Monsanto

MONSANTO COMPANY
ST. LOUIS, MISSOURI 63166

DUPLICATE

INVOICE

CUSTOMER'S ORDER NO	DATE ENTERED	DATE SHIPPED	INVOICE DATE	INVOICE NO
T 933375 REL 15	12-01-72	12-20-72	12-20-72	14-12-80691

BILL TO
I-T-E IMPERIAL CORPORATION
645 EAST ERIE AVENUE
PHILADELPHIA, PENNSYLVANIA 19134

3

PAYMENT — PLEASE MAKE CHECKS PAYABLE TO: MONSANTO COMPANY, MAIL TO P.O. BOX LISTED BELOW

SHIPPED TO
I-T-E IMPERIAL CORPORATION
645 EAST ERIE AVE.
PHILADELPHIA, PENNSYLVANIA

MONSANTO COMPANY
BOX 360478M
PITTSBURGH
PENNSYLVANIA 15230

MAIL INQUIRIES TO: Customer Service Center St. Louis, MONSANTO INDUSTRIAL CHEMICALS CO. St. Louis, Missouri 63166

TERMS OF SALE	DELIVERY F.O.B.	TERMS OF PAYMENT	SHIPPER NO
CGL	AS INDICATED BELOW	NET 30 DAYS	5301601

SHIPPED FROM	CAR NO./T. CARRIER	CUSTOMER SERVICE REPRESENTATIVE
SAUGET IL	MUNX008608	N HADDOX

ITEM	DESCRIPTION PRICE & UNIT		AMOUNT
1	1 6000 GL TANKCAR	107,300.00 LB	
	I-T-E ASKAREL 60		
	AT	.2100	22,533.00
	1050-210-16-0003-47-07-5-00340A		
	FOB SAUGET IL	107,300.00 LB	

THIS PRODUCT CONTAINS
POLYCHLORINATED BIPHENYLS
PCBX WHICH SOME STUDIES
HAVE SHOWN MAY BE PERSISTANT
AN ENVIRONMENTAL CONTAMINANT
AND POSSIBLY INJURIOUS TO
CERTAIN FORMS OF BIRD AQUATIC
AND ANIMAL LIFE PRESENT ANY

ENTRY INTO THE ENVIRONMENT
THROUGH SPILLS LEAKAGE DIS-
POSAL VAPOURISATION RE-USE
OF CONTAINERS OR OTHERWISE
SPILLS LEAKAGES AND WASTE
PRODUCT MUST BE COLLECTED
USE OF THIS PRODUCT MUST BE
RESTRICTED TO APPLICATIONS

CX700 ORC REV 1/71

DUPLICATE

MONSANTO COMPANY
ST. LOUIS, MISSOURI, U.S.A.

Monsanto

TERMS AND CONDITIONS

1. **FORCE MAJEURE.** Deliveries may be suspended by either party in the event of Act of God, war, riot, fire, explosion, accident, flood, sabotage, inability to obtain fuel, power, raw materials, labor, containers or transportation facilities, governmental laws, regulations, orders or action, breakage or failure of machinery or apparatus, national defense requirements or any other event beyond the reasonable control of such party or in the event of labor trouble, strike, lockout or injunction (whether or not such labor event is within the reasonable control of such party), which event prevents the manufacture, shipment, acceptance or consumption of a shipment of the goods or of a material upon which the manufacture of the goods is dependent. If, because of any such event, Seller is unable to supply the total demand for the goods, Seller may allocate its available supply of goods, without obligation to purchase similar goods from other sources, among itself and all of its customers, including those not under contract, on such basis as it determines to be equitable. Deliveries suspended under this section shall be cancelled without liability, but this contract shall otherwise remain unaffected.

2. **BUYER'S CREDIT.** Seller reserves the right, among other remedies, either to terminate this contract or to suspend further deliveries under it in the event Buyer fails to pay for any one shipment when same becomes due. Should Buyer's financial responsibility become unsatisfactory to Seller, cash payments or satisfactory security may be required by Seller for future deliveries and for goods theretofore delivered.

3. **WEIGHTS AND CONTAINERS.** In the case of bulk carload, tank car, tank truck or barge shipments, shipper's weights shall govern unless proved to be in error. Where shipment requires use by Seller of returnable containers, title to such containers shall remain in Seller and a deposit in the amount required by Seller must be made at the time the goods are paid for. Such containers must be kept in good condition, must not be used for any material other than that shipped therein and must be returned within sixty (60) days from date of shipment. On such containers being so returned in good condition, a refund of the deposit will be made.

4. **SHIPMENTS.** The quantity shipped in any contract month may be limited by Seller to either (a) the average of the monthly quantities ordered by Buyer hereunder for the preceding contract months, or (b) the maximum quantity covered by this contract divided by the number of months in the contract period. Seller shall not be bound to tender delivery of any quantities for which Buyer has not given shipping instructions.

5. **LIMITED WARRANTY.** Subject to the limitations of Section 6 and unless otherwise provided herein, Seller warrants title and that all goods sold hereunder shall conform to Seller's standard specifications. Subject to the preceding sentence and except as otherwise expressly provided herein, SELLER MAKES NO REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, AS TO MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE, OR ANY OTHER MATTER WITH RESPECT TO THE GOODS, whether used alone or in combination with other substances.

6. **LIMITATION OF LIABILITY.** Within thirty (30) days after receipt of each shipment of goods sold hereunder, Buyer shall examine such goods for any damage, defects or shortage. All claims, including for alleged damaged or defective goods, shortage, negligence or any other cause whatsoever (defective performance), shall be deemed waived unless made in writing and received by Seller within sixty (60) days after Buyer's receipt of the goods or within thirty (30) days after Buyer learns of the facts giving rise to the claim, whichever shall first occur. Provided, however, that as to any defective performance not reasonably discoverable within said sixty (60) day period (including that discoverable only in processing or in further manufacture) all claims shall be deemed waived unless made in writing and received by Seller within one hundred eighty (180) days after Buyer's receipt of the goods or within thirty (30) days after Buyer learns of the facts giving rise to the claim, whichever shall first occur. Failure of Buyer to give notice of any claim within the applicable time period specified above shall be deemed an absolute and unconditional waiver of such claim, irrespective of whether the facts giving rise to such claim shall have then been discovered or of whether processing, use or resale of the goods shall have then taken place. Buyer's exclusive remedy shall be for damages and Seller's liability for any and all losses or damages resulting from any cause whatsoever, including alleged negligence, shall in no event exceed the purchase price of the goods in respect to which the claim is made; or at the election of Seller, the repair or replacement of such goods. Seller shall not be liable for, and Buyer assumes responsibility for, all personal injury and property damage resulting from the handling, possession, use or resale of the goods by Buyer. In no event shall Seller be liable for incidental or consequential damages, whether Buyer's claim is in contract, negligence or otherwise. Transportation charges for the return of goods shall not be paid unless authorized in advance by Seller.

7. **PATENTS.** Seller warrants that any goods sold pursuant to this contract, except as are made specifically for Buyer according to Buyer's specifications, do not infringe any valid U.S. patent. This warranty is given upon condition that Buyer promptly notify Seller of any claim or suit involving Buyer in which such infringement is alleged, and, if Seller is affected, that Buyer permit Seller to control completely the defense or compromise of any such allegation of infringement. Seller does not warrant that the use of any goods sold hereunder, or articles made therefrom, either alone or in conjunction with other materials, will not infringe a patent. Seller reserves the right to terminate Seller's obligations under this Section 7 at any time with respect to any undelivered goods, it being agreed that in the event of such termination Buyer may, without penalty, thereafter refuse acceptance of any undelivered goods.

8. **FREIGHT-TAXES.** Any increase in freight rates paid by Seller on shipments covered by this contract and any tax or governmental charge or increase in same hereafter becoming effective increasing the cost to Seller of producing, selling, or delivering the goods or of procuring materials used therein, and any tax now in effect or increase in same payable by the Seller because of the sale of the goods, such as Sales Tax, Use Tax, Retailer's Occupational Tax, Gross Receipts Tax, may, at Seller's option, be added to the price herein specified.

9. **LOSS IN TRANSIT.** In case of breakage or loss in transit, Buyer shall have notation of same made on expense bill before paying freight.

10. **PLASTIC MATERIALS.** Because of the conditions involved in the manufacture of plastic materials, where an order calls for a product to be made up specially for Buyer:
   (1) A delivery of not less than 90% of the order will be considered a complete fulfillment of the order.
   (2) In case of an over-run, Seller may deliver and Buyer will accept any such excess up to 10% of the order, but not more than 1,000 pounds.

11. **FAIR LABOR STANDARDS ACT.** The material covered hereunder is warranted to have been produced in compliance with the requirements of the Fair Labor Standards Act of 1938, and with all amendments thereto.

12. **MISCELLANEOUS.** The validity, interpretation and performance of this contract shall be governed and construed in accordance with the laws of the State of Missouri. This contract constitutes the full understanding of the parties, and a complete and exclusive statement of the terms of their agreement. No conditions, understanding or agreement purporting to modify or vary the terms of this contract shall be binding unless hereafter made in writing and signed by the party to be bound, and no modification shall be effected by the acknowledgment or acceptance of purchase order or shipping instruction forms containing terms or conditions at variance with or in addition to those set forth herein. No waiver by either Seller or Buyer with respect to any breach or default or of any right or remedy, and no course of dealing, shall be deemed to constitute a continuing waiver of any other breach or default or of any other right or remedy, unless such waiver be expressed in writing signed by the party to be bound.

Monsanto

MONSANTO COMPANY
ST. LOUIS, MISSOURI 63166

DUPLICATE
INVOICE

CUSTOMER'S ORDER NO	DATE ENTERED	DATE SHIPPED	INVOICE DATE	INVOICE NO
T 533379 NEL 19	12-01-72	12-20-72	12-20-72	14-12-00698

SOLD TO

SHIP TO

PAYMENT: PLEASE MAKE CHECKS PAYABLE TO: **MONSANTO COMPANY** MAIL TO P.O. BOX LISTED BELOW

MONSANTO COMPANY

MAIL INQUIRIES TO: Customer Service Center - St. Louis
MONSANTO INDUSTRIAL CHEMICALS CO.
St. Louis, Missouri 63166

F.O.B. POINT	TERMS OF PAYMENT	SHIPPED NO
COL	AS INDICATED BELOW	NET 30 DAYS	5301601

SHIPPED FROM	CAR NO./TT CARRIER	CUSTOMER SERVICE REPRESENTATIVE
SAUGET IL	MONA008608	M MADDOX

ITEM	DESCRIPTION PRICE & UNIT	AMOUNT
	WHICH CAN BE CONTROLLED SO THAT ENTRY INTO THE ENVIRONMENT DOES NOT OCCUR AND TO APPLICATIONS IN WHICH IT CANNOT COME INTO CONTACT WITH FOOD ANIMAL FEEDSTUFFS OR PHARMACEUTICALS RESTRICTED TO APPLICATIONS	

PAGE 2 22,933.00

C3750 CMC - REV - 72

MONS 097518

TERMS AND CONDITIONS APPEARING ON REVERSE SIDE HEREOF AND ACCEPTANCE BY SELLER OF ANY ORDER ARE SUBJECT TO THE TERMS AND CONDITIONS CONTAINED ABOVE AND ON REVERSE SIDE HEREOF AND NO ADDITIONAL TERMS AND CONDITIONS SHALL BE BINDING UNLESS AGREED TO IN WRITING BY SELLER. NO WAIVER BY SELLER OF ANY OF THE TERMS AND CONDITIONS HEREOF SHALL BE EFFECTIVE UNLESS IN WRITING AND NO WAIVER SHALL BE DEEMED A CONTINUING WAIVER UNLESS SPECIFICALLY STATED THEREIN.

TERMS AND CONDITIONS

1 **FORCE MAJEURE**. Deliveries may be suspended by either party in the event of Act of God, war, riot, fire, explosion, accident, flood, sabotage, inability to obtain fuel, power, raw materials, labor, containers or transportation facilities, governmental laws, regulations, orders or action, breakage or failure of machinery or apparatus, national defense requirements or any other event beyond the reasonable control of such party or in the event of labor trouble, strike, lockout or injunction (whether or not such labor event is within the reasonable control of such party), which event prevents the manufacture, shipment, acceptance or consumption of a shipment of the goods or of a material upon which the manufacture of the goods is dependent. If, because of any such event, Seller is unable to supply the total demand for the goods, Seller may allocate its available supply of goods, without obligation to purchase similar goods from other sources, among itself and all of its customers, including those not under contract, on such basis as it determines to be equitable. Deliveries suspended under this section shall be cancelled without liability, but this contract shall otherwise remain unaffected.

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6 **LIMITATION OF LIABILITY**. Within thirty (30) days after receipt of each shipment of goods sold hereunder, Buyer shall examine such goods for any damage, defects or shortage. All claims, including for alleged damaged or defective goods, shortage, non-delivery or any other cause whatsoever (defective performance"), shall be deemed waived unless made in writing and received by Seller within sixty (60) days after Buyer's receipt of the goods or within thirty (30) days after Buyer learns of the facts giving rise to the claim, whichever shall first occur; provided, however, that as to any defective performance not reasonably discoverable within said sixty (60) day period including that discoverable only in processing or in further manufacture, all claims shall be deemed waived unless made in writing and received by Seller within one hundred eighty (180) days after Buyer's receipt of the goods or within thirty (30) days after Buyer learns of the facts giving rise to the claim, whichever shall first occur. Failure of Buyer to give notice of any claim within the applicable time period specified above shall be deemed an absolute and unconditional waiver of such claim, irrespective of whether the facts giving rise to such claim shall have then been discovered or of whether processing, use or resale of the goods shall have then taken place. Buyer's exclusive remedy shall be for damages and Seller's liability for any and all losses or damages resulting from any cause whatsoever, including alleged negligence, shall in no event exceed the purchase price of the goods in respect to which the claim is made, or at the election of Seller, the repair or replacement of such goods. Seller shall not be liable for, and Buyer assumes responsibility for, all personal injury and property damage resulting from the handling, possession, use or resale of the goods by Buyer. In no event shall Seller be liable for incidental or consequential damages, whether Buyer's claim is founded in contract, negligence or otherwise. Transportation charges for the return of goods shall not be paid unless authorized in advance by Seller.

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MONS 097519

Toxicological Studies of Three Polychlorinated Biphenyls

Otis E. Fancher[1], M. L. Keplinger, E. P. Wheeler[2],

and J. C. Calandra

Industrial BIO-TEST Laboratories, Inc.

Northbrook, Illinois 60062

Running Title: Toxicological Studies of 3 PCB's

[1] Present Address: 624 N. Abrego Drive, Green Valley, Ariz. 85614, to whom proofs are to be sent.

[2] Monsanto Company, St. Louis, Missouri, 63166

MONS 097520

INDEX TERMS

Aroclor 1242

Aroclor 1254

Aroclor 1260

Polychlorinated biphenyls

Ecological effects of

Toxicology of

MONS 097521

ABSTRACT

Toxicological Studies of Three Polychlorinated Biphenyls, Fancher, Otis. E., Keplinger M. L., Wheeler, E. P., and Calandra, J. C. (0000). Toxicol. Appl. Pharmacol. 00, 00 - 00.

The toxicology and reported ecological effects of the polychlorinated biphenyls are selectively reviewed as a background for toxicological studies with Aroclors 1242, 1254 and 1260 which are reported in papers which follow.

MONS 097522

Toxicological Studies of Three Polychlorinated Biphenyls

Otis E. Fancher[1], M. L. Keplinger, E. P. Wheeler[2], and J. C. Calandra

Industrial BIO-TEST Laboritories, Inc.

Northbrook, Illinois 60062

Toxicological Studies of Three Polychlorinated Biphenyls. Fancher, Otis E., Keplinger, M. L., Wheeler, E. P. and Calandra, J. C. (0000). Toxicol. Appl. Pharmacol. 00, 00 - 00.

The toxicology and reported ecological effects of the polychlorinated biphenyls are selectively reviewed as a background for toxicological studies with Aroclors 1242, 1254 and 1260 which are reported in papers which follow.

Aroclors 1242, 1254 and 1260 are members of the family of polychlorinated biphenyls (PCB's), the last two digits of the numerical designations indicating the chlorine content in percent. Since the chlorine atoms are randomly distributed among the 10 ring positions available for substitution, each material is a mixture of isomers.

The PCB's are highly stable toward hydrolysis under either acidic or alkaline conditions and toward heat and oxidation. They do not support combustion, have high resistivity and dielectric strength, are non-drying, and retain adhesiveness and theroplasticity under conditions of repeated stress.

These properties have led to extensive use of the materials for a variety of dielectric applications, as insulation impregnants, as

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diffusion pump oils and liquid sealants, as hydaulic fluids and heat exchange media, as plasticizers for specialty inks, resins, rubbers, and paints and as adjuvants in pesticide formulations. Commercialization of the PCB's began in the early 1930's.

Questions were early raised regarding the systemic toxicity and dermatological effects which might be associated with industrial exposure to these materials. Jones and Alden (1936) reported a high incidence of acneform dermatitis among employees engaged in the manufacture of PCB's. Drinker et al. (1937) exposed rats to PCB's at a chamber concentration of 1 mg/m^3 for 16 weeks and produced liver damage. On the basis of these results and some additional observations, Drinker (1939) suggested a permissible concentration of PCB's in the air of workrooms of 0.5 mg/m^3. Bennett et al. (1938) reported morphological changes in the liver of rats fed or injected with chlorinated biphenyls.

Greenberg et al. (1939) attributed the death of 3 young workers to exposure to chlorinated naphthalenes and biphenyls. Adams et al. (1941) demonstrated chloracneform responses in rabbits exposed to materials, including chlorinated biphenyls, which had been reported to cause acneform dermatitis in man. Miller (1944) reported on animal studies with a trichlorobiphenyl administered topically, by subcutaneous injection or by feeding to guinea pigs, rats and rabbits. The conspicuous pathologic finding consisted of liver damage characterized by degeneration of the centrilobular cells and by fatty degeneration. The greatest liver damage

was found in the guinea pig and the least in the rat.

During succeeding years little information was reported concerning the toxicology of the PCB's until McLaughlin et al. (1963) reported Aroclor 1242 to be toxic in the chick embryo test at levels of 10 or 25 mg/egg. Hatched chicks, which later died, showed some weak deformities and growth retardation.

Questions have been raised as to the causative toxic constituent of the PCB's. Vos et al. (1970) studied three samples of PCB's containing 60 percent chlorine: Clophen A60 (Bayer AG, Leverkusen, Ger.); Phenoclor DP6 (Prodelec S. A., France); Aroclor 1260 (Monsanto Co., St. Louis, Mo.). Using the chick embryo test method and a dose level of 3.5 mg (in 0.05 ml of ethanol) /egg, it was demonstrated that Clophen A60 and Phenoclor DP6 were more toxic than Aroclor 1260, causing higher mortality and producing subcutaneous and abdominal edema, centrilobular liver necrosis, and hydropericardium in almost all chicks. Only an occasional hydropericardium was observed following treatment with Aroclor 1260.

Tetra and pentachlorodibenzofurans were analytically demonstrated to be present in Clophen A60 and Phenoclor DP6 but were not detected in Aroclor 1260. The chlorinated dibenzofurans are known to be potent chloracnegens, being somewhat weaker in this regard than the chlorinated dibenzodioxins (Bauer et al., 1961).

The PCB's remained inconspicuous as possible environmental contaminants until Jensen (1966) assigned a series hitherto unidentified

peaks in chromatograms of wildlife residues to these materials. Holmes et al. (1967) confirmed the presence of PCB's in the eggs and livers of birds in Britain, occurring most frequently and in the highest concentrations in samples from terrestrial predators and marine feeders. Hickey and Anderson (1968) related the drastic decline in populations of peregrine falcons, bald eagles and ospreys to increases in chlorinated hydrocarbon residues. Reproductive failures were associated with effects on calcium metabolism and decreases in eggshell thickness. It was suggested that derangement of calcium metabolism might result from induction by the chorinated hydrocarbons of the microsomal enzymes involved in the metabolism of steroidal hormones. The samples in this study were analyzed for chlorinated hydrocarbons but not for PCB's.

Risebrough et al. (1968) determined that PCB residues were present in significant quantities in samples from a variety of raptorial and fish-eating birds and also related population declines to derangements in calcium and steroid metabolism induced by the chlorinated hydrocarbons. They showed that a PCB (Aroclor 1262) was more active than DDE or DDT in increasing polar metabolites of oestradiol by pigeon liver homogenates.

Koeman et al. (1969) reported the presence of PCB's in fish and birds from the Rhine and the Netherlands coastal area. They observed that the lower chlorinated PCB's occurred more frequently in fish than in sea birds. This suggested that the lower chlorinated compounds are

metabolizable and less persistent than compounds of higher chlorine content.

Many additional reports relating to the ecological impact of the PCB's have continued to appear. Most of these include literature reviews which need not be redetailed here. Pertinent references include Presst et al. (1970), Duke et al. (1970), Peakall and Lincer (1970), Heath et al. (1970), Hansen et al. (1971) and Edwards (1971).

Biological magnification of PCB concentrations by an early element of the food chain was shown to occur by Keil et al. (1971) who demonstrated magnification of Aroclor 1242 concentrations by a factor of 900 to 1000 by the marine diatom, Cylindrotheca closterium, which can also concentrate and metabolize DDT. A concentration of 0.1 ppm in water sharply retarded growth and RNA synthesis.

Biochemical studies relating to possible mechanisms of action of the PCB's have appeared. Using the 18-hour glycogen response of the immature rat uterus as the assay procedure, Bitman and Cecil (1970) demonstrated a low order of estrogenic activity for the lower chlorinated Aroclors. The minimum effective dose of Aroclors containing 48 percent chlorine or less was approximately twice that of p,p'-DDT whose activity in turn was less than that of diethylstilbesterol by a factor of 4×10^4. No activity was demonstrated for Aroclors containing 54 percent chlorine or more.

Villaneuve et al. (1971) demonstrated induction of carboxylester-

ase, aniline hydroxylase and aminopyrine N-demethylase in homogenates of liver from female rabbits treated through the gestation period with Aroclor 1254 at a level of 10 mg/kg/day. Reproduction was not affected, however, and no enzyme induction was demonstrated with Aroclor 1221.

Vos and Koeman (1970) found that PCB could induce chemical porphyria in chickens, Japanese quail and rats and Vos et al. (1971) later showed that porphyria in Japanese quail was associated with induction of liver mitochondrial ALA-synthetase, leading to increased production of δ-aminolevulinic acid, an obligatory precursor for porphyrin synthesis. This induction was brought about by Aroclor 1260 in which chlorinated dibenzofurans were not detected.

Westoo et al. (1970) reported the occurrence of PCB residues in all of 22 samples of human milk analyzed and Biros et al. (1970) demonstrated the presence of PCB residues in human adipose tissue. Nishizumi (1970) cited the occurrence of poisoning among the general population of western Japan as a result of contamination of rice bran oil by leakage of a chlorinated biphenyl (Kanechlor 400) used as a heat exchange medium in the manufacturing process.

In order to define the toxicological profile of the PCB's in terms of systems which have been traditionally used for assessment of the hazard of materials, the studies reported in papers which follow were conducted. Based on the permissible ambient concentration of the PCB's of 0.5 mg/m^3

suggested by Drinker (1939) and assuming that total absorption of the PCB's contained in an estimated daily inhalation volume of 15 m^3 for man, the permissible human exposure would correspond to 7.5 mg/day or to approximately 0.1 mg/kg/day. A high dietary level of 100 ppm, or approximately 10 mg/kg for rats, was selected for all chronic studies since this would correspond to a 100-fold safety factor for man.

MONS 097529

FOOTNOTES

1 Aroclors 1242, 1254 and 1260. Monsanto Company, St. Louis, Missouri.

2 Present Address: 624 North Abrego Drive, Green Valley, Arizona 85614.

3 Monsanto Company, St. Louis, Missouri, 63166, 800 North Lindbergh Boulevard,

REFERENCES

Adams, E.M., Irish D. D., Spencer, H. C. and Rowe, V. K. (1941). The response of rabbit skin to compounds reported to have caused acneform dermatitis. Ind. Med. 10, Ind. Hyg. Sect. 2, 1-4.

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Groenberg, L., Mayers, M. R., and Smith, A. R. (1939). The systemic effects resulting from exposure to certain chlorinated hydrocarbons. J. Ind. Hyg. Toxicol. 21, 29-38.

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Heath, R. G., Spann, J. W. Kreitzer, J. F., and Vance, C. (1970). Effects of polychlorinated biphenyls on birds. Proc. XV Int. Ornithol. Cong.

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