



Exposure Investigation, Serum PCB and Blood Mercury Levels in Consumers of Fish and Turtles from the Watts Bar Reservoir, March 5, 1998

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Site: Oak Ridge Reservation
Conducted by: ATSDR
Time period: 1997
Study area: Watts Bar Reservoir
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Purpose

The purpose of this exposure investigation was to determine whether people consuming moderate to large amounts of fish and turtles from the Watts Bar Reservoir were being exposed to elevated levels of polychlorinated biphenyls (PCBs) or mercury.

Background

Previous investigations of the Watts Bar Reservoir and Clinch River evaluated many contaminants, but identified only PCBs in reservoir fish as a possible contaminant of current health concern. The U.S. Department of Energy (DOE) and the Tennessee Department of Environment and Conservation (TDEC) detected PCBs at levels up to approximately 8 parts per million (ppm) in certain species of fish from the reservoir. PCBs were detected in turtles at levels up to 3.3 ppm in muscle tissue and up to 516 ppm in adipose tissue. Mercury is a historical contaminant of concern for the reservoir due to the large quantities released from the Oak Ridge Reservation. However, recent studies have not detected mercury at levels of health concern in surface water, sediments, or fish and turtles from the Watts Bar Reservoir.

The 1994 DOE remedial investigation for the Lower Watts Bar Reservoir and the 1996 DOE remedial investigation for Clinch River/Poplar Creek concluded that the fish ingestion pathway had the greatest potential for adverse human health effects. The Agency for Toxic Substance and Disease Registry's (ATSDR's) 1996 health consultation of the Lower Watts Bar Reservoir reached a similar conclusion. These investigations based their conclusions on estimated PCB exposure doses and estimated excess cancer risk for people consuming large amounts of fish over an extended period of time. Fish ingestion rates, however, provide large uncertainty to these risk estimates. In addition, these estimated exposure doses and cancer risks do not consider consumption of reservoir turtles because of the uncertainties regarding turtle consumption.

ATSDR conducted this investigation primarily because of the uncertainties involved in estimating exposure doses and excess cancer risk from ingestion of reservoir fish and turtles. Also, previous investigations did not confirm that people are actually being exposed or that they have elevated levels of PCBs or mercury. In addition, a contractor for the Tennessee Department of Health (TDOH) recommended that an extensive region-wide evaluation be conducted of relevant exposures and health effects in counties surrounding the Watts Bar Reservoir. Prior to the initiation of such evaluations, ATSDR believed that it was important to determine whether mercury and PCBs were actually elevated in individuals who consumed large amounts of fish and turtles from the reservoir. Mercury was included in this exposure investigation because it was a historical contaminant of concern released from the Oak Ridge Reservation.

Study Design and Methods

This exposure investigation was cross-sectional in design as it evaluated exposures of the fish and turtle consumers at the same point in time. However, because serum PCB and mercury blood levels are indicators of chronic exposure, the results of this investigation provide information on both past and current exposure for each study participant.

Exposure investigations are one of the approaches that ATSDR uses to develop better characterization of past, present, or possible future human exposure to hazardous substances in the environment. These investigations only evaluate exposures and do not assess whether exposure levels resulted in adverse health effects. Furthermore, this investigation was not designed as a research study (for example, participants were not randomly selected for inclusion in the study and there was no comparison group), and the results of this investigation are only applicable to the participants in the study and cannot be extended to the general population.

Specific objectives of this investigation included measuring levels of serum PCBs and blood mercury in people consuming moderate to large amounts of fish or turtles, identifying appropriate health education activities and follow-up health actions, and providing new information to help evaluate the need for future region-wide assessments.

Study Group

The target population was persons who consumed moderate to high amounts of fish and turtles from the Watts Bar Reservoir. ATSDR recruited participants through a variety of means, including newspaper, radio, and television announcements, as well as posters and flyers placed in bait shops and marinas. ATSDR representatives also made an extensive, proactive attempt to reach potential participants by telephoning several hundred individuals who had purchased fishing licenses in the area.

ATSDR interviewed more than 550 volunteers. Of these, 116 had eaten enough fish to be included in the investigation. To be included in the investigation, volunteers had to report eating one or more of the following during the past year: 1 or more turtle meals; 6 or more meals of catfish and striped bass; 9 or more meals of white, hybrid, or smallmouth bass; or 18 or more meals of largemouth bass, sauger, or carp.

Exposures

Human exposures to PCBs and mercury from fish and turtle ingestion were evaluated.

Outcome Measure

Outcome measures included serum PCB and total blood mercury levels. ATSDR also collected demographic and exposure information from each participant (for example, length of residency near the reservoir; species eaten, where caught, and how prepared).

Results

The 116 participants resided in eight Tennessee counties and several other states. The mean age was 52.5 years and 58.6% of the participants were male and 41.4% were female. A high school education was completed by 65%. Eighty percent consumed Watts Bar Reservoir fish for 6 or more years, while 65.5% ate reservoir fish for more than 11 years. Twenty percent ate reservoir turtles in the last year. The average daily consumption rate for fish or turtles was 66.5 grams per day.

Serum PCB levels above 20 parts per billion (ppb) were considered elevated, and only five individuals had elevated serum PCB levels. Of the five participants with elevated PCB levels, four had levels between 20 and 30 ppb. One participant had a serum PCB level of 103.8 ppb, which is higher than levels found in the general population. None of the participants with elevated PCB levels had any known occupational or environmental exposures that might have contributed to the higher levels.

Only one participant had an elevated blood mercury level—higher than 10 ppb. The remaining participants had mercury levels up to 10 ppb, which is comparable to levels found in the general population.

Conclusions

Serum PCB levels and blood mercury levels in participants were similar to levels found in the general population.

Based on the screening questionnaire, most of the people who volunteered for the study (over 550) ate little or no fish or turtles from the Watts Bar Reservoir. Those who did eat fish or turtles from the reservoir indicated that they would continue to do so even though they were aware of the fish advisory.