Food Exposures to Polychlorinated Biphenyls

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The PCB family of industrial chemicals has been used in a number of useful and beneficial ways for more than 40 years. PCBs have been used in capacitors, as transformer fluids, as heat transfer agents, in plasticizers and adhesives, and in sealants and printing inks. Needless to say, they have no place in the nation's food supply. The scientific community has been aware of the potential hazard of the PCBs since at least 1966. Reports in the foreign literature at that time indicated the detection of this chemical in fish and birds. However, the status of the analytical detection method for organochlorine pesticide residues in reference to PCBs was not perfected until early 1969, after it was discussed in FDA's pesticide analytical workshop and the former Division of Pesticides improved the analytical method, so that it was satisfactory for routine analysis.

We know that as a toxic substance PCBs are a potential but not immediate health hazard and that their environmental background level is not high. We do not know how long-term exposure to PCBs might affect human health, and we cannot yet explain the inconsistent presence of the chemical in certain areas of the environment. We have been faced recently with PCB adulteration of food from accidental sources and from untraceable environmental sources. The exact routes of contamination are subject to speculation. Some theories point to the industrial wastes from plants using PCB, leaching of PCB from plastic objects in waste disposal (burning at waste incineration plants or run-off from landfills into streams), and accidental use of PCB as solvents for which they are not intended (vehicles for spray preparations etc.)

Some of FDA's earliest findings of PCBs in foods occurred during the fall 1969 when PCBs were encountered in coho salmon and milk. In August, 1969, Baltimore District found an adulterant identified as PCBs in 5 of 12 milk samples from West Virginia. During a six-month followup investigation, it was learned that PCBs were commonly used as a heat transfer agent in electrical capacitors in the area from which the milk samples were collected. Further investigation revealed that the electric company had allowed a right-of-way sprayer to utilize a transformer oil base for defoliant spraying. Vegetation collected from the power line right of way was tested and found to be positive for PCBs. It was eventually concluded that the apparent misuse of the transformer fluid containing PCBs for defoliant spraying operations adjacent to dairy pasturage was responsible for the milk contamination.

As a result, in November, 1970, the FDA undertook a specific survey of the incidence of the PCBs in the milk supply.

The Monsanto Company informed FDA on July 16, 1971, that large amounts of fish meal may have been contaminated with PCBs (Aroclor 1242) during pasteurization of fish meal at the East Coast Terminal, Wilmington, North Carolina. PCBs were used as the heat exchange fluid.

The U. S. Department of Agriculture informed FDA on July 19, 1971, that Holly Farms, a large North Carolina poultry producer, had discovered the presence of PCBs in its poultry, resulting from an investigation to determine the cause of reduced hatchability in eggs. The firm's investigation

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implicated the fish meal ingredient as the causative agent.

The FDA tested the processed fish meal and confirmed that fish meal on hand was contaminated with PCBs. Continuing investigation indicated the leak began on April 30 and continued through July 16. Approximately 16,000 tons of fish meal were shipped during that period. The contamination was caused by a leak in the heat exchange equipment, which used PCBs in the heat exchange fluid. Individual fish meal samples examined contained from 14 to 30 ppm PCBs.

Fish meal, the direct subject of this contamination incident, is a minor component of poultry and fish feed. Investigations conducted by FDA and USDA focused attention on the contaminated meal as a possible source of PCB residues in poultry, eggs and commercially raised catfish. The Food and Drug Administration visited primary and subconsignees and initiated followup sampling of fish feeds, commercial fish, and eggs, when the contaminated fish meal was implicated. USDA was informed when investigation indicated eggs were being distributed to egg breakers.

The firm recalled outstanding stocks of fish meal on July 21 and approximately 1,500 tons of fish meal were returned to the plant. Sampling of poultry for PCB residues was instituted promptly by USDA who advised that no lots of broiler poultry were found exceeding the 5 ppm interim guideline for PCB residues.

Follow-up sampling on eggs was initiated on August 3, 1971. As of September 29, 1971, 224 samples of eggs were analyzed in the follow up, with 71 containing residues in excess of 0.5 ppm (range 0.6–4.2).

We seized five shipments of fish feeds in the States of Louisiana, Georgia, and Mississippi that contained from 0.6 to 4.5 ppm PCBs. Eleven samples of catfish, which had been fed the contaminated feed, contained PCB residues within the 5 ppm guideline, ranging from 0.3–3.0 ppm. In addition, we seized a shipment of the contaminated fish meal from East Coast Terminal that had not been recalled and contained in excess of 350 ppm PCBs.

Since November, 1969, the FDA has analyzed all raw agricultural commodities sampled under the pesticide surveillance program for PCBs as well as pesticide residues. Over 17,000 samples have been collected and analyzed. In the past 18 months, 684 samples of fish, cheese, milk, shell eggs and fish by-products, out of 3,505 samples of these commodities, have been found positive for the PCBs.

PCBs were encountered most frequently in fish in 363 of the 670 samples ranging from trace levels to 35.29 ppm. PCBs were detected in fresh water fish including catfish, chubs, and smelt, and also salt water species including porgies, sea trout, bluefish, bonita and sardines. PCBs have only been detectable in shellfish at trace levels. The results of the pesticide program for PCBs for that 18-month period are as follows:

PCB in selected food commodities—7/1/70 to 9/30/71.

	Number of samples examined	Number of samples positive	Percent positive	Low	PCB levels (ppm) high	Average
Fish	670	363	54	T	35.29	1.87
Cheese	1344	91	6	T	1.0	.25
Milk	941	69	7	T	27.8	2.27
Shell eggs	550	161	29	T	3.74	.55
Fish by-product	—	13	—	T	5.0	1.17
Total (excluding fish by-product)	3505	684	19			1.14

Above results reflect both surveillance and compliance* samples.
Average residue levels do not include values indicated as "trace." T indicates "trace", which in normal analyses would be less than approximately 0.1 ppm fish; 1–1.5 ppm milk or cheese fat; 0.2 ppm eggs.
* Compliance samples reflect followup of violative samples hence biased towards high levels.

The FDA total diet studies for 60 market baskets representing a total of 720 composite samples during FY 70 and FY 71 show 22 composite samples to contain PCB residues ranging from a trace to 0.36 ppm. These positive findings were found in the meat, fish, poultry, dairy, and the grain and cereal composites. The 0.36 ppm PCB value reported in the total diet study was found to be caused by migration of PCBs from the grayboard container and dividers to packaged shredded wheat.

Subsequent information gathered on the occurrence seemed to point to the use of reclaimed, or recycled paper in the manufacture of the cardboard packaging material used for these food packages.

Consequently FDA initiated on September 8, 1971, a Survey of PCBs in Food and Food Packaging Material. This survey was designed to cover selected food categories nationwide to determine the extent of food contamination by PCB-containing cardboard packaging materials.

As of November 12, 1971, we had complete information from 12 of the 17 districts showing results on a total of 584 samples.

The packaging material analyzed in this survey included the following types of components:

Types of components comprising packaging material analyzed during survey

Inner wrappers		
	Waxed paper	Cellophane
	Foil	Paper
	Plastic	
Dividers		
	Paper cups (as used for cookies and candy)	
	Plastic trays	
	Paper trays	
Outer Wrappers		
	Foil	Plastic
	Cellophane	Paper
Other		
	Cellophane windows	Fiber cartons
	Plastic bags	Paper envelopes
	Metal can ends	Plastic can ends
	Plastic tear strips	Tea bags

Some of the findings from this survey as received as of that date are shown in the following Figs. 1, 2, 3, 4, 5, 6 and 7.

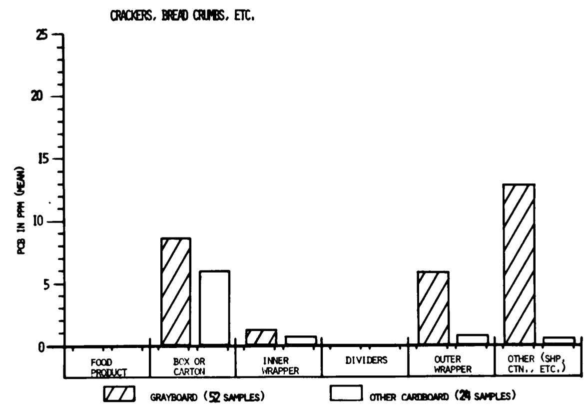

FIGURE 1. Survey—PCB in Food and Food Packaging Material Cumulative Analytical Findings—Sept. 8–Nov. 5, 1971.

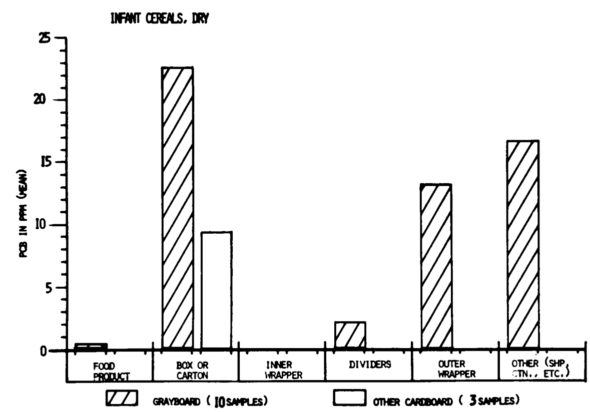

FIGURE 2. Survey—PCB in Food and Food Packaging Material Cumulative Analytical Findings—Sept. 8–Nov. 5, 1971.

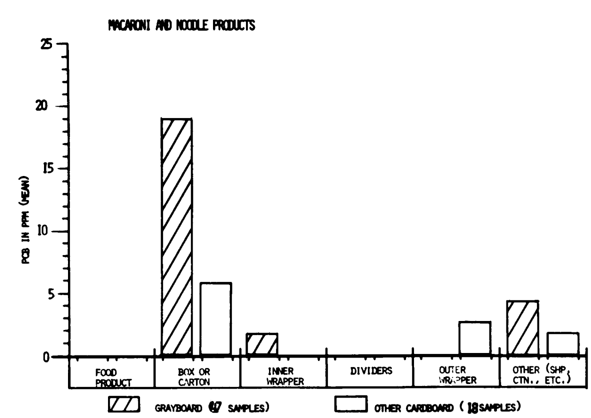

FIGURE 3. Survey—PCB in Food and Food Packaging Material Cumulative Analytical Findings—Sept. 8–Nov. 5, 1971.

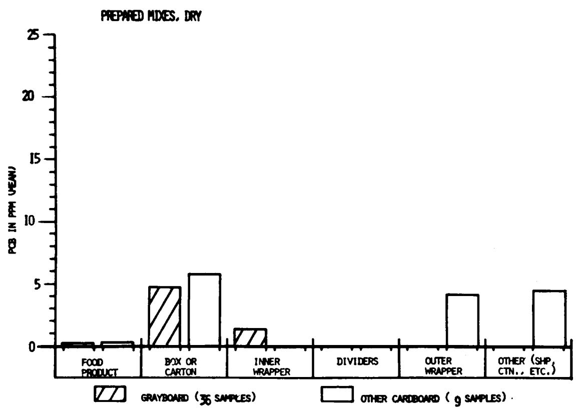

FIGURE 4. Survey—PCB in Food and Food Packaging Material Cumulative Analytical Findings—Sept. 8–Nov. 5, 1971.

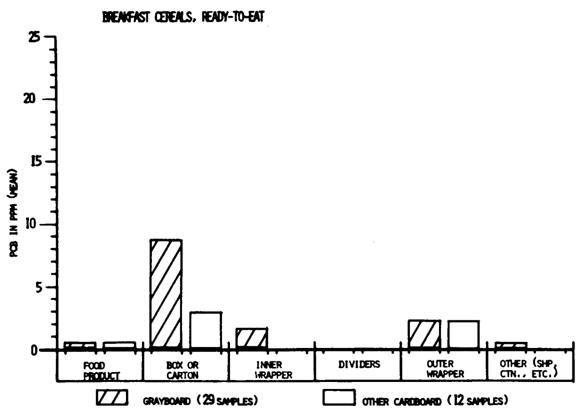

FIGURE 5. Survey—PCB in Food and Food Packaging Material Cumulative Analytical Findings—Sept. 8–Nov. 5, 1971.

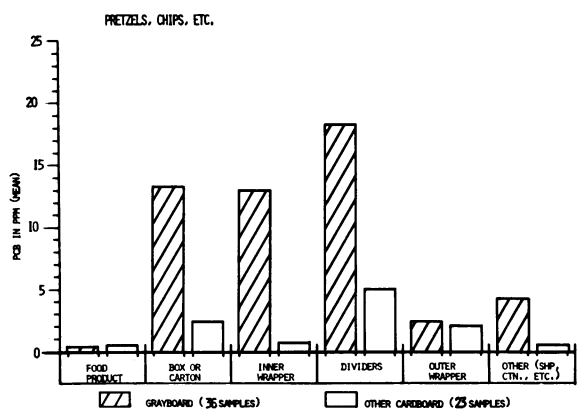

FIGURE 6. Survey—PCB in Food and Food Packaging Material Cumulative Analytical Findings—Sept. 8–Nov. 5, 1971.

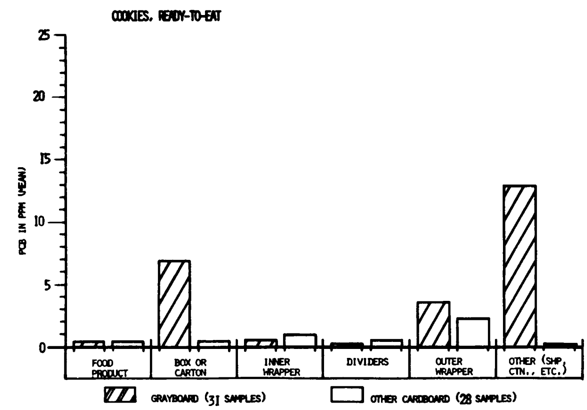

FIGURE 7. Survey—PCB in Food and Food Packaging Material Cumulative Analytical Findings—Sept. 8–Nov. 5, 1971.

It is significant (1) that no PCBs have thus far been reported in fresh fruits and vegetables, (2) that PCBs are found in fish quite frequently, (3) that in addition to poultry, PCBs are also found in milk and eggs, and (4) the PCBs have now been found in various food commodities apparently as the result of migration from their packaging components. At this point the significance of these findings has not been determined.

With the conclusion of the PCBs in Food and Food Packaging Material Survey, FDA has embarked on a program to determine the level of PCBs in animal feeds. Following the PCBs in feed program, FDA will further evaluate PCBs in milk by collecting milk for both bottling and manufacturing use on a nationwide basis. Specific attention will be then given to PCBs in shell eggs.

FDA's current working levels for PCB residue findings are based on specific occurrences of "accidental" contaminations. They are 5 ppm in the edible portion for fish; 5 ppm on a separate fat basis for poultry; 0.2 ppm in whole milk (5 ppm in the fat). Action has been taken against animal feeds and whole eggs associated with the East Coast Terminal incident at the 0.5 ppm level. These levels should not be construed as guidelines permitting consumption of foods containing these amounts of PCBs. If the FDA finds that the frequency of PCB contamination in the nation's food supply increases, the present working guidelines for PCB residues will be substantially lowered.