SUPPLEMENT TO QUESTION 8

The market for this chemical will be strictly controlled. It will be sold only to Dow Chemical Company who will convert it to the phenylphenols. Dow has signed a "Hold Harmless" agreement with Monsanto and has agreed to dispose of all byproducts from their process by incineration. They have set target specifcations on chlorinated biphenyls in phenylphenols as follows:

Monochlorobiphenyls	<10 ppm
Dichlorobiphenyls	< 5 ppm
Individual higher chlorinated biphenyls	< 0.1 ppm

Of the phenylphenols, the ortho-phenylphenol isomer will be used as a component of germicidal compositions and as a dye carrier in the textile industry. The para-phenylphenol isomer will be used as an intermediate in the manufacture of miscellaneous resin coatings. The ortho isomer will be the preponderant product at 8 to 18 M lbs/yr while the para isomer will be produced at 1 to 2 M lbs/yr.

We have calculated (conservatively) that the use of o-phenylphenol from this source in the textile industry should not cause over a 1.0 ppm increase in the PCB content of fish. This calculation is based on 20 M lb/yr usage of o-phenylphenol containing 5.0 ppm of dichlorobiphenyls by one mill located on a small river (650 cubic feet/sec. average flow). This would give a 0.1 ppb concentration of dichlorobiphenyls in the water and (applying an enrichment factor of 10^4) a concentration of 1.0 ppm in fish in the river. This also assumes no loss of dichlorobiphenyls by evaporation or bacterial action (dichlorobiphenyls have been shown to be biodegradable and are the most volatile of the PCBs).

The accidental spraying of germicidal aerosols on food could cause intake of PCBs by humans. We calculate that this hshould not amount to more than 2 nanograms of dichlorobiphenyls in a serving or a concentration of 5 to 10 ppb. This calculation is based on a spray of 15 g of an aerosol containing 0.25% o-phenylphenol over a surface of 170 ft^2 and an exposed surfece of 1.0 ft^2 per serving of 0.5 lbs. of food.

STLCOPCB4000574

		If	Go to:
5.	Is it likely the degradation products from the "closed-loop" disposal system could be harmful to humans?	Yes	-Recycle Degradation Products to 2. Continue at 6.
		(No)	7
6.	Is it likely that the product will degrade in the environment or in any of the currently used disposal systems?	Yes	-Recycle Degradation Products to 1. Continue at 7.
		No	7

ITEMS 7 THROUGH 10 ARE TO ESTABLISH HAZARDS OF PRODUCTS AND DEGRADATION PRODUCTS TO PLANTS, ANIMALS OR ECOSYSTEMS.

7.	Is it probable that the product or degradation products are harmful to plants and animals at concentrations to which they are likely to be exposed?	Yes	8
		(No)	9
8.	Recognizing the hazards to plants and animals, can procedures be devised at reasonable costs to render the material innocuous?	(Yes)	See attached supplement
		No	-Do Not Sell
9.	Is it likely that harmful secondary reaction products could be formed from the harmless parent material as a result of a chemical, biochemical, or biological activity in the environment?	Yes	-Recycle the By-product at 1 & 7. Continue at 10.
		(No)	10
10.	Is there reason to suppose that the material could have deleterious effect on the ecosystem, e.g., through concentration in the food chain, antagonism, synergism, abiotic reactions, chelation or plain physical concentration even though the material was not directly toxic to the biota?	(Yes)	-Recycle to 8. Continue at 11.
		No	11
11.	Have procedures been devised to handle catastrophes in the production, storage, or transportation of the product?	(Yes)	-Sell
12.	Is it necessary to restrict sales to specific end uses?	Yes - Sales will be restricted to Dow Chemical Co. for conversion to phenylphenols.	

DSW 006091

Environmental Compatibility Assessment Scheme

Instructions:

Answer each question in turn, "yes" or "no". Each answer is provided with a directive concerning the question to be answered next: the logic of the scheme assumes that questions skipped would be answered "no" and can thus be ignored. The last question, No. 12, should be considered if it is decided to make and sell materials which are very useful but potentially dangerous to man or his environment. When applying this form, consideration must be given to the product Monsanto supplies, product impurities, as well as thefinal or end product that enters the environment.

ITEMS 1 THROUGH 3 ARE TO ESTABLISH THE HAZARDS TO HUMANS OF PRODUCTS, PRODUCT IMPURITIES, BY-PRODUCTS OR MANUFACTURING AND DEGRADATION PRODUCTS.

	If	Go to:
1. Is the material so physiologically inert that there need be no concern about health hazards to humans?	Yes	4
	(No)	2 & 3
2. a) Is the material toxic to persons as a result of a single contact with high concentrations?	No	Rat oral LD_{50} = 1790 mg/kg Rabbit Skin LD_{50} = 2000-3160 mg/kg Vapor Inhalation - 6 hr exposure of rats had no effect.
b) Is the material toxic to persons at lesser concentrations following repeated or prolonged exposure?	No	See Industrial Biotest Report Nos. B9888 and C9885
c) Is the material likely to be carcinogenic, teratogenic or mutagenic?	No	
3. Recognizing the hazards to people, can procedures be devised for safe handling at reasonable cost?	(Yes)	4
	No	-Do Not Sell

ITEMS 4 THROUGH 6 ARE TO ESTABLISH IF CONSIDERATION HAS BEEN GIVEN TO DISPOSAL, DEGRADATION PRODUCTS OF DISPOSAL AND ENVIRONMENTAL DEGRADABILITY.

	If	Go to:
4. Can "closed-loop" disposal provisions be developed for the product so it will never reach the environment?	(Yes)	5
	No	6

DSW 006092

Monsanto

MEDICAL DEPARTMENT BULLETIN

Data Sheet EC-202

NEW PRODUCTS

Final Environmental Compatibility Assessment

As provided for in corporate procedures (D-II-8 in Management Guide and Medical Department Bulletin EC-201) the division in the company responsible for a new product must obtain a final environmental evaluation before commercialization.

To obtain this evaluation, the individual responsible for the product reviews the Preliminary Environmental Compatibility Assessment (EC-201) form, consults the literature, obtains the best answers he can by consultation with others, and completes Data Sheet EC-202. He sends this to the Medical Director along with a statement of his principal sources of information, the intended product uses and a request for a final environmental evaluation with intent to commercialize.

The Medical Director will respond as to the environmental acceptability, restrictions, or additional information needed, if any, or if unacceptable, the reasons why.

This data sheet applies to both
MCS 1546 and MCS 1547

DSW 006093

STLCOPCB4000577

Our principal sources of information are: (1) Industrial Biotest Laboratories Reports numbered B9888, C9885 and A9380. These reports cover toxicity tests (mostly subacute) on the Aroclors, including Aroclor 1221. We have assumed that the monochlorobiphenyls are equivalent to or less toxic than Aroclor 1221. (2) A Memo dated December 10, 1971 from G. S. Levinskas to J. F. Herber titled "Aroclor 1221 and MCS 1109". This gives acute toxicity and irritation data for these two compositions. MCS 1109 is mostly monochlorobiphenyl. (3) A memo dated October 27, 1971 from W. H. Hunt to P. D. Fowlkes titled "MCS 1109 (Monochlorobiphenyl) Lot KA 801 - Acute Toxicity Screen". This gives acute toxicity, irritation, and vapor inhalation data. (4) A memo dated June 15, 1973 from C. Paton to Dr. R. E. Kelly titled "Dow/Monochlorobiphenyl". This gives Dow Co. specifications on phenylphenols and other pertinent information. (5) A memo dated November 3, 1971 from E. S. Tucker to W. R. Richard titled "MCS 1109". This memo discusses the environmental and physiological impact of monochlorobiphenyl. (6) A memo dated July 19, 1973 from E. M. Emery to W. R. Richard titled "Dow/Monochlorobiphenyl". This memo presents some Dow and Monsanto analytical work on MCS 1546 and MCS 1547. Copies of the above five memos (but not the reports) are appended to this request.

We have supplied Dow with small samples of monochlorobiphenyl and will shortly provide them with a large (20 drums) sample of MCS 1547. At this point, we need a final environmental evaluation from the Medical Department.

D. R. Cova

Js

STLCOPCB4000578

Monsanto INDUSTRIAL CHEMICALS CO.

D. R. Cova - T3C

July 24, 1973

W. R. Richard - T3A
W. B. Papageorge - B2NA

REQUEST FOR FINAL ENVIRONMENTAL EVALUATION
OF MCS 1546 AND MCS 1547 WITH INTENT TO COMMERCIALIZE

TO: R. E. Kelly
Medical Department
A2SA

Enclosed are EC-202 Data Sheets covering the new products, MCS 1546 and MCS 1547. These materials are both monochlorobiphenyls and differ only in the amounts of impurities they contain. Our tentative specifications for these products are as follows:

For MCS 1546

Biphenyl	< 0.2%
o-Chlorobiphenyl	>80.0%
m-Chlorobiphenyl	< 2.0%
Dichlorobiphenyls and more highly chlorinated biphenyls	< 0.2%
p-Chlorobiphenyl	Remainder of the composition

For MCS 1547

Biphenyl	< 0.6%
o-Chlorobiphenyl	>80.0%
m-Chlorobiphenyl	< 4.0%
Dichlorobiphneyls and more highly chlorinated biphenyls	< 1.0%
p-Chlorobiphenyl	Remainder of the composition

Of the polychlorinated biphenyls (PCBs) in the above compositions, the major portion is the dichlorobiphenyls. We do not have quantitative figures for trichlorobiphenyls and higher, but some preliminary work at Dow Chemical Co. indicates that these homologs might be in the ppm range (see attached memo - E. M. Emery to W. R. Richard on July 18, 1973). This is as we would expect from consideration of the process.

Sales of the two products are to be restricted to the Dow Chemical Co. only. Dow will convert these materials to the phenylphenols. They will dispose of byproducts from their process by incineration. They have, furthermore, signed a "Hold Harmless" agreement with Monsanto. Their tentative specifications as to content of chlorinated biphenyls, product usage and quantities and impact on environment are covered in the supplement to question 8 on the EC-202 Data Sheet.

DSW 006095

STLCOPCB4000579

Monsanto

FROM NAME & LOCATION Medical, A2SC

DATE July 18, 1973 cc C. Paton - B2SC

SUBJECT MCS 1546) Preliminary Environmental
MCS 1547) Compatibility Assessment

TO D. R. Gorm
T3C

Elmer Wheeler in a memo to Cunningham (6/25/73) expressed the Medical Department's view that Dow's manufacture of phenylphenol from monochlorobiphenyl would not alarm the PCB task force if Dow maintained its final specification of 0.1 ppm of higher chlorobiphenyls in the end product. Consequently, both of these materials are approved for further development work. Under this approval, samples may be shipped to Dow for evaluation. Specifically, the 20 drums referred to in the memo from H. S. Bergen to C. P. Cunningham (7/12/73) are approved for shipment.

Before this product can be commercialized, EC-202 (Final Environmental Compatibility Assessment) will have to be submitted and evaluated. Since this is a high priority item, and it may soon be referred to upper levels of management for a decision, form EC-202 should be submitted without delay.

G J L

George J. Levinskas

/bks

4-2184

DSW 006096

STLCOPCB4000580

COMPANY CONFIDENTIAL

Medical Department
Page Two

Environmental Compatability Assessment - Data Sheet EC-201 (cont.)

Description of the Product - MCS 1546

Monochlorobiphenyl
(NBP 207152 Blend #1)

Probable End Uses -

A. Is the acute toxicity (via oral ingestion, skin absorption, inhalation) known or can it be estimated by analogy based on data for chemically related compounds? Indicate below:

	Known		Estimated	
1) oral LD_{50}-rats		or	1790	mg/kg
2) skin absorption MLD-rabbits		or	2000	mg/kg
3) inhalation effect		or		
4) skin irritation potential		or	5.6	
5) eye irritation potential		or	16	

B. Are harmful effects from repeated or chronic exposures known or can they be predicted by analogy? This would probably have harm effect as commercial [illegible].

C. Will 1) wastes from manufacturing
2) anticipated use, and/or
3) ultimate disposal of end product create environmental problems because product fails to readily degrade or decompose? This material is to be converted to phenylphenol which readily degrades and is relatively non-toxic.

D. Is there an indication based on data or analogy, that the product can be stored or concentrated in biological systems? Yes, there are such indications, analogous to the [illegible].

E. Is it likely that harmful secondary reaction products will arise from a harmless-appearing parent as a result of chemical, biochemical, or biological activity in the environment? No, because PCB concentration is low (less than 0.2% dichlorobiphenyls).

NOTE: The Medical Department should be consulted for answers to Questions A and B. Questions C - E require speculation by people knowledgeable about the process and end use.

DSW 006097

D. R. Cova

D. R. Cova

STLCOPCB4000581

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Medical Department
Page Two

Environmental Compatability Assessment - Data Sheet EC-201 (cont.)

Description of the Product - MCS 1547

Monochlorobiphenyl
(NBP 207152 Blend #2)

Probable End Uses -

A. Is the acute toxicity (via oral ingestion, skin absorption, inhalation) known or can it be estimated by analogy based on data for chemically related compounds? Indicate below:

	Known		Estimated
1) oral LD_{50}-rats		or	1790 mg/kg
2) skin absorption MLD-rabbits		or	2000 mg/kg
3) inhalation effect		or	
4) skin irritation potential		or	5.6
5) eye irritation potential		or	16

B. Are harmful effects from repeated or chronic exposures known or can they be predicted by analogy? This would probably have same effect as commercial Aroclors.

C. Will 1) wastes from manufacturing
2) anticipated use, and/or
3) ultimate disposal of end product create environmental problems because product fails to readily degrade or decompose? This material is to be converted to phenylphenol which readily degrades and is relatively non-toxic.

D. Is there an indication based on data or analogy, that the product can be stored or concentrated in biological systems? Yes, there are such indications, analogous to polychlorobiphenyls

E. Is it likely that harmful secondary reaction products will arise from a harmless-appearing parent as a result of chemical, biochemical, or biological activity in the environment? No, because PCB concentration is low (0.6% dichlorobiphenyls).

NOTE: The Medical Department should be consulted for answers to Questions A and B. Questions C - E require speculation by people knowledgeable about the process and end use.

DSW 006098

D. R. Cova

D. R. Cova

APPENDIX E

ENVIRONMENTAL COMPATIBILITY, MEMOS AND REPORTS

STLCOPCB4000583

1/74 30 Hours 0.29% $AlCl_3$ 250°C

CR

Steel A285W — Very Uniform Attack
18-6Y3

Yoner 65W — Very Uniform, Light, Attack
621

Hastelloy C — No Attack
63KW

D.W. Sutton

DSW 006100

STLCOPCB4000584

NBP 257498

Nov 27

Bill Daniels

I have looked at these 2 steel coupons, found essentially no local Attack

Dario Cova has original weights and will weigh them back.

Call Dario at 4-4676 so he can pick them up for weighing

I don't know if he can calculate a corrosion rate

Samples exposed 45 hours at 250°C in Liquid phase Aroclor 1142 + $AlCl_3$

AO Fisher

DSW 006101

TABLE XXII

CORROSION DATA CHLORINATION

Page No.	Material	Wt. Loss mg	Exposure Time hrs	Temp. (°C)	Mils/yr	Conditions
257436	Steel A-285-261 643	3.6	8.5	150	11	0.5% $AlCl_3$, chlorination after isomerization
257440-1	Steel A-285 24 643	106.2	17.3	150 & 180	170	Two reactions, after the first one, temp. was raised to 180°C for 4 hours. Al equivalent to 1.0%. $AlCl_3$ and 0.05% $FeCl_3$ were catalyst.
257448	Steel A-238W 15 643	2.0	6.0	200	9	0.2% $AlCl_3$ catalyst
227242	Steel A-235W 15 643	5.2	10.0	150 & 200	13	0.4% $AlCl_3$ catalyst. Reax. at 150°C then 4 hours at 200°C for isomerize
227243	Steel A-235W 15 643	5.1	5.0	200	27	0.4% $AlCl_3$ catalyst
227244	Steel A-235W 15 643	10.3	4.5	150	61	0.08% Al + 0.05% $FeCl_3$ catalyst
265305	Steel A-285W 19 643	2.3	6.3	250	10	0.2% $AlCl_3$
227245	Steel A-235W 15 643	1.1	6.2	200	5	0.1% $AlCl_3$
227246	Steel A-235W 15 643	59.5	6.0	150	260	0.2% Al + 0.05% $FeCl_3$ catalyst
227246	Monel M-W 72 621	24.7	6.0	150	94	" " " " "
265307	Steel A-285W 19643	6.7	5.5	250	~30	0.4% $AlCl_3$ catalyst
265307	Monel M-W 65621	2.3	5.5	250	~7	" " "

STLCOPCB4000586

TABLE XXI (Continued)

CORROSION DATA ISOMERIZATION

Page No.	Material	Wt. Loss mg	Exposure Time hrs	Temp. (°C)	Mils/yr	Conditions
265316	Steel A-285W-10643	3.0	8.0	250	10	Isom. over 0.25% $AlCl_3$ after chlorination over $FeCl_3$
265316	Hastelloy C HC 65K HCW	0.9	8.0	250		" " " "
227251	Steel A-285W-18643	4.5	30.0	250	4.0	Isom. over 0.25% $AlCl_3$ - 5 batches
227251	Monel M-W 65 621	1.7	30.0	250	1.3	" " " " "
227251	Hastelloy C 63K HCW	1.3	30.0	250	1.2	" " " " "
227260	Steel A-285W-18643	6.7	10.0	250	18	Isom, over 0.25% $AlCl_3$ - 2 batches
227260	Monel M-W 65621	3.5	10.0	250	8	" " " " "
227260	Hastelloy C 63K HCW	2.0	10.0	250	5.5	" " " " "
257498	Steel A-285-300-731	5.8	45.0	250	3.3	Isomerization over 0.25% $AlCl_3$ - 9 batches
257498	Steel A-285-299-731	4.4	45.0	250	2.6	" " " " "
293107	Steel A-285-24-643	7.3	45.0	250	4.1	Isomerization over 0.40% $AlCl_3$ - 9 batches
293107 285	Steel A-285-25-643	8.4	45.0	250	5.0	" " " " "

STLCOPCB4000587

TABLE XXI

CORROSION DATA ISOMERIZATION

Page No.	Material	Wt. Loss mg	Exposure Time hrs	Temp. (°C)	Mils/yr	Conditions
257436	Steel A-285-266643	34.3	4.3	200	214	0.5% $AlCl_3$, two reactions of two hours each
257439	Steel A-285W-19-643	19.3	46	180	12	0.5% $AlCl_3$, two replacements of reax mass - ortho fraction used
257439	Steel A-285W-28-643	16.6	46	200	10	Same as above
265311	Monel M-W 65621	4.0	4.0	200	23	0.5% $AlCl_3$ isomerization after chlorination over $FeCl_3$
265311	Steel A-285W-19643	4.2	4.0	200	28	" " " "
265313	Steel A-285W-19643	2.9	4.0	200	20	0.2% $AlCl_3$ isomerization after chlorination over $FeCl_3$
265313	Monel M-W 65621	0.6	4.0	200	3	" " " "
265314	Steel A-235W-15643	6.5	4.2	180	42	0.5% $AlCl_3$ isomerization after chlorination over $FeCl_3$
265314	Monel M-W 72621	2.0	4.2	180	11	" " " "
265316	Steel A-285W-5643	4.8	4.0	250	33	Isomerization over 0.4% $AlCl_3$ after chlorination over $FeCl_3$
265316	Hastelloy C HC 65K HCW	4.3	4.0	250		" " " "

STLCOPCB4000588

APPENDIX D

CORROSION DATA

STLCOPCB4000589

Fig. 4

Variation of 4,4'-Dichlorobiphenyl
Concentration with Specific Gravity, i.e., Degree of Chlorination

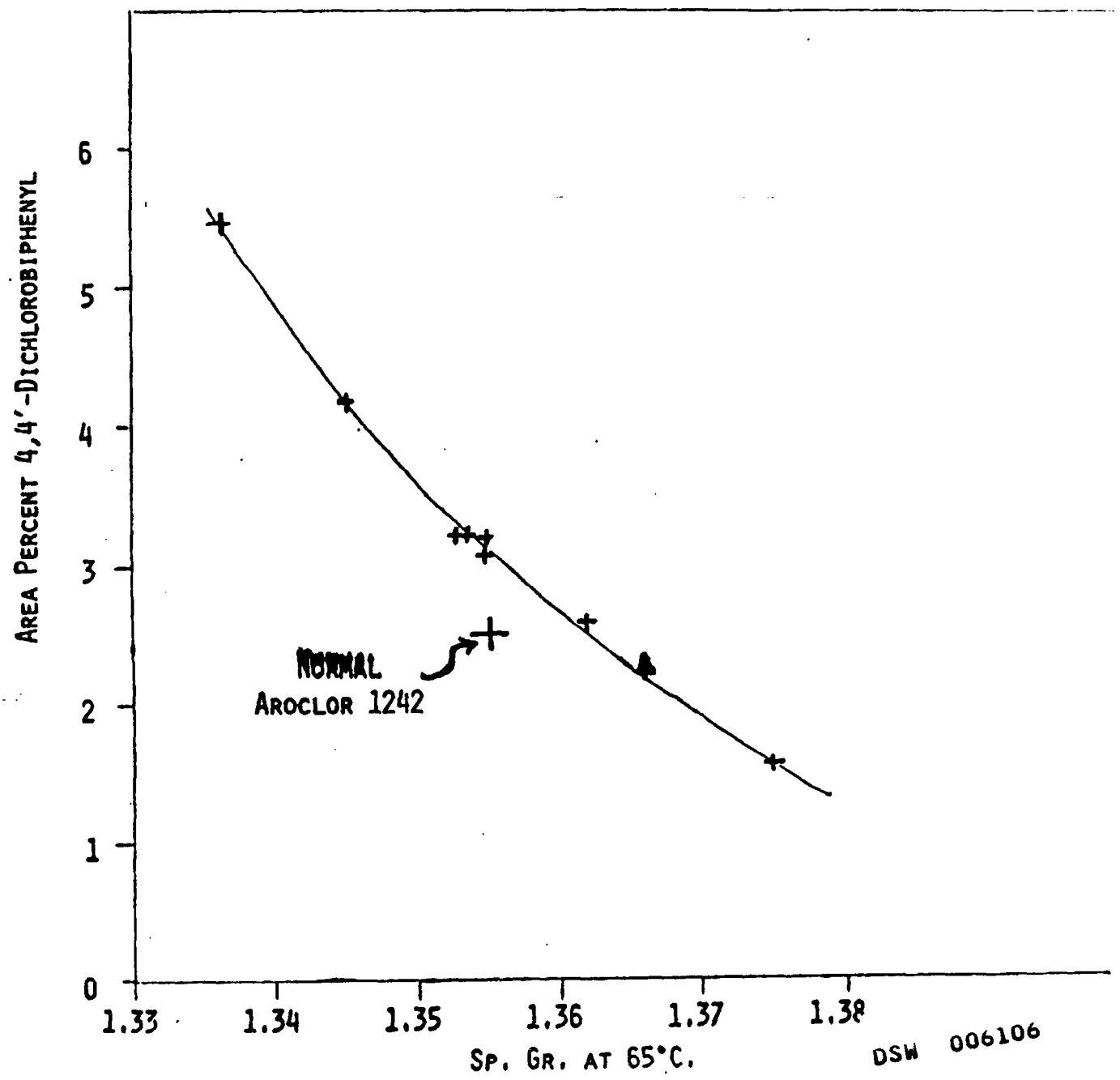

Fig. 3

Saturation Concentrations of
4,4'-Dichlorobiphenyl in Aroclor 1016
at Different Temperatures

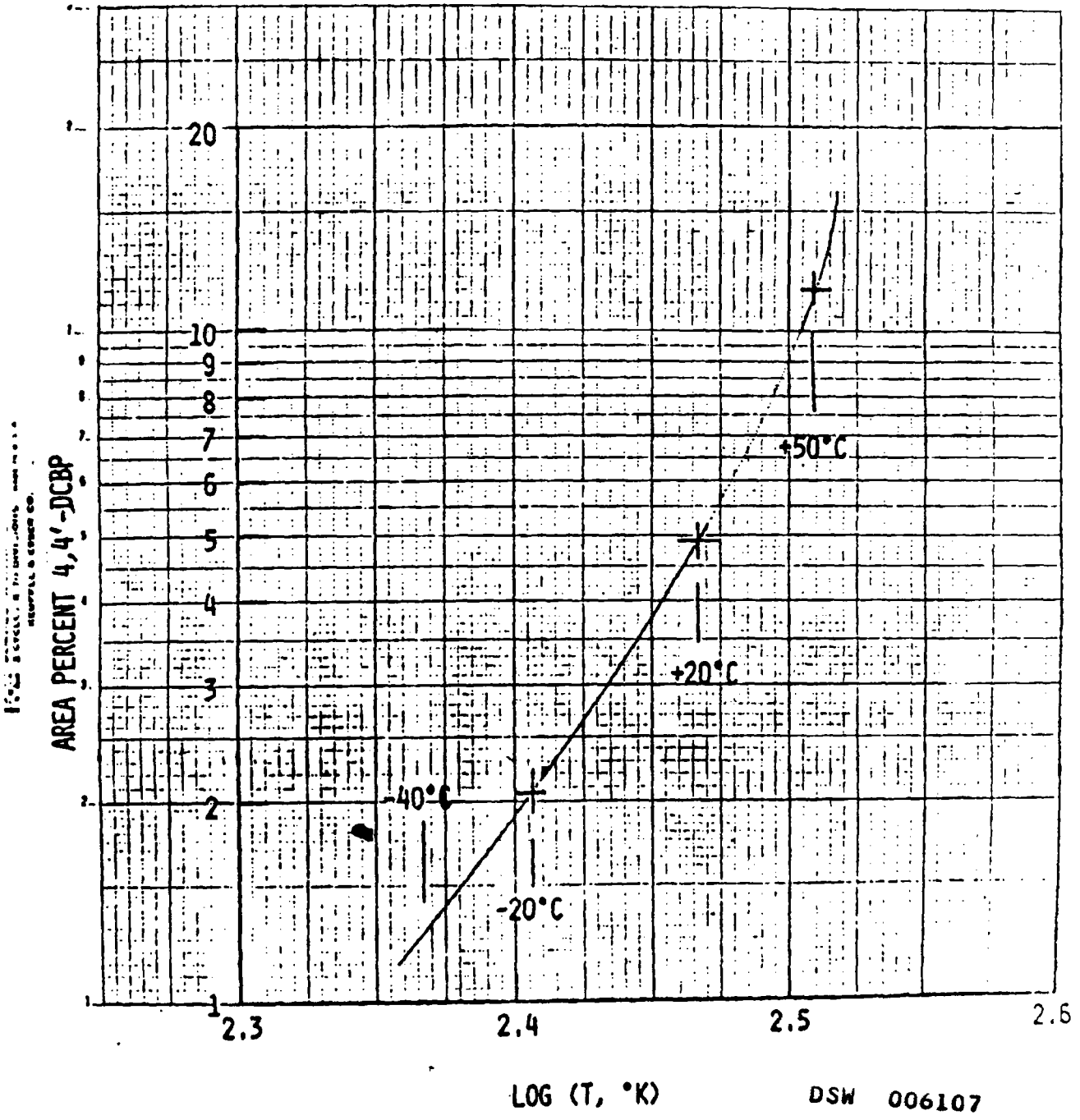

TABLE XX

AREA % OF 4,4'-DCBP IN AROCLOR MADE FROM MCBP RESIDUE

Page No.	Procedure	Catalysts/Conc'n.	% 4,4' Isomer	Remarks
293106	C/I	$FeCl_3$, $AlCl_3$/0.05, 0.40	2.1 2.2	Corrosion test of steel in isomerization at 250°C over 0.4% $AlCl_3$.
293109	C	$FeCl_3$/0.05%	3.7	Chlorination of MCBP residue from WGK plant run.
293109	I	$AlCl_3$/0.25%	1.9	Test of $AlCl_3$ catalyst from Pearsall Chemical Co. to be used in plant isomerization.
227287	C	$FeCl_3$/0.05%	3.9	Chlorination was carried out with proposed plant cycle (starting at 130°C, heating to 150°C, then after 3/4 hour heating to 190°C, and holding there).

I = Isomerization
C = Chlorination
D = Distillation

STLCOPCB4000592

TABLE XX

AREA % OF 4,4'-DCBP IN AROCLOR MADE FROM MCBP RESIDUE

Page No.	Procedure	Catalysts/Conc'n.	% 4,4' Isomer	Remarks
257483	C	$FeCl_3$/0.05%	3.3	7% biphenyl added to distilled MCBP residue to extend chlorination cycle - chlorinated at 150°C
257484	C	$FeCl_3$/0.05%	3.7	Same as above but with MCBP residue from WGK plant run.
257485	C	$FeCl_3$/0.05%	3.8	Control for above - no biphenyl added.
227283	C	$FeCl_3$/0.05%	3.6	14% biphenyl added to MCBP residue from WGK plant run.
257487	C	$FeCl_3$/0.05%	3.9	Residue from WGK plant run
257496-8	I	$AlCl_3$/0.25%	3.0 2.8 2.8 2.9 2.8 2.9 2.6 2.9 2.6	Corrosion study of isomerization at 25°C

I = Isomerization
C = Chlorination
D = Distillation

STLCOPCB4000593

TABLE XX

AREA % OF 4,4'-DCBP IN AROCLOR MADE FROM MCBP RESIDUE

Page No.	Procedure	Catalysts/Conc'n.	% 4,4' Isomer	Remarks
227259	C	$FeCl_3$/0.05%	3.3	Aroclor 1142 by chlorination of residue at 150°C.
227259	C/I	$FeCl_3$, $AlCl_3$/0.05%, 0.25%	1.5	Isomerization of Aroclor 1142 from above (227259) at 250°C.
227260	C/I	$FeCl_3$, $AlCl_3$/0.05, 0.25	3.2	After chlorination of residue to Aroclor 1142 at 150°C
			1.5	After isomerization at 250°C
227262	C/I	$FeCl_3$, $AlCl_3$/0.05, 0.25	4.4	After chlorination of residue to Aroclor 1142 using a fritted glass chlorine sparger.
			3.2	After isomerization at 250°C.
227273	C/I	$FeCl_3$, $AlCl_3$/0.05, 0.25	2.2	Aroclor 1142 from 227258 was chlorinated further to 42.5% chlorine and was then isomerized at 250°C.

I = Isomerization
C = Chlorination
D = Distillation

DSW 006110

STLCOPCB4000594

TABLE XX

AREA % OF 4,4'-DCBP IN AROCLOR MADE FROM MCBP RESIDUE

Page No.	Procedure	Catalysts/Conc'n.	% 4,4' Isomer	Remarks
227251	I	$AlCl_3$/0.25%	2.3	Aroclor 1142 from residue isom. at 250°C - combined sample from first three cycles.
227253	C	$FeCl_3$/0.05%	3.2	Aroclor 1142 from residue - chlor. at 150°C.
207171	C	$FeCl_3$/0.05%	4.9	Aroclor 1016 from residue saturated with 4,4' at room temperature.
265321	C	$FeCl_3$/0.05%	3.2	Aroclor 1142 from residue chlorinated at 150°C.
265322	C	$FeCl_3$/0.025%	3.8	Aroclor 1142 from residue chlorinated at 250°C.
265326	C	$FeCl_3$/0.05%	3.2	Aroclor 1142 from residue chlorinated at 150°C in tubular reactor.
207189	-	-	4.2	This sample dried with $CASO_4$. GLC was run to make certain that 4,4' concn. was not affected. Before treatment concn. was 4.3%.
227254	-	-	11.5	Solubility of 4,4' in Aroclor 1016 at 50°C.
227254	-	-	2.05	Solubility of 4,4' in Aroclor 1016 at -20°C.
227255	C	$FeCl_3$/0.05%	2.9	Aroclor 1142 by chlorination of residue over $FeCl_3$ at 150°C to 42.1% Cl.
227258	C	$FeCl_3$/0.05%	4.1	Aroclor 1142 by chlorination of residue at 150°C in the tubular reactor. This residue was generated from Aroclor 1111 from WGK.

I = Isomerization
C = Chlorination
D = Distillation

STLCOPCB4000595

TABLE XX

AREA % OF 4,4'-DCBP IN AROCLOR MADE FROM MCBP RESIDUE

Page No.	Procedure	Catalysts/Conc'n.	% 4,4' Isomer	Remarks
265312	C	$FeCl_3$/0.05%	2.8	Mono residue was overchlorinated up to 42.5% Cl.
265313	I	$AlCl_3$/0.2%	2.3	Isomerization of product from 265312 at 200°C for 4 hours.
265314	I	$AlCl_3$/0.5%	1.4	Isom, of product from 265312 at 180°C for 4 hours.
265315	C	$FeCl_3$/0.05%		Mono residue chlorinated at 150°C to the following 65°C Sp. Gr.
			5.5	1.336
			4.2	1.345
			3.1	1.355
			2.2	1.366
			1.5	1.375
265316	I	$AlCl_3$/0.4%	1.5	Aroclor 1142 from 265315 isomerized at 250°C for 2.5 hours
			1.2	Above reaction carried out for 4 hours
265316	I	$AlCl_3$/0.25%	2.6	Aroclor 1142 from 265315 isomerized at 250°C for 4 hours.
			2.6	Above reaction after 8 hours.
265317	C	$FeCl_3$/0.05%	2.6	Aroclor 1143 from mono residue.
265318	C	$FeCl_3$/0.5%	3.8	Aroclor 1142 from mono residue at 150°C.

I = Isomerization
C = Chlorination
D = Distillation

TABLE XX

AREA % OF 4,4'-DCBP IN AROCLOR MADE FROM MCBP RESIDUE

Page No.	Procedure	Catalysts/Conc'n.	% 4,4' Isomer	Remarks
227242	C	$AlCl_3$/0.4	5.2	Aroclor 1141 (1% under chlorinated) from residue. Chlorinated at 150°C
227242	I	$AlCl_3$/0.4	5.2	Above reax mass was held at 200°C for 4 hours.
227243	C	$AlCl_3$/0.4	4.9	Aroclor 1141 (1% under chlorinated) from residue. Chlorinated at 200°C
227243	C	$AlCl_3$/0.4	3.6	Above reax mass was further chlorinated up to Aroclor 1242
227244	C	Al, $FeCl_3$/0.03, 0.05	3.5	Aroclor 1242 from residue. Chlorinated at 150°C
227245	C	$AlCl_3$/0.1%	3.8	Aroclor 1142 from residue. Chlorinated at 200°C
257428	C	$FeCl_3$/0.05%	1.4	Aroclor 1242 from biphenyl - at 150°C
265305	C	$AlCl_3$/0.2%	3.2	Aroclor 1142 from residue - at 250°C
265307	C	$AlCl_3$/0.4%	2.1	Aroclor 1142 from residue - at 250°C
227246	C	Al, $FeCl_3$/0.2%, 0.05%	2.4	Aroclor 1142 from residue - at 150°C
265311	C/I	$FeCl_3$, $AlCl_3$/0.05%, 0.5%	1.5	Aroclor 1142 from residue - chlor. over FeCl, $AlCl_3$ added for isom at 200°C for 4 hours

I = Isomerization
C = Chlorination
D = Distillation

DSW 006113

TABLE XX

AREA % OF 4,4'-DCBP IN AROCLOR MADE FROM MCBP RESIDUE

Page No.	Procedure	Catalysts/Conc'n.	% 4,4' Isomer	Remarks
257431, 257437	C/I/D	$FeCl_3$, $AlCl_3$/0.05, 1.0	1.6, 1.9	Aroclor 1242 from residue, chlorinated over $FeCl_3$ at 150°C, isomerized over $AlCl_3$ at 200°C.
257433	I/C/C	$AlCl_3$/0.5%		Aroclor 1242 from residue, isomerized at 200°C, chlorinated at 150°C.
257435	I/D/C/C	$AlCl_3$, $FeCl_3$/0.5, 0.05		Aroclor 1242 from residue, isomerized at 200°C, chlorinated over $FeCl_3$ at 150°C.
257440	C	Al, $FeCl_3$/0.2, 0.05	1.6	Aroclor 1242 from residue, chlorinated over Al + $FeCl_3$ at 150°C. Al from Fisher
257440	C/I	Al, $FeCl_3$/0.2, 0.05	1.6	Reax mass from above was held at 180°C for 4 hours
257443	C/D	Al, $FeCl_3$/0.2, 0.05	2.6	Aroclor 1242 from residue, chlorinated over Al + $FeCl_3$ at 150°C. Reynolds' Al granules from WGK were used.
-	-	-	2.5	Standard WGK Aroclor 1242
257448	C	$AlCl_3$/0.2	3.6	Aroclor from residue. Chlorinated at 150°C
257448	C/I	$AlCl_3$/0.2	3.1	Above reax mass held at 200°C 4 hours
257448	C/I	$AlCl_3$/0.2	3.2	Above reax mass held at 250°C 4 hours

I = Isomerization
C = Chlorination
D = Distillation

STLCOPCB4000598

TABLE XX

AREA % OF 4,4'-DCBP IN AROCLOR MADE FROM MCBP RESIDUE

Page No.	Procedure	Catalysts/Conc'n.	% 4,4' Isomer	Remarks
207171	C/D	$FeCl_3$/0.05%	~7.	Aroclor 1016 from MCBP residue
207183	C/D	$FeCl_3$/0.05	4.9	Aroclor 1016 from MCBP residue
			2.5	Standard Aroclor 1016
207188				Mixture (70/30 and 60/40) of Std. Aroclor with that from 207183
207189	C/D	$FeCl_3$/0.05	-	Aroclor 1242 from residue
207192	C/D	$FeCl_3$/0.05	-	Aroclor 1254 from residue
207199	C/D	$FeCl_3$/0.05	-	Aroclor 1254 from residue cut with trichlorobenzene was comparable to std. Aroclor 1254
257411	I/C/D	$AlCl_3$/0.5		Aroclor 1242 from residue. Isomerized at 200°C, chlorinated at 150°C
257415	I/C/D	$AlCl_3$, $FeCl_3$/0.5, 0.03		Aroclor 1242 from residue, tail cut was isomerized at 200°C. Then residue was added along with $FeCl_3$. Mixture was then chlorinated
257424	I/C/D	$AlCl_3$/0.5	2.6	Aroclor 1242 from residue. Isomerized at 200°C, chlorinated at 150°C.
257426	I/D/C/D	$AlCl_3$, $FeCl_3$/0.5, 0.05	1.9	Aroclor 1242 from residue. Isomerized at 200°C, chlorinated at 150°C over $FeCl_3$.

I = Isomerization
C = Chlorination
D = Distillation

DSW 006115

APPENDIX C

DATA RELATING TO CONTENT OF 4,4'-DCBP IN AROCLORS

The Dow and Monsanto EC/GC analyses are in good agreement with the exception of the 2-chlorobiphenyl levels. I talked with Rudy Stehl regarding this difference and they have checked their method and get good recoveries. We subsequently rechecked our procedure and also obtained good recoveries. Our disagreement on the 2-chlorobiphenyl can probably be resolved with further work. However, since it is an MCB and the level is low, it may not be worth the effort.

Unknown Observed in MCS 1547

Since we have not heard anything from Rudy Stehl regarding finding this "unknown" in the high para MCB recently supplied them, we have not done any further work on it (memo, EST/WRR 11-19-73).

MCS 1109 Biodegradation and Tissue Residue Studies

All work on this material was halted some time ago when it was decided that we did not want to sell MCB. However, several months ago we started feeding MCB to an SCAS unit with the hope of following the degradation of any intermediates. The unit is about lined out and we should have some information soon.

Scott
E. S. Tucker

js

207175 had not been sent to Dow at 12/14/73

DSW 006117

Monsanto INDUSTRIAL CHEMICALS CO.

FROM: E. S. Tucker - T2F

DATE: December 5, 1973

SUBJECT: DOW/MONOCHLOROBIPHENYL (MCB)

REFERENCE:

cc: W. B. Papageorge - B2NA
C. Paton - B2SC
E. P. Wheeler - A2SA
G. M. Gasser - T3E
J. P. Mieure - T2B
R. E. Keller - T1B

TO: W. R. Richard
T3A

MCB Analysis (re-run); G. Gasser

	MCS 1546	MCS 1547	OR 207175
ϕ_2	0.55%	0.19%	0.45%
o-$Cl\phi_2$	85.9%	92.5%	78.3%
m-$Cl\phi_2$	3.36%	1.83%	4.55%
p-$Cl\phi_2$	9.72%	5.09%	15.58%
2,2'-$Cl_2\phi_2$	0.35%	0.15%	0.89%
2,4'	ND	ND	ND
4,4'	ND	ND	ND
Unknown	ND	ND	ND

GC/Mass Analysis PPP; J. Mieure

Component Found	Estimate Concentration
m-phenylphenol	1.6%
Unknown #1	~ 10 ppm*
Unknown #2	~ 10 ppm*
Unknown #3	~ 50 ppm*

*Could not be identified via GC/Mass without prior separation from major component.

EC/GC Analysis

	PPM Found OPP (I)	OPP (H)	PPP ~~OPP~~ (A)
2-$Cl\phi_2$	0.05(0.31)	0.19(0.26)	0.04(0.26)
3&4-$Cl\phi_2$	0.51(0.58)	1.01(0.90)	0.08(<0.10)
2,4'-$Cl_2\phi_2$	0.07(0.12)	0.04(0.05)	ND (<0.05)
4,4'-$Cl_2\phi_2$	ND (<0.05)	ND (<0.05)	ND (<0.05)
~~2,4'~~-$Cl_2\phi_2$	ND (<0.05)	ND (<0.05)	ND (<0.05)
2,2',4,4'-$Cl_4\phi_2$	ND (<0.05)	ND (<0.05)	- (-)

( ) Dow values
ND None Detected <0.05

DSW 006118

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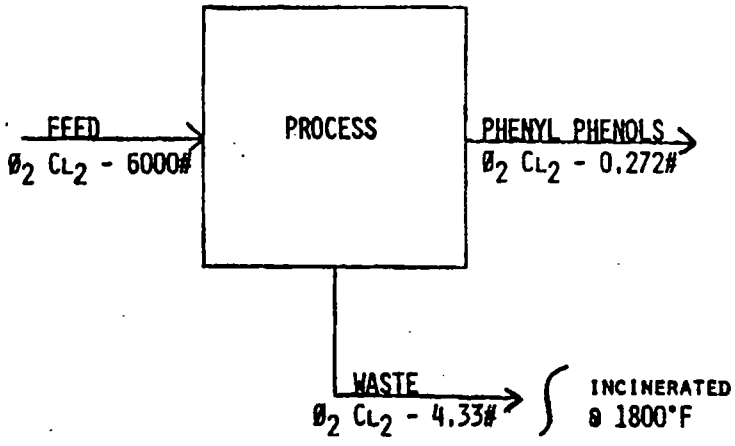
FIG. 2

DISTRIBUTION OF DICHLOROBIPHENYL

BASIS: 1,000,000# FEED, MONSANTO "LOT 1"



DSW 006119

TABLE XIX

MONOCHLOROBIPHENYL

(As Supplied by Monsanto)

	Present Agreed Spec.	Present Product	Proposed Spec.	Estimated Composition
Biphenyl	0.6% max.	~0.5%	0.6% max.	~0.5%
O-chlorobiphenyl	80% min.	87-91	75% min.	~ 78
m- -	4% max.	3-3.5	5.5% max.	~ 5
p- -	△	6-8	14% min.	~ 15
Dichloro +	1% max.	~0.6	1.3% max.	~ 1

DSW 006120

TABLE XVIII

BIO CONCENTRATION OF DICHLOROBIPHENYLS

ASSUMPTIONS:

1. LARGEST CUSTOMER OF OPP USE 3,000,000 LBS./YR.

2. ALL DICHLOROBIPHENYL IN OPP (0.2 PPM) FINDS ITS WAY TO A RIVER THE APPROXIMATE SIZE OF THE TITABAWASSEE.

3. BIO CONCENTRATION FACTOR FROM WATER TO FISH = 100,000.

BASED ON THESE ASSUMPTIONS, DICHLOROBIPHENYL BIO CONCENTRATION IN FISH WILL BE:

0.012 PPM

DSW 006121

TABLE XVII

ANALYSIS OF DOW PARA-PHENYLPHENOL

SAMPLE A

META-PHENYLPHENOL - 3%

2-CHLOROBIPHENYL - 0.26 PPM (1)

3-CHLOROBIPHENYL
4-CHLOROBIPHENYL - <0.1 PPM (1)

2,2'-DICHLOROBIPHENYL - <0.05 PPM (1)

2,4'-DICHLOROBIPHENYL - <0.01 PPM (1)

4,4'-DICHLOROBIPHENYL - <0.05 PPM (1)

TOTAL CHLORINE - 0.44 PPM (2)

TOTAL SODIUM - 0.32 PPM (3)

(1) DETERMINED BY GLC WITH ELECTRON CAPTURE

(2) DETERMINED BY NEUTRON ACTIVATION: PRECISION = ±0.05 PPM

(3) DETERMINED BY NEUTRON ACTIVATION: PRECISION = ±0.1 PPM

DSW 006122

meeting with medical
on 11/13/73

TABLE XVI

DOW TENTATIVE SPEC.

(INTERNAL MFG. - O-PP/P-PP)

Monochlorobiphenyl	:	10 ppm
Dichloro -	:	2 ppm
Trichloro -	:	0.1 ppm
Higher Chloro -	:	0.1 ppm

(1) G.L.C./E.C.D.

(2) For M.I.C.C. Dichloro max. of 1-1.3%

DSW 006123

STLCOPCB4000607

DOW CHEMICAL / MONSANTO MEETING
ON MCB -- OCTOBER 22, 1973

RATE AND TIMING OF MCB DEMAND:

It now appears that Dow will need a tanktruck of our MCB material by late March or early April, 1974, with full production to begin fourth quarter 1974, at a rate of approximately 8M pounds per year. Late 1975 or early 1976, they expect a rate of 15M lbs. per year. It appears that if Dow selects the higher Para content isomer that Monsanto will sell in excess of these quantities on a long term.

ACTION TO BE TAKEN:

1.	W.H.S.	Obtain and send in data on Analytical Methodology, etc. presented by Bob Copeland and Jerry Clark	ASAP
2.	CUMMING PATON/WHS	Arrange for Monsanto to perform analysis on Di-Chloro and higher content materials as well as the unknown factor on MCS 1547 and 1546.	DEC.
3.	CUMMING PATON/WHS	Arrange for analysis of sample of PPP material given to you by Dow.	DEC.
4.	HOWARD BERGEN/WHS	Present data on Dow's use of our MCB product and the disposal and incineration of Di-Chloro and higher isomers in final product to Monsanto higher management to determine need for Government notification.	DEC.
5.	CUMMING PATON/WHS	Determine minimum acceptable increase in price of Benzene and Chlorine to justify increase in the price of MCB product as per Don Black's request.	DEC.
6.	CUMMING PATON/WHS	Send letter to Dow Chemical quoting $.165/lb. with Benzene and Chlorine tolling as well as straight $.24/lb. firm with the escalation factors on Chlorine and Benzene built in. Also, mention our acceptance of a three year Evergreen Contract renewable yearly after the third year with certain outs. This should include a section stating conditions of lead time necessary for notification to Dow should our Aroclor business drop below 25%.	ASAP
7.	J.SAVAGE/ WHS	Determine minimum production quantity feasible for tanktruck order of MCB type material by Dow Chemical	BY DEC.
8.	HOWARD BERGEN/WHS	Determine Monsanto's policy with respect to notification of Government on the MCB sale to Dow Chemical.	TWO WKS.

Bob Copeland is to characterize properties of the Meta stream and send to St. Louis in one month.

DSW 006124

WHS:hm

STLCOPCB4000608

DOW CHEMICAL / MONSANTO MEETING
ON MCB -- OCTOBER 22, 1973

1-b. Chlorine: After November 1, 1973, an increase of $2.00 per ton of Chlorine will increase the price of MCB by ~~$0.05~~ ¢ 0.005/lb. per pound. The base on Chlorine is the OPD Chemical Grade price which is now approximately $75.00 per ton. No other escalators in terms of labor cost will be passed on in 1974.

At this point, Don Black suggested that we set some minimum change in the cumulative effect of Chlorine and Benzene which would be necessary prior to announcing a price change on the MCB.

RAW MATERIAL TOLLING - CHLORINE AND BENZENE:

A. With Dow supplying both Chlorine and Benzene, the price would be $.165¢/lb. FOB St. Louis. The ratio of products would be as follows:

0.875 lbs. of Benzene and 0.376 lbs. of Chlorine for every one pound of MCB. Benzene would be delivered to Anniston; Chlorine, to Krummrich.

B. BIPHENYL TOLLING

We would like the option to take all or part of the Biphenyl requirements where purity was in excess of 99%. The price would be 16.5¢/lb. FOB St. Louis, for the MCB material plus the following tolling factors:

0.376 lbs. of Chlorine plus 1.0 lbs. of Biphenyl for every one pound of MCB. Biphenyl and Chlorine to be delivered to Anniston. In this case we would need a 200 pound sample of Biphenyl and Dow's production specification on their Biphenyl prior to accepting this option.

Monsanto made it clear that in order for us to manufacture MCB with any degree of certainty, Dow must supply the Benzene. Dow seems interested in the $.165/lb. plus Benzene and Chlorine tolling.

DSW 006125

STLCOPCB4000609

DOW CHEMICAL / MONSANTO MEETING
ON MCB -- OCTOBER 22, 1973

into a river, the Di-Chloro content concentration in fish would be approximately 0.012 ppm. It was noted that the FDA maximum is .5 ppm. The analysis of Kevin Carney was given to Howard Bergen and will be distributed with this report.

REGISTRATION - GOVERNMENT INVOLVEMENT:

At present, it seems that Dow is reluctant to disclose anything to the Government and would prefer that Monsanto did likewise. The cost of re-registering the OPP products would be prohibitive and that at the very minimum, Dow may amend their registration to include another source. We mentioned that Dow should assume that Monsanto would notify the Government because of prior committments on PCB. This question, however, should be further defined by Monsanto.

We presented the following alternatives to the 24.5¢/lb. Bulk, FOB St. Louis, price on MCS 1547.

1. We will extend the price of 24.5¢/lb. bulk, FOB St. Louis, to November, 1973, on both specifications, both the old MCS 1547 and the new higher Para Isomer content material. After November 1, 1973, the following will take effect:

   1-a. Benzene: After November 1, 1973, a change of $.01 per gallon in the price of Benzene will increase the price of MCB by $0.185¢/lb. The base price for Benzene will be our September, 1973, price at Anniston, Alabama. Monsanto is willing to notify Dow Chemical monthly of the changes to the Benzene price. Dow Chemical can request validization of this through Haskins & Sells, C.P.A. firm.

= 0.185/lb.

STLCOPCB4000610

(M (NAME & LOCATION) W. H. Slowikowski - Akron

October 30, 1973 (Rec. 10-25-73)

cc H. S. Bergen St. Louis
T. L. Gossage St. Louis
Cumming Paton St. Louis
D. L. Mellon Akron
W. H. Slowikowski Akron

DOW CHEMICAL / MONSANTO MEETING ON MCB
OCTOBER 22, 1973

FILE

PRESENT FOR DOW CHEMICAL:

Don Black	U. S. Purchasing
Bob Copeland	Research & Design
Jerry Clark	Research & Design
Kevin Carney	Plant Design Engineer
Rudy Steihl	Analytical Laboratories(substitute for Bob Gill)
Bob Johnson	Commercial Development in the OPP-PPP Product Group
John Donalds	General Manager of Design Products
Roy Mastic	Production Manager

PRESENT FOR MONSANTO:

Howard Bergen
Tom Gossage
Cumming Paton
Dave Mellon
Bill Slowikowski

ANALYTICAL METHODOLOGY AND RESULTS:

Dow presented their technical analysis of the initial gallon samples of MCS 1547 and MCS 1546 as well as an analysis of the OPP material produced from the MCS 1547. Analysis on both these samples was compared with the results of Monsanto's analysis on the same items. In general, it was noted that both Monsanto and Dow agree on the analysis and that the correlation on all numbers is well within experimental error. The exact numbers presented for discussion will be forwarded to the carbonees when received by Bob Copeland. With respect to the MCS 1547 analysis, Dow methodology further defined the Di-Chloro Benzene and higher impurities on a ppm basis using electron capture gas chromotography. In using this procedure, they noted 22 ppm of an unknown"spike". They would like Monsanto to present data analyzing the Di-Chloro and higher impurities as well as attempting to identify the unknown which appears in this range of analysis.

DSW 006128

REV. 1/73

STLCOPCB4000611