

PETRONAS TECHNICAL STANDARDS
HEALTH, SAFETY AND ENVIRONMENT

SAFE HANDLING AND DISPOSAL OF PCB'S
(GUIDELINE)

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PREFACE

Petronas Technical Standards (PTS) are based on the experience acquired during the involvement with the design, construction, operation and maintenance of processing units and facilities. Where appropriate they are based on, or reference is made to, national and international standards and codes of practice. The objective is to set the recommended standard for good technical practice applied by PETRONAS in oil and gas production facilities, oil refinery, gas processing, chemical plants, marketing facilities or any other such facility, and thereby to achieve maximum technical and economic benefit from standardization.

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AMENDMENTS RECORD SHEET

Chap. No.	Sect No.	Description	Issue No.	Date	Rev No.	Date	App by: (initial)
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FOREWORD

These Guidelines are intended for PETRONAS Operating Units / Joint Ventures – OPU/JV as a general Hygiene and Safety Guide for use wherever polychlorinated biphenyls (PCBs), liquids containing PCBs, or items contaminated by PCBs are transferred, handled, used, stored or disposed of. They may serve as a basis for drafting detailed operating procedures and regulations adapted to local conditions and circumstances. The precautionary measures recommended should be considered as minimum requirements; contractors and other parties involved in Company operations should be advised accordingly. In those countries where statutory regulations or national codes of practice concerning the use, storage or disposal of PCBs apply these must of course be observed. Where these Guidelines differ from national regulations, the more stringent requirements should be adopted.

The principal objectives of these Guidelines are to avoid contamination of the environment and to protect the health of persons who may be required to transfer, handle, transport, store and/or otherwise have to deal with polychlorinated biphenyls (PCBs) or likely to be in contact with or exposed to PCBs. Management of OPU/JV should, therefore, ensure that environmental officers and company medical advisors responsible for the health surveillance of employees who may encounter or be required to deal with PCBs in the course of their employment, are in possession of this publication.

These Guidelines do not specifically address the question of legal liability for harm or injury caused by exposure to PCBs. In general, lack of appropriate precautionary measures in handling, using, transporting or disposing of toxic materials may adversely affect a company's legal position when faced with a claim for damages. Moreover, in some countries even compliance with the most stringent standards and regulations may not absolve a company from all liability. This is particularly the case in those countries where a concept of 'strict liability' is applied to an owner or a user of dangerous goods. Possible liability exposure should always be viewed against the background of local law. It may therefore be advisable to seek legal advice prior to entering into any activities or transactions involving PCBs.

INTRODUCTION

Growing concern about the accumulation of non-biodegradable toxic substances in the environment has led in various countries to new specific regulations on the use and disposal of Polychlorinated Biphenyls (PCBs).

The present report establishes guidelines for PETRONAS with regard to safe handling and disposal of PCBs. The guidelines are based on the US Environmental Protection Agency (EPA) rules for the use, disposal, record-keeping, reporting, clean-up, marking and labeling, inspecting and notification of PCBs (Toxic Substances Control Act, 40CFR Part 761 Revised as of July 1, 1984; 686-721 and amendments from Federal Register, July 10, 1984, Vol. 49, No. 133, 28172-28209), and also information contained in the Proceedings of the PCB-Seminar held on 28-30 September, 1983 in Scheveningen, The Hague, the Netherlands.

When disposal of PCB materials is necessary, national regulations should be observed. When large volumes are to be disposed of, Corporate HSE should be contacted. It should be noted that in some countries, the term PCB, for regulatory purposes, also includes monochlorobiphenyls.

1. TECHNICAL DESCRIPTION AND DEFINITIONS

Polychlorinated biphenyls (PCBs) are a group of man-made biphenyl compounds containing varying amounts of bound chlorine. The amount of chlorine in the product influences its viscosity, causing it to vary from liquid to semi-solid. These compounds have been manufactured in large quantities for a variety of, mainly electrical, uses over the past forty years. They are extremely stable, can withstand high temperatures, are fire resistant, and have good electrical insulating and thermal conduction qualities.

PCBs have been used, *inter alia*, in the following applications; transformers, capacitors in television sets and air-conditioning units, and ballasts in fluorescent lights; non-electrical uses have included hydraulic systems, heat transfer systems, carbonless copy paper, plasticizers and additives.

The most commonly encountered trade names of PCB insulating fluids are 'Askarel', 'Clophen', 'Eucarel' and 'Pyrалene'; these and other names under which PCBs have been commercially available are listed in Appendix I. Properties are described in Appendix II.

Non-PCB synthetic insulating fluids (see Appendix III) are known by such trade names as 'Wemcol', 'Dielektor II', 'R Temp' and 'Edisol'. Other non-PCB synthetic insulating fluids will be identified as such by the manufacturer on the equipment nameplate. Common mineral oil insulating fluids, such as 'Shell Diala' oil (Grades B, C or D), are non-PCB fluids suitable for use in transformers (see Section 3.1.2.).

All other non-PCB synthetic insulating fluids, not mentioned above or not identified as non-PCB on the nameplate of the equipment and suspected of containing PCBs, must be treated as PCBs and handled in accordance with these guidelines.

Definitions

PCB and PCBs	means any chemical substance that is limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances which contains such substance.
PCB Article	means any manufactured article, other than a PCB Container, that contains PCBs and whose surface(s) has been in direct contact with PCBs. PCB Articles can include capacitors, transformers, electric motors, pumps and pipes, contaminated clothing, absorbent, and articles used for clean-up or repair.
PCB Article	means any package, can, bottle, bag, barrel, drum, tank or other Container device used to contain PCB Articles or PCB Equipment, and whose surface(s) has not been in direct contact with PCBs.

PCB Container	means any package, can, bottle, bag, barrel, drum, tank, or other device that contains PCBs or PCB Articles and whose surface(s) has been in direct contact with PCBs.
PCB Equipment	means any manufactured item, other than a PCB Container or a PCB Article Container, which contains a PCB Article or other PCB Equipment, and includes microwave ovens, electronic equipment, and fluorescent light ballasts and fixtures.
PCB Item	is defined as any PCB Article, PCB Article Container, PCB Container, or PCB Equipment, that deliberately or unintentionally contains or has as a part of it any PCB or PCBs at a concentration of 50 ppm or greater.
PCB Transformer	means any transformer that contains 500 ppm PCB or greater.
PCB-Contaminated	means any electrical equipment, including but not limited to Electrical transformers, capacitors, circuit breakers, reclosers, voltage Equipment regulators, switches (including sectionalizers and motor starters), electromagnets, and cable, that contain 50 ppm or greater PCB, but less than 500 ppm PCB. Oil-filled electrical equipment other than circuit breakers, reclosers, and cable whose PCB concentration is unknown must be assumed to be PCB-Contaminated Electrical Equipment.
Large low voltage	means a capacitor which contains 1.36 kg (3 lb) or more of dielectric capacitor fluid and which operates below 2000 volts (AC or DC).
Large high voltage capacitor	means a capacitor which contains 1.36 kg (3 lb) or more of dielectric fluid and which operates at 2000 volts (AC or DC) or above.
Small capacitor	means a capacitor which contains less than 1.36 kg (31b) of dielectric fluid. The following assumptions may be used if the actual weight of the dielectric fluid is unknown. A capacitor whose total volume is less than 1,639 cubic centimeters (100 cubic inches) may be considered to contain less than 1.36 kg (3 lb) of dielectric fluid and a capacitor whose total volume is more than 3,279 cubic centimeters (200 cubic inches) must be considered to contain more than 1.36 kg (3 lb) of dielectric fluid. A capacitor whose volume is between 1,649 and 3,278 cubic centimeters may be considered to contain less than 1.36 kg (3 lb) of dielectric fluid if the total weight of the capacitor is

less than 4.08 kg (9 lb).

**Non-PCB
equipment**

means equipment having been in contact with fluids containing less than 50 ppm of PCBs.

2. HAZARDS TO HEALTH AND ENVIRONMENT

PCBs are very toxic to the environment and have a high potential for bioaccumulation and transfer, especially through the aquatic food chain.

Because of their chemical stability and physical properties, PCBs are highly persistent and not readily biodegradable. The only adequate means of disposal, at present, is high temperature combustion. This is only allowed under strict regulations in approved incinerators and must be carried out by specialized firms (see Section 9).

PCBs are irritating to the skin, eyes and mucous membranes. Prolonged and repeated exposure to the liquids and/or vapors may cause chloracne, which is reversible after discontinuation of exposure. PCBs can be absorbed either by inhalation or by skin contact and may cause systemic effects. They are potential human carcinogens and may affect the reproductive functions of either sex.

Detailed information on toxicological properties, first aid and medical advice is given in Appendices IV and V. Appendix VI provides a summary of ecotoxicological properties.

Secondary hazards can arise as a result of improper disposal of PCBs and PCB items (see Section 9) and when PCB articles are involved in fire situations.

When a PCB-filled transformer has had to be installed in a high fire risk area, the low flammability of PCBs has hitherto been considered advantageous, and no special precautions may have been taken to protect the transformer from fire. The

possible occurrence of toxic decomposition products, including polychlorinated dibenzodioxins and polychlorinated dibenzofurans, in the thermal decomposition products of PCB-containing fluids means that fire risk should be taken into account in the siting of transformers.

The usual approach to evaluating the risk of fire has been to consider the flammability of the chemical or material. It now has to be recognized that the flash-point is not the only property that needs to be known in this context. The behavior of the chemical under fire conditions must also be considered.

The location of existing transformers should therefore be reviewed (see Section 4.1.e; 4.3) and firefighters should approach fires involving PCB articles with extreme caution using positive pressure respirators and total body protection (see Section 7.3.j.).

3. **GUIDELINES AND REGULATIONS**

3.1 **PETRONAS GUIDELINES**

3.1.1 Where alternatives of equivalent performance but less hazardous to health and the environment are available, the purchase and use of PCBs and PCB-containing equipment should be avoided.

3.1.2 When purchasing transformers and capacitors, the purchase orders make a positive statement specifying what liquid fillings may be used:

- Oil-immersed transformers shall be filled with 'Shell Diala' oils of the appropriate grade.
- Synthetic liquid-immersed transformers shall be filled with a non-toxic, non-flame-propagating liquid.
- Instructions for handling, storage, cleaning and filtering shall be furnished with each transformer.
- Liquids known under trade names like Askarel, Pyranol, Clophen, Pyralene, etc., which emit toxic gases, are not acceptable.

3.2 **REGULATIONS**

3.2.1 It is advised that, in all PETRONAS the purchase of PCBs and PCB equipment shall be **prohibited**, and existing equipment shall be phased out at the end of its serviceable life, in favor of less hazardous alternatives.

It is also imperative that PETRONAS should be aware of the current and proposed national legislation concerning the use and disposal of PCBs.

3.2.2 Malaysia

In Malaysia, PCBs are categorized as scheduled waste in the Environmental Quality (Scheduled Waste) Regulations 1989 and is listed in the First Schedule as:

N021 Spent oil contaminated with PCB or PCT

N022 Discarded electrical equipment or parts containing or contaminated with PCB or PCT

N023 Containers contaminated with PCB or PCT

The generation, handling, transportation, treatment, storage and disposal of scheduled waste are governed by these legislations:

- Environmental Quality (Scheduled Waste) Regulations 1989
- Environmental Quality (Prescribed Premises)(Scheduled Waste Treatment and Disposal Facilities) Regulation 1989
- Environmental Quality (Prescribed Premises)(Scheduled Waste Treatment and Disposal Facilities) Order 1989

These regulations require acceptable methods of storage, transportation and disposal, the facilities of which must be licensed by the Department of Environment (DOE).

PCB waste generated from industrial, commercial or institutional activities should be sent to the Integrated Scheduled Waste Management Centre located in the state of Negeri Sembilan. This facility is owned and operated by Kualiti Alam Sdn Bhd, a licensed operator for scheduled wastes treatment. In this facility, PCB waste is sent to the incineration plant. Slag from the incineration process is disposed off at the Secure Landfill while fly ash trapped in the fabric filter is further treated at the Solidification Plant before disposal to the Secure Landfill. PTS 60.177 Waste Management Guidelines go into further detail regarding various treatments of waste.

The Basel Convention has produced a Technical Guideline for the Environmentally Sound Management of Wastes Consisting of, Containing or Contaminated with Polychlorinated Biphenyls (PCBs), Polychlorinated Terphenyls (PCTs) or Polybrominated Biphenyls (PBBs). This Technical Guideline provides information on methods of sampling, analysis and monitoring, identification and inventorying and various methods of environmentally sound disposal of the waste containing PCBs, PCTs or PBBs. This guideline can be utilized as a guidance document, should national legislative and regulatory framework be insufficient to address the safe handling and disposal of PCBs.

4. CHECK-LIST OF ACTIVITIES RELATED TO THE SAFE-HANDLING OF PCBs

Although the assigning of responsibilities for the safe-handling of PCBs may vary according to the structure of individual OPU/JV, it is suggested that activities might be grouped under the following headings:

4.1 SAFETY AND ENVIRONMENT

- (a) Ensure that handling of PCBs meets both local regulations and PETRONAS guidelines as set forth in this document.
- (b) Provide liaison with regulatory agencies.
- (c) Make appropriate notifications and verifications to regulatory agencies and ensure permits are obtained and maintained.
- (d) Coordinate the storage and disposal of PCBs and establish an inventory record.
- (e) Routinely review PCB usage, reports and record keeping, and the location of PCB articles.
- (f) Provide safety training which shall include identification, usage, emergency response, clean-up of spills and disposal.
- (g) Establish management-approved clean-up procedures.
- (h) Provide adequate equipment and supplies for PCB clean-up.
- (i) Provide appropriate facilities for storage of PCBs.
- (j) Provide appropriate guidance to users.

4.2 ELECTRICAL MAINTENANCE

- (a) Identify PCB usage.
- (b) Carry out routine inspections and survey transformers and other PCB equipment.
- (c) Ensure that appropriate notifications to the Safety / Environmental Department are made of inspections, leaks and spills.
- (d) Ensure that maintenance personnel involved with the handling of PCBs attend safety training on PCBs.
- (e) Manage storage areas and maintain identification and sign-posting of areas where PCBs are used and handled and stored.

4.3 FIRE-FIGHTING DEPARTMENT

The Fire-fighting department should establish emergency procedures for fires involving PCBs, as burning PCBs produce toxic fumes (hydrogen chloride, PCB vapors and 'dioxins'). For extinguishing PCB fires, chemicals rather than water should be used (better containment of spills). The emergency procedures should be compatible with existing emergency procedures and, at least, include:

- containment of smoke by closing doors and turning off ventilation;
- evacuation of individuals that may be exposed to smoke;
- immediate isolation and reporting of PCB leaks or spills;
- appropriate first aid (see Appendix V).

5. PROGRAMME FOR CONTROLLING PCB EQUIPMENT

5.1 INSPECTION

- (a) Qualified employees should conduct routine inspections and record findings on inspection forms provided. An example of such an inspection form is given in Appendix VII.
- (b) PCB equipment should be inspected at least quarterly for leaks. Equipment having secondary containment capable of holding at least 100 percent of the fluid volume may be inspected once a year. Once signs of an increased chance of leaking are noticed (e.g. weeping) inspection shall be carried out more frequently.
- (c) Any leak discovered must be repaired or the equipment shut down and isolated as soon as possible and, in all cases, within two days from the time the leak is observed. Cleanup procedures are specified in Section 7.
- (d) All observed leaks will be immediately reported to the Safety/Environmental Department and the Maintenance / Electrical Department.
- (e) Rooms or poorly-ventilated enclosed spaces containing PCBs or PCB equipment should carry an appropriate warning label and entry should be restricted to persons trained in the hazards and handling of PCBs. In the event of operational failure of PCB equipment potentially harmful vapors (e.g. hydrogen chloride) may be generated as when PCB fluids contained in transformers, switches or capacitors are subject to internal arcing. When it is necessary to enter an enclosed space where PCB-insulated equipment is

suspected of failure, the area should be thoroughly ventilated. If emergency entry is required, it will be necessary to use air-supplied, positive-pressure breathing apparatus. (see Sections 2 and 6)

5.2 NOTIFICATION AND RECORDS

Records of the following must be written and held by the HSE Department:

- (a) Dates on which PCBs and PCB-items were removed from service, placed into storage for disposal and transported for disposal.
- (b) Total quantities of PCBs and PCB items remaining in service at the end of each calendar year and quantities of PCBs and PCB items removed from service, specifying:
 - total weight in kilograms of any PCBs and PCB items in PCB containers including the identification of container contents such as liquids or capacitors;
 - total number of PCB-containing transformers and total weight in kilograms of any PCBs contained in the transformers;
 - total number of large PCB-containing High or Low Voltage Capacitors.
- (c) Total weight of PCBs in storage on site.
- (d) Location of all PCBs and PCB items in service. In addition, for PCBs and PCB items removed from service, the location of the initial disposal or storage facility and, should this be off-site, the name and telephone number of the owner or operator of the facility.

5.3 LABELING AND POSTING

A label shall be maintained on all equipment containing over 50 ppm PCBs, indicating:

- that the contents contain PCBs which are toxic substances;
- the requirement for special handling procedures;
- the persons/company to be contacted in the event of leakage or when disposal is to be undertaken.

This label shall conform to the requirements of the Occupational Safety and Health (Classification, Packaging and Labeling) Regulations 1997.

A similar label shall be affixed to all PCB- contaminated items awaiting disposal or transport. Appendix VIII provides an example of an appropriate format.

Storage areas for PCB equipment shall be posted with proper caution signs. A recommended format is provided in Appendix IX.

5.4 STORAGE

Storage areas for PCB containers and equipment designated for disposal shall comply with the following requirements:

- (a) The storage area must be constructed with an adequate roof to prevent rain-water leaking onto the stored equipment;
- (b) A kerbing must surround the site, to provide a containment volume of two times the internal volume of the largest PCB article or 25% of the total volume of the PCB containers or articles, whichever is the greater;
- (c) No drains, sewer lines, or openings that would allow escape of PCB liquids shall be present;
- (d) The floor and kerbings must be constructed of impervious material such as Portland cement or steel;
- (e) The site must be safe from floods;
- (f) Suitable containers must be used for storage of liquid and non-liquid PCBs (see Section 8.1);
- (g) Containers shall be labeled and dated when placed in storage (see Appendix VIII);
- (h) All PCB items in storage shall be inspected monthly;
- (i) Any leaking PCB item shall be placed in a container with absorbent material (see Section 7.3.f) sufficient to confine the leaking product;
- (j) The storage area shall be properly marked (see Appendix IX);
- (k) No equipment used to handle PCBs shall be removed from the storage area until it has been decontaminated by wiping with rags and solvent. Safe-working practices (see Section 6) should be observed. The rags and waste solvent must be disposed of as PCB articles.

6. SAFE-WORKING PRACTICES

6.1 GENERAL

Safe-working practices and procedures shall include those identified in this section. Additional procedures should be added as needed and should always reference the most updated Chemical/Material Safety Data Sheet.

Work procedures should be such that working with PCB materials at temperatures greater than 40 °C is avoided whenever possible. Below 40 °C, the vapor pressure of PCB oils is sufficiently low that, under well-ventilated conditions, the recommended exposure limit for PCB vapors is unlikely to be exceeded. Nevertheless, care should be taken and safe-handling procedures should still be observed.

Only personnel instructed in the hazard and handling of PCBs should work on PCB equipment. Where a PCB hazard may occur, no other personnel should be allowed at the work place, which should be properly roped off. Warning notices (see Appendix X) should be displayed.

6.2 HANDLING PCBs

- (a) All equipment containing over 50 ppm of PCBs shall be labeled according to the specifications in Section 5.3.
- (b) Inspect equipment containing PCBs for leakage or damage before it is handled. If a PCB leak or spill is discovered, the Safety/Environmental Department, as well as the section responsible for clean-up shall be notified.
- (c) All practicable measures should be taken to prevent
 - i) inhalation of PCB vapors or PCB-contaminated dust and
 - ii) skin or eye contact.

PCBs are rapidly and extensively absorbed through the skin and eliminated only slowly from the body. Protective equipment shall be used as follows:

Respiratory protection

Below 40 °C, the vapor pressure of PCB oils is sufficiently low that, under well-ventilated conditions, the recommended exposure limit for PCB vapors is unlikely to be exceeded. Exposure to PCB oils at a temperature above 40 °C, or in poorly ventilated situations, should be controlled by use of a positive-pressure air-supplied breathing apparatus which has a nominal protection factor of 2000. However, an orinasal respirator fitted with combined dust and activated charcoal air purifying cartridges (nominal protection factor 10) is suitable for use in situations where exposure to PCB oils up to a temperature of 60 °C may be anticipated.

Face and Eye protection

A face shield or a full-face piece respirator should be worn.

Hand protection