DOW CHEMICAL U.S.A.

BARSTOW BUILDING
2020 DOW CENTER
MIDLAND, MICHIGAN 48640

June 23, 1975

Mr. Carl Bremer
United States EPA
Surveilance and Analysis Division
230 South Dearborn
Chicago, Illinois 60604

Dear Mr. Bremer:

Thank you for expressing interest in Dow's alternative to PCB's in power capacitors.

For your review and reference, the enclosed statement briefly describes Dow XFS-4169L capacitor fluid.

We hope you find this statement satisfactory to include in your report of PCB's in Lake Michigan to the Toxic Substances Committee.

Sincerely yours,

Dean Branson

Dean R. Branson, PhD.
Environmental Science Research
(517) 636-2730

Enclosure

mmr

DSW 187961

STLCOPCB4051835

PCB ALTERNATIVE: DOW XFS-4169L CAPACITOR FLUID

Since the later 1960's, polychlorinated biphenyls (PCB's) were identified as hazardous to man and his environment. In 1972, there were no acceptable alternatives to PCB's in power capacitors. Today Dow XFS-4169L Capacitor Fluid developed by The Dow Chemical Company is proving to be an acceptable alternative.

Chemically, the new Dow fluid can be described as alkylated chlorodiphenyl oxide. Electrically, the Dow fluid performs as well or better than PCB's. Capacitors impregnated with the new Dow fluid show superior corona behavior and better handling of stress resulting in lower operating costs.

At the same time, the health and environmental characteristics of the Dow fluid have been found to be significantly superior to PCB's. This was accomplished by first screening and evaluating a large variety of chemicals and then selecting that product with the superior health and environmental characteristics. Dow XFS-4169L Capacitor Fluid was found to be highly biodegradable compared with PCB's. It also was found to be less toxic to fish and animals, and less bioaccumulative in fish and animals.

A major manufacturer of power capacitors in the U.S. has found the Dow fluid to be an acceptable alternative to PCB's. The manufacturer plans to complete test marketing the new product in its capacitors by late 1975.

Although the cost of the Dow Capacitor Fluid will be higher than that of PCB's, the overall costs to capacitor manufacturers, as well as electrical consumers, are expected to be lower. This is because the toxicity of PCB's is such that costs for handling, operating and disposal are far more expensive.

DSW 187962

PYROCLOR

TRANSFORMER COOLANT BY **Monsanto**

Pyroclor is Monsanto's brand name for its fire resistant transformer askarel. The term "askarel", as defined by ASTM, generally describes a broad class of fire resistant synthetic chlorinated hydrocarbon liquids used as electrical insulation media in transformers.

Transformer askarels were first used in the United States in 1932 and incorporate chlorinated biphenyl — one of the best liquid insulation materials ever developed. This inert material is chemically stable, fire resistant, heat stable, non-corrosive and has high dielectric strength under the operating conditions encountered in transformers.

In Europe, askarel transformers form a large percentage of the distribution transformers installed today. In France, one third of the distribution transformers brought into service each year are of this type.

PYROCLOR 5

This is the recommended fluid for all Pyroclor-filled transformers operating at normal ambient temperature conditions. Should special operating conditions be envisaged, please consult with Monsanto — it may be possible to provide a modified product.

DSW 187963

STLCOPCB4051837

Advantages of Pyroclor

1. Pyroclor is very fire resistant. It resists ignition and tests have shown it does not burn continuously as a result of transformer arcing.
2. Pyroclor-filled transformers need no special fire precautions as part of the transformer installation.
3. Pyroclor-filled transformers offer greater siting flexibility, particularly where space is limited. They can be located indoors, close to working areas or at the load centre.
4. Properly sealed Pyroclor-filled transformers require little or no maintenance of the fluid over many years of service.
5. Its permittivity is such that the distribution of electrical stress in the transformer is more uniform.

STLCOPCB4051838

Sales Specification for Pyroclor 5

Property	Test Method	Unit	Value
Appearance	ASTM D1702	—	Clear liquid free from suspended matter and sediment
Colour	ASTM D1702	APHA	150 max.
Density at 20° C	ASTM D1810 and ISO/R 649	kg/m^3	1502 - 1524
Refractive Index at 20° C	ASTM D1807	—	1.6173 to 1.6193
Kinematic Viscosity at 20° C	ASTM D445	cSt	32 max.
Fire Point	ASTM D92	°C	None to BP
Pour Point	ASTM	°C	-30 max.
Neutralisation Number	Monsanto	mg KOH/g	0.01 max.
Inorganic Chlorides	ASTM D1821	ppm Cl	0.1 max.
Scavenger Content (PPO)	Monsanto	%	ca. 0.2
Water Content	ISO/R760	ppm	30 max.
Electric Strength at 25° C, 50 Hz	IEC 156	kV	45 min.
Resistivity at 100° C, 500V after 1 minute	Monsanto	G ohm.m	10 min.
Dissipation Factor (tan δ) at 100° C, 50 Hz	Monsanto	%	5 max.
Relative Permittivity at 100° C, 50 Hz	Monsanto	—	4.2 to 4.5

Typical Properties (Not part of specification)

Coefficient of thermal expansion (20 - 100° C)	$°C^{-1}$	0.00073
Specific Heat (20° C)	$J.Kg^{-1}$ $°C^{-1}$	1000
Thermal Conductivity (20° C)	$J\,m^{-1}$ sec^{-1} $°C^{-1}$	0.098

STLCOPCB4051839

Storage, Handling and Disposal of Pyroclor

CAUTION:

Pyroclor contains POLYCHLORINATED BIPHENYLS (PCBs) which some studies have shown may be persistent, an environmental contaminant, and, possibly, injurious to certain forms of bird, aquatic and animal life.

Storage

Inside storage of drums is recommended to avoid moisture contamination. If drums have to be stored outside they should be stacked on their sides with bungs uppermost to prevent moisture being sucked in by breathing. Partially emptied drums should not be left open to the air.

The supply of Pyroclor in bulk offers many advantages to medium and large users. Unloading, storing and transferring to the production unit is safer, easier and cheaper. Material losses due to spillage and incomplete emptying of drums is minimised. The possibility of product contamination during handling is greatly reduced.

Even where storage and handling facilities are not at present available, the economics of bulk handling may quickly pay for the tanks and piping systems required. A booklet, indicating the type of system necessary, is available from Monsanto and experienced Monsanto personnel are available for site discussion regarding the most suitable bulk installation and off-loading procedure.

It is essential that both drum and bulk storage areas should be organised so that leakages and spillages can be collected for safe disposal.

DSW 187966

STLCOPCB4051840

Handling

Transformer askarel has been made, handled and used for over 40 years. It can be handled safely if a few simple precautions are observed.

1. Minimise contact with the skin by using gloves and other protective clothing.

   Remove accidental skin contamination as soon as practicable by thorough washing with soap and water. Short term exposure is unlikely to cause harm except to very sensitive skin, but long term exposure should be avoided. Remove saturated clothing and do not re-use until dry-cleaned.

2. Protect eyes with goggles.

   Accidental eye contact may result in painful irritation but no permanent damage to tissue. If Pyroclor gets in the eyes, flush with large amounts of water. As with all eye-first-aid, refer to a qualified physician. To relieve irritation, ophthalmic anaesthetic solution, ophthalmic cortisone acetate solution, or castor oil may be used under qualified supervision.

3. Avoid breathing Pyroclor vapour, mist or fumes.

   Infrequent exposure to Pyroclor vapour is unlikely to cause ill effects, but prolonged exposure to high vapour concentrations must be avoided. At normal ambient temperature, in well ventilated areas, the concentration of Pyroclor will be below that likely to cause harm. For handling hot Pyroclor in a confined space, a respirator with an active carbon canister should be worn.

4. Do not eat, drink, or smoke when handling Pyroclor. Although Pyroclor is not particularly toxic when ingested orally, this simple precaution will minimise hazard.

STLCOPCB4051841

Disposal of Pyroclor Waste

Where possible the destruction of Pyroclor waste should be accomplished through carefully controlled high temperature incineration. This requires a special incineration facility providing a suitable balance between temperature, dwell-time, oxygen and auxiliary fuel and provision for removal of hydrochloric acid gas from the gasseous emissions. This facility must also make provision for handling the waste which may range from mobile fluid to solid, impregnated with Pyroclor.*

If such a facility does not exist, subject to the provisions of local regulations, the waste should be consigned to a waste disposal site designated for toxic materials.

Do not use empty Pyroclor drums except for waste Pyroclor. Before disposal they should be thoroughly drained and then flushed twice with kerosene type solvent. The solvent should be incinerated and the washed drums consigned to a waste disposal site. Alternatively incinerate unwashed drums in a suitable incinerator.

During handling and disposal of waste Pyroclor take great care to avoid pollution, particularly of drains and waterways.

*Please ask Monsanto for up-to-date information on facilities available for incineration of Pyroclor.

DSW 187968

STLCOPCB4051842

Toxicity

I. **Inhalation**

At ordinary temperatures the chlorinated biphenyls in askarel have not presented industrial toxicological problems. The hazard of potential toxic exposure varies with their volatility; the lower chlorinated, more volatile ones present more of a potential problem from the standpoint of both inhalation and skin contact. When askarel fluids are used at elevated temperatures, engineering controls must be applied, either by the use of closed systems or by effective local exhaust ventilation together with general workroom exhaust.

Vapours of askarel at room temperature should not be breathed in a confined space and no vapour of any fluid evolved at elevated temperatures should be allowed to be dispersed into the general workroom.

Inhalation tests on animals indicate that the maximum safe concentration of vapour is in the range from 0.5 to 1.0 milligramme per cubic metre of air. The threshold limit value (maximum allowable concentration of an 8-hour working day) set by the American Conference of Governmental Hygienists is 1.0 milligramme of the lower-chlorinated biphenyl compounds per cubic metre of air and 0.5 milligramme of the more-highly-chlorinated compounds, per cubic metre of air.

II. **Skin Contact**

Prolonged or repeated skin contact with the askarel fluids must be avoided by the use of gloves and protective garments, because of the possible occurrence of a condition called chloracne. Although reports of this condition caused by askarel are rare, it can be produced by excessive skin contact. If the fluid is spilled on the skin, the skin should be washed in the usual manner with a soap solution.

A burn caused by contact with a hot askarel should be treated like any ordinary burn.

STLCOPCB4051843

Labelling Precautions

Pyroclor drums and containers carry the following label which gives general instructions for handling:

IMPORTANT CHLOROBIPHENYLS (42%-54%) (or 60%) (PCB)

This product contains POLYCHLORINATED BIPHENYLS (PCBs) which some studies have shown may be persistent, an environmental contaminant and, possibly, injurious to certain forms of bird, aquatic and animal life.

PREVENT ANY ENTRY INTO THE ENVIRONMENT THROUGH SPILLS, LEAKAGE, DISPOSAL, VAPOURISATION, RE-USE OF CONTAINERS OR OTHERWISE.

SPILLS, LEAKAGES AND WASTE PRODUCT MUST BE COLLECTED.
Use of this product must be restricted to applications 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.

HARMFUL SUBSTANCE IF TAKEN INTERNALLY OR IF IN PROLONGED CONTACT WITH THE SKIN.

CAUSES IRRITATION OF SKIN AND EYES.

DURING SHIPMENT AVOID SPILLS AND LEAKAGE INTO INLAND WATERWAYS AND THE SEA.

Store away from food, animal feedstuffs and pharmaceuticals.
Keep container tightly closed.
Do not eat or smoke when using.
Avoid breathing vapours, mist or fumes.
Do not wear contaminated clothing.
Wash product from skin with soap and water.
Wash eyes by flushing with water.

DSW 187970

STLCOPCB4051844

All new Pyroclor transformers should carry a label giving the following information:—

CAUTION

The Insulating Liquid In This Transformer Contains Polychlorinated Biphenyls (PCBs). Care Should Be Taken To Prevent Entry Into The Environment. In Case Of Malfunction Or Leaks, Consult The Instruction Manual Or The Manufacturer.

References

Reference should be made to the following publications for information relevant to this bulletin.

1. Guide for Acceptance and Maintenance of Transformer Askarels in Equipment.
   [American Institute of Electrical and Electronic Engineers Guide No. 76, (December 1958), (Revised edition)
   (I.E.E.E. Inc., 345 East 47th Street, New York)]
2. Guidelines for Handling and Disposal of Capacitor and Transformer Grade Askarels Containing Polychlorinated Biphenyls.
   [American National Standards Institute, Committee C 107, 155 East 44th Street, New York.]
3. The Properties of Askarels and Recommendations for Their Use in Electrical Equipment.
   [C.I.G.R.E. Working Group 02, Study Committee 15, Electra *33* (1974) 11-31.]

Published by Monsanto Europe S.A. 16-2(E)ME-1(8/75) Printed in England.

DSW 187971

STLCOPCB4051845

The information in this bulletin is to our best knowledge true and accurate but all instructions, recommendations or suggestions are made without guarantee. Since the conditions of use are beyond their control, Monsanto Company and its subsidiaries disclaim any liability for loss or damage suffered from use of these data or suggestions. Furthermore no liability is accepted if use of any product in accordance with these data or suggestions infringes any patent.

The information, recommendations and suggestions made herein are offered in the light of prevailing legislation and on the basis of present scientific information (1975) available to Monsanto.

DSW 187972

STLCOPCB4051846

HEAD OFFICE
Monsanto Europe S.A.
Place Madou, 1
B-1030 Brussels, Belgium
Telephone: (02) 219 11 01
Telex: 22110/21986

AUSTRIA:
Monsanto Gesellschaft mbH.
A-1010 Vienna
Rudolfsplatz 12
Telephone: 63 88 31
Telex: 07/5601

BELGIUM/LUXEMBURG:
Monsanto Europe N.V.
Mechelsesteenweg 163
B-2000 Antwerp
Telephone: (031) 30 58 40
Telex: 31 657

DENMARK:
Monsanto A/S
6 Rysensteensgade
DK-1564 Copenhagen V
Telephone: (01) 12.88.38
Telex: 19556

FINLAND:
Monsanto Scandinavia AB
Arkadiankatu 8 C 20
SF-00100 Helsinki 10
Telephone: 441186
Telex: 12841

FRANCE:
Société Monsanto
9, rue d'Argenson
F-75008 Paris
Telephone: 265 65 20
Telex: 65281

FEDERAL REPUBLIC OF GERMANY:
Monsanto (Deutschland) GmbH.
D-4000 Düsseldorf
Immermannstraße 3
Telephone: 0211/3 67 51
Telex: 858-1307

ITALY:
Monsanto Italiana S.p.A.
Via Melchiorre Gioia, 8
I-20124 Milano
Telephone: 6273
Telex: 34659

NETHERLANDS:
Monsanto N.V.
Jan van Nassaustraat 53-55
NL-The Hague
Telephone: 070/245015
Telex: 32208

NORWAY:
Monsanto Norge AS
Fred Olsensgt 11
N-Oslo 1
Telephone: (02) 20 48 58
Telex: 19106

POLAND:
Monsanto Poland Inc.
The Forum Hotel
Ul. Nowogrodzka 24/26
00511 Warsaw
Telephone: 282613
Telex: 814704

SPAIN:
Monsanto Iberica S.A.
Lepanto 350
E-Barcelona 13
Telephone: 255 10 00
Telex: 53050

SWEDEN:
Monsanto Scandinavia AB
Ulvsundavägen 108
S-16111 Bromma-11
Telephone: (08) 80 28 30
Telex: 17359

SWITZERLAND:
Monsanto (Suisse) S.A.
Postfach
CH-5600 Lenzburg
Telephone: (064) 51 67 51
Telex: 68855

UNITED KINGDOM:
Monsanto Limited
10-18 Victoria Street
London SW1H 0NQ
Telephone: 01-222 5678
Telex: 916093

Monsanto

DSW 187973

STLCOPCB4051847