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APR 18 1973



DOW CHEMICAL U.S.A.

4001 WEST 77TH STREET
MINNEAPOLIS, MINNESOTA 55438
612 • 820-4040

April 11, 1973

Mr. Howard S. Bergen
Director, Specialty Products
Monsanto Company
800 North Lindbergh Blvd.
St. Louis, MO 63166

Dear Howard:

We are embarrassed by the delay, and delighted to finally forward copies of slides used in our presentation on Dowicide* EC-7. Product samples and specific analysis on them have been provided to the attention of Dale Dill. We are working on clearance of the test methods promised and will forward these at the earliest possible date.

I believe this completes our follow-up commitment on the original meeting. We are looking forward to meeting with you again on April 27 for the purpose of further business discussions regarding pentachlorophenol.

Very truly yours,

Larry Atkins

L. L. Atkins
District Sales Manager,
Designed Products

enc.

SWM

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* Registered Trademark of The Dow Chemical Company

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AN OPERATING UNIT OF THE DOW CHEMICAL COMPANY

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Functional Polymers & Specialty Chemicals
Designed Products Department
DOW CHEMICAL U.S.A.

DOWICIDE EC-7
ANTIMICROBIAL

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initials *PCP*

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ENVIRONMENTAL PROTECTION AGENCY
REGISTRATION NUMBER
464-431



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PENTACHLOROPHENOL USES AND APPLICATIONS U.S. Area

<u>Industrial Application</u>	<u>Approximate % Of Total U.S. Use</u>	<u>Approximate Use Conc.</u>
Wood Preservation	80	0.3 - 0.5 Lb/Cu Ft
Water Treatment	5 - 10	100 - 150 ppm
Leather	1.0	0.25%
Textile	0.5 - 1.0	0.75 - 1.0%
Miscellaneous	Δ	0.01 - 5.0%



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FEDERAL GOVERNMENT

Expression Of Concern ♦ *"Non-Phenolic Impurities"*

JANUARY 15, 1971 AND MARCH 5, 1971

GOVERNMENT AGENCIES REPRESENTED

- United States Department Of Agriculture
PLANT SCIENCE RESEARCH
SCIENCE AND EDUCATION
- Health, Education And Welfare
FOOD AND DRUG ADMINISTRATION
- Environmental Protection Agency
PESTICIDE REGULATIONS DIVISION
- Department Of Commerce
BUREAU OF DOMESTIC COMMERCE

U.S. PENTA PRODUCERS

DOW CHEMICAL U.S.A.
MONSANTO CHEMICAL CO.
REICHOLD CHEMICAL CO.
SONFORD CHEMICAL CO.
VULCAN MATERIALS CO.

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**FEDERAL GOVERNMENT EXPRESSION
OF CONCERN**

**March 5, 1971, Meeting With
U.S. Producers**

"'Penta' Is A Useful Preservative For Wood."

**"Unless Pentachlorophenol Can Be Cleaned
Up, We Will Probably Lose It."**

**"The Subject Of Dioxins Is Pretty Explosive
And Could Blow Up At Any Time."**



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INCIDENTS ATTRIBUTED TO NON-PHENOLIC IMPURITIES IN POLYCHLORINATED PHENOL PRODUCTS

Government Hearings On 2,4,5-T Herbicides	4-14-70
Kimmig & Schultz	1957
Cook, F.D.A. - Report To 1970 I.U.P.A.C.	1970
Poland, et al.	1970
Chick Edema Disease	1958-1972
PROCTER & GAMBLE (Cantrell, et al.)	
F.D.A. (Firestone, Campbell)	
U.S.D.A. (Kearney, Woolson)	
SWEDISH ENVIRONMENT PROTECTION BOARD - JENSEN	
Thomas Whiteside Articles In The "New Yorker"	1970

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BULK COMPOSITION OF PENTACHLOROPHENOL

PENTACHLOROPHENOL	90% ^a
TETRACHLOROPHENOL	8% ^a
TRICHLOROPHENOL	0.1% ^a
HIGH MOLECULAR WEIGHT PHENOLS .	1% ^b
NON-PHENOLIC COMPONENTS	0.5% ^c

^a Determined by infra-red spectroscopy and gas-liquid chromatography for major and minor components. Precision = $\pm 0.5\%$ r.s.d.

^b Determined by gas-liquid chromatography of trimethylsilyl-derivatives and extraction from caustic solution and ion-exchange chromatography

^c Determined by ion-exchange chromatography



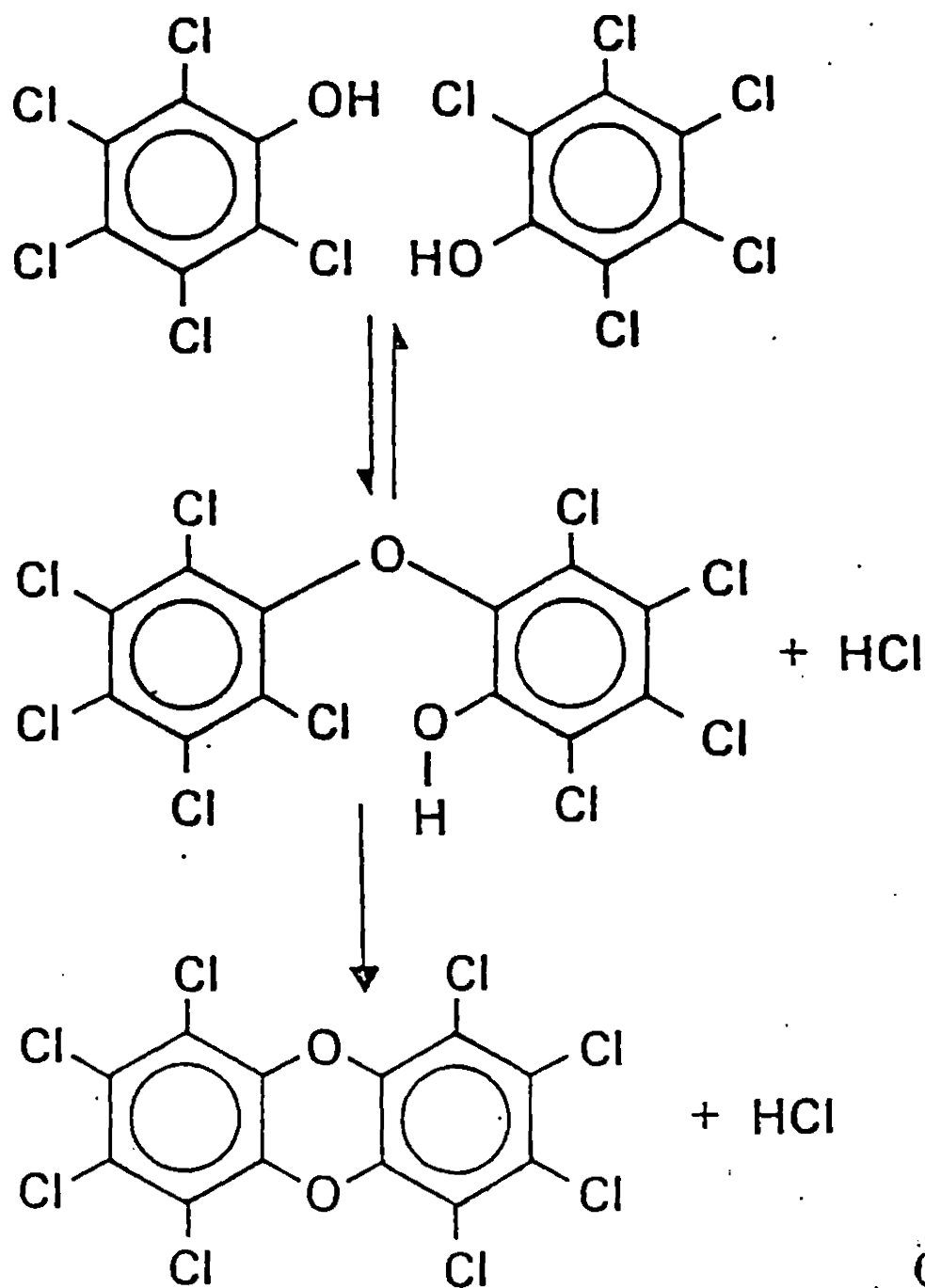
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EXAMPLE OF A POTENTIAL ROUTE TO FORMATION OF NON-PHENOLIC IMPURITIES IN COMMERCIAL PENTACHLOROPHENOL



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TOXICOLOGY OF 2,3,7,8-TETRACHLORO- DIBENZO-p-DIOXIN

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- Acute Lethality

Single Oral LD50 — 0.6 mg/kg - 115 mg/kg

- Acneogenic Response — Positive Response At 0.04 mg/ml

- Chick Edema Factor — Positive At 1 And 10 mg/kg/Day. No Effect Dose Level, 0.1 mg/kg/Day

- Embryotoxicity — Positive At 0.6 mg/kg/Day

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TOXICOLOGY OF HEXACHLORODIBENZO-p-DIOXIN

- Acute Lethality — Not Documented As Yet
- Acneogenic Response — Positive At 10 - 50 mg/ml
- Chick Edema Factor — Positive At 10 And 100 mg/kg/Day
- Embryotoxicity — Positive At 10 mg/kg/Day
- Teratogenicity — Positive At Dose Level Of 100 mg/kg/Day



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TOXICOLOGY OF OCTACHLORODIBENZO-p-DIOXIN

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• Acute Lethality

■ NOT LETHAL TO FEMALE RATS, ORAL
DOSES OF 1 g/kg

■ NOT LETHAL TO MALE MICE, ORAL DOSES
OF 4 g/kg

• Acnegenicity — Negative

• Teratogenicity — Negative At 500 mg/kg/Day

• Embryotoxicity — Positive At 500 mg/kg/Day



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COMMERCIAL PENTACHLOROPHENOL
Monsanto Company

Pentachlorophenol 86.3%

Tetrachlorophenol 4.2%

Highers 9.4%

Octachlorodibenzo-p-Dioxin 1550 ppm

Hexachlorodibenzo-p-Dioxins 18 ppm

Chloracne Response — Positive

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RESULTS OF COMPARATIVE TOXICOLOGY STUDIES

COMMERCIAL PENTACHLOROPHENOL, DOWICIDE 7

- Responsible For Chloracne
- Responsible For Production Of Chick Edema
- Responsible For Histopathological Changes
 - ▣ BLOOD CHEMISTRY CHANGES
 - ▣ GROSS ORGAN CHANGES
- Is Not Teratogenic But Is Embryotoxic



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RESULTS OF COMPARATIVE TOXICOLOGY STUDIES

*Improved Pentachlorophenol (Dowicide EC-7) And Pure
Pentachlorophenol*

Do Not Cause Chloracne

Do Not Cause Production Of Chick Edema

Do Not Cause Histopathological Changes

Not Teratogenic But Are Embryotoxic

Are Equal In Acute Toxicity

Are Equal In Chronic Dietary Feeding Toxicity Studies

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CONCLUSIONS DERIVED FROM COMPARATIVE TOXICOLOGY STUDIES

- Acute Oral Toxicity Of Dowicide EC-7 Is Greater Than Dowicide 7
- Dowicide EC-7 Does Not Cause Chloracne, Dowicide 7 Does
- Dowicide EC-7 Does Not Produce Chick Edema, Dowicide 7 Does
- Dowicide EC-7 Does Not Cause Histopathological Changes In Chronic Feeding Studies, Dowicide 7 Does
- Pentachlorophenol, Regardless Of "Grade," Is Not Teratogenic
- Pentachlorophenol Is Embryotoxic

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UNTOWARD TOXIC EFFECTS
ARE ASSOCIATED WITH THE
CHLORINATED DIBENZO-p-
DIOXIN CONTENT OF COM-
MERCIAL PENTACHLORPHENOL.



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**DOWICIDE EC-7:
WHY HAS TOXICITY BEEN IMPROVED?**

- Total Chlorinated Dioxin (And Furan) Content Has Been Significantly Reduced
- Specification Of 30 ppm, Maximum Octachlorodibenzo-p-Dioxin Has Been Imposed
- Limit Of 1.0 ppm Hexachlorodibenzo-p-Dioxins Assures Absence Of:
 - CHLOROACNE CAUSING IMPURITIES
 - CHICK EDEMA FACTOR
 - HISTOPATHOLOGICAL CHANGES RESULTING FROM TOXIC IMPURITIES

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DOWMILIDIE EC-7 TOXICITY CONCLUSIONS

- Does Not Cause Chloracne
- Does Not Produce Skin Edema
- Minimize Future Environmental Pollution
Both Acute And Chronic Toxicity



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☆ DOWICIDE EC-7, WITH REDUCED
CHLORINATED DIBENZO-p-DIOXIN
CONTENT, DOES NOT CAUSE:

- Chloracne
- Chick Edema
- Histopathological Changes In
Chronic Feeding Studies



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ANALYSIS AND SPECIFICATIONS OF DOWICIDE EC-7 PENTACHLOROPHENOL

PENTACHLOROPHENOL	88-93%
TETRACHLOROPHENOL	12-7%
TRICHLOROPHENOL	< 0.1%
HIGHERS	0.1%
DIOXINS	
2,2,7,8-TETRACHLORODIBENZO- p-DIOXIN	< 0.05 ppm
HEXACHLORODIBENZO-p-DIOXINS	1.0 ppm MAX.
OCTACHLORODIBENZO-p-DIOXIN	30 ppm MAX.

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ANTIMICROBIAL EFFICIENCIES

<u>TEST FUNGI</u>	<u>% DOWICIDE EC-7 FOR INHIBITION</u>
<i>Trichoderma viride</i> , ATCC No. 8678	0.0025-0.005
<i>Trichoderma</i> sp., Madison P-42	0.001-0.0025
<i>Ceratocystis pilifera</i> , ATCC No. 15457	0.0005-0.001
<i>Polyporus tulipiferae</i> , ATCC No. 11245	< 0.0001
<i>Rhizopus stolonifer</i> , ATCC No. 6227a	0.0001-0.00025
<i>Lenzites trabea</i> , Madison 617	0.0001-0.00025
<i>Ceratocystis ips</i> , ATCC No. 12860	0.001-0.0025
<i>Chaetomium globosum</i> , ATCC No. 6205	0.0001-0.00025
<i>Aspergillus niger</i> , ATCC No. 6275	0.001-0.0025

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REF ID: A19234

ANTIMICROBIAL EFFICIENCIES

<u>TEST BACTERIA</u>	<u>% DOWICIDE EC-7 FOR INHIBITION</u>
<i>Bacillus cereus</i> var. <i>mycoides</i> , ATCC No. 11778	0.0005-0.001
<i>Staphylococcus aureus</i> , ATCC No. 6538	0.00025-0.0005
<i>Bacillus subtilis</i> , ATCC No. 8473	0.005-0.01
<i>Escherichia coli</i> , ATCC No. 11229	0.025-0.05
<i>Salmonella choleraesuis</i> , ATCC No. 10708	0.01-0.025
<i>Pseudomonas aeruginosa</i> , ATCC No. 15442	0.1-0.25
<i>Enterobacter aerogenes</i> , ATCC No. 13048	0.05-0.1
<i>Streptomyces griseus</i> , ATCC No. 10137	0.0005-0.001
<i>Flavobacterium arborescens</i> , ATCC No. 4358	0.00025-0.0005

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