Economics & Substitutes Program
David Wood Presentation (Draft)

IN 1971 MONSANTO DISCONTINUED SALE OF PCB-CONTAINING PRODUCTS TO THE FOLLOWING MAJOR APPLICATION AREAS:

- -CARBONLESS PAPER
- -FIRE RESISTANT HYDRAULIC FLUIDS
- -HEAT TRANSFER
- -PLASTICIZER

THERE WERE NUMEROUS MINOR ADDITIONAL APPLICATIONS DISCONTINUED AT THE SAME TIME.

SALES IN THESE AREAS FELL FROM

32.5$\overline{M}$ LBS. IN 1970 TO 752,000 LBS.

IN 1972 and 0 IN 1973.

IN 1975 WE CONTINUE TO SELL TO THE

ELECTRICAL INDUSTRY FOR INCLUSION IN

CAPACITORS, TRANSFORMERS AND ASSOCIATED

CLOSED ELECTRICAL EQUIPMENT

BECAUSE -

1. UTILITY - THE AROCLOR FLUIDS PERFORM AN ESSENTIAL ROLE IN ELECTRICAL DISTRIBUTION.

2. LACK OF EFFECTIVE PROVEN REPLACEMENT.

3. OUR BELIEF THAT USE IN CLOSED SYSTEMS IS CONTROLLABLE.

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MONSANTO CURRENT MARKETING POLICY - PCB

1. SUPPLY ONLY MANUFACTURERS OF SEALED ELECTRICAL EQUIPMENT SUCH AS CAPACITORS/TRANSFORMERS.

2. DO NOT RECLAIM ELECTRICAL FLUIDS.

3. OFFER INCINERATION SERVICE FOR LIQUID PCB WASTES.

4. CONTINUE RESEARCH PROGRAM (STARTED 1969) TO DEVELOP EFFECTIVE REPLACEMENTS.

5. ENSURE THAT SIGNIFICANT DIFFERENCES BETWEEN AROCLOR DIELECTRICS AND REPLACEMENT CANDIDATES ARE FULLY REVIEWED.

## UTILITY IN CAPACITORS

| PROPERTY | FUNCTION |
|---|---|
| FIRE RESISTANCE | CONSUMER/PLANT SAFETY |
| THERMAL STABILITY<br>CHEMICAL STABILITY<br>HYDROLYTIC STABILITY<br>POWER FACTOR | RELIABILITY |
| DIELECTRIC CONSTANT<br>DIELECTRIC STRENGTH | AVAILABILITY<br>CONVERTABILITY<br>ECONOMY |

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UTILITY IN TRANSFORMERS

FIRE RESISTANCE - SAFETY

THERMAL/CHEMICAL STABILITY - RELIABILITY

## TRANSFORMER APPLICATIONS

1. RAILROAD TRANSFORMERS - RAPID TRANSIT SYSTEMS.

2. URBAN SUBSTATIONS.

3. INDUSTRIAL LOAD CENTERS.

4. ELECTROSTATIC PRECIPITATORS.

FIRE RESISTANCE OF ASKAREL TRANSFORMERS

1. FIRE INITIATION.

2. ARC FORMED GASES.

3. FIRE PROPAGATIONS.

## POTENTIAL SUBSTITUTES

## CAPACITORS

### RESEARCH OBJECTIVES

1. MATCH OR EXCEED AROCLOR 1016 CAPABILITY.

   A) DIELECTRIC CONSTANT, DIELECTRIC STRENGTH - AVAILABILITY, CONVERTABILITY

   B) STABILITY, POWER FACTOR - RELIABILITY

   C) SAFETY - FIRE RESISTANCE

2. IMPROVE FURTHER-ENVIRONMENTAL COMPATIBILITY.

3. A) SPAN EXISTING APPLICATIONS - COMPLETE SOLUTION.

   B) INTERNATIONALLY AVAILABLE - NOT SOLELY USA SITUATION.

MCS 1043

1. DICHLOROBIPHENYL TYPE.

2. COULD BE SUBSTITUTED FOR AROCLOR 1016.

3. SLIGHTLY LESS FIRE RESISTANT.

4. FURTHER DEVELOPMENT CONTINGENT ON INDUSTRY/GOVERNMENT/PUBLIC/MONSANTO CONCLUSIONS ON DIFFERENCE IN PCB HOMOLOGUES.

THE CAPACITOR INDUSTRY IS CURRENTLY EXAMINING

MCS 1238

MCS 1588

MCS 1475.

1. THESE CONTAIN NO CHLORINATED BIPHENYL.

2. ALL THESE REPRESENT A SINGLE CONCEPT.

THE ADDITION OF A LIMITED QUANTITY OF VERY HIGH DIELECTRIC CONSTANT FLUID TO A GOOD DIELECTRIC BASE LIQUID TO GIVE A DIELECTRIC MIXTURE "EQUIVALENT" ELECTRICALLY TO AROCLOR 1016.

1. MCS 1238 = HYDROCARBON + SULFONE.

2. MCS 1588 = HYDROCARBON + SULFONE.

3. MCS 1475 = PHTHALATE ESTER + SULFONE. ?

THE MAIN THRUST TODAY IS TOWARDS PRODUCTS 1 & 2.

| PROPERTY | AROCLOR 1016 | MCS 1238 | MCS 1588 |
|---|---|---|---|
| DK 25°C | 5.9 | 6.0 | 6.1 |
| 100°C | 4.85 | 5.1 | 5.1 |
| CORONA IV/EV | INDUSTRY | INDUSTRY | INDUSTRY |
| HYDROLYSIS STABILITY* (NEUTRALIZATION NUMBER) | 0.00 | 0.00 | 0.00 |
| DISSIPATION FACTOR.FLUID TAN 8 60$H_2$ 100°C | 0.0025 | 0.05 | 0.05 |
| DISSIPATION FACTOR.MODEL CAPACITOR | 0.0034 | 0.0039 | 0.0035 |

*SEE TEXT

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## FIRE RESISTANCE

| | AROCLOR 1016 | MCS 1238 | MCS 1588 |
|---|---|---|---|
| FLASH PT. °F. | 358° | 303° | 325° |
| FIRE PT. °F. | NONE TO BOILING PT. (620°) | 328° | 350° |
| AIT. °F. | 1185° | 835° | 870° |

## CONCLUSION

MONSANTO CANDIDATES ARE NOT FIRE RESISTANT.

ENVIRONMENTAL CONSIDERATIONS

EXPOSURE

BIODEGRADATION

ACCUMULATION

TOXICITY → WORKER SAFETY
TOXICITY → ENVIRONMENTAL IMPACT

% BIODEGRADATION

SCAS.

| | 48 HR. | 160 HR. |
|---|---|---|
| AROCLOR 1254 | 15 | ✓ JPM |
| AROCLOR 1016 | 33 | ✓ JPM |
| MCS 1238 | 78 | 86 |
| HYDROCARBON | 90 | 90 |
| SULFONE | 52 | 78 |

RAT TISSUE RESIDUE (JPM)

FISH TISSUE RESIDUE

(TO BE COMPLETED)

## TOXICITY STUDIES -MCS 1238

## IN-PLANT HANDLING

1. RAT - ACUTE SINGLE ORAL DOSE LD50 - 3800 MGS/KG.
2. EYE IRRITATION - RABBIT - 12.0/110.0
   NORMAL AFTER 72 HOURS.
3. RABBIT - DERMAL LD50 - 5.0-8.0 GMS PER KILOGRAM.
4. RABBIT - SKIN IRRITATION (24 HR. CONTACT) - 3.6/8.0.

## ENVIRONMENTAL IMPACT

1. DEGRADATION ✓

2. ACCUMULATION ✓

3. FISH TOXICITY

   - 4 DAY STATIC STUDY

   - 96 HOUR LC50

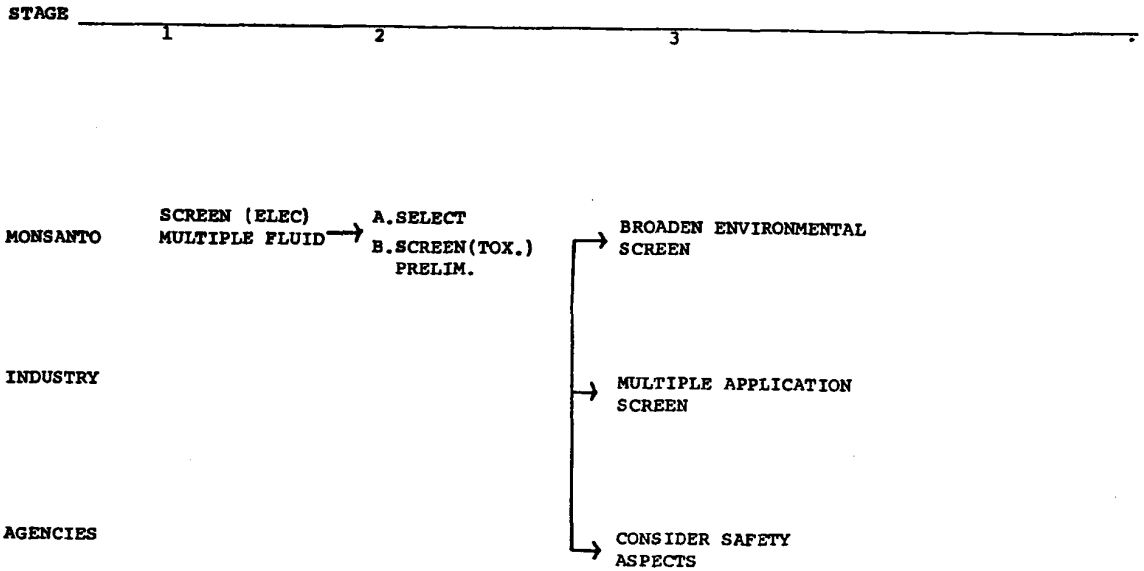
   RAINBOW TROUT - 2.0 PPM

   BLUE GILL - 3.2 PPM

## MCS 1238 - FURTHER PROGRAMS SCHEDULED

1. VAPOR INHALATION.
2. ULTIMATE DEGRADATION.
3. ARC GASES.
4. PILOT FEEDING STUDY.
5. LONG-TERM (2 YEAR) FEEDING STUDIES.
6. FISH TISSUE RESIDUES.

## CAPACITOR REPLACEMENT




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## TRANSFORMERS

WE HAVE NOT DEVELOPED ANY MATERIAL WITH EQUIVALENT FIRE RESISTANCE TO AROCLOR.

A. PROTECTION UNDER TRANSFORMER FAULT CONDITIONS.

B. ARC FORM GASES

C. POTENTIAL SPREAD OF EXTERNAL FIRE.

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WE DO HAVE CANDIDATES WITH

INTERMEDIATE FIRE RESISTANCE

| | MCS | MCS | MCS |
|---|---|---|---|
| PROPERTY | | | |

OUR MAJOR OBSTACLE

ABSENCE OF OBJECTIVE STANDARDS TO

GUIDE

POTENTIAL FLUID SUPPLIER

TRANSFORMER PRODUCERS

TRANSFORMER USERS

INSURANCE GROUPS

SAFETY ORGANIZATIONS

GOVERNMENT AGENCIES

ON REQUIRED LEVEL OF FIRE RESISTANCE.