Illinois PCB Sources and the Occurrence of PCB's in the Lake Michigan Environment

The Illinois sampling program for PCB residues has included samples of wastewater effluents, Illinois streams tributary to the lake, lake sediments, and lake fish. A summary of this data is shown on pages 4-7.

A short analysis of this data is given below. Part of the analysis is based on insufficient data and/or assumptions that are nothing more than "best estimates." Nevertheless, the analysis should be useful in helping to define the magnitude of the PCB question and as a stimulus to the definition of objectives for future sampling programs.

Major Illinois PCB Sources-Pounds per year Discharged

Sources	1971 1242	1971 1254	1972 1242	1972 1254	1973 1242	1973 1254
NSSD-Waukegan STP	121	22	0.2	8	2.7	15.2 (5 mo)
NSSD-North Chicago STP	6.4	1.9	.04	1.5	1.1	1.3
Kellogg Creek	No	Data	No	Data	0	0.14
Waukegan River	---	---	0.84	0.21	0	0.16
Pettibone Creek	0.64	0.75	0.85	1.39	0	0.42
Total	128.04	24.65	1.93	11.10	3.8	17.22 (12 mo)
Total 1242 & 1254	152.69		13.03		21.02	

Bottom Sediment Accumulations

Assuming
1. average sediment concentration of 18.6 ppb Aroclor 1242, average sediment concentration of 14.7 ppb Aroclor 1254.
2. Top 1/2 inch of sediment contains 5 times more PCB residue than average dredge sample analysis
3. Top 1/2 inch of sediment is 3% solids
4. Approximately 1560 square miles in "Illinois portion" of Lake Michigan

top 1/2 inch of sediment contains 0.2 pounds Aroclor 1242/square mile
top 1/2 inch of sediment contains 0.16 pounds Arochlor 1254/square mile
Total Aroclor 1242 in sediment in Illinois Portion = 312 pounds.
Total Aroclor 1254 in sediment in Illinois Portion = 250 pounds.

Fish Flesh Accumulation

Assuming
1. Average PCB concentration of 10ppm in Salmon and lake trout
2. Average PCB concentration of 2ppm in other fish
3. 1,540,000 pounds salmon and trout in Illinois Portion
4. 15,400,000 pounds total fish bio-mass

Total PCB residue in fish in Illinois portion:
15.4 pounds in Salmon and trout
15.4 pounds in balance of fish bio-mass

Presented at Governors Great Lake States Regional Interagency Pesticide Council Jan 30, 1975

MONS 044425

Annual Fish Harvest

Sport fishing	Salmon and Trout	119,000 pounds
Commercial fishing	Trout	17,000 pounds
	others	404,000

Using same assumptions as 1. & 2. above, PCB residue removed:
Lake Trout and Salmon 1.36 lbs./yr.
others - - - 0.8 lbs./yr.

Analysis Summary

Illinois Portion
Lake Michigan Environment
1972-1973

= 20 lbs./year

Annual Illinois PCB input
x lb./year

rainfall and unknown

Fish Biomass has 30.8 lbs. PCB

Top 1/2 inch sediment has 570 lbs. PCB

2.1 lbs./year

Annual Illinois PCB remova

28
216
PCB

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Some additional questions

1. What are the trends in PCB use in the midwest?
2. What is the amount of PCB residue contributed by and removed by other adjoining states and what are the trends?
3. Are PCB residues contributed by precipitation?
4. How do the levels of PCB residue in Lake Michigan compare with levels in other lakes, and the major river systems?
5. Are there other sources of PCB residue in an average diet?
6. Is there a "safe" level of input?
7. Have the long term "safe" levels of PCB residue in the environment been adequately defined and if not, is the risk of possible long term damage worth the costs of banning partial or complete use of the material or regulating disposal and handling of the material?
8. What are the costs associated with banning use of PCB's?
9. What are the major pathways of bio accumulation? Would an immediate halt to PCB input result in reductions in PCB levels in fish flesh or will the levels be sustained by the reservoir of PCB's in the sediment, and for how long?

Illinois EPA
Summary-PCB Sampling 1971-1973

Location	Date	Water(ppt) Aroclor 1242	Water(ppt) Aroclor 1254	Sediment(ppb) Aroclor 1242	Sediment(ppb) Aroclor 1254
Kellogg Creek	1971			1.77	2.56
	5/16/73	ND	200.00		
	7/31/73	ND	40.0		
	8/15/73	ND	82.0		
	9/19/73	ND	38.0		
	12/12/73	ND	62.0		
Bull Creek	1971			13.0	9.1
Dead River	1971			12.3	6.3
Channel(Waukegan)	1971			553.0	83.04
Waukegan River	1971			374.0	131.0
	8/18/71	1810.0	388.0		
	5/24/72	62.0	114.0		
	5/23/72	120.0	136.0		
	5/25/72	57.0	61.0		
	6/29/72	84.0	119.0		
	5/16/73	ND	200.0		
	7/31/73	ND	40.0		
	8/15/73	ND	82.0		
	9/19/73	ND	38.0		
	12/12/73	ND	62.0		
Pettibone Creek	1971			173.4	232.0
	7/29/71	187.0	194.0		
	8/26/71	140.0	192.0		
	5/24/72	ND	111.0		
	5/25/72	ND	107.0		
	6/29/72	653	841.0		
	1/17/73	ND	180.0		
	5/16/73	ND	240.0		
	7/31/73	ND	75.0		
	8/15/73	ND	30.0		
	9/19/73	ND	51.0		
	12/12/73	ND	67.0		
Ravine Park Ravine	1971			ND	ND
Ferry Hall School R.	1971			6.34	12.34
Stone Gate Lane R.	1971			2.48	8.74
Barat Ravine	1971			4.37	2.91
Park Avenue Ravine	1971			4.32	1.54
Ravine Drive Ravine	1971			ND	6.38
Cary Avenue Ravine	1971			3.00	17.90
NSSD Waukegan STP	7/22/71	4020.0	568.0		
	8/04/71	2105.0	472.0		
	9/17/71	601.0	139.0		
	5/16/72	ND	139.0		
	5/19/72	ND	105.0		
	5/23/72	ND	97.0		
	5/22/72	ND	118.0		
	6/17/72	17	111.0		
	2/07/73	4	260.0		
	4/09/73	4	270.0		
	6/05/73	ND	100.0		
	8/29/73	100	94.0		
	9/12/73	ND	60.0		
	10/09/73	250	64.0		
	11/07/73	ND	50.0		
	12/04/73	ND	1100.0		

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Location	Date	Water (ppt) Aroclor 1242	Water (ppt) Aroclor 1254	Sediment (ppb) Aroclor 1242	Sediment (ppb) Aroclor 1254
NSSD N. Chgo. STP	7/23/71	1070.0	250.0		
	8/04/71	268.0	153.0		
	8/25/71	534.0	217.0		
	5/22/72	ND	104.0		
	5/23/72	ND	100.0		
	5/16/72	ND	132.0		
	5/19/72	ND	161.0		
	6/17/72	21.0	178.0		
	2/07/73	ND	340.0		
	6/05/73	ND	80.0		
	8/29/73	220.0	240.0		
	9/12/73	ND	100.0		
	10/09/73	ND	33.0		
	11/07/73	ND	20.0		
	12/04/73	650.0	75.0		
Lake bed station 2	1971			4.98	8.36
5	1971			46.11	34.52
8	1971			24.76	16.30
12	1971			19.25	17.45
15	1971			7.43	5.26
18	1971			10.53	5.56
21	1971			8.60	6.64
24	1971			2.48	5.83
28	1971			18.55	17.25
31	1971			ND	3.87
34	1971			1.24	2.48
37	1971			30.82	33.50
40	1971			17.23	9.38
43	1971			83.35	46.92
46	1971			49.33	38.65
49	1971			13.65	12.42
52	1971			8.48	3.33
55	1971			3.58	3.15
60	1971			4.46	8.63
				354.83	279.50

14 [illegible]

Pesticide and PCB Concentrations Found in the Edible Portions of Lake Michigan Fish in 1973. Values are expressed in parts per million (ppm) on a wet weight basis.

Species	Number and Sex Analyzed	Size in Inches	Sample Location	Date Collected	Dieldrin	Total DDT	PCB's	Heptachlor Epoxide
Yellow Perch	2 Female	8.5 - 9.0	Waukegan	10-11-73	<0.1	0.1	0.1	"
Yellow Perch	5 Female	7.0 - 10.0	Winnetka	10-11-73	<0.1	0.4	1.1	"
Yellow Perch	1 --	6.5	Winnetka	10-11-73	<0.1	0.4	0.9	"
Yellow Perch	2 Male	8.5 - 9.0	Winnetka	10-11-73	<0.1	0.7	2.6	"
Yellow Perch	5 Male	8.5 - 10.3	Waukegan	10-11-73	<0.1	0.1	0.4	"
Yellow Perch	5 Male	7.5 - 9.0	Winnetka	10-11-73	<0.1	0.2	1.3	"
Yellow Perch	5 Male	7.5 - 8.5	Winnetka	10-11-73	0.1	0.7	1.8	"
Chinook Salmon	1 --	11.0	Chicago	11-6-73	0.1	0.6	1.1	"
Chinook Salmon	1 --	10.0	Winnetka	10-11-73	<0.1	0.3	0.4	"
Chinook Salmon	1 Male	36.0	Chicago	11-6-73	0.1	6.0	13.3	"
Chinook Salmon	1 Male	38.5	Chicago	11-6-73	0.1	6.2	15.0	"
Chinook Salmon	1 Male	24.0	Chicago	11-6-73	0.1	3.3	10.0	"
Chinook Salmon	1 Male	27.0	Chicago	11-6-73	<0.1	4.2	10.1	"
Chinook Salmon	1 Male	34.0	Chicago	11-6-73	0.1	6.9	9.5	"
Chinook Salmon	1 Female	36.5	Chicago	11-6-73	<0.1	6.6	12.2	"
Chinook Salmon	1 Female	34.5	Chicago	11-6-73	0.1	5.2	6.9	"
Brown Trout	1 --	20.0	Chicago	11-21-73	0.1	1.6	9.6	"
Brown Trout	1 Female	19.0	Winnetka	10-11-73	<0.1	1.3	2.3	"
Brown Trout	1 Female	25.5	Chicago	11-6-73	0.2	6.6	10.7	"
Brown Trout	1 Female	22.0	Chicago	11-6-73	0.1	3.3	5.6	"
Brown Trout	1 Male	15.5	Chicago	11-6-73	<0.1	1.3	3.7	"
Brown Trout	1 Female	9.5	Chicago	11-21-73	<0.1	0.2	0.4	"
Brown Trout	1 Female	9.0	Chicago	11-21-73	---	0.1	0.3	"
Brown Trout	1 Female	9.0	Chicago	11-21-73	<0.1	0.1	0.4	"
Brown Trout	1 Female	22.5	Chicago	11-21-73	0.2	4.9	9.9	"
Brown Trout	1 Male	24.0	Chicago	11-21-73	0.1	1.7	7.2	"
Brown Trout	1 Male	15.5	Chicago	11- 6-73	<0.1	0.3	3.9	"
Lake Trout	1 Male	21.5	Waukegan	10-11-73	0.2	2.5	7.0	"
Lake Trout	1 Female	23.0	Winnetka	10-11-73	0.3	11.0	15.2	"
FDA "Action" Levels					0.3	5.0	5.0	In most cases <0.1

Species	Number and Sex Analyzed	Size in Inches	Sample Location	Date Collected	Dieldrin	Total DDT	PCB's	Heptachlor Epoxide
Rainbow Trout	1 Female	19.0	Waukegan	10-11-73	0.1	0.5	0.9	*
Rainbow Trout	1 Male	24.5	Chicago	11-21-73	<0.1	1.0	2.5	*
Coho Salmon	1 Female	24.0	Chicago	11-21-73	<0.1	0.5	1.6	*
Coho Salmon	1 Female	23.0	Chicago	11-21-73	0.1	3.2	8.6	*
Carp	1 Female	34.0	Chicago	11-21-73	0.1	4.5	7.0	*
Carp	1 Male	19.0	Chicago	11-21-73	<0.1	0.3	(13.6)*	*
White Sucker	1 --	12.5	Chicago	11-21-73	<0.1	0.1	0.2	*
Northern Pike	1 --	15.0	Chicago	11-6-73	<0.1	0.3	0.9	*
Alewife	5 Female	7.0 - 8.0	Waukegan	6-14-73	0.1	1.3	1.6	*
Alewife	3 Female	7.0 - 9.0	Waukegan	6-14-73	0.1	1.5	3.7	*
Alewife	2 Male	7.0 - 7.5	Waukegan	6-14-73	0.1	1.1	2.5	*
Alewife	5 Male	6.0 - 7.5	Waukegan	6-14-73	0.1	0.9	1.6	*
	70 total Fish analyzed							

*In most cases <0.1

*Aroclor 1242