New York State Department of Health
Center for Environmental Health

Fact Sheet

August 2000

Recreational Use of Nassau Lake

Recently the New York State Department of Health (NYSDOH) reevaluated the potential exposures and health risks associated with recreational use of Nassau Lake. NYSDOH analysis indicates that people may potentially take in PCBs if they are exposed to low levels in sediment or soil. However, NYSDOH does not believe that the possible exposures or any associated health risks at Nassau Lake are at levels to justify a recommendation that people should be prevented from recreational contact with the lake sediment or shoreline soil. Much larger exposures to PCBs are possible if people eat fish from Nassau Lake. Therefore, NYSDOH continues to recommend that no one eat any fish from Nassau Lake.

This recommendation is based on two separate evaluations. One method of evaluating possible exposures and health risks is to use information about PCB levels in the sediment, soil, water, and air around Nassau Lake, and information about how people may be exposed to these substances. This method suggests that PCB exposures (except for eating fish) at Nassau Lake are likely to be small and are unlikely to cause detectable health effects.

Another method of evaluating possible exposures and health risks from PCBs at Nassau Lake was to review studies of people who could have been exposed to PCBs in situations similar to those at Nassau Lake. Studies that measured both PCB levels in people's blood serum and PCB levels in sediment or soil were particularly useful. People in these studies were compared with people not similarly exposed to see if PCBs from the sediment or soil got into their bodies. These studies did not consistently detect elevated serum PCB levels. The PCB levels in soil and sediment in these studies were generally higher than levels near Nassau Lake. Thus, these findings suggest that it may be difficult to detect an increase in PCB serum levels due to exposure to PCBs from Nassau Lake sediment and soil.

Both methods of evaluation suggest that exposure to PCBs in soil or sediment at Nassau Lake is likely to be small and people are unlikely to experience any detectable health effects that can be associated with the exposures. However, NYSDOH cannot rule out that people may have some increase, although difficult to detect, in the amount of PCBs in their body. For some time, NYSDOH has been evaluating possible exposures to PCBs from the sediment and soil around Nassau Lake. Current analysis uses much of the new

information gathered since NYSDOH began its evaluation, and NYSDOH will continue to update its analysis as new information becomes available. Consistent with past statements, evaluations by NYSDOH and the environmental data do not justify a recommendation that people be prevented from using Nassau Lake for recreational purposes. However, if people continue to feel uncomfortable with the conditions at Nassau Lake and want to minimize their potential exposure to PCBs in soil, NYSDOH has some suggestions for them to consider. Some possible actions people can take are rinsing off mud after contact with sediment or soil that may have low levels of PCBs, and rinsing off children's toys that may have sediment or soil on them. NYSDOH continues to remind everyone that no one should eat any fish from Nassau Lake. A more detailed document, ***Nassau Lake Exposure Assessment and Health Risk Information***, is available to provide additional information about PCBs in Nassau Lake.

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INFORMATION SHEET

Nassau Lake Exposure Assessment And Health Risk

August 2000

STATE OF NEW YORK
DEPARTMENT OF HEALTH

Center for Environmental Health
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NASSAU LAKE EXPOSURE ASSESSMENT AND HEALTH RISK INFORMATION

This exposure assessment identifies completed exposure pathways associated with Nassau Lake. An exposure pathway is the process by which an individual may be exposed to contaminants originating from a site. An exposure pathway has five elements: (1) a contaminant source; (2) environmental media and transport mechanisms; (3) a point of exposure; (4) a route of exposure; and (5) a receptor population. Environmental media and transport mechanisms "carry" contaminants from the source to points where people are or may be exposed. The route of exposure is the manner in which a contaminant actually enters or contacts the body (e.g., ingestion, inhalation, dermal absorption). The receptor population is the person or people who are, or may be, exposed.

1. Estimating Possible PCB Exposures at Nassau Lake

Exposure Routes

People could be exposed to PCBs around Nassau Lake in several ways. People could eat PCB-contaminated fish. People, especially children, might incidentally ingest sediment or soil containing PCBs through hand-to-mouth contact. PCBs could be absorbed through skin that is in contact with PCB-containing sediment or soil while wading or playing. PCBs from the sediment or soil could possibly evaporate into the air and people could breathe them in as a vapor. If the sediment or soil becomes airborne, people could possibly breathe in small particles containing PCBs. If PCBs were in the water, people could take in some PCBs by swallowing some lake water during playing or swimming or absorbing some PCBs through the skin. Although all of these exposures could occur in theory, some are more likely than others.

Exposures from Sediment and Soil

Samples of the sediment and soil at Nassau Lake have been analyzed for PCBs. The levels of PCBs in sediment range from less than 0.08 parts per million (ppm) to 9 ppm. The average PCB level in these samples of the lake's sediment is 2.3 ppm. The average for the sediment in the northern end of the lake is higher (3.1 ppm) than for the southern end (1.6 ppm). Soil samples were taken from five properties, at flood-prone areas at the edge of the lake, and the PCB levels ranged from less than 0.018 ppm to 2.2 ppm. The highest average in any one property was 1.4 ppm. For the other properties, PCB levels averaged 0.23 ppm, 0.05 ppm, 0.04 ppm and non-detect. The PCB levels in the sediment are fairly consistent throughout the lake and the soil levels are, for the most part, lower. We've used the average sediment level of 3 ppm to evaluate exposures and risks. Using this value is likely to overestimate, rather than underestimate, exposures and risks.

People can be exposed to PCBs in contaminated sediment or soil by incidentally eating some soil or sediment or by absorbing PCBs through the skin. We estimated the

average daily amount of PCBs that a six-year-old child would take into the body if he or she were exposed to sediment or soil containing 3 ppm of PCBs. Using procedures outlined by the U. S. Environmental Protection Agency (EPA) and the exposure assumptions shown in Table 3, the amounts would be about 0.008 micrograms of PCBs per kilogram of body weight (mcg/kg) through incidental ingestion and 0.003 mcg/kg through the skin. We also evaluated the health risks associated with these amounts. These intakes are about 500 times less than those that have caused health effects in animals (see figure).

One factor that is important in this evaluation is that the amount of soil-bound PCBs absorbed through the skin and into the body is relatively low, particularly compared to absorption after ingestion. Studies in animals and humans consistently show that about 90% or more of ingested PCBs (not bound to soil) are absorbed into the body (ATSDR, 1998). A study with rats suggests that the percent absorption of soil-bound PCBs when ingested is 70 - 90% (Fries et al., 1989). In contrast, an estimate of the percent absorption of soil-bound PCBs (as Aroclor 1242 or Aroclor 1254) applied to monkey skin is about 14% (Wester et al., 1993).

Exposures from Air

People could breathe in PCBs that evaporate into the air or that are on small airborne sediment or soil particles. General Electric (GE) measured air for PCBs at Nassau Lake at three locations on the shore during the summer of 1997. By taking the samples in the summer, GE increased the likelihood of finding PCBs in the air. No PCBs were detected in the air (detection limit of 0.004 micrograms per cubic meter of air). These results are not surprising because PCBs, especially the Aroclor 1260 at Nassau Lake, do not readily evaporate. Also, we would not expect people to breathe in many small soil particles because the sediment/soil is likely to be damp and small particles are not likely to be produced. Given these data and conditions at Nassau Lake, inhalation exposure is unlikely to be important.

Exposures from Water

With one exception, PCBs have not been detected in the water at Nassau Lake. The detection limit for PCBs was 0.022 micrograms per liter (mcg/L). One sample of lake water taken on November 18, 1993, during heavy runoff contained 0.053 mcg/L. This is below the drinking water standard of 0.5 mcg/L. Given these data, we believe that exposure to PCBs while swimming in the water is unlikely to be important.

Uncertainties

This assessment evaluates data to determine the potential for PCBs to cause health effects in people living at Nassau Lake. Uncertainties are inherent in any exposure or risk assessment. In this assessment, uncertainties are associated with the data on PCB levels in sediment, soil, air and water; some of the assumptions used to estimate exposure; the toxicological data on PCBs; and the human exposure studies. In

preparing this assessment, we used what we consider to be the best available scientific data and likely overestimated, rather than underestimated, exposures.

2. PCB Levels in People Living Near PCB-Contaminated Sediment or Soil

Many studies have measured PCB levels in the blood serum of people potentially exposed to PCBs. Some studies were of people who were exposed because of specific activities, such as their occupation. Other studies looked at people living near contaminated areas. The studies show that certain types of activities increase PCB levels in serum above serum PCB levels in the general population. These activities include working with PCBs, eating contaminated food (e.g., fish), playing with contaminated electrical parts, living on a farm with contaminated silos, or living with someone who was exposed at work (ATSDR, 1998). A few studies examined PCB levels in serum of people who lived near sites with sediment or soil containing PCBs (see Tables 1 and 2). The soil or sediment PCB levels at these sites are, for the most part, much higher than the PCB levels at Nassau Lake: At all sites, the PCB levels in the people's serum were not above levels in the general population, except for those people who engaged in the activities listed previously (e.g., eating PCB-contaminated fish). At one site (Housatonic River Area in Table 2), serum PCBs levels in people engaged in activities associated with soil/sediment exposure (yard work, gardening, canoeing) were similar to those of people who did not engage in such activities.

These studies have limitations and cannot be considered definitive. Only a small number of people were in the studies and only two studies included children (Yaffe and Reeder, 1989, and one study in Stehr-Green et al., 1988).

Table 1. Summary of Biomonitoring Data on Populations Living Near PCB-Contaminated Sites (Adapted from Stehr-Green et al., 1988).

Site	Maximum On-Site Soil (ppm)	Maximum Off-Site Soil (ppm)	Blood Serum PCB Levels in People with Highest Exposure Potential*		
			Number of People	Geometric mean (ppb)**	Percent Below 20 ppb**
Sites with No Evidence of Increased Human Serum PCB Levels***					
Sebastian, AR	no data	133,000	20	5.8	100
Wayne, GA	3,436	149	4	5.1	100
Norfork, MA	220,000	3	89	4.1	100
Ashtabula, OH	no data	0.1	57	4.1	100
Allegheny PA	32,000	1,106	9	2.7	100
Chester, PA	36,000	6,400	22	5.3	95
Pickens, SC	no data	130	27	2.6	96
Marion, WV	22,226	205	24	5.0	96
Monroe, IN (3 sites)#	333,000	3,500	51	9.0#	90#
Sites with Evidence of Increased Human Serum PCB Levels					
New Bedford (Newport) MA##	99,000	no data	42	13##	79##

* People with the greatest reported frequency and duration of activities that might lead to contact with contaminated areas; data for non-workers only except for Sebastian, Pickens, and Marion.

** At the time of the studies, most people without occupational exposure had serum PCB levels in the low ppb range with median levels between 5 - 7 ppb and 95% of the levels were below 20 ppb (5% were 20 ppb or above).

*** Sites where ATSDR (Stehr-Green et al., 1988) did not find a statistically significant increased proportion of non-occupationally exposed people with serum PCB levels substantially above background levels (i.e., the proportion of people with serum PCB levels 20 ppb or above was not significantly different from the expected proportion of 5%).

\# ATSDR (Stehr-Green et al., 1986) could not trace elevated levels in people to any specific environmental (non-occupational) route of exposure (including contact with contaminated soil/sediments) with the possible exception of people who reportedly salvaged metal from discarded electrical equipment; 10% of the people had levels 20 ppb or above which is not significantly ($p = 0.12$) different from the proportion expected (5%); ATSDR recommended additional studies to find out sources of exposure.

People who ate large amounts of locally-caught seafood had higher PCB levels than people who did not eat seafood. Thus, the primary source of environmental exposure was determined to be the consumption of contaminated seafood (Telles, 1982; see Table 2 for follow-up study); 21% of the people had levels 20 ppb or above which is significantly ($p < 0.05$) different from the expected proportion of 5%).

Table 2. Conclusions Regarding Human Blood Serum PCB Levels in Populations Living Near PCB-Contaminated Sites in Massachusetts and Canada.

Study	Environmental Contamination	Study Conclusion
Housatonic River Area PCB Exposure Assessment (MDPH, 1997)	**Sediment** (108 samples; 0-0.5 inches in depth; over 4 miles of the most heavily contaminated river areas): Five areas (means) = 20, 20, 30, 15, 3.1 ppm **Soil** (987 samples; all depths, floodplain soil sampling of same river areas as above): Five areas (means) = 12, 22, 22, 2.4, 0.5 ppm	Serum levels of individuals with highest potential for exposure to PCBs from daily activities in and around area were generally within the background range for non-occupationally exposed US populations; occupational exposures increased significantly serum levels; other activities (including eating fish, gardening, other yard work, canoeing) did not increase significantly serum levels
Greater New Bedford PCB Health Effects (MDPH, 1987; Miller et al., 1991)	Hot-spot sediment contamination levels were >200,000 ppm. Mean seafood levels = 131 ppm. Eels were as high as 730 ppm, and lobsters were as high as 68 ppm	The proportion of elevated serum PCBs in the sample of residents was found to be typical of non-occupationally exposed urban populations in the US; eating locally-caught seafood increased serum levels
Norwood Public Exposure Assessment Program (MDPH, 1991)	Initial surface soil samples (before remediation) were as high as 110,000 – 220,000 ppm. Off-site soil samples near 3 residences were 0.1 ppm, 0.1 ppm, and 1.6 ppm	Serum levels found in the Norwood population were well within the normal range of the typical non-occupationally exposed US population
Soil Contamination in Toronto (Yaffe and Reeder, 1989); study area within 500 meters of a plant that had used PCBs	**Soil Levels** / **Study Area** / **Control Area** No. samples: 23 / 20 No. < 0.1 ppm: 7 / 15 No. > 0.25 ppm: 5 / 2 Max: 2.7 ppm / 0.35 ppm GM*: 0.19 ppm / 0.12 ppm *geometric means significantly ($p < 0.2$) different	30 children from study area and 21 children from uncontaminated area similar in age and sex distribution and similar in exposure potentials (including via breastmilk, fish consumption, soil contact, and parental occupation) showed similar serum levels of PCBs, and all levels were comparable to those of other children with no known PCB exposure except the American diet

Table 3. Assumptions for Estimating Exposure to PCBs in Nassau Lake Soil and Sediment.

Parameter	Value
Dermal Exposure Assumptions	
Exposure frequency	5 days per week; 4 months per year (mid-May through mid-September)
Area of exposed skin	lower legs, feet, forearms and hands (2841 square centimeters)
Soil-to-skin adherence factor	0.2 milligrams of soil or sediment per square centimeter of skin
Fraction of PCBs dermally absorbed from soil/sediment	0.14 (14 percent)
Average body weight of 6-year old child	22.6 kilograms
Ingestion Exposure Assumptions	
Exposure frequency for ingestion of outdoor soil/sediment	5 days per week; 4 months per year (mid-May through mid-September)
Exposure frequency for ingestion of outdoor soil/sediment tracked indoors	365 days per year
Amount of outdoor soil/sediment ingested	80 milligrams per day
Amount of indoor soil/sediment ingested	40 milligrams per day
Fraction of PCBs absorbed from ingested soil/sediment	1 (100 percent)
Average body weight of 6-year old child	22.6 kilograms

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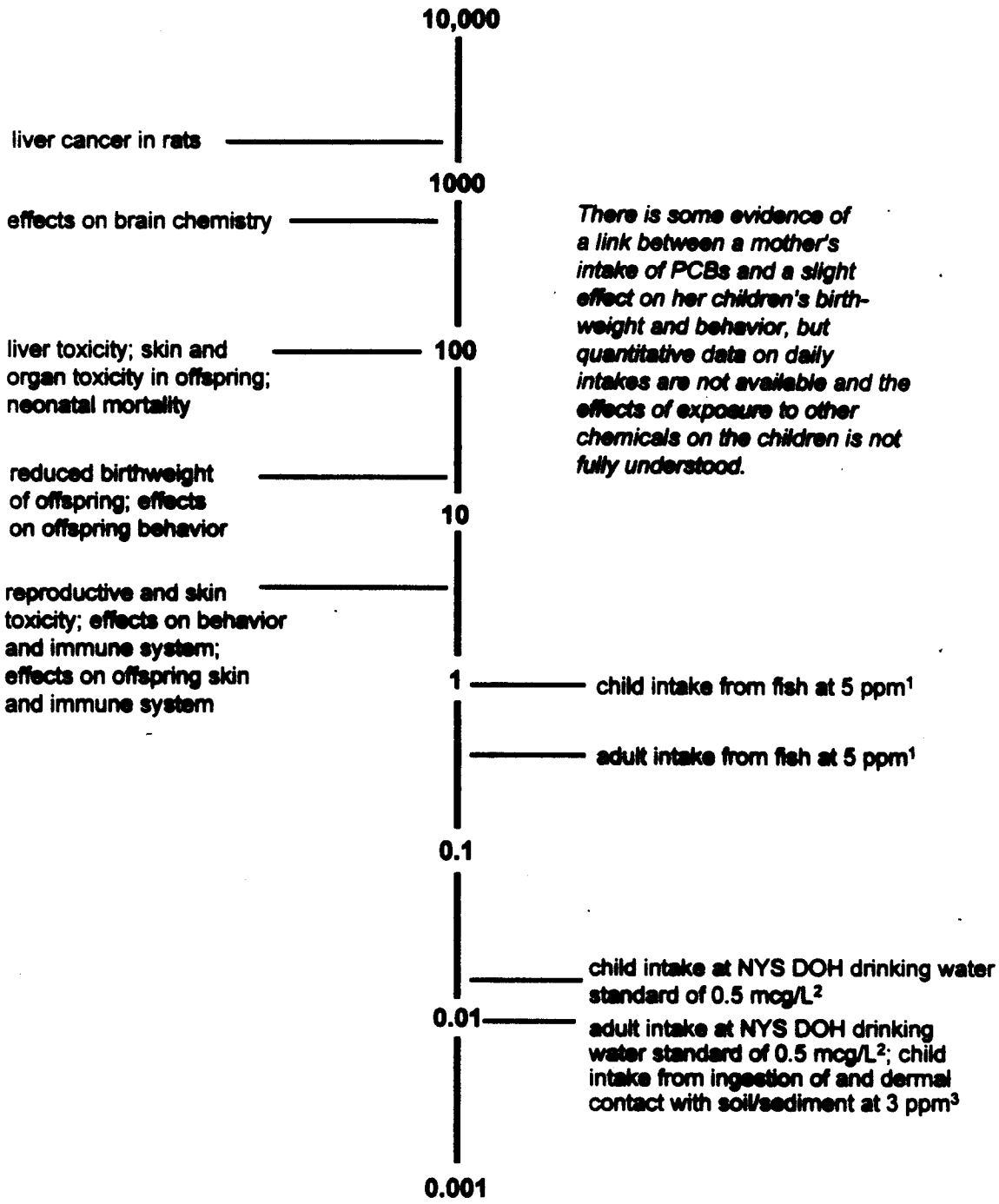
Comparison of PCB Intakes Causing Heath Effects in Animals to Estimated PCB Human Intakes.

Long-term Exposure
(greater than 14 days)



* These effects are listed at the lowest level at which they were first observed. They may also be seen at higher levels.

**Micrograms of PCBs per kilogram body weight per day (mcg/kg/day).

[1] PPM is parts per million. Intake based on 70-kg adult eating 0.5 pound of fish per month and 22.6-kg child eating 0.3 pound of fish per month. The PCB concentration in fish (5 ppm) is based on data for largemouth bass collected from Nassau Lake in 1997.

[2] Intake based on 70-kg adult drinking 2 liters of water per day and 22.6-kg child drinking 1 liter of water per day at 0.5 micrograms PCBs per liter of water (0.5 mcg/L).

[3] See Table 3 for exposure assumptions.

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