

Telephones and Capacitors with Polychlorinated Biphenyls

Abbreviated reprint of article from May 2001 edition. A timely reminder of the dangers of PCBs

This article is aimed at raising the level of awareness of Telephone Collectors to the issue of Polychlorinated Biphenyls (PCBs) that were used in some capacitors in telephones and related equipment. Also applies to radios, televisions, house-hold electrical appliances, commercial and industrial electrical/electronic equipment.

HISTORY OF PCB and ITS USES

During the 1930s electrical engineers expressed the need for a synthetic electrical insulation fluid for transformer and capacitor installations where fire was a particular hazard. The new fluid had to have the same performance and electrical strength as mineral oil but must be fire-resistant. The resulting fluid was Polychlorinated Biphenyl (PCB), which met the requirement but unfortunately, this new fluid (termed 'Askarel') was later found to be environmentally hazardous. Their manufacture in the USA and the UK ceased in 1977. However, there remain a large number of installations which still contain PCB and more importantly these were not always labeled as containing Askarel as the product was sold under many different Trade Names (see Table B). In many instances these units were located in low-risk areas where the need for PCB was unnecessary.

What are PCBs?

PCB's is the common name for polychlorinated biphenyls. PCB's were widely used as a dielectric fluid in electrical transformers and capacitors. PCB's range in appearance from colourless, oily liquids to more viscous and increasingly darker liquids, to yellow then black resins, depending on chlorine content of the PCB. These synthetic compounds are chemically stable and do not degrade appreciably over time.

Why are they hazardous?

PCB is non-biodegradable and is persistent in the environment. When subject to high temperature PCB can produce polychlorinated dibenzofurans (PCDFs) and, in the presence of tri- or tetra-chlorobenzene some polychlorinated dibenzodioxins (PCDD's) can be formed too. Some of these substances are extremely toxic, much worse than PCB, thus PCB's involved in a fire can produce long-lasting contamination of buildings.

If these chemicals are released into the environment, they do not readily break down and

can accumulate in fatty tissues of animals. The longevity of PCB's and their affinity for fatty tissue can result in PCB's moving up and concentrating through the food chain. Research has found that some animal species, such as young fish, are particularly sensitive to PCB's.

PCBs can enter the body in three ways:

- absorption through the skin;
- inhalation of PCB vapour (at room temperature, the vapour concentrations of PCB's are not significant); and
- ingestion if there is contamination of food or drink.

The likelihood of becoming sick from PCB exposure increases with the length of time and the amount of material that a person might come in contact with. The most commonly observed symptom in people exposed to high levels of PCB's is a condition known as chloracne. It is a severe, persistent acne-like rash due to repeated and prolonged contact of PCB's with skin. This condition has also occurred in people who have accidentally ingested PCB's orally. Very high exposure to PCB's may also cause liver damage and damage to the nervous system, resulting in numbness, weakness and tingling in the arms and legs. There is the possibility that PCBs may cause cancers.

Identification of PCB-Containing Equipment

The major use of PCB's in the electrical industry has been as an insulating fluid inside transformers and capacitors. These transformers and capacitors ranged in size from the very large transformers used by electrical supply authorities to the small capacitors that were used in most industrial equipment and communication systems. Capacitors containing PCB's were installed in various types of equipment including fluorescent light fittings during from the 1950's to the 1970's.

Identifying Telephones with PCB filled Capacitors

Early telephones used the 'Mainsbridge' design capacitors which contained only tinfoil and waxed paper but were rather bulky. However all telephones manufactured between the late 1930's and 1970 are likely candidates to have a PCB capacitor in them. This is certainly the case for the telephones that were used by the Australian Post Master General (PMG) department.

The 162 and the later 232 along with the 332, 334,

336, 300, and 400 Series telephones fall within this timeframe. The early versions of the 800 Series Telephone with the round aluminum capacitors should also be considered as potentially containing PCB's. The later 800 Series Telephones have capacitors encased in epoxy resin and do not contain PCB's. Any of the telephones or related equipment in service with the PMG before the mid 1930's with capacitors that have been installed or replaced may also contain PCB's. This also applies to any telephones from other parts of the world and companies involved with Private Automatic Branch Exchanges (PABX's). Telephones used by the Department of Defence, the Australian Broadcasting Commission, the National and State Rail Authorities are also likely to have capacitors with PCB's.

Telephone Exchange Equipment and PCB's

This section describes telephone exchange equipment with capacitors used in Australia by the Post Master General (PMG) department and Telecom. All telephone exchange equipment manufactured between the mid 1930's and the mid 1970's has capacitors that are likely to have a PCB's in them. This is certainly the case for the 2000 Type Step by Step and SE50 Selector switches and the LM Ericsson ARF, ARK Exchanges and the ARD and AKD PABX's. This also includes ARE 11 Cross bar equipment produced before 1977. Other types of exchange equipment with capacitors are also likely to contain PCB's if produced between the late 1930's and the 1970's. Exchange type equipment used by the Department of Defence, the Australian Broadcasting Commission, the National and State Rail Authorities is also likely to have capacitors with PCB's. If the equipment was produced before 1977 and had capacitors installed or replaced before 1977 then the probability that the capacitor has PCB in it is high.

PCB TRADE NAMES

When PCB was used in transformers and capacitors then, depending on their country of origin the name of the liquid used varied considerably. In order to help with identification of PCB's **table A** below has a number of the more well known trade names which have been used:

CAPACITORS BRAND NAMES WITH PCB'S

Table B (*next page*) is a list of capacitor brand names where PCB's were used in some model types. For a full list of model types for each brand refer to the ANZECC publication Identification of PCB Containing Capacitors Appendix IV at <http://www.environment.gov.au/epg/swm/pcb/pcb.pdf>

Table A

ACECLOR	DIACHLOR	NO-FLAMOL
APIROLIO	DISCONOL	KENNECHLOR
AROCLOR B	DUCONOL	PERMATOL
ASBESTOL	DYKANOL	PHENOCOLOR
ASKAREL	ELEMEX	PYRALENE
BAKOLA 131	EUCAREL	PYRACLOR
BICLOR	FENCLOR	PYRANOL
CHLOREXTOL	HIVAR	SAF-T-KUHL
CLOPHEN	HYDOL	SANTOTHERM
CLORINOL	HYVOL	SIKLONYL
CLOPHEN	INERTEEN	SOLVOL
D.K.	KANECLOR	THERMINOL
DIACHLOR	KENNECHLOR	

VISCONOL (used in high-voltage caps in TVs with mains-derived EHT) was also suspected as a PCB.

Safe Handling of PCB-Containing Equipment

Small quantities of PCBs found in capacitors are unlikely to pose a health risk, unless they become damaged and leak. Care must be taken when handling a damaged capacitor to ensure that spillage does not occur. The person handling the damaged capacitor should take the following precautions:

- put on personal protective equipment and clothing before removing damaged or leaking components;
- wear gloves that are made of materials that are resistant to PCBs, such as Viton, polyethylene, polyvinyl alcohol (PVA), polytetrafluoroethylene (PTFE), butyl rubber, nitrile rubber, or neoprene. Mid-arm length gauntlets may be required;
- do not use gloves made of polyvinyl chloride (PVC) or natural rubber (latex);
- use disposable gloves;
- wear disposable overalls made of Tyvek or made of materials with similar chemical resistant properties;
- when working with overhead equipment (eg. fluorescent light fixtures), wear a full face shield and appropriate hair protection;
- wash any non-disposable contaminated equipment with kerosene and collect the kerosene for disposal as a PCB-contaminated solvent;
- if PCB vapours are suspected (eg. PCB leaks onto a hot surface in a confined space), wear a suitable respirator. Use a twin cartridge type respirator suitable for chlorinated vapours. It is always prudent to ensure adequate ventilation. NOTE: PCB's do not vaporise readily at room temperature;

Table B

A.H. HUNT LTD	DUCONOL 'A'	RIC
ACEC	DUCONOLA	RIC CAPACITORS LTD.
AEE	ELNA	RIFA
AEG (Logo Only)	ENDURANCE	RS
AEI	FAC	SCC
AEROVOX	FIRBOURG	SEI
AME	FRAKO	SELENIUM
AME (PYE TMC)	FUJI KEN	SHIZUKI
AME BICC	G.E.	SIEMENS
AME DUBILIER	GEC	SPRAQUE
AME F	HUNTS	STABILAC PTY. LTD.
AME HUNTS	ICAR	STATIC
AME TMC	INCO	STC
AT&E Co.	INTERCAP	STEDEPOWER
ATE	ITAL FARAD	SUDD
BICC	JARD	T.M.C.
BICC NEECO	JOHNSON & PHILLIPS	TCC
BOSCH	LTD.	TEAPOL
BTH	KCC	THE CAPACITRON CO.
CDG	MALLORY	THE TELEGRAPHIC
CPL	METALECT	CONDENSOR CO.
DALY	MF	TMC
DANCO	MF PHILLIPS	UCC
DAWCO	MKP	USHA
DICC	MOTOR START	WATSON
DUBILIER	MP	WEGO CONDENSOR
DUBILIER DUCONOL	NICHICON	CO.
DUCATI	NICHICON CAPACITOR CO.	WESTERN ELECTRIC
DUCON	NICHICON CAPACITOR LTD	WESTON ELECTRIC
DUCON (NZ) LTD	NTK	YESHA
DUCON Condensor Ltd	PLESSEY	YESHA ELECTRICALS
DUCONOL	PLESSEY UK	YUHCHANG

- do not smoke; and
- after handling PCB's, even if gloves were worn, wash hands well in warm, soapy water before eating, drinking, smoking, handling food or drink, or using toilet.

First-Aid

If PCB contacts the eyes, immediately wash it out with copious amounts of running water for at least 10 minutes. Occasionally lift the upper and lower eye lids to ensure complete irrigation of the eye. Obtain medical attention immediately.

If PCB contacts the skin, immediately remove all contaminated clothing. Wash the affected areas with warm, soapy water. Do not use kerosene to remove PCB from your skin or clothing. Obtain medical attention as soon as possible. PCB spills should be handled by first evacuating people not involved with the clean-up from the spill area. Everyone involved with the clean-up needs to take the precautions listed in section on Handling Procedure.

Clean-Up Of Leaks

The procedure detailed below should be followed if any PCB leaks from capacitors, or if PCB-contaminated material, such as kerosene, is accidentally spilt.

Use an absorbent material (preferably commercial absorbent, kitty litter or a diatomaceous earth) to form a barrier to prevent any of the PCB from escaping and soak up the PCB with the absorbent material.

Non-porous surfaces should be cleaned with an organic solvent, for example, kerosene, and the solvent collected and disposed of as a PCB-containing solvent.

All porous material (including protective clothing and the damaged capacitor) which has been contaminated must be placed in a strong, sealed polyethylene bag, which is then to be placed in a sound, sealable metal drum.

An absorbent material should be packed around the PCB equipment to absorb any leaks. The drum should then be sealed.

Any PCB-contaminated solvents from the clean-up must be stored in separate drums. All drums must be adequately labelled 'PCB Waste' together with the name of the equipment or material contained within each drum.

WEBSITE LINKS FOR REFERENCE and ENVIRONMENTAL REGULATORS.

There are National and State government departments with documents on this topic. Government Departments related to work safety, environment or waste disposal are likely to host these documents. Over time the department name may change so I have not listed any links or contact details. All links from 2001 have changed. If you use the acronym PCB or the full word name Polychlorinated Biphenyls plus words like environmental, protection, waste, management, regulator, identification, contamination, hazard, disposal, program, etc you will find articles and contact details.

CONCLUSION

This article is intended to raise the awareness of telephone collectors to the issue of PCB's. If a capacitor has leaked and you suspect that the residue is PCB or you do not know then treat it as if it is PCB and follow the information in this article. Store all telephones that could have PCB in their capacitors in a cool location and inspect them on a regular basis.

REFERENCES

1. Identification of PCB Containing Capacitors. An information booklet for Electricians and Electrical Contractors, ANZECC 1997 ISBN 0 642 54507 3.
2. Polychlorinated Biphenyls (PCB) Safety Warning.
[Http://www.sigtel.com/tv_tech_pcbs.html](http://www.sigtel.com/tv_tech_pcbs.html)