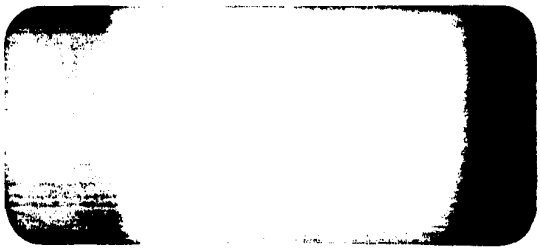
Environment Canada

Environnement Canada

Environmental Protection Service

Service de la protection de l'environnement



MONS 002010

file PCB Canada

PCB HANDBOOK

For the Management of
Electrical Equipment and Wastes
Containing Polychlorinated Biphenyls

Prepared by: **Stothert Engineering Ltd.**

Contract OSB77-08285 for:
Regional Program Report 79-19

Environmental Protection Service
Department of Fisheries and Environment
March 1979

MONS 002011

PREFACE

This handbook was prepared by Stothert Engineering Ltd. of Vancouver, B.C. to fulfill part of a contract with the Environmental Protection Service of Environment Canada, Pacific and Yukon Region to develop guidelines for the management of electrical equipment and wastes containing polychlorinated biphenyls (PCBs), and to investigate the use of PCB-filled electrical equipment in British Columbia industry. The guidelines presented in this handbook were developed to provide a national code of good practise for the safe handling, management and disposal of PCBs and PCB-containing electrical equipment.

The handbook consists of eight booklets providing comprehensive information on PCB management that will be useful to many companies or institutions. Some booklets may be of greater interest and applicability to certain individuals or companies (e.g., those involved in disposal, electrical servicing, etc.), and individual booklets as well as the entire manual are available from the Environmental Protection Service Regional Offices listed in the handbook. Each booklet has a cross-reference index so the reader of any individual booklet can be aware of other topics in the booklet series he may be interested in or require.

Inquiries pertaining to the contents of this manual should be directed to the Environmental Protection Service Regional Offices listed in the handbook.

MONS 002012

Guide des BPC pour la gestion du matériel électrique et des déchets contenant des biphényles polychlorés

---

La réalisation du présent guide par Stothert Engineering Ltd. de Vancouver repond à certains termes d'un marché passé avec la Region du Pacifique et du Yukon du SPE en vue d'élaborer des lignes directrices nationales pour la gestion (y compris la manutention et l'élimination) sûre du matériel électrique et des déchets contenant des BPC et d'étudier l'usage de ce matériel dans l'industrie de la Colombie-Britannique.

Le guide comprend huit brochures où les entreprises privées et les organismes publics pourront trouver tous les renseignements sur la gestion des BPC. Comme certaines brochures peuvent être plus utiles que les autres à certaines personnes ou entreprises (par ex., du secteur de l'élimination ou de l'entretien), on peut se les procurer individuellement ou toutes des bureaux régionaux du SPE énumérés dans le guide. Chaque brochure contient un index complet qui renvoie aussi aux autres brochures.

Pour plus de renseignements sur la teneur de guide, s'adresser aux bureaux régionaux du SPE énumérés dans le guide.

MONS 002013

Booklet 1

BOOKLET 1:

INTRODUCTION TO PCBs

Prepared by:

Stothert Engineering Ltd.
Vancouver, B.C.

Contract OSB77-08285 for:

Environmental Protection Service,
Department of Fisheries and Environment
March 1979

MONS 002015

CROSS - REFERENCE INDEX

			PAGE
BOOKLET 1:	INTRODUCTION TO PCBs		
	1.1	What are PCBs?	1-2
	1.2	Hazards of PCB	1-3
	1.3	How Does PCB - Contamination Occur?	1-4
	1.4	Is PCB Still Available?	1-5
	1.5	Federal Government Legislation On PCB	1-6
	1.6	The Future	1-8
	1.7	Appendix	1-9
BOOKLET 2:	IDENTIFYING PCBs		
	2.1	Brand Names For PCB	2-2
	2.2	Identifying PCB Transformers	2-3
	2.3	Identifying PCB Capacitors	2-6
	2.4	Identifying PCB Liquids	2-8
	2.5	New Labelling System For PCB	2-10
	2.6	Appendix	2-15
BOOKLET 3:	PREVENTIVE MAINTENANCE FOR PCB EQUIPMENT		
	3.1	General	3-2
	3.2	Anatomy Of A Transformer	3-3
	3.3	Typical Problems With Transformers	3-7
	3.4	Preventive Maintenance Program For Transformers	3-9
	3.5	Anatomy Of A Capacitor	3-13
	3.6	Typical Problems With Capacitors	3-14
	3.7	Preventive Maintenance Program For Capacitors	3-15
	3.8	Appendix	3-17

PAGE

BOOKLET 4: HANDLING OF PCB LIQUID, EQUIPMENT AND MATERIALS FOR MAINTENANCE AND DISPOSAL

4.1	General	4-2
4.2	Safe Handling	4-3
4.3	Collection of Askarel	4-6
4.4	Containment For Disposal	
	- Capacitors	4-7
	- Transformers	4-8
	- Askarel Liquid	4-9
	- Solid Wastes	4-9
4.5	Labelling of PCB Wastes and Discarded Equipment	4-10
4.6	Appendix	4-12

BOOKLET 5: STORAGE OF PCB LIQUID, EQUIPMENT AND MATERIALS

5.1	General	5-2
5.2	Selecting A Storage Site	5-3
5.3	Ideal Storage Facilities	5-4
5.4	Precautionary Guidelines	5-7
5.5	Fire Fighting Safety	5-8
5.6	Labelling in Storage Area	5-9
5.7	Record-Keeping	5-13
5.8	Appendix	5-17

BOOKLET 6: CONTAINMENT SYSTEMS AND CLEAN-UP PROCEDURES FOR PCB

6.1	General	6-2
6.2	What Kind Of Askarel Releases Can Occur?	6-3
6.3	Containment Systems	6-5
6.4	Clean-Up Procedures	6-9
6.5	Appendix	6-13

PAGE

BOOKLET 7: TRANSPORTATION PROCEDURES FOR PCB

7.1	General	7-2
7.2	Necessary Arrangements	7-3
7.3	Packaging and Transport Methods	7-4
7.4	Precautionary Guidelines	7-6
7.5	Labelling	7-7
7.6	Appendix	7-9

BOOKLET 8: SUBSTITUTE CHEMICALS FOR PCB

8.1	General	8-2
8.2	Alternatives Available	8-3
8.3	Factors to Consider	8-4
8.4	Appendix	8-7

FOREWORD

This booklet is number 1 in a series of 8 that have been written to answer the questions of the public concerning the proper management of PCB chemicals, particularly as they are used in electrical equipment. PCB is also known as "askarel" when used in such equipment.

This series will be of special interest to the following companies since they will at some time be working with PCBs.

Companies These Booklets Are Written For

- Owners of PCB Equipment
- Electrical Testing Laboratories
- Garbage and Waste Collection Companies
- Transportation Companies
- Scrap Metal Dealers
- Salvage Companies

Under proper control, the equipment using PCBs can provide an important benefit to man, but without proper control they can also pose a serious threat to human health and the environment.

For general enquiries or assistance in emergency situations, contact the nearest Environmental Protection office listed in the back of this booklet.

1.1 WHAT ARE PCBs?

PCB or Polychorinated Biphenyl is the scientific name for a man made liquid chemical that has the unique characteristics of being highly stable, non-corroding, and very fire resistant. There are several different chemical varieties of PCB.

These and other unique characteristics have made it an ideal choice for use inside certain electrical equipment. Its insulating properties prevent internal arcing, and its excellent thermal properties conduct heat away from critical internal areas very efficiently. All of these properties are essential to preventing the outbreak of a fire in electrical equipment.

Since the 1930s, PCB has been widely used in electrical transformers and electrical capacitors. When used in such equipment, PCB is called "askarel". The PCB is part of a blend with other chemicals.

PCB, or askarel, should not be confused with mineral oil. Mineral oil is sometimes used in the same equipment as an alternative to askarel.

Other Applications of PCB

Besides being used in electrical equipment, PCBs have been used for a number of years in these types of products: hydraulic fluids, oils, paints, varnishes, resins, inks, carbonless paper, waxes, sealants, adhesives, caulking compounds, plastics, and asphalts. The reason is the attractive properties of the chemical.

PCBs have been used in many common products.

1.2 HAZARDS OF PCB

No electrical equipment will last forever. Eventually it will fail, perhaps even catastrophically while it is in operation. In such an event, there is the possibility that the PCB may contaminate the environment.

Alternatively, such equipment may face an early retirement by being replaced with more modern equipment. Again, with the removal of the equipment there is the possibility that the PCB may contaminate the environment.

From the time that askarel equipment is first installed, the problem of PCB management is extremely important.

The hazards from PCB contamination are serious.

As well as having many attractive chemical properties, PCB has the very unattractive property of essentially being non-biodegradable. This means that PCB will not break down easily in nature.

In fact, studies have shown that certain types of PCB require more than 50 years before they can decompose sufficiently to be acceptable in nature biologically. In the meantime, PCB contamination can do its damage to human health and the environment.

Hazard to the Environment

Scientific observations of marine life, birds and small mammals have shown that PCBs can produce cases of decreased growth in the newborn, interference with the reproduction cycle, degeneration of organ tissues, and mortality.

Several areas in Canada presently have widespread PCB contamination in aquatic life. These include the Great Lakes, the St. Lawrence River, the Atlantic coast and the Pacific coast.

There could, of course, be many other areas which have not been monitored but which could also contain high concentrations of PCB. A small quantity of PCB liquid can cause a high level of contamination in a local area.

PCB is also present in sewage sludge, therefore, caution should be exercised in using sewage sludge as a fertilizer.

Hazard to Human Health

In 1968, over 1,000 people in southwest Japan consumed rice oil which was contaminated by one type of PCB. The contamination resulted from PCB-filled equipment in the food processing plant leaking some of its contents onto a shipment of rice oil. It was an unnoticed industrial accident.

The result was that people who consumed the rice oil over an extended period of time (it was estimated to be approximately 1/2 to 1-1/2 grams of PCB consumed per person) developed cases of skin eruptions, swelling of the eyelids, eye discharge, skin and nail pigmenting, and visual and digestive disturbances. They also had a higher incidence of malignant tumours than would have been expected. Some of the infants born to the poisoned mothers had below normal birth weights and exhibited skin discolourations.

Recent studies have shown that since PCB does not degrade, it can bind itself to cellular tissue, and that this in turn may cause the formation of cancerous tumours.

MONS 002021

1.3 HOW DOES PCB-CONTAMINATION OCCUR ?

The 1968 incident in Japan is an obvious case of PCB poisoning. There are other less obvious ways in which PCB may contaminate the environment and create a hazard to human health.

PCB in Water

PCB which leaks from damaged or rusted electrical equipment or which is spilled onto the ground can eventually seep into streams, rivers and lakes. It may also inadvertently be poured directly into sewage drains for disposal.

Once into the environment, the PCB contamination can be accumulated in the bodies of all types of life. The contamination is then passed on through the "food chain". For example: fish will ingest PCB in the water; game and animals will consume the contaminated fish; and man will consume the contaminated fish, game, and animals.

PCB in Air

Liquid PCB will vaporize and become airborne through improper incineration. It will then be dispersed by the wind and deposited back to the earth in rain and snowfall. For this reason, askarel liquids and other products containing PCB should never be burned.

Scientists are presently studying the feasibility of using special high temperature furnaces having temperatures in excess of 1000° C., for the destruction of PCBs.

Exposure on the Job

Some individuals who are involved in maintenance of electrical transformer and capacitors, or who are involved in the clean up of askarel leakage can accidentally come into contact with the liquid.

If askarel is accidentally splashed on unprotected skin it can cause some types of skin irritation. The extent of the irritation depends upon how long the askarel is allowed to remain on the skin. Prolonged contact on unprotected, sensitive skin can lead to drying, chapping or perhaps the development of a rash.

These skin irritations are surface conditions only. In addition, they are not contagious so they will not be passed from one person to another. Similar conditions may also result from exposure to paint thinners.

Government Standards of Contamination

Government standards declare that any substance that contains more than 0.01% by weight or 100 ppm of PCB is considered to be contaminated, and must be treated as a PCB substance. Examples include:

- askarel fluids
- mineral oil contaminated with PCB
- certain hydraulic & heat exchange fluids
- rinsing solvents
- components from askarel-filled transformers & capacitors, & heat transfer systems
- containers for PCB waste & unused fluids

Since one electrical transformer can contain upwards of 100 gallons of PCB askarel, this amount, if allowed to reach a water system, could potentially contaminate a very large area.

In actual fact, however, unless the askarel from a spill is strongly agitated by waves, etc., it will tend to collect in pools at the bottom of the water body. The level of contamination will decrease as the distance from these pools increase.

Unfortunately, once traces of PCB are in water, they cannot easily be removed by filtering, adding chemicals or boiling. Nor

can the contamination be seen with the naked eye.

For more information on the extent of contamination that can occur with PCB, see Booklet 6 under "Clean Up Procedures".

1.4 IS PCB STILL AVAILABLE?

PCBs have always been imported into Canada rather than being manufactured here. There are presently no known manufacturers of PCBs in Canada.

In 1971, the major importer of PCB liquids into Canada began restricting the sale of the product, selling only to electrical equipment manufacturers from that point on. In 1977, the major supplier of PCBs to North America discontinued production of these chemicals altogether.

PCBs are still available from other countries, but with the introduction of new Federal regulations under the Environmental Contaminants Act, it will be prevented from being imported into the country.

Manufacturers are presently working on developing substitute chemicals to replace PCBs in many applications.

1.5 FEDERAL GOVERNMENT LEGISLATION ON PCBs

PCBs are everywhere in the environment. They are in varying concentrations in water, air, soil, sewage sludge, and in many types of life.

To prevent further concentrations of PCB from contaminating the environment, the Government of Canada has been preparing special regulations under the Environmental Contaminants Act. These regulations will ban the use of PCBs in certain applications in the future. The ban will, however, allow PCBs to be used in certain other applications where control can be maintained to prevent contamination of the environment.

The Canadian Environmental Contaminants Act is in addition to the Federal Fisheries Act, which is already in effect to prosecute individuals who discharge or who allow to be discharged, harmful substances such as PCB into waters frequented by fish. See the Appendix for a fact sheet on the Environmental Contaminants Act. The United States also has regulations pertaining to the control of PCBs.

The regulations under the Environmental Contaminants Act are included in the Appendix of this booklet. Interpretations of the regulations are provided here for reference purposes:

Initial Regulations

As of September 1, 1977, the following restrictions were in effect under the Environmental Contaminants Act:

1. The regulation produced the restriction that certain products may no longer be manufactured in Canada or imported into the country if they contain PCB. These products include:

   - Paints
   - Varnishes
   - Laquers
   - Resins
   - Inks
   - Pigments
   - Waxes
   - Adhesives
   - Caulking compounds
   - Sealants
   - Carbonless copy paper
   - Hydraulic fluid
   - Cutting oils
   - Oils
   - Lubricants
   - Rubbers
   - Petroleum additives
   - Plasticizers
   - Pesticide extenders
   - Dedusting agents
   - Fire retardants
   - Heat transfer fluids
   - Vapour diffusion fluids

   Such products are still allowed if substitute chemicals for PCB are used.

2. Certain equipment and machinery may no longer be manufactured in Canada or imported into the country if it uses PCBs. These include:

   - Heat transfer equipment
   - Hydraulic equipment
   - Vapour diffusion pumps

3. PCB may not be used for operating, servicing or maintaining any new installation of the types of equipment and machinery listed in item 2.

These initial regulations did not apply to any PCB products, equipment or machinery which were manufactured in or imported into Canada before September 1, 1977. The intention was to prevent any new uses or installations of PCB in Canada, except for electrical capacitors, electrical transformers and associated switchgear.

Proposed Regulations

Proposed amendments to the intitial regulation would include these restrictions as of January 1, 1979:

1. PCB may not be used for operating, servicing or maintaining any new or already installed equipment and machinery such as:

   - Heat transfer equipment
   - Hydraulic equipment
   - Vapour diffusion pumps

2. The following electrical equipment will no longer be allowed to be manufactured in Canada or imported into the country if it uses PCBs:

   - Electrical capacitors
   - Electrical transformers
   - Electrical switchgear

3. PCBs will not be allowed for servicing electrical capacitors. These capacitors will have to be disposed of instead.

4. PCBs will not be allowed as a new filling or for make-up fluid in the servicing of electrical transformers or electrical switchgear. Substitute chemicals will have to be used instead.

The Federal Government is also considering regulations which would pertain to:

- the control of PCB releases to the environment.
- record-keeping of PCB equipment and PCB-wastes.
- a resale prohibition on used PCB equipment and machinery.

The PCB regulations may appear very demanding; however, they are designed to protect the Canadian public. At the present time there are no other feasible alternatives for halting the increasing contamination of our environment.

Note

The interpretation of these regulations is that of Stothert Engineering Ltd. and does not necessarily represent an interpretation by the Government of Canada. This interpretation is also limited to the *Chlorobiphenyl Regulations* No. 1 and the proposed amendment shown in the Appendix of this booklet.

Changes to the proposed amendment are presently being considered by the Environmental Protection Service. When the final regulations are available, this page will be revised and reissued to all in receipt of this booklet.

MONS 002025

1.6 THE FUTURE

Due to the limited supply of PCBs in recent years, and due to the increasing knowledge about the hazards of PCB, many manufacturers of transformers and capacitors discontinued production of their equipment, before the regulations came into effect.

The future holds many challenges.

There are a tremendous number of products presently in use or in storage which contain PCBs. Now comes the challenge of keeping watch over these PCB products, equipment and machinery to ensure that no situations develop which could accidentally release quantities of PCB into the environment.

It is hoped that this booklet along with the other seven in this series will provide the informative instructions to meet that challenge.

1.7

APPENDIX

ENVIRONMENTAL PROTECTION SERVICE OFFICES

Region	Address	Telephone
Pacific	Environmental Protection Service Kapilano 100 Park Royal West Vancouver, B.C. V7T 1A2	Emergency (604) 666-6100 Office (604) 666-6711
Northwest	Environmental Protection Service Room 804 9942 - 108th Street Edmonton, Alberta T5K 2J5	Emergency (403) 425-5128 Office (403) 425-5128
Ontario	Environmental Protection Service 7th Floor 25 St. Clair Avenue East Toronto, Ontario M4T 1M2	Emergency (416) 966-5840 Office (416) 966-5840
Quebec	Environmental Protection Service 4th Floor 1550 de Maisonneuve Blvd. West Montreal, Quebec H3G 1N2	Emergency (514) 283-2333 Office (514) 283-2345
Atlantic	Environmental Protection Service 16th Floor, Bank of Montreal Tower 5151 George Street Halifax, N.S. B3J 1M5	Emergency (902) 426-6200 Office (902) 426-6141

MONS 002028

Registration
SOR/77-734 7 September, 1977

ENVIRONMENTAL CONTAMINANTS ACT

Chlorobiphenyl Regulations No. 1

P.C. 1977-2470 31 August, 1977

Whereas a copy of the proposed Regulation substantially in the form set out in the schedule hereto, was published in the *Canada Gazette* Part I on February 26, 1977;

And Whereas no notice of objection was filed with the Minister pursuant to subsection 5(3) of the Environmental Contaminants Act,

Therefore, His Excellency the Governor General in Council, on the recommendation of the Minister of Fisheries and the Environment and the Minister of National Health and Welfare, pursuant to paragraph 18(*c*) of the Environmental Contaminants Act, is pleased hereby to make the annexed Regulations prescribing certain uses in respect of which certain chlorobiphenyls may not be used.

REGULATIONS PRESCRIBING CERTAIN USES IN RESPECT OF WHICH CERTAIN CHLOROBIPHENYLS MAY NOT BE USED

Short Title

1. These Regulations may be cited as the *Chlorobiphenyl Regulations No. 1*.

Interpretation

2. In these Regulations,

"Act" means the *Environmental Contaminants Act*;

"chlorobiphenyls" means those chlorobiphenyls that have the molecular formula $C_{12}H_{10-n}Cl_n$ in which "n" is greater than 2;

"Minister" means the Minister of the Environment.

Prescription of Uses

3. For the purpose of subsection 8(2) of the Act, the following commercial, manufacturing and processing uses are hereby prescribed effective September 1, 1977, as uses in respect of which chlorobiphenyls may not be used:

(*a*) use in the operation, servicing or maintenance of any product, machinery or equipment other than

(*i*) electrical capacitors, electrical transformers and associated switchgear and machinery or equipment used to manufacture electrical capacitors, electrical transformers and associated switchgear,

(ii) heat transfer equipment, hydraulic equipment and vapour diffusion pumps that were designed to use

Enregistrement
DORS/77-734 7 septembre 1977

LOI SUR LES CONTAMINANTS DE L'ENVIRONNEMENT

Règlement sur les biphényles chlorés (n° 1)

C.P. 1977-2470 31 août 1977

Vu qu'une copie du Règlement proposé essentiellement dans la forme exposée à l'annexe ci-après a été publiée dans la *Gazette du Canada* (Partie I) le 26 février 1977;

Et vu qu'aucune objection n'a été formulée au ministre en vertu du paragraphe 5(3) de la Loi sur les contaminants de l'environnement,

A ces causes, sur avis conforme du ministre des Pêcheries et de l'Environnement ainsi que du ministre de la Santé nationale et du Bien-être social et en vertu de l'alinéa 18 *c*) de la Loi sur les contaminants de l'environnement, il plaît à Son Excellence le Gouverneur général en conseil de mettre en vigueur le Règlement ci-annexé interdisant certains emplois de certains biphényles chlorés.

RÈGLEMENT INTERDISANT CERTAINS EMPLOIS DE CERTAINS BIPHÉNYLES CHLORÉS

Titre abrégé

1. *Règlement sur les biphényles chlorés (n° 1)*.

Définitions

2. On entend par

«biphényles chlorés» les byphényles dont la formule moléculaire est $C_{12}H_{10-n}Cl_n$ où «n» est plus grand que 2,

«loi» la *Loi sur les contaminants de l'environnement*,

«ministre» le ministre de l'Environnement.

Emplois interdits

3. Pour l'application du paragraphe 8(2) de la Loi, les emplois suivants des biphényles chlorés dans le commerce, la fabrication et la transformation sont interdits à compter du 1er septembre 1977:

a) les emplois dans l'exploitation, la réparation et l'entretien de tout produit, machinerie ou équipement sauf:

(i) les condensateurs électriques, les transformateurs électriques et l'appareillage connexe et la machinerie ou l'équipement servant à leur fabrication,

(ii) tout matériel de transfert de la chaleur, tout matériel hydraulique ou toute pompe à diffusion de vapeur utilisés au Canada avant le 1er mars 1977 et dont la conception exige l'emploi de biphényles chlorés et

MONS 002029

chlorobiphenyls and were in use in Canada before March 1, 1977, and

(iii) machinery or equipment, the operation of which is intended to destroy the chemical structure of chlorobiphenyls; and

(*b*) use as a constituent of any machinery, equipment or product manufactured in or imported into Canada after September 1, 1977 other than electrical capacitors, electrical transformers and associated switchgear.

(iii) la machinerie ou l'équipement destinés à détruire la structure chimique des biphényles chlorés et

b) les emplois dans les produits, la machinerie ou l'équipement fabriqués ou importés au Canada après le 1er septembre 1977, sauf les condensateurs électriques, les transformateurs électriques et l'appareillage connexe.

QUEEN'S PRINTER FOR CANADA, OTTAWA, 1977 IMPRIMEUR DE LA REINE POUR LE CANADA, OTTAWA, 1977

MONS 002030

DEPARTMENT OF FISHERIES AND THE ENVIRONMENT

ENVIRONMENTAL CONTAMINANTS ACT

Proposed Amendment to Chlorobiphenyl Regulations No. 1

Notice is hereby given, pursuant to subsection 5(2) of the Environmental Contaminants Act, that the Minister of the Environment and the Minister of National Health and Welfare

(*a*) have consulted with the governments of the provinces and appropriate departments and agencies of the Government of Canada pursuant to subsection 5(1) of that Act in order to determine whether the significant danger that the entry of chlorobiphenyls into the environment will constitute in Canada to human health or the environment will be eliminated by any action taken or proposed to be taken pursuant to any other law;

(*b*) are satisfied that the significant danger referred to in paragraph (*a*) will not be eliminated by any action taken or proposed to be taken pursuant to any other law; and

(*c*) propose to recommend to the Governor General in Council that Chlorobiphenyl Regulations No. 1 made by Order in Council P.C. 1977-2470 of 31 August, 1977 be amended pursuant to paragraph 18(*c*) of the Environmental Contaminants Act to further restrict the use of chlorobiphenyls in accordance with the following schedule.

Any person having an interest therein may within sixty days of the publication of this notice file a notice of objection with the undersigned.

Given at Ottawa, this seventh day of November, 1978

LEN MARCHAND
Minister of the Environment

MINISTÈRE DES PÊCHES ET DE L'ENVIRONNEMENT

LOI SUR LES CONTAMINANTS DE L'ENVIRONNEMENT

Projet de modification au Règlement sur les biphényles chlorés (nº 1)

Avis est par les présentes donné, conformément au paragraphe 5(2) de la *Loi sur les contaminants de l'environnement*, que le ministre de l'Environnement et le ministre de la Santé nationale et du Bien-être social

a) ont consulté les gouvernements des provinces ainsi que les ministères et organismes compétents du gouvernement du Canada, selon le paragraphe 5(1) de ladite Loi, afin de déterminer si le danger réel que constitue pour la santé ou l'environnement la présence des biphényles chlorés dans l'environnement au Canada, sera éliminé par des mesures prises ou projetées en application de quelque autre loi,

b) sont convaincus que le danger visé à l'alinéa *a*) ne sera pas éliminé par les mesures en question, et

c) se proposent de recommander au gouverneur général en conseil qu'il modifie, conformément à l'alinéa 18*c*) de la *Loi sur les biphényles chlorés (nº 1)*, le *Règlement sur les biphényles chlorés (nº 1)* établi par le décret C.P. 1977-2470 du 31 août 1977, afin de réduire davantage l'emploi des biphényles chlorés.

Tout intéressé peut, dans les soixante jours de la publication de cet avis, déposer un avis d'opposition auprès du soussigné.

Ottawa, ce 7e jour de novembre 1978

Le ministre d'État (environnement)
LEN MARCHAND

SCHEDULE

1. Section 3 of the Chlorobiphenyl Regulations No. 1 is revoked and the following substituted therefor:

"3. For the purpose of subsection 8(2) of the Act, the following commercial, manufacturing and processing uses are hereby prescribed as uses in respect of which chlorobiphenyls may not be used:

(*a*) effective January 1, 1979, use in the operation of any product, machinery or equipment other than

(i) electrical capacitors, electrical transformers and associated switchgear;

(ii) heat transfer equipment, hydraulic equipment, electromagnets, and vapour diffusion pumps that were designed to use chlorobiphenyls and were in use in Canada before March 1, 1977; and

(iii) machinery or equipment, the operation of which is intended to destroy the chemical structure of chlorobiphenyls;

ANNEXE

1. L'article 3 du *Règlement nº 1 sur les biphényles chlorés* est ainsi remplacé:

«3. Aux fins du paragraphe 8(2) de la Loi, les emplois suivants des biphényles chlorés dans les opérations commerciales, la fabrication et la transformation sont interdits:

a) à compter du 1er janvier 1979, dans l'exploitation de tout produit, machinerie ou équipement sauf:

(i) les condensateurs électriques, les transformateurs électriques et l'appareillage connexe;

(ii) l'équipement de transfert de chaleur, l'équipement hydraulique, les électro-aimants et les pompes à diffusion de vapeur conçus pour utiliser des biphényles chlorés et mis en service au Canada avant le 1er mars 1977;

(iii) la machinerie ou l'équipement destinés à détruire la structure chimique des biphényles chlorés;

MONS 002031

(*b*) effective January 1, 1979, use in the operation of electromagnets that are used to handle food, animal feed or anything intended to be added to food or animal feed for any purpose whatsoever;

(*c*) use as a constituent of any product, machinery or equipment manufactured in or imported into Canada after September 1, 1977, other than electrical capacitors, electrical transformers and associated switchgear;

(*d*) use as a constituent of electrical capacitors, electrical transformers and associated switchgear manufactured in or imported into Canada after January 1, 1979;

(*e*) use, after January 1, 1979, in the servicing or maintenance of any product, machinery or equipment, other than electrical transformers and associated switchgear; and

(*f*) use, after January 1, 1979, as new filling or as make-up fluid in the servicing or maintenance of any electrical transformer or associated switchgear."

(48-1-o)

b) à compter du 1er janvier 1979, dans l'exploitation d'électro-aimants qui servent à manutentionner les aliments destinés à l'homme et aux animaux ou leurs additifs;

c) dans les produits, la machinerie ou l'équipement fabriqués ou importés au Canada après le 1er septembre 1977, sauf les condensateurs électriques, les transformateurs électriques et l'appareillage connexe;

d) dans les condensateurs électriques, les transformateurs électriques et l'appareillage connexe fabriqués ou importés au Canada après le 1er janvier 1979;

e) après le 1er janvier 1979, dans la réparation et l'entretien des produits, de la machinerie ou de l'équipement autres que les transformateurs électriques et l'appareillage connexe; et

f) après le 1er janvier 1979, comme nouveau fluide de remplissage ou comme fluide d'appoint pour la réparation ou l'entretien des transformateurs électriques et l'appareillage connexe.»

(48-1-o)

MONS 002032

Environment Canada Environnement Canada

Health and Welfare Canada Sante et Bien-etre social Canada

FACT SHEET

Environmental Protection Service

MONS 002033

Number 4

Environmental Contaminants Act

The Nature of the Problem

Many substances enter the environment in quantities, concentrations or under conditions that harm the environment and thereby men. The Environmental Contaminants Act is designed to assist in protecting human health and the environment from such substances.

Where a substance is known to pose a direct threat to human health, controls can be imposed under present federal and provincial legislation. However, many substances may not pose a direct threat but, through their release to the environment, may cause long-range adverse effects to ecological systems and may also pose an indirect threat to human health.

In addition to a variety of potential adverse health effects, the consequences of contamination of the environment by substances include a loss of food species, curtailment of important economic activities and a variety of irreversible ecological changes that threaten man's future use and enjoyment of the living world.

The most troublesome substances have some common characteristics:

- they may become widely dispersed in the environment;
- they may be highly persistent and accumulate indefinitely in the environment;
- they may be accumulated in biological tissues and pass through food chains;
- they may cause biological changes at trace concentrations;
- they may be irretrievable once dispersed in the environment and
- they may enter the environment in many ways from a large number of sources.

The magnitude of the problem is difficult to visualize but some relevant facts are available.

- A few million chemicals are known to science. Of these, according to a Japanese Government list, about 20,000 are in commercial use.
- The U.S. Department of Health, Education and Welfare has a published list of 15,000 toxic chemicals, an unknown number of which are in commercial use.
- It has been estimated on the basis of U.S. information that about 500 new chemicals are introduced into commercial use each year and it is estimated that about 10% of these new chemicals are likely to cause concern.

Effective management of new substances that enter commerce requires investigation and prediction (of their biological effects and of how they enter the environment) and the application of controls designed to prevent their entry into the environment in quantities, concentrations or under conditions deemed unacceptable.

The government is concerned about the lack of pertinent knowledge of the safety or hazard of existing chemicals and new chemicals. It is concerned about the variety of new widespread uses of existing chemicals. It is concerned about the introduction of new chemicals into commercial use.

The Sphere of the Environmental Contaminants Act

There are a number of federal and provincial laws that deal directly or indirectly with contamination of the environment. There are three categories:

a) Media-oriented legislation (e.g. Fisheries Act, Clean Air Act), which seeks to control the discharge of pollutants into a given medium, e.g. water or air.

b) Product-oriented legislation (e.g. Hazardous Products Act), which deals with certain products and their constituent chemical components with respect to their hazard to man.

c) Substance-oriented legislation (e.g. Pest Control Products Act) whereby the adverse effects of potentially dangerous substances are reviewed and the use of the chemicals may be restricted.

The new Environmental Contaminants Act is in category c) and provides the government with the power to obtain a systematic overview of the problem of contamination of the environment by a substance regardless of source, use, product or media, and to apply the appropriate controls, if necessary, in those cases where other legislative authority does not exist or is not used.

The Act has four characteristics:

a) The focus is upon substances

b) It is comprehensive. All relevant facets of production, use, disposal and sources of entry of a substance into the environment can be examined to find out what controls, if any, should be imposed. No special activities are exempted from the ambit of the Act.

c) Because of its comprehensive scope, it was necessary within the Act itself to define the relationship of the Environmental Contaminants Act to other laws in the application of controls. The Act is designed to operate as a back-up to other laws, federal or provincial. The control provision is intended to apply only where other authorities fail or neglect to implement appropriate controls. These control provisions of the Act are intended to be residuary.

d) Because of the long term nature of problems created by environmental contaminants, the gov-

ernment intends to stress the preventive aspects of the Act. For this to be effective, one must know or be able to predict what is likely to take place in the future. For example, it is necessary to know or to be able to predict biological effects of chemicals present in the environment at trace concentrations. Hence the Act contains wide powers to collect information *and to require testing.*

Main Features of the Act

The Act has two main features. One is the power to undertake systematic investigation of substances or classes of substances in order to determine their fate in commerce and in the environment. Under Section 4, industry may be required to submit data on imports and production as well as details of processes, impurities and losses to the environment. Furthermore, industries may be required to carry out tests respecting the physical, chemical and biological properties of selected substances to improve the understanding of what threats they may pose. An integral part of the investigation will be an assessment of the potential impact of a substance, leading to a risk decision by the Government as to first, the likelihood of the entry of that substance into the environment, and second, whether it constitutes a significant danger to *human health or the environment.*

The other main feature of the Act is concerned with controls. Sections 8 and 18 of the Act which should be read together contain comprehensive powers to restrict or prohibit

1. the release of a named substance into the environment
2. the use of that substance for certain purposes, or
3. the incorporation of it in a manufactured product.

Controls under the Act will be effected by adding a substance or class of substances to a schedule to the Act and by prescribing regulations to prevent the entry of the substance into the environment in quantities, concentrations or under conditions deemed unacceptable. The Schedule, therefore, will be a list of substances and classes of substances that the Government believes pose a significant danger to human health and the environment, and for which regulations have been prescribed under the Act.

Other Features of the Act

Subsection 4(6) requires companies that manufacture or import a chemical compound for the first time in excess of 500 kilograms in a year to notify the Government. The notification must include the name of the chemical compound, of the quantity produced or imported and of any information the company has regarding the chemical's hazards. This provision of the Act will alert the Government to new chemicals that are attaining commercial importance. Subsection 3(1) requires companies to detail their immediate past and future trade in these chemicals to be specified from time to time. It will also enable the Government to identify, in advance, the prospective increase in the commercial use of a chemical and thereby to obtain a warning of possible future difficulties with it.

If the Government becomes concerned about a substance or class of substances presently in commercial use, it may, under Subsection 4(1), require companies dealing in that substance to supply the Government with information, to assist in an evaluation of its safety or hazard.

Before publishing the proposed regulations and scheduling a substance, the Government must, under Subsection 5(1), offer to consult the provinces.

Within sixty days of publication of the terms of a proposed regulation control under the Act, a company may, under Section 6, require a Board of Review. The Board will inquire into the nature of the danger posed by the substance and shall give interested and knowledgeable persons an opportunity to be heard. After the Board has issued its report the government may add that substance to the Schedule and prescribe regulations for its control.

The Government may take action to deal with emergencies but may have to establish a Board of Review.

The Act contains several sections concerning enforcement such as inspection, seizure, analysis. These sections are similar in form and intent to those found in other federal acts. Those persons not complying with the regulations, are liable to fines of up to $100,000 or to imprisonment for up to 2 years.

Administration of the Act

The Act is the joint responsibility of the Departments of Environment and National Health and Welfare. The latter will be concerned with human health matters and Environment Canada will assess the ecological and environmental impact of chemicals. Environment Canada, through the Environmental Contaminants Control Branch, will administer the Act in cooperation with other D.O.E. Services and National Health and Welfare. As indicated in Section 3 of the Act, the advice and support of a variety of agencies, federal, provincial and non-governmental, will be sought and used. This will be particularly important in the development and effective implementation of the preventive aspect of the Act, which requires an Early Warning System to pinpoint problems and to predict future levels of environmental contaminants and their hazards.

MONS 002034

For more information,

Public information,
Environmental Protection Service,
Environment Canada,
Ottawa, Ontario,
K1A 0H3.

or

Any regional office of the
Environmental Protection Service
of Environment Canada.

Booklet 2

MONS 002035

BOOKLET 2:

IDENTIFYING PCBs

Prepared by:

Stothert Engineering Ltd.
Vancouver, B.C.

Contract OSB77-08285 for:

Environmental Protection Service,
Department of Fisheries & Environment
March 1979

MONS 002036

CROSS - REFERENCE
INDEX

			PAGE
BOOKLET 1:		INTRODUCTION TO PCBs	
	1.1	What are PCBs?	1-2
	1.2	Hazards of PCB	1-3
	1.3	How Does PCB - Contamination Occur?	1-4
	1.4	Is PCB Still Available?	1-5
	1.5	Federal Government Legislation On PCB	1-6
	1.6	The Future	1-8
	1.7	Appendix	1-9
BOOKLET 2:		IDENTIFYING PCBs	
	2.1	Brand Names For PCB	2-2
	2.2	Identifying PCB Transformers	2-3
	2.3	Identifying PCB Capacitors	2-6
	2.4	Identifying PCB Liquids	2-8
	2.5	New Labelling System For PCB	2-10
	2.6	Appendix	2-15
BOOKLET 3:		PREVENTIVE MAINTENANCE FOR PCB EQUIPMENT	
	3.1	General	3-2
	3.2	Anatomy Of A Transformer	3-3
	3.3	Typical Problems With Transformers	3-7
	3.4	Preventive Maintenance Program For Transformers	3-9
	3.5	Anatomy Of A Capacitor	3-13
	3.6	Typical Problems With Capacitors	3-14
	3.7	Preventive Maintenance Program For Capacitors	3-15
	3.8	Appendix	3-17

PAGE

BOOKLET 4: HANDLING OF PCB LIQUID, EQUIPMENT AND MATERIALS FOR MAINTENANCE AND DISPOSAL

4.1	General	4-2
4.2	Safe Handling	4-3
4.3	Collection of Askarel	4-6
4.4	Containment For Disposal	
	- Capacitors	4-7
	- Transformers	4-8
	- Askarel Liquid	4-9
	- Solid Wastes	4-9
4.5	Labelling of PCB Wastes and Discarded Equipment	4-10
4.6	Appendix	4-12

BOOKLET 5: STORAGE OF PCB LIQUID, EQUIPMENT AND MATERIALS

5.1	General	5-2
5.2	Selecting A Storage Site	5-3
5.3	Ideal Storage Facilities	5-4
5.4	Precautionary Guidelines	5-7
5.5	Fire Fighting Safety	5-8
5.6	Labelling in Storage Area	5-9
5.7	Record-Keeping	5-13
5.8	Appendix	5-17

BOOKLET 6: CONTAINMENT SYSTEMS AND CLEAN-UP PROCEDURES FOR PCB

6.1	General	6-2
6.2	What Kind Of Askarel Releases Can Occur?	6-3
6.3	Containment Systems	6-5
6.4	Clean-Up Procedures	6-9
6.5	Appendix	6-13

MONS 002038

			PAGE
BOOKLET 7:	TRANSPORTATION PROCEDURES FOR PCB		
	7.1	General	7-2
	7.2	Necessary Arrangements	7-3
	7.3	Packaging and Transport Methods	7-4
	7.4	Precautionary Guidelines	7-6
	7.5	Labelling	7-7
	7.6	Appendix	7-9
BOOKLET 8:	SUBSTITUTE CHEMICALS FOR PCB		
	8.1	General	8-2
	8.2	Alternatives Available	8-3
	8.3	Factors to Consider	8-4
	8.4	Appendix	8-7

FOREWORD

This booklet is number 2 in a series of 8 that have been written to answer the questions of the public concerning the proper management of PCB chemicals, particularly as they are used in electrical equipment. PCB is also known as "askarel" when used in such equipment.

This series will be of special interest to the following companies since they will at some time be working with PCBs.

Companies These Booklets Are Written For

- Owners of PCB Equipment
- Electrical Testing Laboratories
- Garbage and Waste Collection Companies
- Transportation Companies
- Scrap Metal Dealers
- Salvage Companies

Under proper control, the equipment using PCBs can provide an important benefit to man, but without proper control they can also pose a serious threat to human health and the environment.

For general enquiries or assistance in emergency situations, contact the nearest Environmental Protection office listed in the back of this booklet.

2.1 BRAND NAMES FOR PCB

PCB or Polychlorinated Biphenyl is called askarel when used in electrical equipment. The PCB is in a blend with other chemicals.

The following is an alphabetical listing of most of the different brand names for askarel that are used around the world.

Brand Names For Askarel

Apirolio (Italy)
Aroclor (U.S.A. & Great Britain)
Asbestol
Askarel
Chlorextol
Clophen (Germany)
Clorinol
Diaclor
DK (Decachlorodiphenyl) (Italy)
Dykanol
Elemex
Eucarel
Fenclor (Italy)
Hyvol
1 Inerteen (Canada & U.S.A.)
Kanechlor (Japan)
Montar (U.S.A.)
No-Flamol
Phenoclor (France)
Pydraul (U.S.A.)
Pyralene (France)
2 Pyranol (Canada & U.S.A.)
Pyroclor (Great Britain)
Saf-T-Kuhl
Santotherm FR (Japan)
Therminol FR (U.S.A.)

1 Westinghouse product
2 General Electric product

2.2 IDENTIFYING PCB TRANSFORMERS

The following instructions will provide the necessary information on how to identify whether a transformer contains askarel or mineral oil. Both are commonly used in transformers, but mineral oil does not present the contamination problems of askarel.

Appearance

Transformers containing askarel or mineral oil will have rows of metal tubes on their outside for cooling purposes. The tubes serve the same purpose as the radiator in a car. They could be rounded or slightly flattened in shape and will run down the length of the transformer casing to allow for maximum air circulation around the transformer liquid located inside. Some transformers also have a fan mounted above the tubes to increase air circulation around the tubes.

The only difference in outer appearance between an askarel transformer and a mineral oil transformer will be in size. A mineral oil transformer will be larger than an askarel transformer having the same power handling capacity.

Transformers with no tubes on the outside are a dry type. Such transformers contain no liquids of any kind.

Transformer Locations

Electrical transformers are easy to recognize because of their size. The problem is in knowing where to look for them. These are most likely locations:

Typical Locations For Transformers

- Inside a plant or building (usually along a wall)
- Inside a plant or building (enclosed in a concrete vault or electrical room)
- On the roof
- Underground (usually in mines only)
- Outside on a concrete pad
- Outside on a utility pole

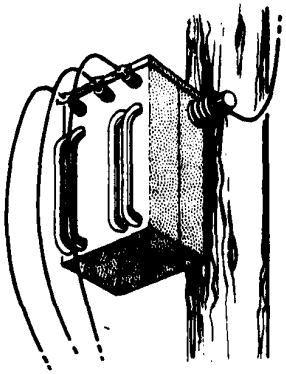
It should be pointed out that some companies may have several transformers installed. Some may be located inside and others may be located outside on a concrete pad.

In most cases, a transformer which is located inside a building, on a roof or underground will contain askarel. The reason is fire safety.

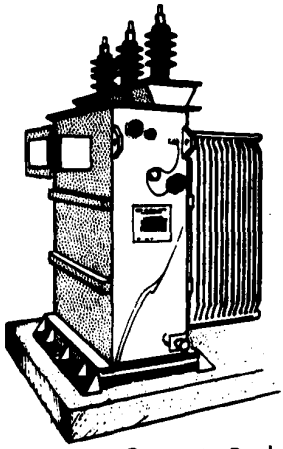
Fire regulations would not allow a transformer to be located in such situations unless it were filled with a nonflammable liquid such as askarel. Mineral oil would not be allowed instead of askarel because it is more flammable and could create a fire hazard if ignited.

The only exception to this rule would be if the transformer were sealed in a specially designed protective vault. Then mineral oil transformers could be used inside a building, on a roof or underground. Vaults are usually made of concrete and have a fire door that must be locked.

LOCATIONS



Utility Pole



Concrete Pad

Caution - The reader is cautioned that some transformers located outdoors could also contain askarel. It would not be required under fire regulations, however, some owners may have decided to use PCB anyway, for fire safety in the area. Such situations are rare since PCB transformers are much more costly than mineral-oil types. Regardless, it should be verified.

Nameplate Information

Most transformers have a metal nameplate or tag mounted on the outside casing to show the name of the manufacturer and provide technical details about the transformer. The nameplate also states what kind of liquid is contained inside (liquid-filled types only) and how many gallons or litres there are.

If the liquid used in a transformer is on the list of brand names in the front of this booklet, then the transformer contains PCB. If the nameplate says oil, then it is filled with mineral oil, not askarel.

On the same nameplate or metal tag, the Type Number will also indicate if the transformer contains askarel. Any Type Number beginning with an "L" indicates askarel is used in the transformer. Some typical Type Numbers are LFAF, LFAN, LFWN, LNAF, LNP, LNS, LNW, LNWN. Any Type Number beginning with an "O" indicates the transformer contains oil, not askarel. One Type Number common for oil-filled transformers is ONAN.

Testing the Liquid

If for any reason it is still not certain what liquid is in a transformer, then a simple test may be done. The instructions are as follows.

1. Clean the drain spout located at the base of the transformer of any dirt by wiping with a clean rag.

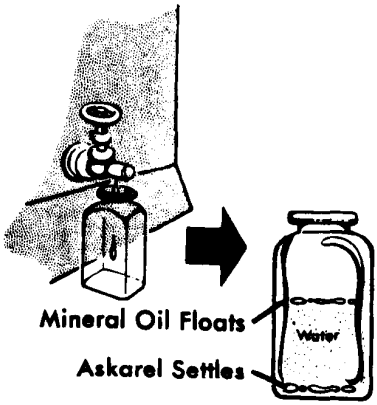
Drain a small quantity of the transformer liquid into a clean glass bottle. Only a few drops are necessary. Add a small quantity of clean water to the bottle.

Pure askarel is heavier than water. Pure mineral oil is lighter than water.

---

2. If the drops of transformer liquid settle to the bottom of the bottle, then the liquid is askarel. Alternatively, if the transformer liquid rises to the top level of the water, then it is mineral oil.

   If the liquid does neither, then it indicates the transformer liquid has been contaminated by impurities from the transformer or from other sources, and should be taken to a testing laboratory for professional analysis. (It is also quite possible for a mineral oil transformer to be contaminated with askarel during topping up. Vice versa for an askarel transformer.)



Caution - Do not pour the contents of the bottle back into the transformer since the water will degrade the electrical performance of the askarel (or mineral oil) in the transformer.

If the test demonstrates that the transformer contains askarel, dispose of the contents of the bottle, and the bottle, as instructed in the booklet in this series concerning the handling and disposal of PCBs (Booklet 4).

MONS 002044

2.3 IDENTIFYING PCB CAPACITORS

Almost every electrical capacitor manufactured since the 1930s has been made with askarel so it must be assumed that all capacitors still in existence today contain PCB.

Capacitors are used primarily by manufacturers and large commercial buildings to correct for low power factor. This produces reduced electrical bills because of the more efficient usage of electrical power.

The following types of electrical equipment cause low power factor, therefore, if any are found on the premises then capacitors will likely be found on the premises also.

Equipment Producing Low Power Factor

-A.C. Motors (three phase and single phase types)
-Induction Furnaces
-Lamp Ballasts (fluorescent, mercury, metal halide, high pressure sodium)
-Electric Welders

Appearance

Capacitors vary in size considerably. The smallest size is used in lamp ballasts where they can be as small as an ice cube. The capacitors have two electrical terminals extending from one end of the hermetically-sealed metal casing.

Larger capacitors are used for power factor correction of motors and electric welders. They may be as large as 4 feet high by 18 inches wide by 9 inches deep, but do vary in size depending upon the horsepower of the motor or electrical load they are correcting. They typically have three electrical terminals in a row extending from the top of the capacitor. Usually the terminals are not obvious due to being covered by a metal box for protection against damage.

In other applications for large capacitors, such as for the correction of induction furnaces, a group of individual capacitors may be wired together side by side in a "bank" to provide even greater power factor correction. The bank may be installed in a metal enclosure for protection against damage. In some instances, the number of capacitors is so large that all of the capacitor banks are installed in a room of their own.

Capacitor Locations

Indoors - Capacitors can be found in a variety of different locations in a plant or building. They can be found secured to the floor, walls, columns, and ceiling or located inside electrical cabinets or attached to individual motor frames.

To assist in locating capacitors inside the building, an electrical wiring diagram for the building would be very useful. It might not show the capacitors, due to the fact that capacitors are sometimes installed long after a plant is built, but it will show the location of the electrical lines, and these can be traced to determine if capacitors are connected to the electrical system.

Typical Locations For Capacitors

-Wired to the electrical terminals of individual A.C. motors (if 30 horsepower and larger), electric welders, induction furnaces.

-In the plant area, wired to buss bars feeding a row of motors or electric welders.

-Connected to motor control center panels (M.C.C.)

-Connected to the main service cables inside the Electrical Room.

Since capacitors should be kept as cool and dry as possible when in operation, they will likely be found installed in the cooler, dryer parts of the building or plant.

Capacitors which are used with lamp ballasts are usually encased together with the ballast transformer. The container is filled with a sealing compound and may be located inside the light fixture or a remote distance away from the fixture.

Outdoors - Capacitors can sometimes be found outdoors on oilfields, irrigation areas or in other motor installations. These capacitors will probably be housed in a weatherproof, welded steel housing of rectangular construction.

Power utilities also have a large number of capacitors mounted outdoors. These capacitors are connected in banks to high voltage power cables and are usually located inside a substation area protected by a security fence. They can also be found on utility poles, particularly in rural areas.

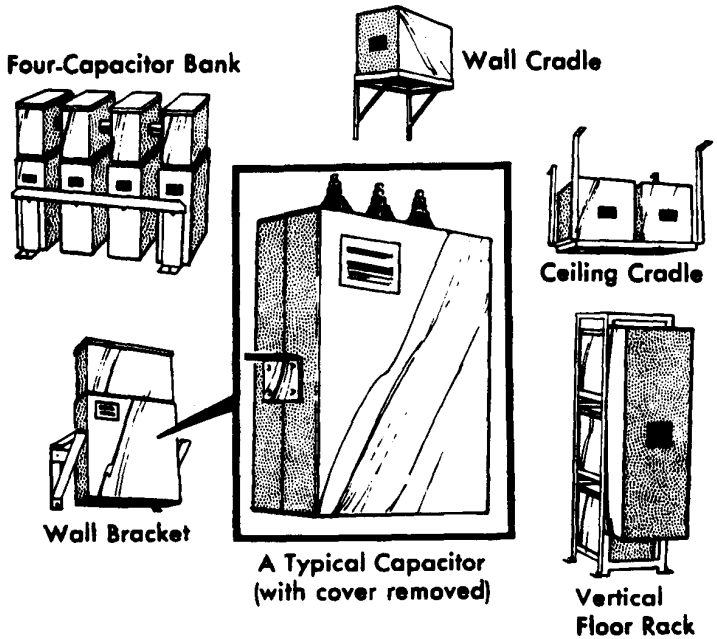
Capacitor Markings

A capacitor can be recognized by the letters KVAR or KVAC stamped on its nameplate. This indicates the electrical size of the capacitor, which could range anywhere from 5 KVAR to over 200 KVAR.

Large capacitors may even have the word ASKAREL or one of the brand names for askarel printed across its side. See the various brand names for askarel which are listed in the front of this booklet. Very small capacitors will probably not have any printing on them because of insufficient room for labelling.

Testing the Liquid in Capacitors

Capacitors are hermetically sealed to reduce the possibility of leakage. For this reason, the liquid cannot be tested to verify it is askarel.



MONS 002046

2.4 IDENTIFYING PCB LIQUIDS

In this section, some basic instructions are provided on how to identify new PCB liquid in storage or PCB liquids which will be disposed of.

If there is any doubt at all about the contents of an unmarked container, then a chemical testing laboratory should be contacted for a detailed analysis. They are listed in the yellow pages under Laboratories.

New Askarel

Some owners of electrical transformers will have askarel stored in drums or barrels for maintenance of their electrical equipment.

Askarel should be handled only when wearing protective gloves and a splash apron. See Booklet 4 for instructions.

New or reconditioned askarel will have the physical characteristics listed in the following table. The most obvious difference between askarel and mineral oil is the odour. Askarel has a very strong odour. Also, mineral oil is lighter than water. Askarel is heavier.

Physical Characteristics of Askarel

Colour	-Crystal clear to pale yellow
Vapours	-Invisible
Odour	-Bitter smell
Texture	-Somewhat slippery
Weight	-Heavier than water

To check the colour of the liquid, pour a small amount into a clear glass bottle and hold it against a white background for contrast.

At temperatures below $15^{\circ}F$ ($-10^{\circ}C$), white crystals may be found floating on top of the askarel. This is normal. The crystals are formed from one of the chemicals constituents of askarel. It is not ice. The crystals will dissolve when the askarel warms up.

To test whether a container actually contains askarel, not mineral oil, follow the steps in the earlier part of this booklet concerning the identification of PCB transformers.

Used Askarel

Askarel which has been drained out of electrical equipment for disposal or for reconditioning usually does not have the same physical appearance as new askarel.

Askarel which has been in equipment may have become contaminated with impurities such as dirt, moisture, black carbon particles due to arcing, and bits of insulation from inside the equipment. These impurities will degrade the electrical performance of the askarel, as well as making it appear cloudy or darker in colour. Other types of impurities may cause a light brown, green, red or a bluish tinge.

Used askarel can be reconditioned by treating with special filters. Afterwards it can then be put back into the equipment.

Used askarel is just as hazardous to the environment as new askarel and should be handled with the same caution.

To test that a liquid is actually used askarel, follow the same test procedures as with new askarel. If this test fails to provide a conclusive answer, then two other tests are possible.

Test 1 - Beilstein Test

1. Oxidize a piece of copper wire in a flame.

2. Dip the hot wire into the liquid that is being treated.

3. Put the wire back into the flame. If a bluish green flame results, then the liquid being tested may be askarel. It is not conclusive either.

Test 2 - Trace Test

Certain professional laboratories will test the contents of liquids and materials using a gas chromatography technique. The cost may be up to $100, depending upon the substance being examined. These are the sample sizes required and the levels of PCB that are detectable:

Substance to Be Examined	Sample Size Required	Lowest Quantity of PCB That is Detectable *
Water	4½ litres (1 gallon)	10 p.p. trillion
Oil	4½ litres (1 gallon	5 p.p. billion
Dredged sediment	30-50 grams (1-2 oz.)	5 p.p. billion
Tissue	25 grams (1 oz.)	5 p.p. billion

* Parts per trillion or billion

2.5 NEW LABELLING SYSTEM FOR PCB

A new labelling system for PCBs has been developed by the Federal Environmental Protection Service to alert persons to the presence of PCBs in equipment and to prepare an inventory listing of PCB equipment which is located throughout Canada.

PCB Equipment and Unused PCB Liquid

The labels for PCB equipment and spare PCB liquid are brightly coloured with black printing against a white background of self-adhesive vinyl paper. There are two sizes: one 3 inches by 3 inches to be placed on the casing of small items such as PCB capacitors, and another 6 inches by 6 inches for PCB transformers and drums of PCB liquid.

Each label has a registration number printed across the bottom for registering the equipment which the label will be adhered to. The labels should never be removed from the equipment, even if it is later removed from service for disposal.

The PCB labels are now available from the Regional offices of the Environmental Protection Service, and one serialized label should be attached to each piece of electrical equipment that has been positively identified as containing PCB. This includes transformers and capacitors in storage, as well as those in service.

With proper PCB labelling, it will be obvious to anyone working with the equipment that it contains PCB and that caution is necessary. Contact the Environmental Protection office for labels.

A special label should be attached to each piece of electrical equipment containing PCBs, even if it already has some other kind of labelling on it for PCB or askarel.

Other labels will not have a serial number printed on them for identification purposes.

PCB Wastes and Discarded Equipment

Drums containing waste PCB liquid, materials contaminated by askarel, and scrapped electrical equipment should each be labelled with the Number 4 - Severe Hazard label, also available from the Environmental Protection Service.

It is a non-serialized label which is used for many different types of chemicals. When used with PCBs, it should be filled out as follows:

HEALTH	- 4
FIRE	- 1
ENVIRONMENT	- 4
REACTIVITY	- 1
CONTENTS	- PCBs are contained inside
DISPOSAL	- (leave blank)
HANDLING	- Class 9
ORIGINATOR	- (your company name)
TELEPHONE	- (your telephone number)
DATE	- (the date)

The label will then contain the information that is necessary for a PCB container either being stored or later being shipped to a disposal site.

The code numbers that are written into the four boxes on the top line of the label indicate the severity of PCB in that particular situation. For example: PCB is a high health hazard because of its effect on the food chain, it will not burn easily, it is a high hazard to the environment, and it does not react easily with other chemicals or materials.

MONS 002049

The Handling classification is a special coding system pertaining to the handling and transportation of hazardous goods. See booklet 7 if details are required.

Entrance to Electrical Room and Storage Areas

Each entrance way into an electrical room, transformer vault, chain linked area or storage compound containing PCBs should be posted with the non-serialized version of the 6 inch by 6 inch black-and-white PCB label.

This will properly inform personnel entering the area that PCB is being stored and caution is necessary. With such information, they might also notice a situation which would otherwise go unreported until an authorized employee makes his formal inspection rounds of the compound.

How to Apply the Labels

Peel the protective backing from the label and press it firmly against a clean, dry area where it is most likely to be seen by personnel. Rub the surface of the label well to ensure it is securely attached.

ATTENTION

CONTAINS **PCB** CONTIENT DES

POLYCHLORINATED BIPHENYLS BIPHENYLES POLYCHLORES

A TOXIC ENVIRONMENTAL CONTAMINANT SCHEDULED UNDER THE ENVIRON - MENTAL CONTAMINANTS ACT. IN CASE OF ACCIDENT, SPILL OR FOR DISPOSAL INFORMATION, CONTACT THE NEAREST OFFICE OF THE ENVIRONMENTAL PROTECTION SERVICE ENVIRONMENT CANADA

PRODUITS TOXIQUES MENTION NES DANS L'ANNEXE DE LA LOI SUR LES CONTAMINANTS DE L'ENVIRONNEMENT EN CAS D'ACCIDENT, OU DE DEVERSEMENT, OU POUR SAVOIR COMMENT LES ÉLIMINER, CONTACTER LE BUREAU DU SERVICE DE LA PROTECTION DE L'ENVIRONNEMENT MINISTÈRE DE L ENVIRONNEMENT LE PLUS PRÈS

PR 20108

LABEL FOR TRANSFORMER

CAUTION ATTENTION

CONTAINS CONTIENT DU

PCB

AN UN

ENVIRONMENTAL CONTAMINANT CONTAMINANT DE L ENVIRONNEMENT

PR 11896

LABEL FOR CAPACITOR

4	SEVERE HAZARD EXTREME DANGER		
HEALTH SANTE	FIRE INCENDIE	ENVIRONMENT ENVIRONNEMENT	REACTIVITY REACTIVITE
CONTENTS / CONTIENT			
DISPOSAL ELIMINATION		HANDLING MANIPULATION	
ORIGINATOR / EXPEDITEUR			TEL. TEL.
			DATE
04-1914 (01-77)			

FOR USE ON PCB WASTES AND DISCARDED EQUIPMENT



FOR USE ON ELECTRICAL ROOM, TRANSFORMER VAULT, CHAIN LINKED AREA AND STORAGE COMPOUND

2.6

APPENDIX

ENVIRONMENTAL PROTECTION SERVICE OFFICES

Region	Address	Telephone
Pacific	Environmental Protection Service Kapilano 100 Park Royal West Vancouver, B.C. V7T 1A2	Emergency (604) 666-6100 Office (604) 666-6711
Northwest	Environmental Protection Service Room 804 9942 - 108th Street Edmonton, Alberta T5K 2J5	Emergency (403) 425-5128 Office (403) 425-5128
Ontario	Environmental Protection Service 7th Floor 25 St. Clair Avenue East Toronto, Ontario M4T 1M2	Emergency (416) 966-5840 Office (416) 966-5840
Quebec	Environmental Protection Service 4th Floor 1550 de Maisonneuve Blvd. West Montreal, Quebec H3G 1N2	Emergency (514) 283-2333 Office (514) 283-2345
Atlantic	Environmental Protection Service 16th Floor, Bank of Montreal Tower 5151 George Street Halifax, N.S. B3J 1M5	Emergency (902) 426-6200 Office (902) 426-6141

Booklet 3

BOOKLET 3:

PREVENTIVE MAINTENANCE

FOR

PCB EQUIPMENT

Prepared by:

Stothert Engineering Ltd.
Vancouver, B.C.

Contract OSB77-08285 for:

Environmental Protection Service,
Department of Fisheries & Environment
March 1979

MONS 002057

CROSS - REFERENCE
INDEX

			PAGE
BOOKLET 1:	INTRODUCTION TO PCBs		
	1.1	What are PCBs?	1-2
	1.2	Hazards of PCB	1-3
	1.3	How Does PCB - Contamination Occur?	1-4
	1.4	Is PCB Still Available?	1-5
	1.5	Federal Government Legislation On PCB	1-6
	1.6	The Future	1-8
	1.7	Appendix	1-9
BOOKLET 2:	IDENTIFYING PCBs		
	2.1	Brand Names For PCB	2-2
	2.2	Identifying PCB Transformers	2-3
	2.3	Identifying PCB Capacitors	2-6
	2.4	Identifying PCB Liquids	2-8
	2.5	New Labelling System For PCB	2-10
	2.6	Appendix	2-15
BOOKLET 3:	PREVENTIVE MAINTENANCE FOR PCB EQUIPMENT		
	3.1	General	3-2
	3.2	Anatomy Of A Transformer	3-3
	3.3	Typical Problems With Transformers	3-7
	3.4	Preventive Maintenance Program For Transformers	3-9
	3.5	Anatomy Of A Capacitor	3-13
	3.6	Typical Problems With Capacitors	3-14
	3.7	Preventive Maintenance Program For Capacitors	3-15
	3.8	Appendix	3-17

PAGE

BOOKLET 4: HANDLING OF PCB LIQUID, EQUIPMENT AND MATERIALS FOR MAINTENANCE AND DISPOSAL

4.1	General	4-2
4.2	Safe Handling	4-3
4.3	Collection of Askarel	4-6
4.4	Containment For Disposal	
	- Capacitors	4-7
	- Transformers	4-8
	- Askarel Liquid	4-9
	- Solid Wastes	4-9
4.5	Labelling of PCB Wastes and Discarded Equipment	4-10
4.6	Appendix	4-12

BOOKLET 5: STORAGE OF PCB LIQUID, EQUIPMENT AND MATERIALS

5.1	General	5-2
5.2	Selecting A Storage Site	5-3
5.3	Ideal Storage Facilities	5-4
5.4	Precautionary Guidelines	5-7
5.5	Fire Fighting Safety	5-8
5.6	Labelling in Storage Area	5-9
5.7	Record-Keeping	5-13
5.8	Appendix	5-17

BOOKLET 6: CONTAINMENT SYSTEMS AND CLEAN-UP PROCEDURES FOR PCB

6.1	General	6-2
6.2	What Kind Of Askarel Releases Can Occur?	6-3
6.3	Containment Systems	6-5
6.4	Clean-Up Procedures	6-9
6.5	Appendix	6-13

			PAGE
BOOKLET 7:	TRANSPORTATION PROCEDURES FOR PCB		
	7.1	General	7-2
	7.2	Necessary Arrangements	7-3
	7.3	Packaging and Transport Methods	7-4
	7.4	Precautionary Guidelines	7-6
	7.5	Labelling	7-7
	7.6	Appendix	7-9
BOOKLET 8:	SUBSTITUTE CHEMICALS FOR PCB		
	8.1	General	8-2
	8.2	Alternatives Available	8-3
	8.3	Factors to Consider	8-4
	8.4	Appendix	8-7

FOREWORD

This booklet is number 3 in a series of 8 that have been written to answer the questions of the public concerning the proper management of PCB chemicals, particularly as they are used in electrical equipment. PCB is also known as "askarel" when used in such equipment.

This series will be of special interest to the following companies since they will at some time be working with PCBs.

Companies These Booklets Are Written For

- Owners of PCB Equipment
- Electrical Testing Laboratories
- Garbage and Waste Collection Companies
- Transportation Companies
- Scrap Metal Dealers
- Salvage Companies

Under proper control, the equipment using PCBs can provide an important benefit to man, but without proper control they can also pose a serious threat to human health and the environment.

For general enquiries or assistance in emergency situations, contact the nearest Environmental Protection office listed in the back of this booklet.

3.1 GENERAL

A well-designed askarel transformer should be depended upon for over 30 years of reliable operation. This is especially true of modern transformers because of their superior design and construction.

In spite of these important distinctions, the lifetime of a transformer can be cut short or plagued with troublesome problems, depending upon these and other critical factors:

- The power handling capability of the transformer in its particular application. Is it operating near its rated kVA capacity?

- Its operating temperature on a day-to-day basis.

- The amount of physical abuse it receives. Is it in a high traffic area?

If a transformer should fail in operation, not only could it create an environmental hazard, but it could also become a very expensive proposition to remedy. The cost of rebuilding a transformer — which includes de-tanking, rewiring, and refilling, can be as much as 2/3 of the cost of a new transformer and would require some 3 - 4 months to complete. Alternatively, transformers are not usually off-the-shelf items so the delivery of a new transformer could take up to 1 year.

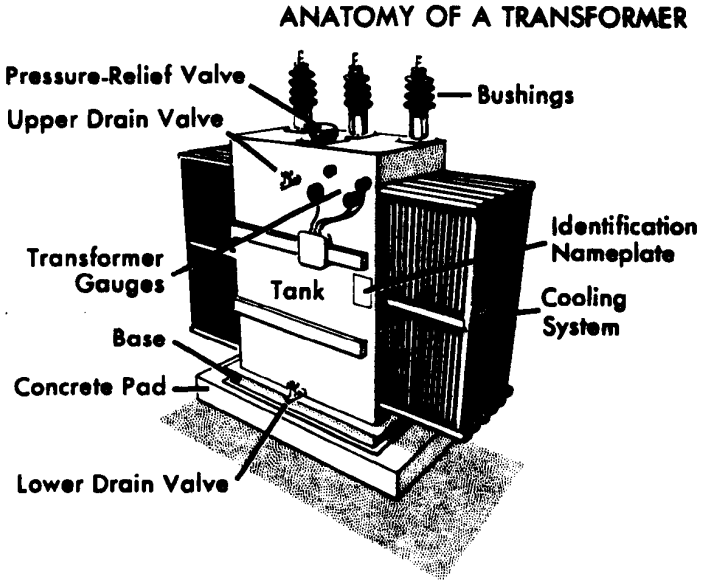
One of the ways to prevent this cost, inconvenience, and possible environmental hazard from happening is through preventive maintenance. It applies to both transformers and capacitors. That is the theme of this booklet.

MONS 002062

3.2 ANATOMY OF A TRANSFORMER

Most power transformers are externally quite similar in appearance. Their primary difference is in physical size, the location of the monitoring gauges, and the presence of optional features such as fan-cooling or special bushing connections.

The following sketch for a pad-mounted transformer shows the type of equipment that can be found on many askarel-filled transformer (and many oil-filled types as well). Most of the items shown here are standard accessories for larger transformers.



High Voltage Protection

The primary purpose of a transformer is to convert electrical power from one operating voltage to another. Whether the voltage is 13.8 kV, 4160 volts or 600 volts, the application is still the same - a power transformer is used to convert high voltage.

Askarel is well suited to this type of application since it is an excellent insulating medium. By immersing the transformer core and coil windings in a tank of askarel, the electrical insulating factor that results between the coil windings is much better than with any other type of liquid.

Sparks inside a transformer are not an unusual occurrence. They occur as a result of lightning strokes, switching surges, and transient fault conditions on the power line. Normally they last only a fraction of a second and the current flow is so small that the disturbance is not even detected by protective relays on the power system. This is what happens when a spark occurs in a tank of askarel. It occurs almost instantaneously:

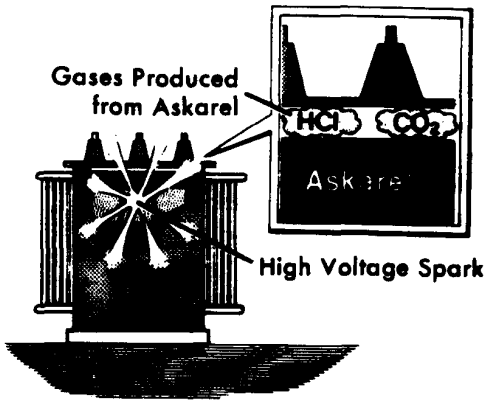
1. High voltage sparks between conductors generate tremendous heat and decompose askarel in the vicinity of the spark.

   Hydrogen chloride gas, carbon dioxide, askarel vapour, carbon particles, and other hydrocarbon gases are produced as a result of this decomposition.

2. Gases bubble out of the askarel, creating pressure in the container.

3. The gases slowly condense over a period of time, and the pressure in the container gradually reduces back to normal. As the gas condenses, it forms a weak concentration of hydrochloric acid which recombines with the askarel liquid in the tank.

This sequence of events can happen hundreds of times a year, without creating enough pressure to cause a release of the pressure relief valve on the transformer.



Details on Transformer Accessories

The gauges installed on the side of the transformer tank can provide important information on the transformers internal performance and might possibly avert an environmental hazard. Details on the transformer gauges and the pressure-relief valve follow. They should be periodically checked for any change.

1. **Dial-Type Thermometer Gauge**

   This gauge measures the temperature of the askarel liquid inside the transformer tank.

   Some small change in the temperature reading can be expected because of variations in the electrical load of the transformer. For example, certain motors in a plant may be switched on only at certain times of the day, resulting in the transformer windings, and therefore askarel, becoming hotter.

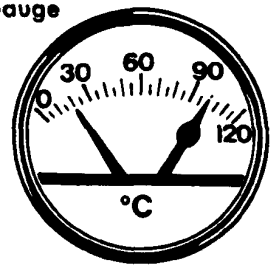
   Normally the temperature of the askarel should remain much less than 105°C. Excessive temperatures indicate the transformer is overheating, possibly due to a loss of askarel. The rate of deterioration of the insulating materials in the transformer can double for every 8°C rise in temperature, therefore, it is important to take action as quickly as possible to remedy the situation.

2. **Liquid Level Gauge**

   This gauge measures the level of the askarel inside the transformer tank. There is approximately a 2-inch air gap in the space between the surface of the askarel and the underside lid of the tank.

   The reading of this gauge will also change with variations in the electrical load because higher temperatures cause expansion of the askarel liquid and a subsequent rise in its level.

Temperature Gauge



Liquid Level Gauge



Check with the transformer manufacturer to determine the minimum acceptable level of askarel for the design of the transformer. Mark it on the dial of the gauge. Any lower reading indicates that there is not sufficient askarel inside to conduct heat away from the windings or to keep them insulated. Both situations are dangerous so it should be topped up immediately. TTCB can be used in limited quantities as a topping up fluid for askarel transformers.

3. **Pressure-Vacuum Gauge**

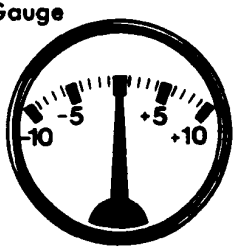
This gauge measures the amount of built up pressure, or vacuum, in the air space between the top level of the askarel and the underside cover of the transformer tank.

Some nominal change in reading can be expected due to variations in the electrical load. Larger electrical loads cause more internal heating of the transformer and some expansion of the askarel liquid. As the liquid expands, it will compress the air space above the liquid, producing a higher reading of the gauge towards the PRESSURE end of the scale. If the gauge reading never moves, then there is an air leak into the transformer, probably through one of the gaskets.

An abnormally high pressure indicates that there is a build up of pressure inside, probably due to internal short circuits and arcing. The Pressure-Relief valve should release this pressure before it strains or ruptures the transformer tank.

Check with the transformer manufacturer to determine the maximum acceptable reading for the gauge (usually around 10 psi). Mark it on the gauge. Any reading above this amount indicates the Pressure-Relief valve is not functioning properly and should be repaired.

Vacuum/Pressure Gauge



An abnormally high vacuum reading on an energized transformer indicates that the level of the askarel is low, probably due to a loss of askarel. Transformer burnout will occur as soon as the level of the askarel drops below the top part of the transformer windings. In addition, the vacuum condition can draw air, moisture and dirt into the transformer tank through weak gaskets and contaminate the askarel. Check with the transformer manufacturer for the maximum acceptable vacuum reading under normal operation. With a normal vacuum reading the level of the askarel will be low, but still adequate to cover the transformer coils.

4. **Pressure-Relief Valve**

This device is calibrated at the factory so as to release abnormally high internal pressure at a set limit. It is mechanically automatic and self-resetting. The valve is fitted with a visible signal to indicate when it is open. It should reseal itself after every operation to keep moisture, dirt and other contaminants from entering the transformer tank.

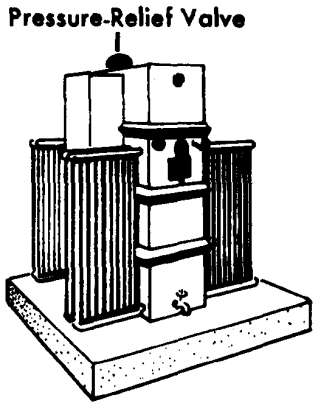
3.3 TYPICAL PROBLEMS WITH TRANSFORMERS

This section of the booklet contains a partial listing of some common transformer problems. Opposite each is a description of what can happen if the problem goes unnoticed for a long period of time.

It is important to realize that simple inspections could prevent most of these problems from becoming serious because most involve gradual rather than sudden change.

PROBLEM	WHAT CAN HAPPEN
Gradual contamination of the transformer liquid by moisture, dirt, carbon or chemicals resulting from arcing inside the transformer.	Insulating quality of askarel liquid weakens. High voltage sparks will occur inside the transformer, causing a build-up of internal pressure. Excess pressure will force askarel out of the transformer through the pressure-relief valve or through weakened gaskets. Possible contamination of the environment.
Weakening of transformer seals and gaskets due to aging.	Leaks develop. With substantial loss of askarel, transformer will overheat, even burn out. Loss of askarel allows electric arcs to occur inside the transformer since it is no longer properly insulated. A catastrophic failure may result.
Physical damage or rusting of the cooling radiators. Structural damage to transformer tank.	Leaks develop. With substantial loss of askarel, transformer will overheat, even burn out. Loss of askarel allows electrical arcs to occur inside the transformer since it will no longer be properly insulated.

Over-heating of transformer due to being undersized for its application (overloading), or because of loss of askarel.	Insulation on electrical windings and insulation materials will deteriorate, allowing short circuits and internal sparks to occur between windings. Decrease in life expectancy and possible loss of askarel to the environment.
Lightning surges and short circuits on the power line.	High voltage sparks are produced inside the transformer, causing a build-up of internal pressure. Excess pressure will force askarel out through pressure-relief valve or through weak gaskets.



3.4 PREVENTIVE MAINTENANCE PROGRAM FOR TRANSFORMERS

This maintenance program is presented in four parts. Parts 1 and 2 need only be done once, while Part 3 should be carried out once every 6 months to a year. Part 4 concerns professional services that might be required on an occasional basis.

Part 1 - Check Transformer Sizing and Location

Sizing - Have an electrician check whether the transformer is normally operated at or near the power level rated on its nameplate. Additional loads might have been connected to the circuitry since the transformer was first installed.

If the transformer is operating near its power rating, consider investing in another transformer to share the power handling requirements. Alternatively, consider whether part of the load can be shed at peak load times.

Operation at the rated power level does not leave much safety factor for the transformer in the event of a fault condition on the power line.

Location - Is the transformer located close to a source of excessive heat, such as a furnace? If so, consider installing forced air cooling to reduce the transformer's operating temperature.

Are the transformer tank or radiator fins likely to be damaged by vehicle traffic? If so, install a protective fence around the unit. Allow for free air ventilation through the fence.

Part 2 - Consider Installing Alarm Circuits

The gauges on many power transformers are fitted with mechanical contacts to provide remote warnings or to de-energize the transformer automatically in the event of an abnormal situation. In most cases, de-energizing the transformer will protect it from serious damage.

Consider connecting the contacts to alarm systems or to control circuitry, if they are not already connected. These are some of the more common alarms and protective devices available for power transformers:

Dial-Type Liquid Thermometer Alarm - Contacts close when the temperature rises above a set limit.

Liquid Level Gauge Alarm - Contacts close when the askarel level drops below a set limit.

Pressure-Vacuum Gauge Alarm - Contacts close under abnormal conditions.

Pressure-Relief Valve - Contacts close every time the valve operates.

Sudden Pressure Relay - Contacts operate whenever there is an abnormally rapid change in internal pressure due to internal faults in the transformer. Such rapid changes would not cause the pressure-relief contacts to operate.

Winding Temperature Indicator - This device is equipped with several sets of contacts, preset to operate at increasing temperatures. They might control the cooling equipment, the alarm circuits and the circuit breakers, in that order.

MONS 002069

Part 3 - Routine Inspections

1. Appoint one person in charge of transformer inspections.

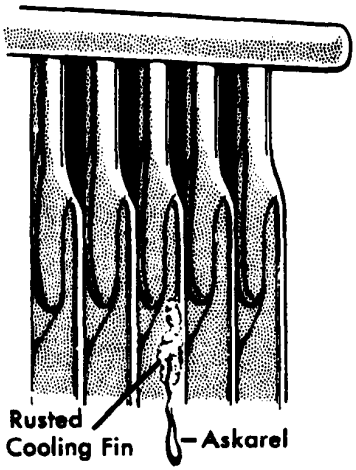
   It is recommended that inspections be done on a regular basis once every 6 months.

2. Develop a separate record-keeping sheet for each transformer and keep track of all observations on each tour. The observations might predict a serious problem before it happens.

3. Check these items on each tour:

INSPECT	WHAT TO LOOK FOR
Condition of gauges	Are any faceplates cracked or the gauges damaged? Consider installing a plexiglass sheet over the gauges for protection against damage.
Reading of gauges	Have the readings changed much since the last tour? Are they near an unacceptable reading?
Corrosion on tank and radiator fins	Check radiators very carefully. They are manufactured of thin gauge steel to obtain maximum cooling and will rust through more quickly than the rest of the transformer, especially in a caustic environment. Clean them to bare metal and paint with primer and finish coats if rusted.
Paint finish of tank and radiator fins	Is paint starting to weather away? All paints will weather eventually. Repaint as often as necessary to prevent rusting.

Leakage or weep of askarel from: - tank - radiator fins - top cover (if gasketed) - manhole cover - top or bottom drain spout - high and low voltage bushings	Wet slickness and gummy residue. Do the gaskets or seals appear to be deteriorating? Important - if there has been leakage, take steps to clean it up promptly! Refer to Booklet 4 for clean-up instructions.
Pressure-relief valve	Are the gaskets displaced so the valve is not seating properly?
High and low voltage bushings	Are they cracked or chipped? Low voltage bushings are larger, therefore, they are more likely to leak first.
Colour of askarel	Take a small sample. Is the colour changing from clear to a blue, green, red or blackish cast? If so, it is picking up impurities and becoming contaminated. Consider a laboratory test to check its quality.



Part 4 - Professional Services

Professional services might occasionally be required for a transformer, depending upon the performance indicated by its gauges. These services might be required:

1. Removal of an askarel sample (1 - 2 pints) to test the quality of the askarel in the transformer.

2. Filter pressing or Fuller's earth treatment to remove moisture and other contaminants from the askarel.

These are the steps that a professional laboratory will follow when taking an askarel sample for laboratory analysis:

1. The sample will be taken on a dry day when the humidity is less than 75% and the transformer is warm.

2. The 1/2" sampling valve at the top of the transformer will be wiped clean of any dirt. (A sample from the top spout is more representative of the condition of the askarel than from the bottom spout.)

3. About 1 to 2 pints of askarel will be run into a metal catch bucket to flush away any dirt lodged inside the spout.

4. A one-quart sample bottle and Bakelite screw cap will be rinsed 2 or 3 times with askarel from the transformer and then filled with a sample.

5. The bottle will be capped tightly with an aluminum or tin capliner to keep out moisture and dust.

6. The bottle will be labelled as containing askarel.

7. After a number of samples have been taken over a period of time, the transformer will have to be topped up with tri/tetrachlorobenzene (TTCB) or some other suitable make-up fluid to replenish the lost liquid. If the composition of the insulating liquid is not known, it should be determined before any significant amounts of TTCB are added. See Booklet 8 for further information on topping up of transformers.

In addition, after each test the askarel liquid that is released in steps 3 and 4 will have to be properly disposed of as indicated in Booklet 4.

3.5 ANATOMY OF A CAPACITOR

An askarel capacitor is a hermetically sealed unit which contains only metal foil, paper, plastic film, and askarel. There are no moving parts inside.

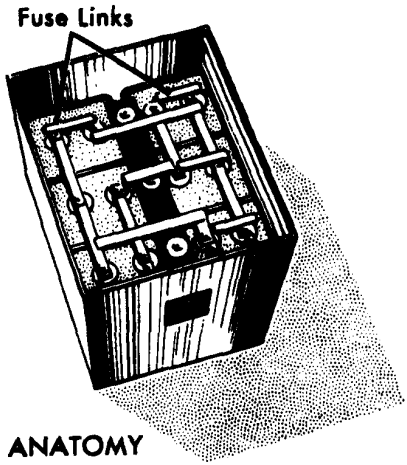
In spite of this simple design, an askarel capacitor has a lifetime of at least 10 to 20 years. Since the unit is sealed, there is no provision to add or remove fluid or perform internal maintenance for increasing this lifetime.

As with transformers, a capacitor could create an environmental hazard when it fails.

Details on Capacitor Construction

Most capacitors are equipped with fusing to de-energize the capacitor in the event of a breakdown. One type of breakdown failure, an internal short circuit, can create enough internal pressure to burst the case seams open if the power is not disconnected.

Some types of capacitors are constructed with a number of individually fused cells. Under this arrangement, the defective capacitor cell removes itself from the circuit when a fuse melts. This allows the remaining capacitors to still provide a certain amount of power factor correction to the plant.



ANATOMY
OF A CAPACITOR

3.6 TYPICAL PROBLEMS WITH CAPACITORS

Here is a partial listing of some common capacitor problems. Opposite each is a description of what can happen.

PROBLEM	WHAT CAN HAPPEN
Rusting of casing, damage to insulator bushings	Leaks develop. With loss of askarel, capacitor will overheat and internal insulation will fail. Internal short-circuits will develop and build up pressure inside casing. A rupture of the casing may contaminate the environment.
Physical damage to capacitor casing	Internal insulation may be damaged. Internal short-circuits can develop and build up pressure inside casing.
Over-heating of capacitor due to loss of askarel or proximity to sources of heat	Internal insulation will deteriorate. Internal short-circuits can develop and build up pressure inside casing.
End of lifetime	Internal insulation will fail. The capacitor will draw large amounts of current and pressure will be built up inside the casing.

3.7 PREVENTIVE MAINTENANCE PROGRAM FOR CAPACITORS

This maintenance program is presented in two parts. Part 1 need only be done once while Part 2 should be carried out on a periodic basis every 6 months.

Part 1 - Check the Capacitors Location

Properly functioning capacitors are normally warm to the touch. The temperature of the casing should not exceed 55°C., under normal operating conditions. Such conditions are defined as the nameplate voltage and line frequency for which the capacitor was designed. Any conditions above these will increase the temperature of the capacitor and decrease its lifetime.

Check the following:

1. The Operating Voltage - The operating voltage will be especially high during periods of light loading of the power system. If the operating voltage is 10% or more above the capacitor's rated voltage, consider improving the regulation of the power system or disconnecting the capacitors during such periods.

2. Proximity to sources of heat such as furnaces or direct sunlight.

3. Adequacy of freely circulating air ventilation around the capacitors. The ambient air temperature should always be less than 40°C.

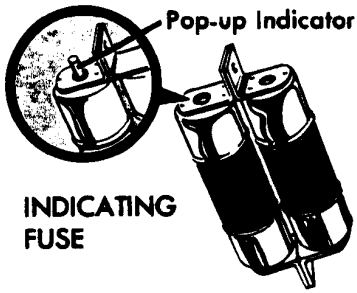
4. Are the capacitors likely to be damaged by vehicle traffic? If so, install a cage around the capacitors. Allow for free air ventilation through the cage.

Part 2 - Routine Inspections

1. Appoint one person in charge of capacitor inspections. It is recommended that inspections be done on a regular basis once every 6 months.

2. Check these items on each tour:

INSPECT	WHAT TO LOOK FOR
Corrosion on casing	Rusting is more likely to occur in a caustic environment.
Physical damage	Dents, broken insulator bushings.
Leakage or weep of askarel	Wet slickness and gummy residue. Important - if there is leakage, remove and dispose of the capacitor!
Melted fuses	Some capacitors with external fuses have a visual indicator to signal that the fuse has melted. Conduct a continuity test on the capacitor. If defective, dispose of the capacitor. Alternatively, replace the fuse and if it melts again, dispose of the capacitor (see Booklet 4 for disposal instructions).
Temperature of the capacitor casing	The casing should be warm to the touch. If it is cold, check the fuse. If it is hot, check for the cause of the excessive temperature.



3.8

APPENDIX

ENVIRONMENTAL PROTECTION SERVICE OFFICES

Region	Address	Telephone
Pacific	Environmental Protection Service Kapilano 100 Park Royal West Vancouver, B.C. V7T 1A2	Emergency (604) 666-6100 Office (604) 666-6711
Northwest	Environmental Protection Service Room 804 9942 - 108th Street Edmonton, Alberta T5K 2J5	Emergency (403) 425-5128 Office (403) 425-5128
Ontario	Environmental Protection Service 7th Floor 25 St. Clair Avenue East Toronto, Ontario M4T 1M2	Emergency (416) 966-5840 Office (416) 966-5840
Quebec	Environmental Protection Service 4th Floor 1550 de Maisonneuve Blvd. West Montreal, Quebec H3G 1N2	Emergency (514) 283-2333 Office (514) 283-2345
Atlantic	Environmental Protection Service 16th Floor, Bank of Montreal Tower 5151 George Street Halifax, N.S. B3J 1M5	Emergency (902) 426-6200 Office (902) 426-6141

Booklet 4

BOOKLET 4:

HANDLING OF

PCB LIQUID, EQUIPMENT AND MATERIALS

FOR

MAINTENANCE AND DISPOSAL

Prepared by:

Stothert Engineering Ltd.
Vancouver, B.C.

Contract OSB77-08285 for:

Environmental Protection Service
Department of Fisheries and Environment
March 1979

MONS 002080

CROSS - REFERENCE
INDEX

			PAGE
BOOKLET 1:	INTRODUCTION TO PCBs		
	1.1	What are PCBs?	1-2
	1.2	Hazards of PCB	1-3
	1.3	How Does PCB - Contamination Occur?	1-4
	1.4	Is PCB Still Available?	1-5
	1.5	Federal Government Legislation On PCB	1-6
	1.6	The Future	1-8
	1.7	Appendix	1-9
BOOKLET 2:	IDENTIFYING PCBs		
	2.1	Brand Names For PCB	2-2
	2.2	Identifying PCB Transformers	2-3
	2.3	Identifying PCB Capacitors	2-6
	2.4	Identifying PCB Liquids	2-8
	2.5	New Labelling System For PCB	2-10
	2.6	Appendix	2-15
BOOKLET 3:	PREVENTIVE MAINTENANCE FOR PCB EQUIPMENT		
	3.1	General	3-2
	3.2	Anatomy Of A Transformer	3-3
	3.3	Typical Problems With Transformers	3-7
	3.4	Preventive Maintenance Program For Transformers	3-9
	3.5	Anatomy Of A Capacitor	3-13
	3.6	Typical Problems With Capacitors	3-14
	3.7	Preventive Maintenance Program For Capacitors	3-15
	3.8	Appendix	3-17

PAGE

BOOKLET 4: HANDLING OF PCB LIQUID, EQUIPMENT AND MATERIALS FOR MAINTENANCE AND DISPOSAL

4.1	General	4-2
4.2	Safe Handling	4-3
4.3	Collection of Askarel	4-6
4.4	Containment For Disposal	
	- Capacitors	4-7
	- Transformers	4-8
	- Askarel Liquid	4-9
	- Solid Wastes	4-9
4.5	Labelling of PCB Wastes and Discarded Equipment	4-10
4.6	Appendix	4-12

BOOKLET 5: STORAGE OF PCB LIQUID, EQUIPMENT AND MATERIALS

5.1	General	5-2
5.2	Selecting A Storage Site	5-3
5.3	Ideal Storage Facilities	5-4
5.4	Precautionary Guidelines	5-7
5.5	Fire Fighting Safety	5-8
5.6	Labelling in Storage Area	5-9
5.7	Record-Keeping	5-13
5.8	Appendix	5-17

BOOKLET 6: CONTAINMENT SYSTEMS AND CLEAN-UP PROCEDURES FOR PCB

6.1	General	6-2
6.2	What Kind Of Askarel Releases Can Occur?	6-3
6.3	Containment Systems	6-5
6.4	Clean-Up Procedures	6-9
6.5	Appendix	6-13

PAGE

BOOKLET 7: TRANSPORTATION PROCEDURES FOR PCB

7.1	General	7-2
7.2	Necessary Arrangements	7-3
7.3	Packaging and Transport Methods	7-4
7.4	Precautionary Guidelines	7-6
7.5	Labelling	7-7
7.6	Appendix	7-9

BOOKLET 8: SUBSTITUTE CHEMICALS FOR PCB

8.1	General	8-2
8.2	Alternatives Available	8-3
8.3	Factors to Consider	8-4
8.4	Appendix	8-7

MONS 002083

FOREWORD

This booklet is number 4 in a series of 8 that have been written to answer the questions of the public concerning the proper management of PCB chemicals, particularly as they are used in electrical equipment. PCB is also known as "askarel" when used in such equipment.

This series will be of special interest to the following companies since they will at some time be working with PCBs.

Companies These Booklets Are Written For

- Owners of PCB Equipment
- Electrical Testing Laboratories
- Garbage and Waste Collection Companies
- Transportation Companies
- Scrap Metal Dealers
- Salvage Companies

Under proper control, the equipment using PCBs can provide an important benefit to man, but without proper control they can also pose a serious threat to human health and the environment.

For general enquiries or assistance in emergency situations, contact the nearest Environmental Protection office listed in the back of this booklet.

MONS 002084

4.1 GENERAL

The subject of askarel disposal is very controversial because of public concern over the effectiveness of any disposal method.

Scientists have found that askarel can be almost completely destroyed by temperatures above 1000°C, however, there are presently no approved sites for such special incineration in Canada.

The Federal Environmental Protection Service *recommends* that any liquid askarel or askarel-contaminated material which needs to be disposed of should be held in storage by its owner until government approved landfill sites or special incineration plants become available to the public. Ordinary landfill dump sites are inappropriate to control contamination to the environment due to the danger that leaking containers may contaminate ground water or surface runoff.

This booklet, and Booklets 5 and 6 in this series, provide information on how to store askarel properly in the meantime and how to avoid any risk to the environment. Ensure that your employees are familiar with the contents of these booklets.

It should be remembered that individuals who discharge askarel, or who allow askarel to be discharged into waters frequented by fish, can be prosecuted under the Federal Fisheries Act. Furthermore, discharge of askarel into the environment may be in violation of other statutes, specifically the proposed control on PCB release under the Environmental Contaminants Act and certain provincial pollution control statutes.

MONS 002085

4.2 SAFE HANDLING

Askarel can be handled safely by observing routine precautions. Such precautions should apply whether the purpose of the job is to work on a piece of equipment containing askarel or simply to move a drum of askarel from one location to another.

Wear proper clothing to protect against the hazard of splashes or spills.

These garments are considered appropriate for handling askarel:

- coated gloves or an industrial-type barrier cream on the hands. Gloves are preferable.
- a face shield or safety glasses fitted with side guards.
- a splash apron made of PVA, Viton material by Dupont, or Teflon.
- disposable clothing which can be discarded after handling askarel.
- boots or rubbers and a safety hat.

Rubber or neoprene garments are not recommended since they are slowly dissolved by askarel and will no longer provide adequate protection.

Store all garments in a separate locker and use them only for working with askarel and askarel equipment.

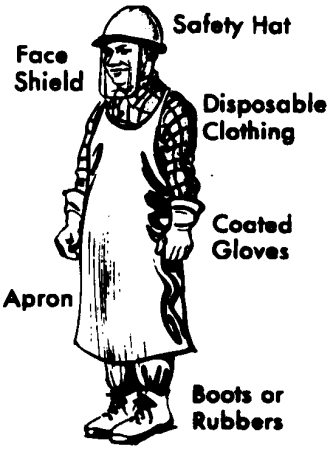
Provide additional air ventilation when working with askarel hotter than 55°C.

The fumes from hot askarel (55°C) can be very irritating to the eyes and lungs. Askarel at room temperature (25°C) is not so irritating.

If maintenance is required on a transformer, de-energize it, let it cool, and ensure that there is adequate air ventilation in the work area before beginning maintenance. Opening all doors would be helpful. The same procedure should be followed when working with askarel kept in storage.

The recommended unloading, handling and pumping temperature for the most widely used types of askarel are:

Askarel Product	Handling Temperatures
Pyranol A13B3B-3	20° - 55°C
Inerteen 70-30	20° - 55°C
Inerteen 100-42	35° - 75°C



If exposure to hot askarel (55°C or above) is necessary, such as under emergency conditions, wear an approved gas mask with an organic cannister or wear a self-contained breathing apparatus. An application of castor oil will help to provide a barrier against the irritation of askarel fumes on unprotected skin.

Also, provide forced air ventilation in the work area. Exhaust the air to the outside of the building to prevent other people in the building from becoming irritated by the fumes.

Some other precautionary measures when handling askarel are:

1. Pump, do not pour askarel into containers or equipment. This will minimize the possibility of splashing and spills to the ground.

2. Frequently inspect pumps, hoses, nozzles, pump motors, and wiring of equipment used to handle askarel. Replace them at the first sign of deterioration.

3. Do not use askarel pumps and hoses for any other purpose, otherwise other liquids will become contaminated.

4. Centrifugal pumps recommended for handling hot oil are acceptable for use with askarel. Gear-type pumps are not. These are some details on the most appropriate centrifugal pumps:

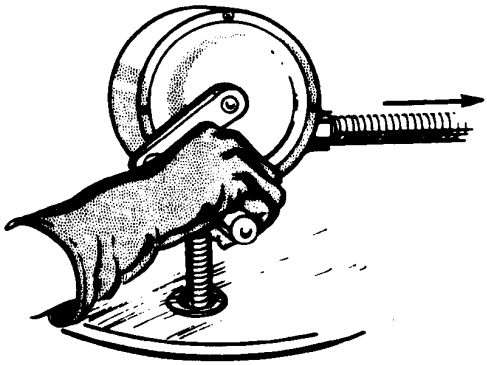
   - All wetted surfaces of the pump should be made of stainless steel.

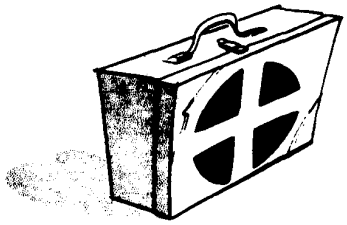
   - The shaft seal should be an external carbon ring type to eliminate the packing material being exposed to the deteriorating effects of askarel.

   - Acceptable valves are brass or stainless steel-lined.

   - Suitable hoses are flexible metal or lined with tetrafluoroethylene or silicone polymers for protection against deterioration.







Become familiar with the steps of first aid for askarel. Have a first aid kit handy in case of accidents. A portable eyewash kit is also useful.

What to do:

IN CASE OF	FIRST ACTION	SECOND ACTION
Askarel on skin	Wash in usual manner with warm water and soap.	Apply cold cream to reduce any feeling of irritation. If askarel was hot, treat like any burn.
Askarel in eyes	Flush eyes with gentle stream of lukewarm water for 15 minutes, keeping eyelids apart.	Add a drop or two of castor oil, opthalmic anesthetic solution, or orthalmic cortisone acetate solution to reduce irritation. Have eyes examined by physician.
Askarel swallowed	Press down at back of tongue to cause vomiting. Do not give victim anything to drink.	Write down details about the liquid and take victim to hospital emergency room or physician immediately.
Strong askarel fumes inhaled	Get victim into fresh air.	If discomfort does not clear up, take victim to physician.

After working with askarel, wash hands in usual manner with soap and water before eating, drinking, smoking or using toilet facilities.

4.3 COLLECTION OF ASKAREL

These guidelines should be kept in mind when collecting askarel and collecting materials contaminated by askarel:

1. Never spill askarel down drains or on the ground. Follow the procedures recommended in this booklet for disposal.

2. All containers used for askarel should be clearly marked as containing PCB, even if they are presently empty.

3. Any askarel collected in open drip pans under transformers should be transferred into storage drums as soon as possible. This will minimize the amount of askarel left sitting in open containers.

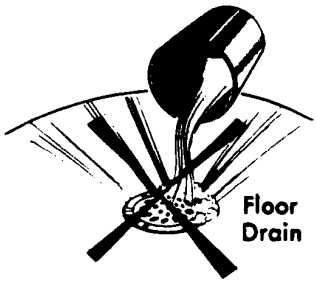
4. Move askarel from one location to another only in sealed containers.

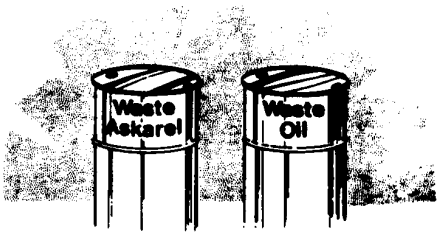
5. Other liquids should never be mixed with askarel since other liquids will not need the same storage precautions as askarel. This will minimize the size of containers needed to store askarel.

6. Containers used for the collection of askarel should never be used for any other purpose since the containers will be contaminated after one use with askarel.

7. Plastic containers should not be used for catching drips under transformer spouts since plastic can be dissolved by askarel. Use metal containers of good quality only. Empty them into storage drums promptly.

8. Spilled askarel should be cleaned up immediately, using absorbing materials such as sawdust and wiping rags. Dispose of all wipe-up materials as recommended in the next section of this booklet. For more instructions on cleaning up spilled askarel, see Booklet 6 in this series.





Separate Metal Containers for Askarel and Oil

4.4 CONTAINMENT FOR DISPOSAL

Anything which comes into contact with askarel should be contained for disposal using the procedures recommended in this section of the booklet. Items to be disposed of can include: discarded capacitors and transformers, contaminated askarel, earth and gravel, clothing, clean-up materials, pieces of wood, etc.

Items contaminated by askarel should never be burned. Ordinary incineration will allow PCB to become airborne.

Planning and Preparation

Before moving any askarel items, plan the route that will be followed. Then prepare the area along the route by ensuring all floor cracks are well-caulked, by checking the seal of floor drains, and by laying down absorbent blankets to catch any accidental leakage or spills which might occur. Be overly cautious in this planning and preparation stage.

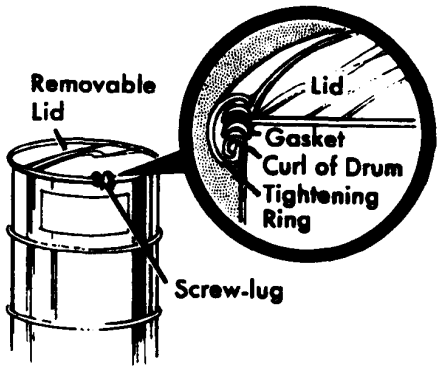


Containment of Capacitors

1. When a failed capacitor must be removed from service, leave the case unopened. If it is leaking already, ensure all leakage is wiped up (see Booklet 6 for clean-up instructions).

2. Wrap each capacitor in a heavy duty plastic bag and tie it shut.

3. Place the wrapped capacitor directly into a 45-gallon steel drum fitted with a removable steel lid and a gasket made of PCB-resistant material. (Store with capacitor terminals up to prevent eventual leakage from capacitor bushings.) A heavy-construction drum of Number 16 gauge or heavier is suitable for storage. This drum should preferably be the first and last that the capacitor is put into in order to minimize accidents in handling.



The drum should be new and free from corrosion or defects so as to ensure long term storage and eventual transportation for disposal. Reconditioned drums are not recommended, nor are plywood, fiberboard or plastic drums, due to insufficient durability.

4. Pack the drum well with sawdust to prevent shifting around inside. The sawdust will also absorb any leaks which may develop. Sand should not be used for this purpose since it will make the drum too heavy for convenient handling.

5. Seal the drum, label it, and move it to the storage area using routine material handling precautions. See this booklet for labelling instructions and Booklet 5 for storage instructions.

Be careful when moving askarel! Most spills occur during the movement of askarel equipment and containers. Ensure any drums will not fall from the transport vehicle.

Scrapping a Transformer

1. DO NOT dismantle a transformer for the purpose of selling it for scrap. A drained askarel transformer still contains enough askarel saturated in its core to still be considered a threat to the environment. In fact, a new regulation is being considered by the Federal government which will prevent the re-sale of askarel transformers and capacitors because of this hazard.

   It should be mentioned that mineral oil transformers are sometimes topped up with askarel during servicing so be very sure that a non-PCB transformer is indeed free from askarel contamination before disposing of it. Have it professionally tested if necessary. See Booklet 2 for Trace Test details.

2. Before moving any askarel-filled transformer, pump the contents into a good quality double-bung, 45-gallon steel drum of Number 16 gauge or heavier, using a pump and hoses devoted specially to handling askarel. Keep clean-up materials handy in case of an accidental spill.

3. If a transformer must be partially dismantled before it can be moved, it should first have a triple rinse with a suitable solvent. This will remove most, but not all, of the askarel from the transformer. The transformer should still be considered a possible source of contamination.

   These are the instructions to follow:

   Step 1 - Place a containment system under the transformer. See Booklet 6 for details.

   Step 2 - Pump the askarel from the transformer into drums.

   Step 3 - Fill the transformer with a flushing solvent such as trichlorobenzene, kerosene, or fuel oil.

   Step 4 - Let the transformer sit for 18 hours or more so that the solvent can soak into the transformer core.

   Step 5 - Pump the askarel-contaminated solvent from the transformer into drums. See Booklet 5 for instruction in storing drums. Also refer to Section 2.5 of the Guideline for the Management of Waste Materials Containing Polychlorinated Biphenyls, which is published by the Environmental Protection Service. This document provides information on the treatment of contaminated equipment and containers for disposal.

MONS 002091

Step 6 - Repeat steps 3, 4 and 5.

Step 7 - Repeat steps 3, 4 and 5 again.

Step 8 - Commence dismantling of the transformer.

Step 9 - Wipe up all drippings in the area and properly dispose of wastes.

4. Build a protective crate around the transformer for moving. Ensure the drain spouts are protected against damage since they can be easily broken off during moving. The cooling tubes can also be easily crushed or punctured, allowing askarel contaminants to leak out.

5. Move the transformer to the storage area using routine material handling precautions. Be careful when using a fork lift truck. Transformers have been reported to have fallen from them during transport.

6. See Booklet 5 for storage instructions.

USE CAUTION . . .



Containment of Askarel Liquid

Askarel liquid and other liquids which have been contaminated by askarel should be stored in a good quality, double-bung, 45-gallon steel drum of Number 16 gauge or heavier. The bungs should provide a leakproof seal. Leave at least a 3" - 4" air space inside the drum to allow for expansion of the liquid.

Other types of waste liquids such as oils, etc., should be kept in separate drums since they will not need the same storage precautions as askarel.

Containment of Solid Wastes

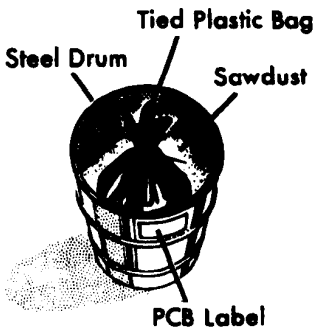
1. Wrap any contaminated clothing, clean-up materials, lighting ballasts, or pieces of contaminated wood and metal in a heavy duty plastic bag and tie it shut.

2. Place the plastic bags in a good quality 45-gallon steel drum of Number 16 gauge or heavier, fitted with a removable steel lid and a gasket with a screw-lug tightening ring. Pack the drum well with sawdust.

3. Shovel any soil, gravel, snow, etc. contaminated by askarel directly into the same type of 45-gallon drum.

4. Seal the drums, label them, and move them to the storage area using routine material handling precautions.

5. See Booklet 5 for storage instructions.



4.5 LABELLING OF PCB WASTES AND DISCARDED EQUIPMENT

Drums containing waste PCB liquid, materials contaminated by askarel, and scrapped electrical equipment should each be labelled with the Number 4 - Severe Hazard label which is available from the Environmental Protection Service.

It is a non-serialized label which is used for many different types of chemicals. When used with PCBs, it should be filled out as follows:

HEALTH	- 4
FIRE	- 1
ENVIRONMENT	- 4
REACTIVITY	- 1
CONTENTS	- PCBs are contained inside
DISPOSAL	- (leave blank)
HANDLING	- Class 9
ORIGINATOR	- (your company name)
TELEPHONE	- (your telephone number)
DATE	- (the date)

The label will then contain the information that is necessary for a PCB container either being stored or later being shipped to a disposal site.

The code numbers that are written into the top line of the label indicate the severity of PCB in that particular situation. For example: PCB is a high health hazard because of its effect on the food chain, it will not burn easily, it is a high hazard to the environment, and it does not react very easily with other chemicals or materials.

The handling classification is a special coding system pertaining to the handling and transportation of hazardous goods. See Booklet 7 if details are required.

How to Apply the Label

Peel the protective backing from the label and press it firmly against a clean, dry area where it is most likely to be seen by personnel. Rub the surface of the label well to ensure it is securely attached.

4	SEVERE HAZARD EXTREME DANGER		
HEALTH SANTE	FIRE INCENDIE	ENVIRONMENT ENVIRONNEMENT	REACTIVITY REACTIVITE
CONTENTS / CONTIENT			
DISPOSAL ELIMINATION		HANDLING MANIPULATION	
ORIGINATOR / EXPEDITEUR			TEL. TEL.
			DATE
04-1914 (01-77)			

FOR USE ON PCB WASTES AND DISCARDED EQUIPMENT

MONS 002094

4.6

APPENDIX

ENVIRONMENTAL PROTECTION SERVICE OFFICES

Region	Address	Telephone
Pacific	Environmental Protection Service Kapilano 100 Park Royal West Vancouver, B.C. V7T 1A2	Emergency (604) 666-6100 Office (604) 666-6711
Northwest	Environmental Protection Service Room 804 9942 - 108th Street Edmonton, Alberta T5K 2J5	Emergency (403) 425-5128 Office (403) 425-5128
Ontario	Environmental Protection Service 7th Floor 25 St. Clair Avenue East Toronto, Ontario M4T 1M2	Emergency (416) 966-5840 Office (416) 966-5840
Quebec	Environmental Protection Service 4th Floor 1550 de Maisonneuve Blvd. West Montreal, Quebec H3G 1N2	Emergency (514) 283-2333 Office (514) 283-2345
Atlantic	Environmental Protection Service 16th Floor, Bank of Montreal Tower 5151 George Street Halifax, N.S. B3J 1M5	Emergency (902) 426-6200 Office (902) 426-6141

Booklet 5

MONS 002097

BOOKLET 5:

STORAGE

OF

PCB LIQUID, EQUIPMENT AND MATERIALS

Prepared by: **Stothert Engineering Ltd.**

Contract OSB77-08285 for: **Environmental Protection Service, Department of Fisheries and Environment**
March 1979.

MONS 002098

CROSS - REFERENCE INDEX

			PAGE
BOOKLET 1:	INTRODUCTION TO PCBs		
	1.1	What are PCBs?	1-2
	1.2	Hazards of PCB	1-3
	1.3	How Does PCB - Contamination Occur?	1-4
	1.4	Is PCB Still Available?	1-5
	1.5	Federal Government Legislation On PCB	1-6
	1.6	The Future	1-8
	1.7	Appendix	1-9
BOOKLET 2:	IDENTIFYING PCBs		
	2.1	Brand Names For PCB	2-2
	2.2	Identifying PCB Transformers	2-3
	2.3	Identifying PCB Capacitors	2-6
	2.4	Identifying PCB Liquids	2-8
	2.5	New Labelling System For PCB	2-10
	2.6	Appendix	2-15
BOOKLET 3:	PREVENTIVE MAINTENANCE FOR PCB EQUIPMENT		
	3.1	General	3-2
	3.2	Anatomy Of A Transformer	3-3
	3.3	Typical Problems With Transformers	3-7
	3.4	Preventive Maintenance Program For Transformers	3-9
	3.5	Anatomy Of A Capacitor	3-13
	3.6	Typical Problems With Capacitors	3-14
	3.7	Preventive Maintenance Program For Capacitors	3-15
	3.8	Appendix	3-17

PAGE

BOOKLET 4: HANDLING OF PCB LIQUID, EQUIPMENT AND MATERIALS FOR MAINTENANCE AND DISPOSAL

4.1	General	4-2
4.2	Safe Handling	4-3
4.3	Collection of Askarel	4-6
4.4	Containment For Disposal	
	- Capacitors	4-7
	- Transformers	4-8
	- Askarel Liquid	4-9
	- Solid Wastes	4-9
4.5	Labelling of PCB Wastes and Discarded Equipment	4-10
4.6	Appendix	4-12

BOOKLET 5: STORAGE OF PCB LIQUID, EQUIPMENT AND MATERIALS

5.1	General	5-2
5.2	Selecting A Storage Site	5-3
5.3	Ideal Storage Facilities	5-4
5.4	Precautionary Guidelines	5-7
5.5	Fire Fighting Safety	5-8
5.6	Labelling in Storage Area	5-9
5.7	Record-Keeping	5-13
5.8	Appendix	5-17

BOOKLET 6: CONTAINMENT SYSTEMS AND CLEAN-UP PROCEDURES FOR PCB

6.1	General	6-2
6.2	What Kind Of Askarel Releases Can Occur?	6-3
6.3	Containment Systems	6-5
6.4	Clean-Up Procedures	6-9
6.5	Appendix	6-13

PAGE

BOOKLET 7: TRANSPORTATION PROCEDURES FOR PCB

7.1 General 7-2
7.2 Necessary Arrangements 7-3
7.3 Packaging and Transport Methods 7-4
7.4 Precautionary Guidelines 7-6
7.5 Labelling 7-7
7.6 Appendix 7-9

BOOKLET 8: SUBSTITUTE CHEMICALS FOR PCB

8.1 General 8-2
8.2 Alternatives Available 8-3
8.3 Factors to Consider 8-4
8.4 Appendix 8-7

FOREWORD

This booklet is number 5 in a series of 8 that have been written to answer the questions of the public concerning the proper management of PCB chemicals, particularly as they are used in electrical equipment. PCB is also known as "askarel" when used in such equipment.

This series will be of special interest to the following companies since they will at some time be working with PCBs.

Companies These Booklets Are Written For

- Owners of PCB Equipment
- Electrical Testing Laboratories
- Garbage and Waste Collection Companies
- Transportation Companies
- Scrap Metal Dealers
- Salvage Companies

Under proper control, the equipment using PCBs can provide an important benefit to man, but without proper control they can also pose a serious threat to human health and the environment.

For general enquiries or assistance in emergency situations, contact the nearest Environmental Protection office listed in the back of this booklet.

5.1 GENERAL

Askarel storage is an ongoing concern. When askarel liquid and materials contaminated by askarel are placed in storage, they just cannot be forgotten about. There is an ever present environmental hazard with this chemical.

Putting them in storage is only the beginning. The next step is periodic inspections to ensure that the integrity of all containers of askarel remains in good condition. This will ensure that there is no danger of askarel leakage to the environment.

These are the sort of contaminated articles that will require conscientious effort in order to provide safe and effective storage. Information on how to store them are included in this booklet:

New articles

- Spare askarel capacitors
- Spare transformers filled with askarel

Discarded articles

- Used capacitors
- Scrapped transformers
- Scrapped lighting ballasts

Askarel wastes

- Askarel drained from equipment
- Askarel collected in drip pans placed under askarel equipment

Contaminated materials

- Earth, asphalt, snow, gravel, etc. contaminated by askarel
- Absorbent material used for clean-up of askarel leakage and spills

Clothing

- Clothing worn when working with askarel

Askarel-Handling Equipment

- Pumps and hoses used to transfer askarel from equipment to containers

It should be remembered that individuals who discharge askarel, or who allow askarel to be discharged into waters frequented by fish, can be prosecuted under the Federal Fisheries Act. Furthermore, discharge of askarel into the environment may be in violation of other statutes, specifically the proposed control on PCB release under the Environmental Contaminants Act and certain provincial pollution control statutes.

Note

Companies or individuals intending to construct commercial collection or storage facilities for PCB wastes should also refer to the Guideline on Central Collection and Storage Facilities for Waste Materials Containing PCBs, published by the Environmental Protection Service. This document outlines the requirements, in addition to those presented here, concerning the bulk storage of PCB wastes and the requirements for the operation of such a commercial facility.

MONS 002103

5.2 SELECTING A STORAGE SITE

The first matter to consider is, "Where can askarel and askarel contaminated articles be safely stored?"

These factors should be kept in mind when selecting a site:

1. Indoor storage is preferable to outdoor storage.

   This will eliminate the danger of rainwater runoff and contamination of melting snow.

   If outdoor storage is absolutely necessary, contact the Federal Environmental Protection Service for information on how to assess the leaking potential, geological conditions, and surface water runoff possibilities of the outdoor storage area.

2. One large storage site is better than several small sites.

   This will minimize the amount of supervisory effort required to monitor the askarel.

3. A special building or separate storage area with no vehicle traffic is ideal.

   This will minimize the potential for mechanical damage. The site should also be handy enough for regular inspections.

4. The storage area should be large enough:

   -For future askarel storage requirements.

   -To enable aisleways to be set up between rows of containers for periodic inspections.

   -To segregate containers which are used frequently from containers which are never used once filled. This will minimize the amount of handling in the storage area and the possibility of accidental spilling.

5. An ideal indoor storage area should be located where there is:

   -Non-corrosive atmosphere to prevent rusting of containers.

   -Air ventilation to the outside.

   -Fresh air make-up in case of emergencies.

   -Normal room temperatures (about 25°C) or cooler.

   -A concrete floor with no floor drains. If floor drains are present, they should be properly stoppered.

   -Very dry surfaces.

6. Above all else, select a site that can be used for many years to come. Make-shift interim sites are hazardous because of the additional material handling which will be required to transport the askarel to a final site.

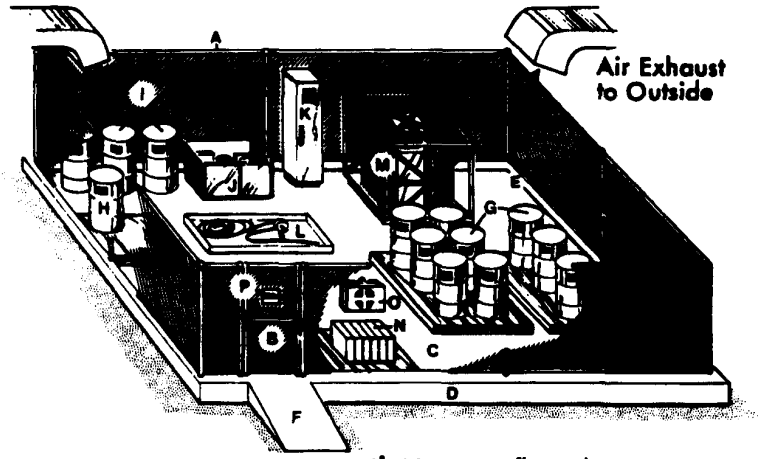
MONS 002104

5.3 IDEAL STORAGE FACILITIES

Indoor Storage Area

A storage area which is located indoors would ideally have these features:

IDEAL INDOOR STORAGE AREA



* No open floor drains in vicinity
All floor cracks sealed

(A) Security fence of chain-link construction.

(B) Padlocked door.

(C) Concrete floor, with no floor drains. All cracks and expansion joints between slabs sealed with compound. Floor painted with epoxy paint to prevent askarel from working its way through the concrete. Note: certain paints and compounds deteriorate in PCB. Check with the manufacturer before using.

(D) Concrete curb around perimeter of storage area. Inside of curb painted with epoxy, same as the floor. See Booklet 8 for more information on constructing such containment systems.

(E) Sealing compound (grouting) at corner of curb to prevent leakage under the curb.

(F) Ramp over concrete curb, into storage area.

(G) Drums containing used askarel, used capacitors, and contaminated materials. Stored on pallets for mobility.

(H) Drums containing unused askarel stored on pallets.

(I) Spare drums for askarel materials.

(J) Uncontaminated clean-up materials stored in bin and labelled.

(K) Locker for garments worn when working with askarel.

(L) Pumps and hoses for use with askarel laid in an open pan to catch drips.

(M) Scrapped transformer in protective crate.

(N) Spare new capacitors stored on pallets.

(O) First aid kit.

(P) PCB label on door.

Outdoor Storage Area

As mentioned earlier in this booklet, outdoor storage of PCB containers and equipment is definitely not recommended. The potential for escape to the environment is just too great.

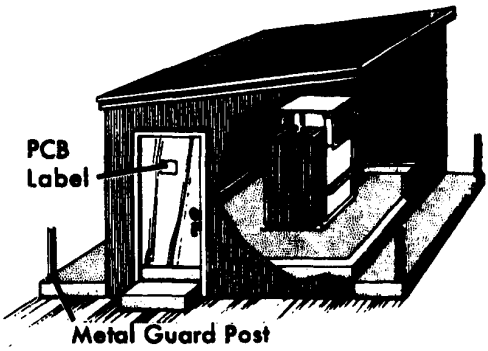
In a situation where there is not any room to store a scrapped transformer inside a building, however, it may have to be stored outside regardless. These are some of the factors that should influence the design of a suitable outdoor storage facility:

- Will the transformer be stored full or empty? The containment system for an empty transformer can be sized much smaller. There is only a small amount of askarel retained in the core of the transformer.
- Is the paint finish of the transformer suitable to protect the transformer without the need to shelter it against weather, fly ash, etc? Check with the manufacturer of the transformer for the durability of the paint finish.
- Would the transformer be vandalized or tampered with if not enclosed?
- Is the transformer being stored in a high traffic area where it might accidentally be backed into by vehicles?
- If the contents of the transformer did leak into its containment system, how would maintenance personnel clean up the contamination?

The drawing on this page shows an outdoor storage facility constructed of fiberglass sheeting. The transformer is mounted on a concrete floor to keep if from shifting, and a concrete curb is integrated into the floor to provide containment of any leakage from the transformer.

Both the floor and the curb are painted with an appropriate sealer. The sealer paint must be resistant to askarel or any other solvents used for flushing the transformer. See Booklet 6 for more information on designing containment systems.

OUTDOOR STORAGE FACILITY FOR DE-ENERGIZED TRANSFORMER



5.4 PRECAUTIONARY GUIDELINES

By following these precautionary guidelines, problems associated with askarel storage should be avoided:

1. Appoint one person as the official custodian in charge of the askarel storage area. Ensure that all transfers of items into and out of this area are authorized by this one person.

2. Check that the custodian is familiar with the contents of this booket and other booklets in this series.

3. Display emergency procedures for cleaning up spilled askarel in an obvious location in the storage area.

4. Post several large and obvious signs in the storage area to inform workers that askarel is being stored on the premises and that caution is necessary in the area. Keep the door locked for security.

5. Keep a first aid kit handy in the storage area, for askarel treatment.

6. Store askarel liquid and askarel contaminated materials in steel drums of heavy construction to avoid leakage. Number 16 gauge and heavier gauge drums are suitable. See Booklet 4 for packing instructions when filling the drums.

   Liquids should be stored in a double-bung, closed top, 45-gallon drum. Solid items such as discarded capacitors should be stored in a 45-gallon drum fitted with a removable steel lid and PCB resistant gasket (with a bolt-type closure).

7. Do not stack containers of askarel or askarel contaminated material. They may fall and break open.

8. Ensure all containers for askarel are always well-painted to prevent rusting.

9. Scrapped transformers which require movement to the storage site should be drained of askarel and flushed out first. Follow the 9 steps in Section 4.4 of Booklet 4 for flushing instructions.

10. While a transformer is in storage, hang a metal catch bucket from the drain spouts to localize any small leakage from the spouts of the transformer. This is a precaution in case the seals of the valve deteriorate. More extensive leakage will be contained by concrete curbs, etc. Also, remove the handles from the valves.

11. Ensure that all containers, boxes, etc. in the storage area are well labelled. See Section 5.6 of this booklet for labelling instructions. Keep clean-up materials handy at the storage site.

12. Install smoke detectors around the storage area and in the vicinity of askarel equipment. They may provide an early warning of a fire and thereby enable it to be extinguished before there is any damage to the askarel containers or to the environment.

13. Seal all openings, ventilation ducts, cracks around doors, cables passing through walls, etc., between rooms containing askarel and other parts of the building. This precaution will localize the dispersion of any contaminated soot or fumes resulting from a fire, thereby making clean up after a fire much more complete (see Booklet 6 for clean up instructions).

14. Set up a record-keeping system to keep track of all items entering and leaving the storage area and of their whereabouts. See Section 5.7 of this booklet for details.

15. Maintain an inspection program for the storage area. All containers should be periodically checked for signs of leakage, and any askarel leakage cleaned up immediately. See Booklet 6 for clean-up instructions.

5.5 FIRE FIGHTING SAFETY

If a fire does break out in a building or area where askarel is being stored or being used in transformers or capacitors, inform the Fire Department to take special precautions. There are two factors to emphasize:

1. **Personal Safety**

   Askarel will not burn easily, but the askarel vapours heated in a fire can be extremely irritating.

   The safe handling techniques of Booklet 4 still apply. In particular, the firemen should be informed that a self-contained breathing apparatus is required, as well as conventional fire fighting clothing with coated gloves.

   The garments may be contaminated by askarel vapours and soot so they should be disposed of later. See Booklet 6 for instructions in clean up after the fire.

2. **Environmental Safety**

   Water runoff should be minimized to prevent contamination to the environment. A concrete curbing already in place or sandbag diking would help to contain runoff.

   If at all possible, foam or dry chemicals rather than water should be used to extinguish the fire.

5.6 LABELLING IN STORAGE AREA

Entrances to Storage Area

Each entrance way into a chain link area or storage compound containing PCBs should be posted with the non-serialized version of the 6 inch by 6 inch black-and-white PCB label.

This will properly inform personnel in the area that PCB is being stored and caution is necessary. With such information, they might also notice a situation which could otherwise go unreported until an authorized employee make his formal inspection rounds.

PCB Wastes and Discarded Equipment

Drums containing waste PCB liquid, materials contaminated by askarel, and scrapped electrical equipment should each be labelled with the Number 4 - Severe Hazard label, also available from the Environmental Protection Service.

It is a non-serialized label which is used for many different types of chemicals. When used with PCBs, it should be filled out as follows:

HEALTH	- 4
FIRE	- 1
ENVIRONMENT	- 4
REACTIVITY	- 1
CONTENTS	- PCBs are contained inside
DISPOSAL	- (leave blank)
HANDLING	- Class 9
ORIGINATOR	- (your company name)
TELEPHONE	- (your telephone number)
DATE	- (the date)

The label will then contain the information that is necessary for a PCB container either being stored or later being shipped to a disposal site.

The code numbers that are written into the top line of the label indicate the severity of PCB in that particular situation. For example: PCB is a high health hazard because of its effect on the food chain, it will not burn easily, it is a high hazard to the environment, and it does not react easily with other chemicals or materials.

The handling classification is a special coding system pertaining to the handling and transportation of hazardous goods. See Booklet 7 if details are required.

Spare PCB Equipment and Unused PCB Liquid

Spare askarel transformer, spare capacitors, and unused PCB liquid should each be labelled with the serialized versions of the black-and-white PCB label.

Use the 6 inch by 6 inch label for transformers and drums of unused askarel. Capacitors should be labelled with the 3 inch by 3 inch label.

How to Apply the Labels

Peel the protective backing from the label and press it firmly against a clean, dry area where it is most likely to be seen by personnel. Rub the surface of the label well to ensure it is securely attached.



FOR USE ON ELECTRICAL ROOM, TRANSFORMER VAULT, CHAIN LINKED AREA AND STORAGE COMPOUND

4	SEVERE HAZARD EXTREME DANGER		
HEALTH SANTE	FIRE INCENDIE	ENVIRONMENT ENVIRONNEMENT	REACTIVITY REACTIVITE
CONTENTS / CONTIENT			
DISPOSAL ELIMINATION		HANDLING MANIPULATION	
ORIGINATOR / EXPEDITEUR			TEL. TEL.
			DATE
04-1914 (01-77)			

FOR USE ON PCB WASTES AND DISCARDED EQUIPMENT

ATTENTION

CONTAINS **PCB** CONTIENT DES

POLYCHLORINATED BIPHENYLS BIPHENYLES POLYCHLORES

A TOXIC ENVIRONMENTAL CONTAMINANT SCHEDULED UNDER THE ENVIRON - MENTAL CONTAMINANTS ACT IN CASE OF ACCIDENT, SPILL OR FOR DISPOSAL INFORMATION, CONTACT THE NEAREST OFFICE OF THE ENVIRONMENTAL PROTECTION SERVICE ENVIRONMENT CANADA

PRODUITS TOXIQUES MENTION NES DANS L'ANNEXE DE LA LOI SUR LES CONTAMINANTS DE L'ENVIRONNEMENT EN CAS D'ACCIDENT, OU DE DÉVERSEMENT, OU POUR SAVOIR COMMENT LES ÉLIMINER, CONTACTER LE BUREAU DU SERVICE DE LA PROTECTION DE L'ENVIRONNEMENT MINISTÈRE DE L'ENVIRONNEMENT LE PLUS PRÈS

PR 20108

LABEL FOR TRANSFORMER

CAUTION CONTAINS

ATTENTION CONTIENT DU

PCB

AN ENVIRONMENTAL CONTAMINANT

UN CONTAMINANT DE L'ENVIRONNEMENT

PR 11896

LABEL FOR CAPACITOR

5.7 RECORD-KEEPING

A properly kept record system is advisable for the storage area. It should be updated each time an item is taken out or brought into the storage area.

By keeping track of all askarel contaminated articles, it will minimize the possiblity that anything from the storage compound might be left lying around to contaminate the environment.

Information Recommended

The following types of information are recommended for the storage area. The Federal Government is presently considering new regulations on this topic:

Date - The date that the goods are removed from or brought into the storage area.

Description - A description of the goods that are being transferred. Include nameplate description, serial numbers, PCB label registration number, and quantity.

Destination/Source - An indication of where the goods are being taken to or where they have come from.

Storage Code - For outgoing goods, an identification number indicating where the goods were stored in the storage area. For example: a barrel number or box number.

Alternatively, if goods are being brought into the storage area, an identification of where they are being stored. For example: a barrel number or pallet number.

Authorization and Department - The name and department of the person in charge of the transfer of the goods.

This listing may be modified to suit individual situations. A typical Askarel Storage Record sheet is shown following this section of the booklet. It may be duplicated directly from this booklet or modified.

The two sheets following the Askarel Storage Record form show an example of how the form may be used for the transfer of a discarded capacitor from the plant area to the storage room. In this example, the barrel is removed from the storage area and taken to the location of the capacitor. Another sheet would also be required to record the transfer of other materials such as plastic bags, wipe-up materials, special clothing, etc.

Setting Up the System

Step 1 - Record all items in the storage area on its appropriate Askarel Storage Record sheet.

Step 2 - Update the record sheets immediately when askarel goods are being taken out or brought into the storage area.

Step 3 - Occasionally double-check the records against the items in the storage area.

MONS 002114

ASKAREL STORAGE RECORD

FOR: DRUMS, CAPACITORS, TRANSFORMERS, OTHER

DATE	REMOVED	RETURNED	DESCRIPTION	DESTINATION/ SOURCE	STORAGE CODE	AUTHORIZATION & DEPARTMENT

ASKAREL STORAGE RECORD

FOR: (DRUMS,) CAPACITORS, TRANSFORMERS, OTHER

DATE	REMOVED	RETURNED	DESCRIPTION	DESTINATION/ SOURCE	STORAGE CODE	AUTHORIZATION & DEPARTMENT
march 5/79	✓		45 gallon drum	To #1 Feedwater Pump - Boiler House	Barrel 26	J. Smith, Chief Electrician
march 5/79		✓				J. Smith, Chief Electrician
					MONS 002116	

ASKAREL STORAGE RECORD

FOR: DRUMS, (CAPACITORS,) TRANSFORMERS, OTHER

DATE	REMOVED	RETURNED	DESCRIPTION	DESTINATION/ SOURCE	STORAGE CODE	AUTHORIZATION & DEPARTMENT
March 5/97		✓	50 KVAR capacitor Catalog #816C80DA13 PCB Serial #PR11869 Inerteen	From #1 Feed Water Pump - Boiler House	Barrel 26	J. Smith, Chief Electrician

5.8

APPENDIX

ENVIRONMENTAL PROTECTION SERVICE OFFICES

Region	Address	Telephone
Pacific	Environmental Protection Service Kapilano 100 Park Royal West Vancouver, B.C. V7T 1A2	Emergency (604) 666-6100 Office (604) 666-6711
Northwest	Environmental Protection Service Room 804 9942 - 108th Street Edmonton, Alberta T5K 2J5	Emergency (403) 425-5128 Office (403) 425-5128
Ontario	Environmental Protection Service 7th Floor 25 St. Clair Avenue East Toronto, Ontario M4T 1M2	Emergency (416) 966-5840 Office (416) 966-5840
Quebec	Environmental Protection Service 4th Floor 1550 de Maisonneuve Blvd. West Montreal, Quebec H3G 1N2	Emergency (514) 283-2333 Office (514) 283-2345
Atlantic	Environmental Protection Service 16th Floor, Bank of Montreal Tower 5151 George Street Halifax, N.S. B3J 1M5	Emergency (902) 426-6200 Office (902) 426-6141

Booklet 6

BOOKLET 6:

CONTAINMENT SYSTEMS

AND

CLEAN-UP PROCEDURES FOR PCB

Prepared by:

Stothert Engineering Ltd.
Vancouver, B.C.

Contract OSB77-08285 for:

Environmental Protection Service,
Department of Fisheries and Environment
March 1979

MONS 002121

CROSS - REFERENCE
INDEX

			PAGE
BOOKLET 1:	INTRODUCTION TO PCBs		
	1.1	What are PCBs?	1-2
	1.2	Hazards of PCB	1-3
	1.3	How Does PCB - Contamination Occur?	1-4
	1.4	Is PCB Still Available?	1-5
	1.5	Federal Government Legislation On PCB	1-6
	1.6	The Future	1-8
	1.7	Appendix	1-9
BOOKLET 2:	IDENTIFYING PCBs		
	2.1	Brand Names For PCB	2-2
	2.2	Identifying PCB Transformers	2-3
	2.3	Identifying PCB Capacitors	2-6
	2.4	Identifying PCB Liquids	2-8
	2.5	New Labelling System For PCB	2-10
	2.6	Appendix	2-15
BOOKLET 3:	PREVENTIVE MAINTENANCE FOR PCB EQUIPMENT		
	3.1	General	3-2
	3.2	Anatomy Of A Transformer	3-3
	3.3	Typical Problems With Transformers	3-7
	3.4	Preventive Maintenance Program For Transformers	3-9
	3.5	Anatomy Of A Capacitor	3-13
	3.6	Typical Problems With Capacitors	3-14
	3.7	Preventive Maintenance Program For Capacitors	3-15
	3.8	Appendix	3-17

MONS 002122

PAGE

BOOKLET 4: HANDLING OF PCB LIQUID, EQUIPMENT AND MATERIALS FOR MAINTENANCE AND DISPOSAL

4.1	General	4-2
4.2	Safe Handling	4-3
4.3	Collection of Askarel	4-6
4.4	Containment For Disposal	
	- Capacitors	4-7
	- Transformers	4-8
	- Askarel Liquid	4-9
	- Solid Wastes	4-9
4.5	Labelling of PCB Wastes and Discarded Equipment	4-10
4.6	Appendix	4-12

BOOKLET 5: STORAGE OF PCB LIQUID, EQUIPMENT AND MATERIALS

5.1	General	5-2
5.2	Selecting A Storage Site	5-3
5.3	Ideal Storage Facilities	5-4
5.4	Precautionary Guidelines	5-7
5.5	Fire Fighting Safety	5-8
5.6	Labelling in Storage Area	5-9
5.7	Record-Keeping	5-13
5.8	Appendix	5-17

BOOKLET 6: CONTAINMENT SYSTEMS AND CLEAN-UP PROCEDURES FOR PCB

6.1	General	6-2
6.2	What Kind Of Askarel Releases Can Occur?	6-3
6.3	Containment Systems	6-5
6.4	Clean-Up Procedures	6-9
6.5	Appendix	6-13

			PAGE
BOOKLET 7:	TRANSPORTATION PROCEDURES FOR PCB		
	7.1	General	7-2
	7.2	Necessary Arrangements	7-3
	7.3	Packaging and Transport Methods	7-4
	7.4	Precautionary Guidelines	7-6
	7.5	Labelling	7-7
	7.6	Appendix	7-9
BOOKLET 8:	SUBSTITUTE CHEMICALS FOR PCB		
	8.1	General	8-2
	8.2	Alternatives Available	8-3
	8.3	Factors to Consider	8-4
	8.4	Appendix	8-7

FOREWORD

This booklet is number 6 in a series of 8 that have been written to answer the questions of the public concerning the proper management of PCB chemicals, particularly as they are used in electrical equipment. PCB is also known as "askarel" when used in such equipment.

This series will be of special interest to the following companies since they will at some time be working with PCBs.

Companies These Booklets Are Written For

- Owners of PCB Equipment
- Electrical Testing Laboratories
- Garbage and Waste Collection Companies
- Transportation Companies
- Scrap Metal Dealers
- Salvage Companies

Under proper control, the equipment using PCBs can provide an important benefit to man, but without proper control they can also pose a serious threat to human health and the environment.

For general enquiries or assistance in emergency situations, contact the nearest Environmental Protection office listed in the back of this booklet.

6.1 GENERAL

Most of the recommendations and procedures presented in this series of booklets have been concerned with the prevention of emergency situations involving PCBs.

Unfortunately, regular maintenance, conscientious handling, safe storage, and regular inspection programs are but a first line of defence against the prevention of PCB emergencies. These practices cannot guarantee that an emergency situation will never occur. For this reason, a second line of defence is a wise precaution. That is the subject of this booklet.

The emphasis in this booklet will be to provide a second line of defence for PCB transformers and capacitors which are already installed and in service. Details on clean-up procedures for askarel are also included for reference purposes.

It should be remembered that individuals who discharge askarel, or who allow askarel to be discharged into waters frequented by fish, can be prosecuted under the Federal Fisheries Act. Furthermore, discharge of askarel into the environment may be in violation of other statutes, specifically the proposed control on PCB release under the Environmental Contaminants Act and certain provincial pollution control statutes. In the event of a spill, the onus is on the responsible parties to ensure that the contamination is cleaned up properly.

MONS 002126

6.2 WHAT KIND OF ASKAREL RELEASES CAN OCCUR?

This section describes the type of situations that should be protected against.

Transformers

1. **Catastrophic Failure**

This can only happen to a transformer which is energized. It is a rupturing or splitting open of the transformer due to a combination of factors: a build-up of internal pressure caused by a power supply problem, failure of the pressure relief valve opening quickly enough, and failure of the electric power being disconnected in sufficient time.

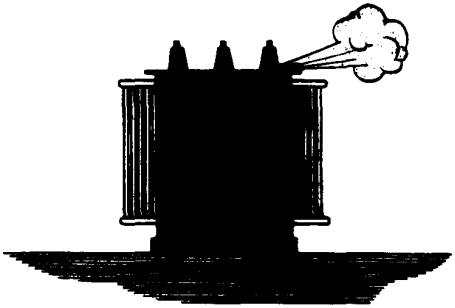
As a result, an opening can force itself through the weakest point in the transformer casing, gaskets, or cooling fins. Alternatively, the sides of the transformer may just balloon out slightly, provided the pressure is not excessive and there are no weak spots in the transformer.

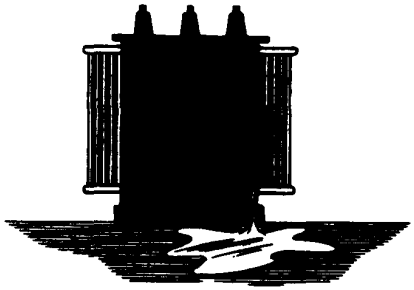
Either of two types of askarel releases can occur, depending upon whether the rupture of the weak point is above or below the level of the askarel liquid in the transformer:

(1) If the opening is above the level of the askarel, a mixture of hydrogen chloride gas, askarel vapour, and askarel droplets will be sprayed out through the rupture and away from the transformer.

(2) If the opening is below the level of the askarel, the pressure will force a spray of askarel liquid out through the rupture. As the pressure is reduced, the askarel will drain out down to the level of the rupture.

Rupture ABOVE Askarel Level





Rupture BELOW Askarel Level

Either of these situations may be avoided by ensuring that the transformer has an adequate design safety factor, by carrying out regular inspections to detect weak points, and by checking that pressure-relief valves and protective disconnect switches are in good working order. See Booklet 3 in this series for an inspection plan for transformers.

2. **Controlled Pressure Release**

This can only happen to a transformer which is energized. It is a release of pressure through the pressure-relief

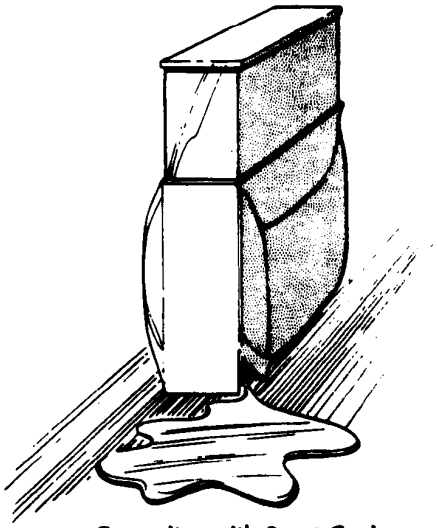
valve. The situation is due to a buildup of internal pressure caused by a power supply problem and failure of the electric power being disconnected in sufficient time.

As a result of the release, a momentary burst of hydrogen chloride gas, askarel vapour, and askarel droplets will be sprayed out through the valve. Depending upon the pressure, the askarel droplets may spray away from the transformer rather than run down the outside of the casing.

3. **Askarel Leakage**

This can occur to a transformer which is either energized or in storage. It is a leakage through deteriorating gaskets, rusted-through cooling fins or casing, broken high voltage bushings or physically punctured cooling fins and casing. The drain spouts on a transformer are also very fragile. Askarel will drain or drip out down to the level of the opening in the transformer.

If the level of the liquid in an energized transformer becomes too low, a controlled pressure release or catastrophic failure may then occur because the transformer will no longer be properly cooled or insulated.



Capacitor with Burst Casing

Capacitors

1. **Catastrophic Failure**

This can only happen to a capacitor which is energized. It is a rupturing or splitting open of the capacitor casing due to a build-up of internal pressure and failure of the power supply being disconnected in sufficient time.

As a result of the excessive pressure, an opening can force itself through the weakest point in the casing, and askarel will be sprayed out. Alternatively, the sides of the capacitor may just balloon out slightly if the pressure is not excessive and there are no weak spots in the casing.

Routine inspections to detect weak spots, dented cases, and leakage are a good practice to prevent catastrophic failure. See Booklet 3 in this series for an inspection plan for capacitors.

2. **Leakage**

This can occur to a capacitor which is either energized or in storage. It is a leakage through a rusted or physically damaged casing. Askarel will drain or drip out down to the level of the opening.

If the level of the liquid in an energized capacitor becomes too low, a catastrophic failure may then occur because the capacitor will no longer be properly cooled or insulated.

6.3 CONTAINMENT SYSTEMS

Custom-designed containment systems, sized for the shape and location of each piece of askarel equipment, are the most viable alternative for coping with the accidental release of askarel from electrical equipment.

These systems may not catch all of the askarel escaping in a release, but they will likely trap enough askarel to prevent a serious situation from becoming a major hazard to human health and the environment. Containment should be considered in all situations, but especially in:

- food processing plants
- grain handling facilities
- downtown core areas of cities
- locations close to waterways and drainage facilities

Materials Compatible with Askarel

Askarel is a powerful solvent.

Although askarel is a powerful solvent, these materials will not react or deteriorate in the liquid. They may be incorporated into the design of a containment system:

- Wood, paper, paperboard
- Asbestos, glass, ceramic, bakelite, sand
- Aluminum, brass, stainless steel, lead, tin, copper, galvanized iron, black iron
- Cork, nitrile rubber, cork-nitrile material (satisfactory for a limited period of time)
- Viton material (by DuPont), Teflon, Silastic 50 material (by Dow Corning)
- Many silicone elastomer materials (verify resistance to askarel first)
- Glyptal 1276 cement (by General Electric)
- Epoxy cement (such as Scotchcast Resin #4 by 3M)
- Dewaxed orange shellac
- Paints with an epoxy-urethane resin (such as APC 60-410 and APC 60-411 by Argosy Industrial Coatings)
- Certain grouting compounds (check with manufacturer first)

Materials Not Compatible with Askarel

These materials should definitely not be used in any askarel containment system since their ability to withstand the solvent action of askarel is limited or negligible. They will eventually soften and weaken:

- Organic materials other than wood and paper. For example: varnishes, lacquers, and common paints should not be used unless tested first.
- Natural rubber, neoprene rubber, butyl rubber
- Lucite (methyl methacrylate)
- Hypalon (chlorosulfonated polyethylene)
- PVC (polyvinyl chloride, polyvinyl formal)
- Koroseal, Hycar P

Design Principles

Bearing in mind the types of askarel releases that can occur from electrical equipment (e.g. sprays, drips, large ruptures), these design principles should be considered when designing suitable containment facilities:

1. An energized transformer requires adequate air circulation to keep it from overheating. Do not construct the sides of a containment facility so high that they block the flow of air to the cooling fins of the transformer. Also, leave sufficient room around the base of the equipment to enable inspections and clean-up to be carried out.

2. If splash walls are constructed around a capacitor to contain an askarel spray, allow for sufficient entry of circulating air and room to carry out maintenance functions on the capacitor.

   Design the splash walls so that any spray will drip down into a containment system located beneath the capacitor(s).

3. An entire room can be used as a containment facility provided the floor is concrete, all floor cracks are plugged and the floor is well-sealed. The doorway will have to be blocked off with concrete curbing. Grout the joint at the base of the wall and the floor.

   The walls of the room should be painted with a sealer paint to prevent askarel from an askarel spray from penetrating into the concrete surface.

4. Metal and concrete containment systems are more durable and reliable than sand-bagging. Sand-bag dikes should only be considered for emergency containment of a spill.

5. The containment system should be sized to hold the full contents of the transformer (or capacitor) plus an allowance for the volume of the transformer base sitting inside the container.

   1 Imperial gallon of askarel occupies roughly 1/6 of a cubic foot of volume, therefore, a transformer containing 125 gallons will contain almost 21 cubic feet of askarel (1 litre of askarel occupies roughly 1/25 of a cubic foot of volume).

   If containers of askarel are being stored inside the containment facility, each 45 gallon drum will contain roughly 7-1/2 cubic feet of askarel. Size the containment facility to hold future requirements also.

6. Allow sufficient work space for cleaning up askarel which has been released from equipment or containers.

7. If metal trays are being fabricated for use under individual transformers or capacitors, ensure the weld is continuous, not spot welded. The trays can be very simple in design since they will not be subjected to mechanical stress. They can be home-fabricated or purchased from transformer manufacturers.

8. It is advisable to hang metal catch buckets from transformer drain spouts to localize small amounts of leakage from the spouts. This makes clean up and disposal much easier.

9. If a transformer requires jacking in order to slide a metal tray underneath, jack only at approved bearing surfaces on the transformer. This will prevent damage to the transformer tank.

10. Where several transformers are located in a common area it is advisable to provide each with a containment system to reduce the area to be cleaned in the event of a spill.

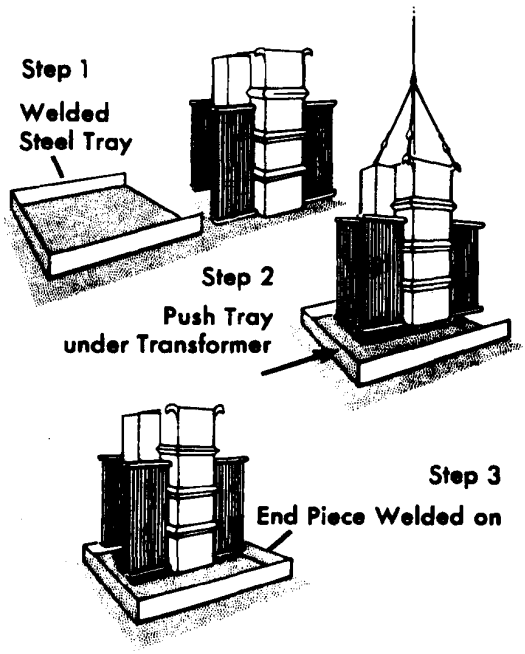
11. Rain water accumulating in a containment system located outdoors will not seriously defeat the purpose of the container. Askarel is much heavier and will displace the water. However, to avoid container flooding as well as corrosion of the transformer it is recommended that a roof be erected over askarel-filled transformers located outdoors.

12. Askarel transformers located indoors are not required to have the protection of a concrete vault, and as such are more vulnerable to damage from a fire in the building. If the fire risk is present, a containment system constructed of plywood covered with fibreglass would not be desirable.

13. The pressure relief vent on top of a transformer may release a mist of askarel amounting to several litres on sudden transformer failure. If a ventilation duct from the pressure vent is provided at all it should direct the mist down into the containment system rather than to the atmosphere exterior to the building where the dispersal of askarel would be uncontrolled.

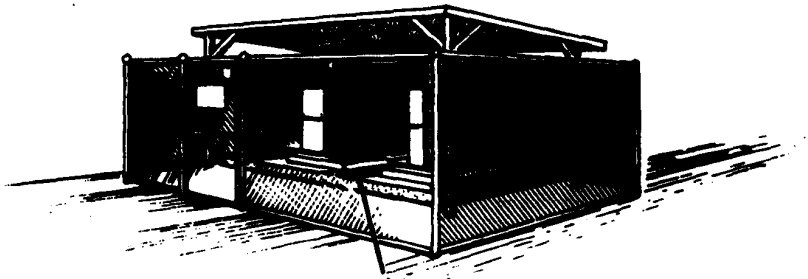
Some Designs

The following 3-stage drawing shows a de-energized transformer being raised so that a partially fabricated metal tray can be slid underneath. A fork lift truck could also be used for lifting, provided there is sufficient room to manoeuvre. After the end piece is welded on, the entire tray should be painted with an askarel-resistant paint to prevent rusting and make clean up easier.



The following drawing shows a design using concrete curbing around a concrete floor. If several transformers were located in the same compound, it would be advisable to construct concrete curbing around and between each transformer to confine an askarel release to as small an area as possible. This would make clean up much easier. Paint the concrete to seal it against the penetration of askarel.

OUTDOOR CONTAINMENT SYSTEM FOR ENERGIZED TRANSFORMER



Curbing between Transformers

These guidelines are also helpful:

1. Concrete surfaces should be thoroughly cleaned of all dirt, grease, etc. before plugging cracks or applying any sealing paint. Use an industrial strength cleaner if necessary.

2. The adhesion between new concrete curbing and an old concrete floor can be insured by:

   (1) Chipping down the old concrete to a fresh level.

   (2) Installing 5/8" self-drilling anchor pins on 3 foot centers along the perimeter for the new curb. Leave 3" - 4" exposed above the surface of the floor.

   (3) Preparing the mating surface with a concrete bonding agent. Approach concrete accessory suppliers for the necessary supplies.

3. All cable-entries to a transformer via the floor should be well-sealed at the floor entrance with a caulking compound.

4. Roof-water drainage should be directed away from the inside of the containment facility to prevent a build-up and possible runoff of contaminated water.

5. Drain spouts incorporated into the base of concrete curbing are not recommended for leading off askarel collected inside the containment area. They may leak and will certainly allow spillage onto the ground during the drainage process.

6.4 CLEAN UP PROCEDURES

General

A variety of absorbent materials are suitable for soaking up askarel (PCB) collected in containment systems and for cleaning up larger types of spills. Many of them are also suitable for use with oil spills.

The following types of materials should be obtained and kept available in case of an emergency involving PCBs:

- Sawdust
- Vermiculite
- Sorbent-C (by McAllister Pollution Control, Montreal)
- Imbiber Beads (by Dow Chemical, Sarnia)
- Hy-Dry (by Tennier Chemicals, Hamilton)
- Diasorb (by Diamond Shamrock, Cleveland, Ohio)
- Stay-Dry (by Waverly Mineral Products, Philadelphia)
- Oil-Dry (by Waverly Mineral Products, Philadelphia)
- Oil-Sorb (Seneca Paper Products, Oakville, Ontario)
- Activated charcoal
- Soil with a high humus content.

Products such as Diasorb by Diamond Shamrock are packaged in the form of one-half cubic foot pillows and can pick up and retain most types of hazardous chemicals at a ratio of one gallon of chemical per one pound of Diasorb material.

Solvents suitable for wiping up and decontaminating surfaces exposed to askarel are:

- Varsol
- Kerosene
- Turpentine
- #2 Fuel Oil
- Trichlorobenzene
- Trichloroethane
- Toluene

Acetone is not recommended because of the flammability danger with this type of solvent.

Leakage Into Containment Systems

In the event there is contamination to the environment, have someone notify the Environmental Protection Service as soon as possible. See the phone numbers listed in the back of this booklet.

These are the steps to follow for clean up and decontamination of the area:

1. Be safety conscious to avoid personal contamination. Observe the routine safety precautions and handling guidelines prescribed in Booklet 4.

2. Use a pump to transfer large volumes of askarel into storage drums.

   Alternatively, soak up the leakage using the absorbent materials listed at the beginning of Section 6.4. Drop these soaked materials directly into storage drums.

3. Wipe up the remaining askarel using a mop, cleaning rags and paper towels.

4. Wet rags with one of the solvents listed at the beginning of Section 6.4 and wipe down the containment area to remove traces of askarel contamination.

5. Dispose of all contaminated materials and waste askarel as indicated in Booklet 5.

Spills on Concrete and Asphalt

With this type of spill, the askarel will flow to low lying areas and collect in pools. If the surface has not been treated with PCB resistant paint, there will be some penetration of askarel into the surface.

In the event there is contamination to the environment, have someone notify the Environmental Protection Service as soon as possible. See the phone numbers listed in the back of this booklet.

These are the steps to follow for clean up and decontamination of the area:

1. Be safety conscious to avoid personal contamination. Observe the routine safety precautions and handling guidelines prescribed in Booklet 4.

2. Plug or dike all drains to sewers. If spillage occurs on a roadway, dike the area to prevent askarel from soaking into the shoulder of the road or from running into nearby bodies of water.

3. Soak up the askarel using absorbent materials listed at the beginning of Section 6.4. If the absorbent material is a loose fill type, sweep it around the area to soak up askarel. Drop the soaked absorbents directly into storage drums.

4. Wipe up the remaining askarel using a mop, cleaning rags and paper towels.

5. Wash and wipe up the area using the solvents listed at the beginning of Section 6.4. Use additional absorbent materials for wiping up. Repeat this procedure to decontaminate the surface.

6. Dispose of all contaminated materials, gravel and soil as indicated in Booklet 5.

7. Obtain one inch deep core samples of the concrete or asphalt to determine how far the askarel has penetrated into the surface.

   The surface material will have to be removed to the level of the contamination. In the meantime, block off the area to pedestrian and vehicle traffic. Cover the area with plastic sheeting to shed rainfall until the excavation work is complete.

Spills on Soil

With this type of spill, the askarel will soak into the ground and cling to individual particles of soil. It may also flow to low lying areas if the ground is hard packed. During rainfall, the soil particles and askarel will be carried downstream to larger bodies of water.

Have someone notify the Environmental Protection Service as soon as possible that contamination has occurred. See the phone numbers listed in the back of this booklet.

These are the steps to follow for clean up and decontamination of the area:

1. Be safety conscious to avoid personal contamination. Observe the routine safety precautions and handling guidelines prescribed in Booklet 4.

2. Build dikes or trenches to contain the askarel to as small an area as possible. This will also help to keep it from flowing into bodies of water. Use plastic sheeting, temporarily, to prevent askarel from soaking into the ground.

3. Use a pump to transfer pools of askarel into storage drums.

   Alternatively, soak up the pools of spilled askarel by using the absorbent materials listed in the beginning of Section 6.4. Be gentle to minimize the penetration of askarel deeper into the soil. Drop the soaked materials directly into storage drums.

4. Remove all soil which is visibly stained with askarel. Shovel it directly into storage drums.

5. Dispose of all contaminated materials and drums of soil as indicated in Booklet 5. Decontaminate earth-handling equipment by rinsing and wiping using solvents.

6. Obtain 2 feet deep core samples in the spill site to determine how far the askarel has penetrated vertically and horizontally beyond the excavated area.

   This contaminated soil should also be removed for disposal. In the meantime, block off the area to pedestrian and vehicle traffic and cover the area with plastic sheeting in a manner which will shed rainfall.

7. After the second excavation is complete, obtain another set of core samples of the area as a safety check of the completeness of the excavations. Dispose of all additional contaminated soil. Decontaminate earth-handling equipment by rinsing and wiping using solvents.

8. Wells and other bodies of water in the vicinity should then be monitored for traces of askarel contamination.

Spills into Water

Since askarel has a higher specific gravity than water, askarel in a body of water will settle to the bottom — provided the water is not flowing or agitated by waves. In a still body of water, the askarel will collect in pools on the bottom or soak into the sediment material.

Have someone notify the Environmental Protection Service as soon as possible that contamination has occurred. See the phone numbers listed in the back of this booklet.

This is the initial step to take if an askarel spill has reached a waterway:

> Take action to minimize agitation of the water. Close off the body of water to all boat traffic, and dam the contaminated area upstream and downstream (the incoming water should be by-passed around the contaminated section).

The next step is clean up. The Environmental Protection Service can best advise on the clean up procedures appropriate for the particular situation. A variety of techniques are possible, such as the use of suction dredges to collect pools of askarel and contaminated sediment, and the use of absorbent materials to soak up askarel collected in pools.

Clean Up After a Fire

A fire involving askarel will produce a contaminated soot which will cling to all surfaces in the area. All other materials directly exposed to askarel liquid will also be contaminated.

These are the steps to follow for clean up and decontamination of the area:

1. Do not begin clean up until the temperature in the area has reduced to normal temperatures.

2. Be safety conscious to avoid personal contamination. Observe the routine safety precautions and handling guidelines prescribed in Booklet 4.

3. Wipe down all impervious surfaces to remove the contaminated soot. Rinse and wipe several times using rags and the solvents listed at the beginning of Section 6.4.

4. Collect all contaminated liquids, materials, soil, clothing etc. and dispose as indicated in Booklet 5.

5. Obtain core samples of concrete surfaces, asphalt surfaces, and soil to determine the extent of contamination. Follow the same procedures as for Spills on Concrete and Asphalt and Spills on Soil. Excavate the contaminated material.

6.5

APPENDIX

ENVIRONMENTAL PROTECTION SERVICE OFFICES

Region	Address	Telephone
Pacific	Environmental Protection Service Kapilano 100 Park Royal West Vancouver, B.C. V7T 1A2	Emergency (604) 666-6100 Office (604) 666-6711
Northwest	Environmental Protection Service Room 804 9942 - 108th Street Edmonton, Alberta T5K 2J5	Emergency (403) 425-5128 Office (403) 425-5128
Ontario	Environmental Protection Service 7th Floor 25 St. Clair Avenue East Toronto, Ontario M4T 1M2	Emergency (416) 966-5840 Office (416) 966-5840
Quebec	Environmental Protection Service 4th Floor 1550 de Maisonneuve Blvd. West Montreal, Quebec H3G 1N2	Emergency (514) 283-2333 Office (514) 283-2345
Atlantic	Environmental Protection Service 16th Floor, Bank of Montreal Tower 5151 George Street Halifax, N.S. B3J 1M5	Emergency (902) 426-6200 Office (902) 426-6141

Booklet 7

BOOKLET 7:

TRANSPORTATION PROCEDURES

FOR PCB

Prepared by: **Stothert Engineering Ltd.**

Contract OSB77-08285 for: **Environmental Protection Service**
Department of Fisheries and Environment
March 1979

MONS 002141

CROSS - REFERENCE INDEX

			PAGE
BOOKLET 1:	INTRODUCTION TO PCBs		
	1.1	What are PCBs?	1-2
	1.2	Hazards of PCB	1-3
	1.3	How Does PCB - Contamination Occur?	1-4
	1.4	Is PCB Still Available?	1-5
	1.5	Federal Government Legislation On PCB	1-6
	1.6	The Future	1-8
	1.7	Appendix	1-9
BOOKLET 2:	IDENTIFYING PCBs		
	2.1	Brand Names For PCB	2-2
	2.2	Identifying PCB Transformers	2-3
	2.3	Identifying PCB Capacitors	2-6
	2.4	Identifying PCB Liquids	2-8
	2.5	New Labelling System For PCB	2-10
	2.6	Appendix	2-15
BOOKLET 3:	PREVENTIVE MAINTENANCE FOR PCB EQUIPMENT		
	3.1	General	3-2
	3.2	Anatomy Of A Transformer	3-3
	3.3	Typical Problems With Transformers	3-7
	3.4	Preventive Maintenance Program For Transformers	3-9
	3.5	Anatomy Of A Capacitor	3-13
	3.6	Typical Problems With Capacitors	3-14
	3.7	Preventive Maintenance Program For Capacitors	3-15
	3.8	Appendix	3-17

PAGE

BOOKLET 4: HANDLING OF PCB LIQUID, EQUIPMENT AND MATERIALS FOR MAINTENANCE AND DISPOSAL

4.1	General	4-2
4.2	Safe Handling	4-3
4.3	Collection of Askarel	4-6
4.4	Containment For Disposal	
	- Capacitors	4-7
	- Transformers	4-8
	- Askarel Liquid	4-9
	- Solid Wastes	4-9
4.5	Labelling of PCB Wastes and Discarded Equipment	4-10
4.6	Appendix	4-12

BOOKLET 5: STORAGE OF PCB LIQUID, EQUIPMENT AND MATERIALS

5.1	General	5-2
5.2	Selecting A Storage Site	5-3
5.3	Ideal Storage Facilities	5-4
5.4	Precautionary Guidelines	5-7
5.5	Fire Fighting Safety	5-8
5.6	Labelling in Storage Area	5-9
5.7	Record-Keeping	5-13
5.8	Appendix	5-17

BOOKLET 6: CONTAINMENT SYSTEMS AND CLEAN-UP PROCEDURES FOR PCB

6.1	General	6-2
6.2	What Kind Of Askarel Releases Can Occur?	6-3
6.3	Containment Systems	6-5
6.4	Clean-Up Procedures	6-9
6.5	Appendix	6-13

			PAGE
BOOKLET 7:	TRANSPORTATION PROCEDURES FOR PCB		
	7.1	General	7-2
	7.2	Necessary Arrangements	7-3
	7.3	Packaging and Transport Methods	7-4
	7.4	Precautionary Guidelines	7-6
	7.5	Labelling	7-7
	7.6	Appendix	7-9
BOOKLET 8:	SUBSTITUTE CHEMICALS FOR PCB		
	8.1	General	8-2
	8.2	Alternatives Available	8-3
	8.3	Factors to Consider	8-4
	8.4	Appendix	8-7

MONS 002144

FOREWORD

This booklet is number 7 in a series of 8 that have been written to answer the questions of the public concerning the proper management of PCB chemicals, particularly as they are used in electrical equipment. PCB is also known as "askarel" when used in such equipment.

This series will be of special interest to the following companies since they will at some time be working with PCBs.

Companies These Booklets Are Written For

- Owners of PCB Equipment
- Electrical Testing Laboratories
- Garbage and Waste Collection Companies
- Transportation Companies
- Scrap Metal Dealers
- Salvage Companies

Under proper control, the equipment using PCBs can provide an important benefit to man, but without proper control they can also pose a serious threat to human health and the environment.

For general enquiries or assistance in emergency situations, contact the nearest Environmental Protection office listed in the back of this booklet.

7.1 GENERAL

This booklet concerns the transportation of askarel wastes and askarel equipment. The point of origination for these materials might be a plant where askarel equipment is being used, a storage location for askarel or the site of an askarel spill.

The transportation of all hazardous products is of such tremendous concern that a bill has been introduced into Parliament to legislate an act which will "promote public safety and (result in) the protection of the environment in the transportation of dangerous goods". The act will be termed the Transportation of Dangerous Goods Act and will cover many types of hazardous goods.

Once the act is passed, it will be regulated by the Transportation of Dangerous Goods Code which is presently in its third draft form. It is intended that both the provinces and the Federal Government will be responsible for administration of the regulations. Information from the code is included in this booklet. It is recommended that the procedures be adopted at this time even though the Act is not yet passed.

Under the transportation code, Polychlorinated Biphenyls (PCBs) are listed as United Nations number UN2315. This is a permanently assigned number which will enable containers of PCBs to be recognized internationally.

7.2 NECESSARY ARRANGEMENTS

These are the sort of arrangements that should be made before transporting a load of PCB materials inside the province, between provinces or across an international border:

1. **Receiver**

   Check that the receiver will accept the shipment. The receiver may not accept the shipment due to not having the appropriate facilities for handling or storing askarel safely.

2. **Transport Company**

   Ensure that the transport company, whether a private trucking or waste handling company, has the knowledge, ability and proper equipment to move the contaminated materials off your premises and to the destination safely.

3. **Provincial Government**

   Contact the Provincial Government and obtain the necessary permits, waybills and placard information in observance of Provincial transportation regulations. This information is not included here due to the varying transport regulations for each province.

4. **Federal Transportation Department**

   For inter-provincial or international shipments, contact the Federal Government and obtain the necessary permits, waybills and placard information in observance of Federal regulations. Until the Transportation of Dangerous Goods Act is passed, the Canadian Transport Commission regulations must be followed for rail shipments.

   As a point of interest, the Marine Administration of the Department of Transport presently regulates shipments of hazardous goods by ship. The Air Administration of the Department of Transport regulates shipments by air. It is doubtful whether PCB materials would require transport by ship or air.

5. **Environmental Protection Service**

   For inter-provincial or international shipments, contact the Environmental Protection Service Emergency office in each province along the route (see the back of this booklet for listings). Contact them ten working days before the shipment.

   Provide the emergency offices with information concerning the date of the shipment, the route, name and quantity of PCBs, name of carrier company, name of driver, vehicle identification and vehicle licence numbers.

   (1) Any changes in the above information should be brought to the attention of the nearest emergency office as soon as possible. That office will notify all other emergency offices along the route.

   (2) The Environmental Protection Service requires that the driver notify the nearest emergency office in the event of a delay en route, an accident or a spillage of PCB contamination. Precise details on the event are required.

MONS 002147

7.3 PACKAGING AND TRANSPORT METHODS

The following guidelines have been selected from the Transportation of Dangerous Goods Code. Once the Transportation of Dangerous Goods Act is legislated, these recommended methods will become regulations under the Act.

Packaging

1. Remove any spouts fitted to drums and replace with leak-proof bungs.

2. No drums of askarel liquid or materials should be transported unless they are free from mechanical defects.

3. Drums should be strapped vertically to pallets and horizontally to each other. They should also be braced to prevent movement during transport and to withstand shocks resulting from sudden changes in speed or direction of the vehicle.

   The end, sides or doors of the truck body should not be relied upon to prevent shifting of the containers.

4. The load on the transport vehicle should be arranged to take account of the floor strength and the centre of gravity.

5. Solid materials which are transported on the same vehicle should be braced to prevent puncturing the containers.

6. Transformers should be wrapped in plastic and secured to pallets before being transported.

Transport

1. Containers, equipment, etc., should not be subjected to any unnecessary rough handling such as dragging, dropping, etc.

2. Ensure there is no tampering with the containers and that there has been no discharge of contents between the point of origin and the point of final destination.

3. Label each container on at least two sides. See Section 7.5 for labelling instructions.

4. Place placards on the transport vehicle if the quantity of PCB being transported is greater than the minimum acceptable quantity under the Dangerous Goods Act. See Section 7.5 for placarding instructions.

As an exception, a vehicle which is loaded with PCB material but is not placarded can be moved, provided:

   (1) The driver is accompanied by a Federal, Provincial or Municipal Government representative or

   (2) The driver has the permission of the Ministry of Transport or

   (3) Movement of the vehicle is necessary to protect life or property.

5. Ensure the driver of the vehicle is fully informed of:

   (1) The nature of the load.

   (2) The location of emergency equipment and its use.

   (3) The reporting procedures to be followed in the event of an accident or incident.

   (4) The need to replace placards and labels which are damaged or lost in transit. Keep an extra supply in the vehicle.

MONS 002148

(5) The requirement to notify the receiver of the goods immediately that PCBs are being transported.

6. A qualified person should always be present at on-loading and off-loading. A qualified person is considered to be a person who is familiar with the emergency equipment for askarel and with recommended procedures. He should have the means and ability to move the containers safely.

7. Ensure that askarel containers are not on-loaded or off-loaded unless the handbrake of the vehicle is securely set and that precautions have been taken to prevent motion of the vehicle.

8. Any vehicle which shows signs of leakage from containers should be decontaminated after unloading but before it is returned to service. See Booklet 6 for clean-up instructions.

7.4 PRECAUTIONARY GUIDELINES

These precautionary guidelines are also recommended to prevent contamination of the environment:

1. See Booklet 4 for instructions on how to contain askarel wastes for storage or shipment.

2. Transport clean-up materials in the same vehicle as the containers of askarel. See Booklet 6 for a listing of suitable absorbents and solvents.

3. Also transport empty containers which might be required in the event of a container developing a leak or in case of an accidental spill. Pack appropriate clothing for handling askarel. See Booklet 4.

4. Metal-lined truck boxes are preferable to flat bed trailers or wooden box trucks. It will help to contain any askarel leakage and make decontamination of the vehicle easier. The bed of the truck should be lined with plastic sheeting for added protection.

5. In case of an askarel leak, stop the vehicle immediately to prevent spreading askarel. Use some other form of transportation to notify the Environmental Protection Service office. Follow the procedures in Booklet 6 to contain leakage until clean-up can begin.

   If leakage cannot be contained inside the truck box, spread vinyl sheeting underneath the truck to prevent leakage from soaking into the ground.

7.5 LABELLING

PCB Wastes and Discarded Equipment

Drums containing waste PCB liquid or materials contaminated by askarel, and scrapped electrical equipment should each be labelled with the Number 4 - Severe Hazard Label. This label is available from the Environmental Protection Service.

It is a non-serialized label which is used for many different types of chemicals. When used with PCBs, it should be filled out as follows:

HEALTH	- 4
FIRE	- 1
ENVIRONMENT	- 4
REACTIVITY	- 1
CONTENTS	- PCBs are contained inside
DISPOSAL	- (leave blank)
HANDLING	- Class 9
ORIGINATOR	- (your company name)
TELEPHONE	- (your telephone number)
DATE	- (the date)

The label will then contain the information that is necessary for a PCB container or discarded equipment being shipped.

The code numbers that are written into the four boxes on the top line of the label indicate the severity of PCB in that particular situation.

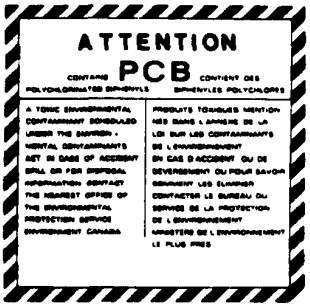
For example: PCB is a high health hazard because of its effect on the food chain, it will not burn easily, it is a high hazard to the environment, and it does not react easily with other chemicals.

The handling classification is a coding system pertaining to the handling and transportation of Polychlorinated Biphenyls under the Dangerous Goods Code.

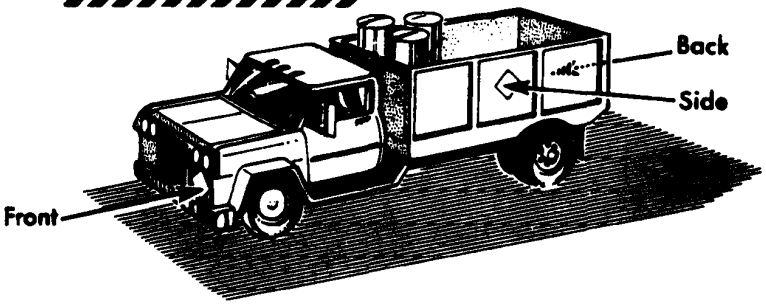
Placarding

An identifying placard is required on each side of the transport vehicle. It can be made of tag board, plastic, metal or some other material and should be at least 250 millimeters (10 inches) by 250 millimeters.

Ensure the placards are clearly visible from every direction but mounted in an area that is separate from advertising on the truck. Such advertising might reduce the effectiveness of the placard. The illustration on the next page shows a typical arrangement of placards for a truck transporting PCBs.


ATTENTION
CONTAINS PCB CONTIENT DES
POLYCHLORINATED BIPHENYLS BIPHENYLES POLYCHLORES
A TOXIC ENVIRONMENTAL
CONTAMINANT DESIGNATED
UNDER THE CANADIAN
ENVIRONMENTAL CONTAMINANTS
ACT IN CASE OF ACCIDENT
SPILL OR FOR DISPOSAL
INFORMATION CONTACT
THE NEAREST OFFICE OF
THE ENVIRONMENTAL
PROTECTION SERVICE
ENVIRONMENT CANADA
PRODUITS TOXIQUES MENTION-
NES DANS L'ANNEXE DE LA
LOI SUR LES CONTAMINANTS
DE L'ENVIRONNEMENT
EN CAS D'ACCIDENT OU DE
DEVERSEMENT OU POUR SAVOIR
COMMENT LES ELIMINER
CONTACTER LE BUREAU OU
SERVICE DE LA PROTECTION
DE L'ENVIRONNEMENT
MINISTERE DE L'ENVIRONNEMENT
LE PLUS PRES

PLACARD


Back
Side
Front

7.6

APPENDIX

ENVIRONMENTAL PROTECTION SERVICE OFFICES

Region	Address	Telephone
Pacific	Environmental Protection Service Kapilano 100 Park Royal West Vancouver, B.C. V7T 1A2	Emergency (604) 666-6100 Office (604) 666-6711
Northwest	Environmental Protection Service Room 804 9942 - 108th Street Edmonton, Alberta T5K 2J5	Emergency (403) 425-5128 Office (403) 425-5128
Ontario	Environmental Protection Service 7th Floor 25 St. Clair Avenue East Toronto, Ontario M4T 1M2	Emergency (416) 966-5840 Office (416) 966-5840
Quebec	Environmental Protection Service 4th Floor 1550 de Maisonneuve Blvd. West Montreal, Quebec H3G 1N2	Emergency (514) 283-2333 Office (514) 283-2345
Atlantic	Environmental Protection Service 16th Floor, Bank of Montreal Tower 5151 George Street Halifax, N.S. B3J 1M5	Emergency (902) 426-6200 Office (902) 426-6141

Booklet 8

BOOKLET 8:

SUBSTITUTE CHEMICALS

FOR PCB

Prepared by: **Stothert Engineering Ltd.**

Contract OSB77-08285 for: **Environmental Protection Service**
Department of Fisheries and Environment
March 1979

MONS 002156

CROSS - REFERENCE INDEX

			PAGE
BOOKLET 1:	INTRODUCTION TO PCBs		
	1.1	What are PCBs?	1-2
	1.2	Hazards of PCB	1-3
	1.3	How Does PCB - Contamination Occur?	1-4
	1.4	Is PCB Still Available?	1-5
	1.5	Federal Government Legislation On PCB	1-6
	1.6	The Future	1-8
	1.7	Appendix	1-9
BOOKLET 2:	IDENTIFYING PCBs		
	2.1	Brand Names For PCB	2-2
	2.2	Identifying PCB Transformers	2-3
	2.3	Identifying PCB Capacitors	2-6
	2.4	Identifying PCB Liquids	2-8
	2.5	New Labelling System For PCB	2-10
	2.6	Appendix	2-15
BOOKLET 3:	PREVENTIVE MAINTENANCE FOR PCB EQUIPMENT		
	3.1	General	3-2
	3.2	Anatomy Of A Transformer	3-3
	3.3	Typical Problems With Transformers	3-7
	3.4	Preventive Maintenance Program For Transformers	3-9
	3.5	Anatomy Of A Capacitor	3-13
	3.6	Typical Problems With Capacitors	3-14
	3.7	Preventive Maintenance Program For Capacitors	3-15
	3.8	Appendix	3-17

PAGE

BOOKLET 4: HANDLING OF PCB LIQUID, EQUIPMENT AND MATERIALS FOR MAINTENANCE AND DISPOSAL

4.1	General	4-2
4.2	Safe Handling	4-3
4.3	Collection of Askarel	4-6
4.4	Containment For Disposal	
	- Capacitors	4-7
	- Transformers	4-8
	- Askarel Liquid	4-9
	- Solid Wastes	4-9
4.5	Labelling of PCB Wastes and Discarded Equipment	4-10
4.6	Appendix	4-12

BOOKLET 5: STORAGE OF PCB LIQUID, EQUIPMENT AND MATERIALS

5.1	General	5-2
5.2	Selecting A Storage Site	5-3
5.3	Ideal Storage Facilities	5-4
5.4	Precautionary Guidelines	5-7
5.5	Fire Fighting Safety	5-8
5.6	Labelling in Storage Area	5-9
5.7	Record-Keeping	5-13
5.8	Appendix	5-17

BOOKLET 6: CONTAINMENT SYSTEMS AND CLEAN-UP PROCEDURES FOR PCB

6.1	General	6-2
6.2	What Kind Of Askarel Releases Can Occur?	6-3
6.3	Containment Systems	6-5
6.4	Clean-Up Procedures	6-9
6.5	Appendix	6-13

MONS 002158

			PAGE
BOOKLET 7:	TRANSPORTATION PROCEDURES FOR PCB		
	7.1	General	7-2
	7.2	Necessary Arrangements	7-3
	7.3	Packaging and Transport Methods	7-4
	7.4	Precautionary Guidelines	7-6
	7.5	Labelling	7-7
	7.6	Appendix	7-9
BOOKLET 8:	SUBSTITUTE CHEMICALS FOR PCB		
	8.1	General	8-2
	8.2	Alternatives Available	8-3
	8.3	Factors to Consider	8-4
	8.4	Appendix	8-7

MONS 002159

FOREWORD

This booklet is number 8 in a series of 8 that have been written to answer the questions of the public concerning the proper management of PCB chemicals, particularly as they are used in electrical equipment. PCB is also known as "askarel" when used in such equipment.

This series will be of special interest to the following companies since they will at some time be working with PCBs.

Companies These Booklets Are Written For

- Owners of PCB Equipment
- Electrical Testing Laboratories
- Garbage and Waste Collection Companies
- Transportation Companies
- Scrap Metal Dealers
- Salvage Companies

Under proper control, the equipment using PCBs can provide an important benefit to man, but without proper control they can also pose a serious threat to human health and the environment.

For general enquiries or assistance in emergency situations, contact the nearest Environmental Protection office listed in the back of this booklet.

8.1 GENERAL

Retrofilling

The removal and replacement of askarel fluid in electrical equipment with other types of insulating liquids is termed "retrofilling".

As stated in the Guideline for the Management of Waste Materials Containing Polychlorinated Biphenyls, retrofilling of askarel-filled transformers is not recommended by the Environmental Protection Service.

As an exception, if a transformer is already in service and its contents must be drained for some reason, then retrofilling may be appropriate. A careful study should be made of the effects of the new fluid on the transformer's insulating qualities and heat transfer properties. The manufacturer of the transformer should be consulted for a detailed investigation.

Other important factors to consider are highlighted in this booklet.

Topping Up

Another term referred to in the servicing of electrical transformers is "topping up". It is an adding of liquid to replenish askarel which is lost due to leakage or sample testing.

Under the regulations of the Environmental Contaminants Act, topping up with askarel is prohibited. Tri/tetrachlorobenzene (TTCB) or some other suitable make-up fluid such as refined paraffinic oil may be used to replenish the volume of the coolant.

Check with the transformer manufacturer for the maximum allowable make-up fluid that can be added (likely 25-40% of the tank size). Excessive quantities of make-up fluid may alter the performance of the transformer or soften the insulation on the transformer windings.

Large quantities of make-up fluid should not be added quickly. Add it slowly to allow for proper mixing with the askarel.

Capacitors

Capacitor casings are not designed for retrofilling or topping up so the question of substitute chemicals for installed capacitors is not a consideration.

Under the regulations of the Environmental Contaminants Act, PCB-filled capacitors may no longer be manufactured in Canada or imported into the country. As a result, once suppliers' inventories of PCB capacitors deplete, PCB capacitors will no longer be available in Canada. Substitute chemicals will then be needed for the many applications requiring capacitors.

In recent years, many of the manufacturers of PCB capacitors have developed capacitors which contain alternative fluids. The merit of each manufacturers' capacitors should be investigated when new capacitors are required. Such an analysis is beyond the scope of this booklet.

MONS 002161

8.2 ALTERNATIVES AVAILABLE

Material suppliers are frequently asked, "Do you have a liquid that can be used to replace askarel in transformers?" Unfortunately, there is no simple answer to this question.

There are several liquids which could be considered for use in an askarel transformer. These include:

- Transformer oil
- Silicone fluid
- Refined paraffinic oil
- TTCB fluid

The problem is that none of these liquids are totally acceptable from an environmental, technical, cost and safety point of view. For that matter though, neither is PCB liquid because of its environmental hazard.

The next section of this booklet includes a comparison of some of the characteristics of these fluids.

MONS 002162

8.3 FACTORS TO CONSIDER

Environmental Hazard

The removal of PCB from an askarel transformer and several flushings with a solvent will not be sufficient to declare the transformer free of PCB contamination. There will still be enough askarel retained in the windings of the transformer to contaminate the new fluid. A retrofilled transformer is still considered to be filled with PCB.

If PCB levels in the insulating fluid exceed 100 ppm, the transformer will still require labelling and consideration as a PCB transformer. There is also the problem of storing the large quantity of drained askarel and flushings safely.

Technical and Economic Factors

This is a summary of some of the technical and economic factors for alternative transformer liquids. Additional details are provided after the table:

Factor	Transformer Oil	Silicone Fluid	Refined Paraffinic Oil	TTCB Fluid
Flammability	Very flammable	May be affected	May be affected	Okay
Loadability	Okay	Reduced	May be reduced	Okay
Insulation reliability	Okay	May be reduced	Okay	May be reduced
Action of tap changers & pumps	Okay	May be affected	Okay	Okay
Approximate cost per gallon	$1	$24	$10	$11

1. **Flammability**

Tests have demonstrated that in the event of a high power arc inside a transformer filled with oil, hydrogen gas will be produced in large quantities. If ignited by the arc, the gas will explode, causing the oil to burn continuously.

With silicone fluid, large quantities of hydrogen gas will also be produced, but the liquid will not continue to burn. Silicone fluid apparently has the tendency to prevent the ignition from spreading.

The flammability index for several fluids are as follows. The index for water is included for comparison:

Water	0
Askarel	2-3
Silicone	4-5
Transformer Oil	10-20
Ether	100

The flash points for some transformer fluids are:

Transformer Oil	Approx. 160°C
Silicone	Approx. 285°C
Refined paraffinic Oil	Approx. 285°C

From a safety point of view, fireproof vaults may have to be constructed around an indoor transformer installation in order to gain compliance with electrical codes.

From an insurability point of view, insurance companies are tending to evaluate retrofilled transformers on an individual basis.

2. **Loadability**

Loadability represents the ability of an askarel transformer to maintain its nameplate rating with an alternative fluid inside.

Since silicone fluid is a highly viscous fluid, it does not have the same cooling efficiency as transformer oil or askarel. For this reason, the power handling capability of the transformer may have to be reduced by up to 10% after retrofilling.

3. **Insulation Reliability**

Both silicone fluid and TTCB have a higher coefficient of thermal expansion than askarel (silicone is 1-1/2 times that of askarel).

This means that at low temperatures the volume of the level in the transformer will drop significantly. It may drop so much that internal parts of the transformer are exposed and electric arcs can occur.

A transformer filled with TTCB should not be energized when the temperature of the liquid is below 0°C, for this reason.

4. **Action of Tap Changers & Pumps**

Silicone exhibits poor lubrication qualities. This may cause tap changes and pumps of askarel transformers to seize or fail. Maintenance would be required.

Furthermore, some askarel transformers use silicone rubber gaskets. This material will swell and weaken when exposed to silicone liquid. Leaks will develop.

5. **Approximate Cost Per Gallon**

Several flushings with a solvent will be required to cleanse the transformer of most of its askarel. Added to this the cost of labour for draining, flushing and filling, plus the cost of insuring and transporting the solvents and askarel, retrofill becomes a very expensive proposition to implement.

6. **Other Factors**

Silicone vapours released from a pressure relief valve on a transformer will cling to surfaces and inhibit such activities as maintenance painting of transformer cooling fins. In order to obtain good adhesion of the paint, special additives will have to be added.

The vapours released from a silicone filled transformer located in a mine may activate methane detectors.

7. **Conclusions**

As mentioned earlier in this booklet, retrofilling of askarel filled transformers is not recommended as a viable alternative.

It should be emphasized, however, that in the case of new transformers, the unit will be designed to *minimize* the shortcomings of the selected transformer fluid. Transformer manufacturers are very willing to discuss how their product compares against the performance of askarel fluid.

8.4

APPENDIX

ENVIRONMENTAL PROTECTION SERVICE OFFICES

Region	Address	Telephone
Pacific	Environmental Protection Service Kapilano 100 Park Royal West Vancouver, B.C. V7T 1A2	Emergency (604) 666-6100 Office (604) 666-6711
Northwest	Environmental Protection Service Room 804 9942 - 108th Street Edmonton, Alberta T5K 2J5	Emergency (403) 425-5128 Office (403) 425-5128
Ontario	Environmental Protection Service 7th Floor 25 St. Clair Avenue East Toronto, Ontario M4T 1M2	Emergency (416) 966-5840 Office (416) 966-5840
Quebec	Environmental Protection Service 4th Floor 1550 de Maisonneuve Blvd. West Montreal, Quebec H3G 1N2	Emergency (514) 283-2333 Office (514) 283-2345
Atlantic	Environmental Protection Service 16th Floor, Bank of Montreal Tower 5151 George Street Halifax, N.S. B3J 1M5	Emergency (902) 426-6200 Office (902) 426-6141