DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
CENTER FOR DISEASE CONTROL

NATIONAL INSTITUTE FOR OCCUPATIONAL
SAFETY AND HEALTH
5600 FISHERS LANE
ROCKVILLE, MARYLAND 20852

November 4, 1975

NOV 6 1975

Mr. W. B. Papageorge
Speciality and Process Chemicals
Division
Monsanto Industrial Chemicals Company
800 North Lindberg Boulevard
St. Louis, Missouri 63166

Dear Mr. Papageorge:

Thank you for your assistance in providing us with information on polychlorinated biphenyls.

Enclosed is a copy of the current intelligence bulletin on polychlorinated biphenyls which was released yesterday afternoon.

Sincerely,

Harvey P. Stein

Harvey P. Stein, Ph.D.
Chemist
Priorities Evaluation Branch
Office of Occupational Health
Surveillance and Biometrics

Enclosure

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NOV 3 1975

Dear Colleague:

The enclosed background material has been prepared by this office to inform the occupational health community of current knowledge concerning industrial uses and toxicity of polychlorinated biphenyls.

Your comments and suggestions for changes to future reports are solicited.

Sincerely yours,

J. William Lloyd, Sc.D.
Director
Office of Occupational Health
Surveillance and Biometrics

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BACKGROUND INFORMATION ON POLYCHLORINATED BIPHENYLS

Office of Occupational Health Surveillance and Biometrics

National Institute for Occupational Safety and Health

November 3, 1975

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POLYCHLORINATED BIPHENYLS

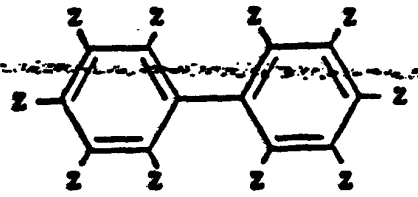
Introduction

Reports of adverse health effects in humans and the demonstration of carcinogenic effects in certain animal species have led to the reexamination of the distribution of polychlorinated biphenyls (PCBs) in the environment and the potential health effects of human exposure.

Because the industrial environment represents the major source of potentially high exposures to PCBs, the National Institute for Occuptional Safety and Health (NIOSH) has gathered pertinent information on the manufacture, uses, and reported deleterious effects of polychlorinated biphenyls and is advising the occupational health community of these hazards.

Background

Polychlorinated biphenyls (PCBs) describe a group of synthetic chlorinated organic compounds having the following structure:



where each of the ten Z's can represent either a hydrogen or a chlorine atom. There are two hundred nine different chlorinated biphenyls and they are collectively referred to as PCBs although many are not actually polychlorinated. Approximately half of these compounds have been synthesized and characterized.

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Mixtures of polychlorinated biphenyls are important industrial products. The most common tradenames for these mixtures are Aroclor,[a] Inerteen,[b] Kanechlor,[c] and Pyranol.[d] Other known tradenames for PCB-containing products are listed in Table I. PCB-containing dielectrics (electrical insulators), are generally referred to as "askarels" in the electrical industry.

Mixtures of polychlorinated biphenyls are very resistant to degredation, are thermally stable, and resistant to oxidation, acids, bases, and other chemical agents. They are soluble in most of the common organic solvents and lipids, but only slightly soluble in water, glycerol, and glycols. PCBs are good electrical insulators. Although most individual polychlorinated biphenyls are solids at room temperatures, the mixtures vary in consistency from mobile oils to viscous liquids or sticky resins.

PCBs are generally prepared industrially by the chlorination of biphenyl with anhydrous chlorine in the presence of iron filings or a ferric chloride catalyst. Trace quantities of chlorinated naphthalenes and chlorinated dibenzofurans have been reported in some commercial samples of PCBs and it has been suggested that the presence of these impurities may be of toxicological significance.(1,2,3)

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[a] Aroclor is a registered trademark of the Monsanto Company.

[b] Inerteen is a registered trademark of the Westinghouse Electric Corporation for its brand of PCB containing dielectric fluids.

[c] Kanechlor is a registered trademark of the Kanegafuchi Chemical Industry Company, Ltd.

[d] Pyranol is a registered trademark of the General Electric Company for its brand of PCB containing dielectric fluids.

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Commercial PCBs are generally mixtures of many different chlorinated biphenyls, as shown in Table II, manufactured to meet operational specifications (such as dielectric constant, flash point, fire point, density, percent chlorine, and color); these commercial mixtures may vary chemically from batch to batch.

PCBs have found wide use in industry and have been manufactured in the United States since 1929. The major domestic manufacturer, Monsanto Company, produces PCBs at Sauget, Illinois and reports manufacturing 40 million pounds of PCBs in the United States during 1974 (down from 85 million pounds in 1970).(4) Monsanto's domestic production and sales of PCBs by grade and category from 1957 through the first quarter of 1975 are shown in Table III.

Uses

PCBs are employed in capacitors and transformers because they combine attractive dielectric properties with chemical stability and fire resistance. Approximately twice as many pounds of PCBs are used in the manufacture of capacitors as in the manufacture of transformers.

Prior to the environmental concern surrounding the persistence and ubiquitousness of PCBs,(5) they were more widely used in industry as fluids for heat transfer systems, hydraulic systems, gas turbines, and vacuum pumps, as fire retardants, and as plasticizers in adhesives, textiles, surface coatings, sealants, printing, and carbonless copy paper.

Beginning in 1971, Monsanto voluntarily restricted its domestic sales of PCBs to closed system dielectric applications in capacitors and transformers.(6) Other current domestic applications of PCBs include use in investment casting processes, as heat exchange fluids, and as hydraulic

fluids. Imports of PCBs have been estimated to exceed 375,000 pounds for 1974. Reclaimed PCBs also are reported to be available.(7)

More than 95 percent of all power capacitors contain PCBs. Among their applications are use on electric utility lines, in air conditioners, and in the ballast of fluorescent lamp fixtures. PCBs are employed for safety, reliability, and long life, as well as to achieve size compatibility with equipment and installation requirements. However, non-PCB power capacitors are being manufactured (e.g., General Electric's Econol line and Sprague's Eccol line) which may serve as alternatives.(8)

PCBs are employed in transformers at locations where their proximity to people and/or property demand a fire resistant dielectric. Approximately 5 percent of transformers are PCB filled and each of the transformers so filled contains between 40 and 500 gallons of PCBs (about 235 gallons is average). Possible alternatives to PCB filled transformers may include dry transformers (which are larger) as well as transformers filled with silicone fluids or other materials under evaluation.(8,9)

Chlorinated terphenyls, as well as PCBs, are used in some formulations of wax for investment casting processes.(8) The chemical structure of chlorinated terphenyls resembles that of PCBs. Chlorinated terphenyls have been reported to have toxicological effects similar to those of PCBs.(10)

Approximately 330,000 pounds of chlorinated terphenyls were imported into the United States during 1974(11) and 125,532 pounds during 1973.(12)

Toxicity

PCBs are poorly metabolized and tend to accumulate in animal tissues, including humans.(13,14,15,16,17) The accumulation, particularly in

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tissues and organs rich in lipids, appears to be higher in the case of penta and more highly chlorinated biphenyls.(18)

Studies have revealed PCBs in human fat tissue and blood plasma. PCBs, in amounts greater than 2 parts per million, were reported in 198 of 637 (31 percent) samples of human fat tissue taken from the general population of 18 states and the District of Columbia.(14) PCB residues ranging up to 29 parts per billion have also been found in 43 percent of 616 plasma samples collected from volunteers in a southeastern U.S. county.(15)

Human:

The known toxic effects of PCBs in humans include an acnelike skin eruption (chloracne), pigmentation of the skin and nails, excessive eye discharge, swelling of eyelids, and distinctive hair follicles.(19)

For a number of years, chloracne of the face and neck has been reported among workers exposed to chlorinated hydrocarbons. Workers exposed to PCBs in the process of insulating cables,(20) in the production of condensers(21) and in the manufacture of chlorobiphenyls(22) have reported these skin lesions along with systemic effects such as digestive disturbances, edema of the face and hands, burning of the eyes, impotence, and hematuria.(16,22)

The toxic effects of PCBs in humans are further illustrated by a 1968 outbreak of poisoning in Japan that involved over 1,000 people who ingested PCB contaminated rice bran oil for a period of several months. The contamination of the oil (estimated 1,500 to 2,000 ppm) occurred when heat transfer pipes immersed in the oil during processing developed pin-sized holes. The clinical aspects of the poisoning included chloracne,

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brown pigmentation of the skin and nails, distinctive hair follicles, increased eye discharge, swelling of eyelids, transient visual disturbance, and systemic gastrointestinal symptoms with jaundice(19). In some patients, symptoms persisted 3 years after PCB exposure was discontinued. Infants born to poisoned mothers had decreased birth weights, and showed skin discoloration due to PCB placental passage. Two stillbirths to PCB exposed women were also reported.(23)

Animal:

The toxic effects of PCBs in animals have been studied extensively. Reports of malignant, non-malignant, and reproductive effects are shown in the following three tables:

MALIGNANT PATHOLOGIC EFFECTS INDUCED BY PCBS IN ANIMALS

PCB Mixture	Treatment	Animal	Effects
Kanechlor 500(24) Kanechlor 400 Kanechlor 300	500 ppm, 250 ppm and 100 ppm in diet for 32 weeks	Mice	Liver weight increased with percent chlorine and dosage. Kanechlor 400 and 500 produced liver cell hypertrophy. 500 ppm of Kanechlor 500 produced hyperplastic nodules in 7 of 12 mice and hepatocellular carcinomas in 5 of 12 mice No nodules or carcinomas in controls
Aroclor 1254(25)	300 ppm in diet for 6 & 11 months	Mice	Increased liver weight. Adenofibrosis in all mice fed for 11 months. None of 22 mice fed for 11 months had hepatomas. One of 24 mice fed for 6 months had a hepatoma. No hepatomas in control mice.
Aroclor 1260(26)	100 ppm in diet for 21 months	Rats	Hepatocellular alteration in 183 of 184 rats fed PCBs and in 28 of 173 control rats. Neoplastic nodules in 26 of 184 PCB fed rats and none in control rats. Hepatocellular carcinomas in 20 of 184 rats fed PCBs and in 1 of 173 control rats.

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NON-MALIGNANT PATHOLOGIC EFFECTS INDUCED BY PCBS IN ANIMALS

PCB Mixture	Animal	Route of Administration	Effects
ACUTE EFFECTS			
Unspecified Product Containing 42 % Chlorine(27)	Guinea Pigs Rats Rabbits	Subcutaneous injection Skin application Feeding	Fatty degeneration and central atrophy of the liver.
Aroclor 1242(28) Aroclor 1254	Guinea pigs Rats Mice Rabbits Cat	Inhalation	Aroclor 1242 produced no ill effects on basis of mortality, growth, pathology, organ enlargement, liver function, or hematological changes. Aroclor 1254 produced no harmful effects regarding growth or mortality, but did produce enlarged livers with microscopic evidence of hepatic cellular injury.
Aroclor 1248(29)	Monkeys	Feeding	Weight loss, hair loss, mouth and eyelid edema, acneform lesions, decreased hemoglobin and hematocrit, severe gastric mucosal ulceration and extreme hypertrophy of the liver.
CHRONIC EFFECTS			
Aroclor 1254(30) Aroclor 1260	Rats	Feeding	Hypertrophy of the liver cells, a brown pigment in the Kupffer cells, lipid accumulation in the cytoplasm of hepatocytes and adenofibrosis.

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REPRODUCTIVE EFFECTS OF PCBS IN ANIMALS

PCB Mixture	Animal	Route of Administration	Effects
Aroclor 1242(31) Aroclor 1254 Aroclor 1260	Chickens	Feeding	Aroclor 1242 and 1254 reduced egg production and hatchability and caused thin eggshells. Aroclor 1260 produced no harmful effects.
Aroclor 1254(32)	Mallards Bobwhites	Feeding	No adverse effects.
Aroclor 1254(33)	Pheasant	Feeding	Reduced egg production and hatchability.
Aroclor 1254(34)	Mink	Feeding	Severely affected reproduction.
Aroclor 1248(29)	Female monkeys	Feeding	Reduced ability to become pregnant. Pregnancies produced small infants with PCBs in tissues.

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Occupational Exposure

It is estimated that 12,000 people are occupationally exposed to polychlorinated biphenyls. The majority of these exposures are in capacitor production and in investment casting processes.

Permissible Occupational-Exposure

The current Occupational Safety and Health Administration, Department of Labor standards for chlorinated biphenyls are 1 mg/cubic meter for 42 percent chlorine mixtures and .5 mg/cubic meter for 54 percent chlorine mixtures. These are based on the Threshold Limit Values (TLV) established by the American Conference of Governmental Industrial Hygienists.(35)

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TABLE I

TRADENAMES FOR KNOWN PCB CONTAINING PRODUCTS

Tradename	Tradename Owner
Aroclor	Monsanto Company St. Louis, MO
Chlorextol	Allis-Chalmers Milwaukee, WI
Clophen	Farbenfabricken Bayer GmbH Germany
Dykanol	Federal Pacific Electric Co. Newark, NJ
Fenclor	Caffaro S.P.A. Italy
Inerteen	Westinghouse Electric Corp. Pittsburgh, PA
Kanechlor	Kanegafuchi Chemical Industry Co., Ltd. Japan
Noflamol	Wagner Electric Corporation Newark, NJ
Phenoclor	Prodelec France
Pyralene	Prodelec France
Pyranol	General Electric Co. Schenectady, NY
Santotherm	Mitsubishi-Monsanto Japan
Therminol*	Monsanto Co. St. Louis, MO

*Therminol products now formulated in the U.S. do not contain PCBs.

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TABLE 11
DESCRIPTION OF PCB MIXTURES

	Aroclor 1221[a]	Aroclor 1016[a]	Aroclor 1242[a]	Aroclor 1254[a]	Aroclor 1260[b]	Kanechlor 300[c]	Kanechlor 400[c]	Kanechlor 500[c]
Approximate Chlorine Content	21%	42%	42%	54%	60%	42%	48%	53%
Components								
Biphenyl	11	<0.1	<0.1	<0.1				
Monochlorobiphenyls	51	1	1	<0.1				
Dichlorobiphenyls	32	20	16	0.5		7	3	
Trichlorobiphenyls	4	57	49	1		60	33	5
Tetrachlorobiphenyls	2	21	25	21		13	44	27
Pentachlorobiphenyls	<0.5	1	8	48	12	0.6	16	55
Hexachlorobiphenyls	none detected	<0.1	1	23	38		5	13
Heptachlorobiphenyls	none detected	none detected	<0.1	6	41			
Octachlorobiphenyls	none detected	none detected	none detected	none detected	8			
Nonachlorobiphenyls					1			

Aroclor is a registered trademark of the Monsanto Company.

Kanechlor is a registered trademark of the Kanegafuchi Chemical Industry Company, Ltd.

It must be emphasized that these are approximate compositions of the PCB mixtures and that a particular product may vary in chemical composition from batch to batch.

[a] Weight-weight percent. None detected = less than 0.01%. Source of component compositions: Monsanto Company, quoted in Hutzinger, O., et al., op. cit., p. 23

[b] Percent. Source of component compositions: Thruston, A., PCB Newsletter, No. 3, July 1971, quoted in Hutzinger, O., et al., op. cit., p. 23

[c] Percent. Source of component compositions: Ito, N., et al., op. cit., p. 1617

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PCB MANUFACTURE AND SALES

MONSANTO INDUSTRIAL CHEMICALS COMPANY
1965 THROUGH 1975
(Thousands of Pounds)

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975 (1st quarter)
U.S. PRODUCTION	60480	65849	75309	82854	76389	85054	34994	38600	42178	40466	8532
DOMESTIC SALES	51796	59078	62466	65116	67194	73061	34301	26408	37742	34406	7986
U.S. EXPORT SALES	4234	6852	8124	11231	10624	13651		6388	8346	5395	1538
DOMESTIC SALES BY CATEGORY											
Heat Transfer	1237	1766	2262	2529	3050	3958	3060	752			
Hydraulics/ Lubricants	4616	4258	4643	5765	8039	7403	1552	0			
Misc. Industrial	1841	1779	1426	1283	1079	1627	1155	0			
Transformer	8657	8910	11071	11585	12105	13828	11134				
Capacitor	23749	28884	29703	29550	25022	26708	14141	25656	37742	34406	7986
Plasticizer Applications	11696	13481	13361	14404	16460	19537	3259	0			
Petroleum Additives	--	--	--	--	1439	--	--	0			
DOMESTIC SALES BY PCB GRADE											
Aroclor 1221	369	528	442	136	507	1476	2215	171	35	57	10*
Aroclor 1232	7	16	25	90	273	260	171	0	0	0	0
Aroclor 1242	31533	39557	43055	44853	45491	48588	21981	728	6200	6207	2201**
Aroclor 1248	5565	5015	4704	4894	5650	4073	213	807	0	0	0
Aroclor 1254	7737	7035	6696	8891	9822	12421	4661	3495	7976	6185	2115**
Aroclor 1260	5831	5875	6417	5252	4439	4890	1725	305	0	0	0
Aroclor 1262	558	768	840	720	712	1023	1	0	0	0	0
Aroclor 1268	196	284	287	280	300	330	0	0	0	0	0
Aroclor 1016	0	0	0	0	0	0	3334	20902	23531	21955	3660*

* Used primarily in capacitors

** Used primarily in transformers

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PCB MANUFACTURE AND SALES

MONSANTO INDUSTRIAL CHEMICALS COMPANY
1957 THROUGH 1964
(Thousands of Pounds)

	1957	1958	1959	1960	1961	1962	1963	1964
U.S. PRODUCTION	(1)	(1)	(1)	37919	36515	38353	44734	50833
DOMESTIC SALES	32299	26061	31310	35214	37538	38043	38132	44869
U.S. EXPORT SALES	(2)	(2)	(2)	(2)	(2)	(2)	3647	4096
DOMESTIC SALES BY CATEGORY								
Heat Transfer	--	--	--	--	--	157	582	929
Hydraulics/Lubricants	1612	1549	2685	2523	4110	3915	3945	4374
Miscellaneous Industrial	704	755	1569	1559	2114	1681	1528	1692
Transformer	12955	5719	5984	7921	6281	7984	7290	7997
Capacitor	17028	14099	16499	16967	15935	15382	15606	19540
Plasticizer Applications	(1)	3939	4573	6244	9098	8924	9181	10337
Petroleum Additives	--	--	--	--	--	--	--	--
DOMESTIC SALES BY PCB GRADE								
Aroclor 1221	23	16	254	103	94	140	361	596
Aroclor 1232	196	113	240	155	241	224	13	13
Aroclor 1242	18222	10444	13598	18196	19827	20654	18510	23571
Aroclor 1248	1779	2559	3384	2827	4023	3463	5013	5238
Aroclor 1254	4461	6691	6754	6088	6294	6325	5911	6280
Aroclor 1260	7587	5982	6619	7330	6540	6595	7626	8535
Aroclor 1262	31	184	359	326	361	432	414	446
Aroclor 1268	--	72	102	189	158	210	284	190
Aroclor 1016	--	--	--	--	--	--	--	--

(1) Production figures and Plasticizer Applications figures unavailable during year indicated.

(2) U.S. Export Sales figures unavailable during year indicated.

SOURCE: Monsanto Industrial Chemicals Company, St. Louis, Missouri, September, 1975.

F. J. Fitzgerald
Vice-President, Monsanto Chemical Company

January 14, 1976

Good afternoon, my name is Jack Fitzgerald. I am a vice president of Monsanto Company, a member of its Corporate Administrative Committee and managing director of Monsanto Industrial Chemicals Company, an operating unit of Monsanto Company.

Since I am responsible for the operating unit which manufactures polychlorinated biphenyl dielectric fluids, John Hanley, our president, has asked me to represent him today and reaffirm to you Monsanto's commitment to continue working with the EPA and the electrical industry in finding solutions to the PCB issue.

Let me state at the outset that Monsanto agrees wholeheartedly with EPA's desire to work toward the goal of eventually eliminating all uses of PCB's.

Monsanto has already taken several steps designed to restrict the entry of PCB's into the environment.

First, Monsanto began restricting the use of PCB's solely to closed electrical systems, for which no viable alternates existed, back in 1970. It should be noted that this voluntary program was fully implemented prior to the completion of the study done on PCB's by a Federal Interagency Task Force in 1972.

Secondly, Monsanto has been working for a number of years on non-PCB replacement products. These materials, designed to replace PCB fluids in capacitors and transformers, are currently being evaluated by the major electrical manufacturers in the United States.

While the PCB issue is a tough one to handle, the difficulty does not nor will not in the future stem from any lack of cooperation on the part of Monsanto. The problems that we face, collectively, are rather rooted in the unique characteristics of PCB's and the irreplaceable role they have served in our electrical-industrial environment for the past 45 years. The challenge: Replacing them in an orderly manner without creating another hazard of equal or potentially greater consequence, while at the same time avoiding serious power and transportation disruptions.

Let me emphasize that we have no desire to remain in the PCB manufacturing business any longer than is necessary. By this I mean as soon as we are satisfied that the electrical power supply industry's needs for usable, acceptable alternate dielectric fluids have been met by whomever, Monsanto will voluntarily shut down

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its PCB manufacturing unit. In the interim, we will continue to work with industry and government to ensure that the restrictive measures and controls we implemented in the early 1970's remain in force and are diligently pursued.

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Monsanto

MONSANTO INDUSTRIAL CHEMICALS CO.
800 N. Lindbergh Boulevard
St. Louis, Missouri 63166
Phone: (314) 694-1000

December 11, 1975

Mr. Earl J. Stephenson
Director, Enforcement Division
Environmental Protection Agency
1735 Baltimore
Kansas City, Missouri 64108

Dear Mr. Stephenson:

Attached is a response to the questionnaire which accompanied Mr. Stanley Legro's letter dated October 17, 1975.

To the best of my knowledge and belief, the information contained in this response represents the best information available to Monsanto.

If I can be of further assistance, please let me know.

Sincerely,

W. B. Papageorge
Manager, Product Acceptability
Process Chemicals Division

ajt

Attachment

CC: Mr. Stanley W. Legro
US Environmental Protection Agency
401 "M" Street, SW
Washington, D.C. 20460

TOWOLDMON0001454

NEWS

Monsanto

FOR RELEASE
IMMEDIATELY 1976

MONSANTO INDUSTRIAL CHEMICALS
D. R. Bishop
(314) 694-2891

PUBLIC RELATIONS DEPARTM
800 N. Lindbergh Boulevard
St. Louis, Missouri 63166

MONSANTO RAISES PCB PRICE
CITES PHASE OUT EXPENSES

ST. LOUIS, Dec. 17 -- Monsanto Company said today that effective Jan. 1, 1977, it will increase the price of all grades of its polychlorinated biphenyl (PCB) dielectric insulating fluids by about 24 per cent. Monsanto markets PCBs exclusively to the electrical power supply industry for use as fire resistant dielectric fluids in transformers and capacitors.

Monsanto announced last October its intentions to terminate the production, sale and distribution of its PCB products by Oct. 31, 1977. The company said that it would have withdrawn sooner, but a majority of its customers required that much lead time to complete field testing and convert to replacement products.

According to Monsanto, this protracted phase out program has caused certain production imbalances that make efficient operation impossible. The company said the resulting higher unit costs, combined with other phase-out-related expenses, were major reasons behind the price increase.

-o0o-

TOWOLDMON0001455

Monsanto

SPECIALTY CHEMICALS DIVISION

MONSANTO INDUSTRIAL CHEMICALS CO.
800 N. Lindbergh Boulevard
St. Louis, Missouri 63166
Phone: (314) 694-1000

September 22, 1977

Mr. Dick Jones, Senior Buyer
Westinghouse Electric Corporation
469 Sharpsville Avenue
Sharon, Pa. 16416

Dear Mr. Jones:

As you know, Monsanto will completely withdraw as a supplier of PCB dielectrics October 31, 1977. Concurrent with this withdrawal date, Monsanto will stop making available to askarel users the "Transformer Askarel Inspection and Maintenance Guide", Bulletin No. IC/FF-38R-2. Although operators of askarel transformers have used this askarel guide as a reference manual in the past, environmental regulations on PCB's are changing rapidly and have made the bulletin obsolete. This bulletin will not be updated. (May I suggest that you destroy all copies in your files and offices so we don't inadvertently supply obsolete information to the industry.)

If your company has ever used our bulletin as a supplement to your own literature, we want you to be aware of our decision. Equally, we ask you to note that in your own use of this bulletin you recognize that the last edition was issued August 1976. It should not be relied upon now or in the future.

Sincerely,

J. A. Alley

J. A. Alley
Industry Specialist
Dielectrics

tmc

100324

249

TOWOLDMON0001456

Monsanto MATERIAL SAFETY DATA

NOTE:
NO REPRESENTATION IS MADE AS TO THE ACCURACY OF THE INFORMATION AND RECOMMENDATIONS HEREIN. SEE PAGE 4 FOR CONDITIONS UNDER WHICH DATA ARE FURNISHED.

[redacted]

MONSANTO PRODUCT NAME

[redacted]

POLYCHLORINATED BIPHENYLS—PCB's*

*See page 4 for definition and notes

[redacted]

MONSANTO COMPANY
800 N. LINDBERGH BLVD.
ST. LOUIS, MO. 63166
EMERGENCY PHONE NO.
(CALL COLLECT)
(314) 694-1000

PRODUCT IDENTIFICATION

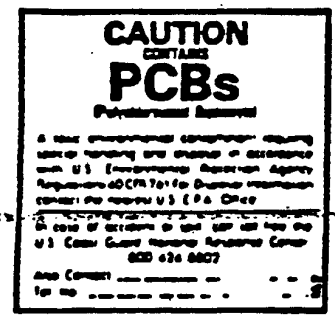
Synonyms	Trade Names (Commonly used Monsanto products)
PCB's	Askarel**
Chlorodiphenyl (__% Cl)	Aroclor®[1] Series 1016, 1221, 1232, 1242, 1248, 1254, 1260
Chlorinated biphenyl	Pyranol®[2] Series
Polychlorinated biphenyl	Inerteen®[3] Series
Chlorinated biphenyls (approx. __% Cl)	Therminol®[1] FR Series

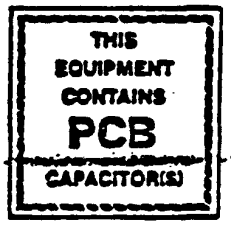
*See page 4 for notes

CAS No. 001336363, 053469219, 021672296, 01109769, 011096825 and others

WARNING STATEMENTS

Federal regulations under the Toxic Substances Control Act require PCB's and PCB items to be marked. (Check regulations for details.*)







EMERGENCY AND FIRST AID PROCEDURES

Ingestion—Consult a physician. Do not induce vomiting or give any oily laxatives.
NOTE TO PHYSICIAN—If large amounts ingested, gastric lavage is suggested.

Skin—If liquid or solid PCB's are splashed or spilled on skin, contaminated clothing should be removed and the skin washed thoroughly with soap and water.
NOTE TO PHYSICIAN—Hot PCB's may cause thermal burns.

Eyes—Eyes should be irrigated immediately with copious quantities of running water for at least 15 minutes if liquid or solid PCB's get into them. A petrolatum-based ophthalmic ointment may be applied to the eye to relieve the irritating effects of PCB's.

Inhalation—Remove to fresh air. If skin rash or respiratory irritation persists, consult a physician. NOTE TO PHYSICIAN—If electrical equipment arcs over, PCB's or other chlorinated hydrocarbon dielectric fluids may decompose to produce HCl, hydrochloric acid, a respiratory irritant.

TOWOLDMON0001457

OCCUPATIONAL CONTROL PROCEDURES

Inhalation—Workplace exposure should be maintainted below the OSHA eight-hour, time-weighted ave age Threshold Limit Value (TLV). At room temperatures, the hazard of inhalation is considered slight c absent. Chemical cartridge respirators or gas masks approved for protection against organic vapors ar recommended in the event of spills or leaks of hot fluids. These will provide good protection up to th concentrations shown on the approval labels and the odor will give ample warning if it comes through th device. Self-contained breathing apparatus should be worn when PCB's are encountered in an enclose space.

Threshold Limit Value (TLV)—Chlorodiphenyl (42% chlorine) 1.0 mg/cu.m.
Chlorodiphenyl (54% chlorine) 0.5 mg/cu.m.

Skin Contact—Avoid prolonged or repeated skin contact. Where employees may come into direct contac with PCB's, protective clothing impervious to PCB's should be worn. Gloves, boots, overshoes and bib-typ aprons that cover the boot tops should be used when necessary. This protective equipment should b regularly inspected for defects and to ensure that it is in clean and satisfactory working condition. Contam nated clothing, gloves, etc., should be disposed of as prescribed by regulations.

Eye Contact—Eye protection should be used where there is a possibility of liquid splashes.

Ingestion—Ingestion of these materials is generally not a problem in industry.

PHYSIOLOGICAL EFFECTS SUMMARY:

Skin Contact—Can be absorbed through intact skin. Local action on skin is similar to that of common organi solvents where contact leads to removal of natural fats and oils with subsequent drying and cracking of th skin. A potential exists for the contracting of chloracne.

Eye Contact—The liquid products and their vapors are moderately irritating to eye tissues.

Ingestion—The acute oral toxicities of the undiluted compounds are: LD_{50} rats—8.65 gm/kg for 42% chlor nated, and 11.9 gm/kg for 54% chlorinated—"slightly toxic."

Inhalation—Animal experiments of varying duration and at different air concentrations show that for simila exposure conditions, the 54% chlorinated material produces more liver injury than the 42% chlorinate material.

Other—There are literature reports that PCB's can impair reproduction function in monkeys. A study reporte in the literature with female rats using Aroclor® 1260 stated that Aroclor 1260 caused liver cancers. Monsant sponsored animal feeding studies of Aroclor 1242, 1254 and 1260. These compounds, fed to both sexes of rat did not produce cancers. The National Cancer Institute performed a study in 1977 using Aroclor 1254 with bot sexes of rats. NCI stated that the PCB, Aroclor 1254 was not carcinogenic under the conditions of the bioassay.

The consistent finding in animal studies with PCB's is that they produce liver injury following prolonged an repeated exposure by any route, if the exposure is of sufficient degree and duration. Liver injury is produce first, and by exposures that are less than that alleged to cause cancer in rodents. Therefore, exposure by a routes should be kept sufficiently low to prevent liver injury.

FIRE PROTECTION INFORMATION

Fire and Explosion—Chlorodiphenyls are essentially non-combustible compounds. They may decom form CO, CO_2, HCl, phenolics and aldehydes under severe conditions such as exposure to flame surfaces. No phosgene is formed.

MATERIAL SAFETY DATA Monsanto

TOWOLDMON0001458

Standard fire fighting wearing apparel and self-contained breathing apparatus should be worn when fighting fires that involve possible exposure to chlorodiphenyls. Fire fighting equipment must be thoroughly cleaned and decontaminated after use.

PHYSICAL DATA

TABLE I—Properties of Selected Aroclors®

Property	1016	1221	1232	1242	1248	1254	1260
Color (APHA)	—	100	100	100	100	100	150
Physical state	mobile oil	mobile oil	mobile oil	mobile oil	mobile oil	viscous liquid	sticky resin
Stability	inert	inert	inert	inert	inert	inert	inert
Density (lb/gal 25°C)	11.40	9.85	10.55	11.50	12.04	12.82	13.50
Specific gravity x/15.5°C	1.36-1.37 x-25°	1.18-1.19 x-25°	1.27-1.28 x-25°	1.30-1.39 x-25°	1.40-1.41 x-65°	1.48-1.50 x-65°	1.55-1.56 x-90°
Distillation range (°C)	323-356	275-320	290-325	325-366	340-375	365-390	385-420
Acidity mg KOH/g, maximum	—	.014	.014	.015	.010	.010	.014
Fire point (°C)	none to boiling point	176	238	none to boiling point	none to boiling point	none to boiling point	none to boiling point
Viscosity (100°F)	71-81	38-41	44-51	82-92	185-240	1400-2500	—

REACTIVITY DATA

PCB's are very stable, fire-resistant compounds.

SPILL, LEAK & DISPOSAL INFORMATION

If PCB's leak or are spilled, the following steps should be taken immediately:

All non-essential personnel should leave the leak or spill area.

The area should be adequately ventilated to prevent the accumulation of vapors.

The spill/leak should be contained. Loss to sewer systems, navigable waterways and streams should be prevented. Spills/leaks should be removed promptly by means of absorptive material, such as sawdust, vermiculite, dry sand, clay, dirt or other similar materials, or trapped and removed by pumping or other suitable means (traps, drip-pans, trays, etc.).

Personnel entering the spill or leak area should be furnished with appropriate personal protective equipment and clothing as needed.

Personnel trained in the emergency procedures and protected against the attendant hazards should shut off sources of PCB's, clean up spills, control and repair leaks and fight fires in PCB areas.

All wastes and residues containing PCB's (e.g., wiping cloths, absorbent material, used disposable protective gloves, clothing, etc.) should be collected, placed in proper containters, marked and disposed of in the manner prescribed by EPA regulations (40 CFR 761).

Various federal and state regulations may require reporting of PCB spills. Consult your attorney or appropriate regulatory officials for information relating to spill reporting.

TOWOLDMON0001459

NOTE:
ALTHOUGH THE INFORMATION AND RECOMMENDATIONS SET FORTH IN THIS SHEET ARE BELIEVED TO BE CORRECT AS OF THE DATE HEREOF, MONSANTO COMPANY MAKES NO REPRESENTATION AS TO THE COMPLETENESS OR ACCURACY OF SUCH INFORMATION AND RECOMMENDATIONS. MONSANTO COMPANY SHALL IN NO EVENT BE RESPONSIBLE FOR ANY DAMAGES OF WHATSOVER NATURE DIRECTLY OR INDIRECTLY RESULTING FROM THE PUBLICATION OR USE OF OR RELIANCE UPON SUCH INFORMATION AND RECOMMENDATIONS.

NO WARRANTY, EITHER EXPRESS OR IMPLIED, OR MERCHANTABILITY OR FITNESS OR OF ANY OTHER NATURE WITH RESPECT TO THE PRODUCT OR TO THE INFORMATION AND RECOMMENDATIONS HEREIN IS MADE HEREUNDER.

This form has been approved by the Occupational Safety and Health Administration as "equivalent to" OSHA Form 20.

*POLYCHLORINATED BIPHENYLS

For regulatory purposes, under the Toxic Substances Control Act the term "PCB's" refers to a chemical substance limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances which contain 50 ppm (on a dry weight basis) or greater of such substance (40 CFR 761).

Chemically, however, PCB's are defined as a series of technical mixtures, consisting of many isomers and compounds that vary from mobile oily liquids to white crystalline solids and hard non-crystalline resins. Technical products vary in composition, in the degree of chlorination and possibly according to batch.

The mixture generally used contains an average of 3 atoms chlorine per molecule (42% chlorine) to 5 atoms of chlorine per molecule (54% chlorine). They are used as dielectric fluids in transformers and capacitors. Prior to 1972, PCB applications included heat transfer media, hydraulic and other industrial fluids, plasticizers, carbonless paper, paints, inks and adhesives. "Federal regulations now specify that non-totally enclosed PCB activities are permitted only if specifically exempted or authorized." (40 CFR 761 see FEDERAL REGISTER, Vol. 44, P. 31514, May, 31, 1979)

CAS No. 001336363: For general class of compounds

TRADE NAMES

*ASKAREL—Generic name for a broad class of fire-resistant synthetic chlorinated hydrocarbons used as dielectric fluids.

*1 Registered trademark of Monsanto Company
*2 Registered trademark of General Electric Company
*3 Registered trademark of Westinghouse Electric Corporation

This list of trade names is representative of several commonly used Monsanto products (or formulated with Monsanto products). Many other trademarked products were marketed by Monsanto and other chemical manufacturers. PCB's were also manufactured and sold by several European and Japanese producers. Contact the manufacturer of the trademarked product directly, if not in this listing, to determine if the formulation contained PCB's.

DATE September 15, 1980	REVISED	X	SUPERCEDES All prior to 9/15/80

FOR ADDITIONAL NON-EMERGENCY INFORMATION, CONTACT:

John H. Craddock, Manager,
Product & Environmental Safety
Monsanto Industrial Chem. Co.
800 North Lindbergh Boulevard
St. Louis, Missouri 63166
(314) 694-4764

MATERIAL SAFETY DATA Monsanto

80-010

ADM 002162

TOWOLDMON0001460

PCB MANUFACTURING AND SALES
MONSANTO INDUSTRIAL CHEMICALS COMPANY
1957 thru 1978
(Thousands of Pounds)

	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
U.S. PRODUCTION	(1)	(1)	(1)	37919	36515	38353	44734	50833	50480	65849
DOMESTIC SALES	32299	26061	31310	35214	37538	38043	38132	44869	51796	59078
U.S. EXPORT SALES	(2)	(2)	(2)	(2)	(2)	(2)	3647	4096	4234	6852
DOMESTIC SALES BY CATEGORY										
Heat Transfer	0	0	0	0	0	157	552	929	1237	1766
Hydraulics/Lubricants	1612	1549	2685	2523	4110	3915	3945	4374	4616	4258
Misc. Industrial	704	755	1569	1559	2114	1881	1528	1892	1841	1779
Transformer	12955	5719	5984	7921	6281	7984	7290	7987	8657	8910
Capacitor	17026	14099	16499	16967	15935	15382	15606	19540	23749	28884
Plasticizer Applications	(1)	3939	4573	6244	8098	8924	9181	10337	11698	13481
Petroleum Additives	0	0	0	0	0	0	0	0	0	0
DOMESTIC SALES BY PCB GRADE										
Aroclor 1221	23	16	254	103	94	140	361	596	369	526
Aroclor 1232	196	113	240	165	241	224	13	13	7	16
Aroclor 1242	18222	10444	13598	18196	19827	20654	18510	23571	31533	39557
Aroclor 1248	1779	2559	3394	2827	4023	3463	5013	5238	5565	5015
Aroclor 1254	4461	6691	6754	8086	6294	6325	5911	6280	2727	7035
Aroclor 1260	7587	5982	8619	7330	6540	6595	7626	8535	5831	5875
Aroclor 1262	31	184	399	326	361	432	414	446	558	768
Aroclor 1268	0	72	102	189	158	210	284	190	196	284
Aroclor 1016	0	0	0	0	0	0	0	0	0	0

(1) Production figures and Plasticizer Applications figures unavailable during year indicated.
(2) U.S. Export Sales figures unavailable during year indicated.

ACM 00081

TOWOLDMON0001461

1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
75309	82854	76389	85054	45417	38600	42178	40118	29710	29592	13330	0
62466	65116	67194	73061	34301	32242	37742	34406	25611	24329	12701	0
8124	11231	10624	13651	10648	8388	8346	5396	5712	4744	1548	0
2262	2529	3050	3958	3060	752	0	0	0	0	0	0
4643	5765	8039	7403	1552	0	0	0	0	0	0	0
1426	1283	1079	1627	1155	0	0	0	0	0	0	0
11071	11585	12105	13828	11134	11314	14176	12394	12783	6002	1617	0
29703	29550	25022	26708	14141	20176	23566	22012	12848	18327	11084	0
13361	14404	16460	19537	3259	0	0	0	0	0	0	0
0	0	1439	0	0	0	0	0	0	0	0	0
442	136	507	1476	2215	26	35	57	28	20	0	0
25	90	273	260	171	0	0	0	0	0	0	0
43055	44853	45491	48588	21981	5537	6200	6207	6435	4418	51	0
4704	4894	5650	4073	213	0	0	0	0	0	0	0
6696	8891	9822	12421	4661	6118	2978	6185	6328	1584	1566	0
6417	5252	4439	4890	1725	414	0	0	0	0	0	0
840	720	712	1023	1	0	0	0	0	0	0	0
287	280	300	330	0	0	0	0	0	0	0	0
0	0	0	0	3334	20150	23531	21955	12820	18307	11084	0

ADM 000613

TOWOLDMON0001462

PCB YEARLY SALES TOTALS

WESTINGHOUSE - ALL LOCATIONS

ALL PCB PRODUCTS

1954 - 1977

1954

4,681,644 lbs

1955

4,346,780 lbs

1956

7,083,144 lbs

1957

8,367,139 lbs

1958

4,562,464 lbs

1959

5,648,271 lbs

1960

8,294,977 lbs

1961

6,591,368 lbs

1962

5,843,134 lbs

1963

7,517,688 lbs

ADM 006972

TOWOLDMON0001463

1964

7,492,896 lbs

1965

9,271,259 lbs

1966

8,027,542 lbs

1967

10,856,219 lbs

1968

10,316,063 lbs

1969

8,038,072 lbs

1970

9,071,230 lbs

1971

6,851,689 lbs

1972

6,740,904 lbs

1973

7,951,141 lbs

1974

9,080,243 lbs

1975

7,754,663 lbs

1976

5,456,521 lbs

TOWOLDMON0001464

1977

693,993 lbs

Total All Years: 170,539,344 lbs

ADM CG8974

TOWOLDMON0001465

IN THE CIRCUIT COURT OF THE CITY OF ST. LOUIS
STATE OF MISSOURI

GLENN BROWN, et al,	)	
	)	
Plaintiffs,	)	
	)	
vs.	)	Cause No. 862-00694
	)	
MONSANTO COMPANY,	)	
	)	
Defendant.	)	

AFFIDAVIT IN SUPPORT OF MOTION TO SEVER

THOMAS M. BISTLINE, being first duly sworn, on his oath states:

1. I am Litigation Counsel for Monsanto Company. I make this Affidavit in support of Monsanto Company's Motion to Sever.

2. The information set forth in this Affidavit was compiled at my direction from historical sales summaries of Monsanto Company which were prepared annually in the ordinary course of Monsanto Company's business. The matters set forth herein are true to the best of my knowledge, information, and belief.

3. Monsanto Company sold the following products containing polychlorinated biphenyls to Westinghouse Electric Corporation at its plant in Bloomington, Indiana:

1957-1967

Aroclor 1242
Aroclor 1286 (Less than 6,000 lb./yr.)
Aroclor 1254 (Less than 100 lb./yr.)

TOWOLDMON0001466

1968-1970

Aroclor 1242
Aroclor 1232 (Less than 1,500 lb./yr.)
Aroclor 1254 (Less than 200 lb./yr.)
Transformer Inerteen PPO (Less than 1,000 lb./yr.)

1971-1977

Aroclor 1242
Aroclor 1016
Inerteen 54201 CF
Inerteen 54201 A9
Inerteen 54201 KJ
Capacitor 21
Capacitor Aroclor 1489 (Less than 100 lb.)

4. Monsanto Company sold the following products containing polychlorinated biphenyls to Westinghouse Electric Corporation at its plant in Muncie, Indiana:

1964-1970

Therminol FR-2

1971

Therminol FR-1

1972-1977

No sales

5. Monsanto Company sold the following products containing polychlorinated biphenyls to Westinghouse Electric Corporation at its plant in Cincinnati, Ohio:

1959-1968

Transformer Inerteen PPO

1969-1972

Transformer Inerteen PPO
Transformer Inerteen 100-42 (Less than 1,000 lb./yr.)

TOWOLDMON0001467

1973-1976

Inerteen 70-30

THOMAS M. BISTLINE

COUNTY OF ST. LOUIS)
) SS.
STATE OF MISSOURI)

Subscribed and sworn to before me, a Notary Public, this 26th day of March, 1987.

Notary Public

SHIRLEY J. SCHOMBURG
NOTARY PUBLIC, STATE OF MISSOURI
MY COMMISSION EXPIRES 7/24/87
ST. LOUIS COUNTY

/38

HUSCH, EPPENBERGER, DONOHUE,
CORNFELD & JENKINS

Charles E. Merrill - #27238
100 North Broadway-14th Floor
St. Louis, MO 63102
(314) 421-4800

Attorneys for Defendant
Monsanto Company

TOWOLDMON0001468