of buffalo from Lake Saracen per week (six months out of a year) is not within the EPA target risk range of 1.0E-06. The estimated child LCR is 1.71E-05, or approximately 2 people in 100,000. This represents a low risk of possible cancer effects using this estimate.

PCBs produce a wide range of adverse biological and toxicological effects. PCBs are absorbed through the gastrointestinal (GI) tract and distributed throughout the body. Absorption of PCBs from oral exposures is high, and because of their lipophilic ("fat-loving") nature, PCBs tend to accumulate in lipid-rich tissues (i.e., the liver, adipose tissue, skin, and breast milk). Offspring can also be exposed to PCBs in the womb. Studies in humans have shown PCBs to cause irritation of the skin, nose, or lungs, changes in the blood and liver, and depression and fatigue. The EPA classifies PCBs as probable human carcinogens [4].

Conclusions

Based on the analysis of the recent fish data collected in 2010, ADH/ATSDR reached three conclusions for adults and children consuming fish caught from Lake Saracen:

1. ADH/ATSDR concludes that when adults and children eat (or consume) the fish species: largemouth bass, crappie, channel catfish, or blue catfish caught from Lake Saracen, it is not expected to harm their health.
2. ADH/ATSDR concludes that when general-population adults eat a six-ounce PCB-contaminated buffalo fish meal caught from Lake Saracen (no more than twice per week for 24 weeks per year), it is not expected to harm their health because calculated exposure estimates fall just under the MRL (health screening value) and adequate LCR levels. However, the calculated value may not be applicable for pregnant women or sensitive sub-population adults who may also ingest a PCB-contaminated buffalo fish meal caught from Lake Saracen.
3. ADH/ATSDR concludes that when children eat a six-ounce PCB-contaminated buffalo fish meal caught from Lake Saracen (no more than twice per week for 24 weeks per year), it could harm their health because calculated exposure estimates are over the MRL (health screening value) and represent a higher LCR probability. Further action would involve following all recommendations or advisories set forth pertaining to fish caught and consumed from Lake Saracen.

Recommendations

Based on the evaluation described above, and following the less than 2 ppm FDA tolerance level for PCBs in edible fish portions, ADH/ATSDR recommends the following as a prudent public health measure:

1. A fish consumption advisory should be issued by ADH for buffalo fish in Lake Saracen. A fish advisory posting for buffalo should be clear for all people who fish and consume fish caught from Lake Saracen.
2. No one should eat any buffalo fish caught in Lake Saracen (including adults, pregnant women, or children). If buffalo are caught, it would be advisable to release them back into the lake.
3. To follow precautionary public health practices, people should limit meals of all other fish species caught from Lake Saracen to no more than twice per week.

References

1. Arkansas Department of Environmental Quality (ADEQ), "Lake Saracen Evaluation Request of Fish Composite Samples"; January 26, 2010.

2. Arkansas Department of Environmental Quality (ADEQ), "PCB Analysis Table of Catfish Samples Caught from Lake Saracen"; March 15, 2010.

3. U.S. Environmental Protection Agency, "Polychlorinated Biphenyls (PCBs) Update: Impact on Fish Advisories" Fact Sheet. Office of Water 4305, pp. 1 – 7, September 1999.

4. Agency for Toxic Substances and Disease Registry (ATSDR) Toxicological Profile for Polychlorinated Biphenyls (PCBs). Available at: http://www.atsdr.cdc.gov/toxprofiles/tp17.html .

5. Agency for Toxic Substances and Disease Registry (ATSDR) *TopHat Tool*. Exposure Dose Calculator.

If there are any questions, I can be reached by phone at 501-280-4041, by fax at 501-280-4090, or by email at Ashley.Whitlow@arkansas.gov.

Sincerely,

Ashley Whitlow, M.S., CPM
Epidemiologist /ATSDR Cooperative Agreement Health Assessor

cc: Shirley Louie, M.S., CIH, Applied Epidemiology Branch Chief, ADH
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Certification

The Arkansas Department of Health prepared this letter health consultation for Lake Saracen, Pine Bluff, AR under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It was completed in accordance with approved methodology and procedure existing at the time the health consultation was initiated. Editorial review was completed by the cooperative agreement partner.

Jeff Kellam, M.S.
Technical Project Officer
Division of Health Assessment and Consultation (DHAC)
ATSDR

The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this health consultation and concurs with its findings.

Alan W. Yarbrough
Cooperative Agreement Team Leader, DHAC, ATSDR