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Polychlorinated Biphenyls in Auto Parts and Auto Fluff

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Polychlorinated biphenyls (PCBs) are chlorinated aromatic hydrocarbons that were manufactured in the United States by the Monsanto Company for industrial use under the trade-name "Aroclor." The most common preparations are Aroclors 1242, 1248, 1254 and 1260. The first two digits represent the molecular type, biphenyl, and the last two digits indicate the weight percent of chlorine in the molecule (Hutzinger et al 1974).

PCBs are highly stable compounds which resist decomposition at extreme temperatures and in strong acid or alkaline solutions (Pal et al 1980). Due to these thermal and chemical properties, PCBs were used extensively in many industrial materials such as hydraulic fluids, electrical insulating fluids, rubber products, plasticizers, polyurethane foam, dyes, and polishes.

The use of PCBs has been restricted in industrial materials since the early 1970's after reports linking them to liver disorders and tumors in laboratory animals (Kimbrough and Linder 1974). Residues of PCBs in the environment have resulted from both accidental and intentional disposal of PCB contaminated materials. As a consequence, PCBs have contaminated land fills and have entered the sediments of lakes and rivers (Pal et al 1980). Measurable concentrations of PCBs have been reported in birds and fish, and PCBs have been shown to bioconcentrate within the food chain in the fatty tissues of animals and in human milk (Sawhney and Hankin 1985, Jensen 1983). Therefore the presence of PCBs in the environment is of great concern.

One potential source of PCB contamination is the non-metallic, shredded material, known as "auto fluff" which results when automobiles are scrapped. The materials in the fluff may contain PCBs, especially from automobiles that were manufactured before 1976 (Code of Federal Regulations 1989). The objective of this investigation was to determine if substantial amounts of PCBs were present in auto fluff and to examine some of the individual auto parts to quantify specific sources of PCBs among those components.

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MATERIALS AND METHODS

Samples of auto parts, vinyl, polyurethane foam, rubber gaskets, oil, etc., and auto fluff were collected by inspectors of the Connecticut Department of Environmental Protection. The parts came from the following automobiles: 1964 Volvo, 1964 Chevrolet Corvair, 1967 Pontiac Tempest, 1968 Toyota Land Cruiser, 1969 & 1970 MG, 1970 Ford Pickup Truck, 1971 MGB, and a 1971 BMW from junk yards in Berlin and Waterford, CT. Nine samples of auto fluff were collected from a single pile at a metal recycling facility in North Haven, CT. The history of the vehicles which composed the pile was not known.

Aroclors that were used for standards were obtained from the Monsanto Co., St. Louis, MO; Quality Assurance Reference Materials from U. S. Environmental Protection Agency (EPA), Research Triangle, NC; Petroleum Ether, 9265-3, from J.T. Baker Inc., Phillipsburg, NJ; Florisil, PR grade, from U.S. Silica Co., Berkeley Springs WV; Chromatographic column, 22 mm x 300 mm, CG-1204-07, and other necessary glassware from Chemglass Inc., Vineland, NJ.

All samples were prepared using official and recommended methods (Pesticide Analytical Manual 1968, Environmental Protection Agency 1986, Krull 1977). Test sample weights for the auto parts ranged from 8 grams to 10 grams; engine coil oil samples were 0.1 gram; auto fluff samples were 100 grams. Larger samples of auto fluff were used to compensate for the lack of homogeneity of the sample. Extraction volumes of petroleum ether were 100 mLs for the auto parts and 500 mLs for the auto fluff. All samples were extracted in a covered beaker, unstirred, at room temperature for 24 hours. A portion of the extract equivalent to 5 grams of original sample was placed directly on a Florisil column and the PCBs were eluted with 200 mLs of petroleum ether. The extract was then concentrated to 10 mLs using a Kuderna-Danish flask.

Two microliters of the concentrated extract was injected into a Hewlett Packard 5890 gas chromatograph equipped with a ^{63}Ni electron capture detector. Specific conditions were: Packed Column, 6 ft. x 2 mm, 1.5% SP-2250/1.95% SP-2401 on 100/120 mesh Supelcoport; Carrier gas, 5% Methane in Argon; Flow rate, 25 mLs/min. Peak areas were calculated using a Hewlett Packard 3396 integrator by the area summation of individual PCB peaks in the sample. The area sums were then matched to external standard chromatograms of Aroclors 1242, 1248, 1254 and 1260, for both identification and quantitation of samples containing either an individual PCB or a mixture of PCBs (Webb and McCall 1973).

Recoveries of PCBs by the procedure were monitored using EPA standard reference samples. Recoveries ranged from 85% to 95% for Aroclors 1242

and 1248 and from 88% to 102% for Aroclors 1254 and 1260. Solvent blanks, processed in a like manner, contained no PCBs.

RESULTS AND DISCUSSION

The auto parts were separated into eight groups based on their general matrix type, eg. rubber parts, vinyl parts, exterior parts, interior parts and miscellaneous parts. Samples from each group were tested in duplicate and the average result in ppm is given in Table 1. Due to the nonhomogeneous nature of the samples, statistical calculations were not meaningful. The individual sample results agreed, however, to within 0.3 ppm. One sample (group 1, gasket) that contained 12.8 ppm Aroclor 1254 was tested in triplicate since it was significantly higher than any other sample. This result was not used in calculations of the averages.

Thirty percent of the samples from groups 1-7 contained two different Aroclors and 13% of the samples contained three different Aroclors (Table 1). In the engine coil oil, shown in group 8, no PCBs above a detection limit of 0.01 ppm were found.

Table 2 lists the results of the nine individual samples taken from the pile of auto fluff. Since this fluff material was not homogeneous, the samples were all tested in quadruplicate, and since sample to sample variability was high, statistical calculations were not meaningful. Except for sample number 5, all samples contained a minimum of three Aroclors.

The PCB content of the auto fluff and the individual auto parts could not be correlated since the auto parts did not come from the same auto fluff pile. The average total PCB content of the auto fluff was higher than the average total of the eight auto part groups. The most common PCBs in the auto fluff and in the auto parts, groups 1-7, were Aroclors 1248 and 1254. No sample from any of the eight auto part groups or the auto fluff contained greater than 15 ppm total PCBs.

A likely possibility for the higher PCBs in the auto fluff could be from oils that were dispersed throughout the auto fluff. If the oils contributed significantly to the PCB content of the auto fluff then separation of engine coils from the shredding process could greatly reduce the oily residue in the fluff. Results obtained from group 8 (Table 1), however, indicate that the oils tested, were not a source of PCBs.

The EPA regulates the use and disposal of PCBs under the Toxic Substances Control Act (Code of Federal Regulations 1989). In most cases, the disposal of waste material containing PCBs at concentrations greater than 50 ppm is regulated. The data in this report show that concentrations of PCBs in the auto fluff and auto parts that were analyzed, are below this regulatory limit.

Table 1. PCBs (ppm) Found in Auto Parts.

Description of Sample	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Total
Group-1 Rubber Gasket					
1964 Volvo, Window Gasket			0.20	0.30	0.50
1970 MG, Door Gasket			0.18		0.18
1964 Chevrolet Corvair, Door Gasket	0.17		0.19	0.19	0.55
1971 BMW, Windshield Gasket		12.80[a]			12.80[a]
1970 Ford Pickup, Door Gasket		0.31			0.31
1968 Toyota Land Cruiser, Window Gasket					N.D.
Average	0.17	0.31	0.19	0.25	1.05
Group-2 Vinyl & Foam Rubber Padding					
1968 Toyota Land Cruiser, Dashboard					N.D.
1970 MG, Dashboard	0.38				0.38
1971 BMW, Dashboard		0.13	0.75		0.88
1970 Ford Pickup, Dashboard				0.19	0.19
Average	0.38	0.13	0.75	0.19	0.48
Group-3 Interior Rubber					
1964 Chevrolet Corvair, Floor Pad	0.19		0.22	0.22	0.63
1968 Toyota Land Cruiser, Floor Mat		0.14			0.14
1970 Ford Pickup, Foot Pedal Cover				0.30	0.30
Average	0.19	0.14	0.22	0.26	0.36
Group-4 Exterior Rubber					
US Royal, Truck Tire				0.25	0.25
Goodyear, Truck Tire			0.18		0.18
Firestone, Car Tire			0.04	0.07	0.11
Average			0.11	0.16	0.18
Group-5 Vinyl & Foam Padding					
1964 Volvo, Seat Cover		0.49	0.60		1.09
1970 MG, Seat Cover			1.00	1.20	2.20
1970 MG, Sunvisor			0.32		0.32
1964 Chevrolet Corvair, Seat Cover		0.71	0.50	0.26	1.47
1968 Toyota Land Cruiser, Seat Cover				0.32	0.32
1968 Toyota Land Cruiser, Seat Padding			0.38	0.49	0.87
1970 Ford Pickup, Seat Cover				0.43	0.43
1970 Ford Pickup, Seat Padding		0.57	1.14		1.71
Average		0.59	0.66	0.54	1.05
Group-6 Vinyl & Foam Rubber					
1964 Volvo, Door Covering			1.75		1.75
1964 Chevrolet Corvair, Door Covering		0.20	0.27	0.12	0.59
1971 BMW, Door Covering		0.69		0.24	0.93
Average		0.45	1.01	0.18	1.09
Group-7 Miscellaneous					
1964 Chevrolet Corvair, Tail Light Gasket	0.05		0.05		0.10
1971 BMW, Firewall Insulation				0.25	0.25
1971 BMW, Air Intake Filter				0.12	0.12
Average	0.05		0.05	0.19	0.16
Group-8 Engine Coil Oil					
1971 MGB, Oil					N.D.
1969 MG, Oil					N.D.
1967 Pontiac Tempest, Oil					N.D.

[a] Result not used in calculation of average.

Table 2. PCBs (ppm) Found in Auto Fluff.

Sample Number	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Total
1	2.04	3.00	5.30	0.92	11.26
2	2.69	3.01	6.58	2.24	14.52
3	0.65	1.65	3.18	1.42	6.90
4	2.03	1.80	3.78	1.29	8.90
5			8.87		8.87
6		1.00	3.93	1.12	6.05
7		2.14	3.76	0.86	6.76
8		2.61	2.40	2.65	7.66
9		1.63	2.55	1.83	6.01
Average	1.85	2.11	4.48	1.54	8.55

Although the data reported in Table 2 show low concentrations of PCBs in auto fluff, there still is environmental concern, and auto fluff will be subject to EPA regulation, if testing of other auto fluff piles reveals the presence of PCBs at concentrations greater than 50 ppm.

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