# GUIDELINES FOR ENVIRONMENTALLY SOUND MANAGEMENT OF PCBS IN THE MEDITERRANEAN

UNEP

MAP

40 Years TOGETHER FOR A SUSTAINABLE MEDITERRANEAN

Strategic Partnership for the Mediterranean Sea Large Marine Ecosystem

MedPartnership

Together for the Mediterranean Sea

GEF UNEP

# GUIDELINES FOR ENVIRONMENTALLY SOUND MANAGEMENT OF PCBs IN THE MEDITERRANEAN

These Guidelines have been commissioned by the marine pollution assessment and control unit (MED POL) of the Mediterranean Action Plan (UNEP/MAP) to the Regional Activity Centre for Sustainable Consumption and Production (SCP/RAC) under the MedPartnership Project.

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# PREFACE

This technical guide is focused on different aspects of PCB life cycle environmentally sound management (ESM), including inventory and monitoring until their final phasing out and disposal and its final objective is to provide the Mediterranean countries with information in order to establish a proper management system to prevent human health and environmental hazard.

It has been developed by UNEP/ MAP MED POL Programme under the MedPartnership project[1] and in the framework of MAP Programme of Work 2014-2015.

Polychlorinated Biphenyls (PCBs) are among the Persistent Organic Pollutants (POPs) identified by the international community for immediate international action, along with the pesticide DDT, highly toxic Dioxins and Furans (unintentionally formed by-products as a result of incomplete combustion or chemical reactions) and other substances. The Stockholm Convention on Persistent Organic Pollutants (POPs) aims for the worldwide elimination of these substances.

PCBs have serious health and environmental effects, which can include carcinogenicity, reproductive impairment, immune system changes, and effects on wildlife causing a loss of biological diversity. The existing PCBs and all equipment contaminated with PCBs have to be eliminated in an environmentally sound manner without producing hazards for humans or the environment by 2028. Other global and regional conventions regulate the management of dangerous chemicals and hazardous wastes addressing PCB such as the Basel Convention, as well as the Rotterdam Convention. In addition the Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean and its related Protocols (Land-based Sources and Activities Protocol, and the Hazardous Waste Protocol) also addresses the PCB phase out and disposal.

This technical guide provides background information on data collection, identification, sampling and monitoring of PCB containing equipment and describes PCB management of closed applications. It also explains maintenance of equipment containing PCB focusing on safety, emergency actions as well as phase out, packing and temporary storage. Finally it refers to international and national regulations for the transport of hazardous goods, as well as pretreatment, treatment and disposal of PCBs.

The guide was reviewed and agreed at a Regional Expert meeting, with experts nominated by the Contracting Parties, which was held from 7-9 April 2015 in Istanbul, Turkey and approved as appropriate by the MED POL focal point meeting. It is published online in English and French to serve as a technical guidance for the Mediterranean countries in implementing the relevant priority actions of the National Action Plans adopted in the framework of Article 5 and 15 of the LBS Protocol of the Barcelona Convention and its Strategic Action Programme SAP-MED.

1. The Strategic Partnership for the Mediterranean Sea Large Marine Ecosystem (MedPartnership) is a collective effort of leading organizations (regional, international, nongovernmental, etc.) and countries sharing the Mediterranean Sea towards the protection of the marine and coastal environment of the Mediterranean. The MedPartnership is being led by United Nations Environment Programme (UNEP) Mediterranean Action Plan (MAP) and the World Bank and is financially supported by the Global Environment Facility (GEF), and other donors, including the European Union (EU) and all participating countries.

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## Abbreviations and Definition of Terms

**AC** Alternating Current

**ADR** European agreement on the international road transport for hazardous goods

**Askarel** Trade name of PCB cooling fluid (USA, Monsanto)

**BAT** Best Available Technique

**BC** Basel Convention on the trans-boundary movement of hazardous wastes and their disposal

**BCD** Base catalysed decomposition

**BEP** Best Environmental Practice

**BRS** Basel, Rotterdam, Stockholm Convention (Secretariat)

**CaO** Calcium oxide

**Capacitor** Equipment or unit to supply lagging kilovars for power factor correction of an electric system; some capacitors were manufactured with PCB as cooling fluid

**Capacitor Bank (General)**
Practically there are three different ways of power factor (PF) correction:
Capacitors for «individual» PF-correction; the capacitor is directly connected to the terminals of an equipment (motors, welding machine etc.) producing the «lagging kilovars»

**Capacitor Bank (LV)**
Capacitors for «group» PF-correction; the capacitor(s) is (are) connected to the LV-busbar of a transformer station, which feeds a number of consumers with individual motors, welding machines etc.

**Capacitor Bank (MV)**
Capacitors for «central» PF-correction; Large capacitor installation connected to the Middle- or High Voltage busbars of a substation where many individual electrical appliances (motors etc.) of various size operate at different times and periods.

**CHD** Catalytic hydrodechlorination

**Closed Systems**
Capacitors and transformers, where the PCB itself is in completely closed containers; PCBs rarely emit from closed systems (in good condition)

**Congener** Depending on the number and position of the chlorine atoms in the Biphenyl molecule, 209 isomers and homologue Chlorine Biphenyls are theoretically possible. A single compound from this group is called PCB congener.

**Container 20'**
Internationally used expression for Transport or Storage Containers

with the Standard size of 2 x 2 x6 meters (40' Container – 2 x 2 x 12 meters)

**Container Box**
There are various types of 20' and 40' Containers available, the most common is the Box Container with a front door, from an open top Container the roof can be removed for loading and off-loading activities (e.g. ideal for transformers)

**Cooling Fluid**
Dielectric fluid

**COP** Conference of the Parties
**DC** Direct Current
**DDT** Dichlorodiphenyltrichloroethane
**DE** Destruction efficiency
**DRE** Destruction and removal efficiency
**e.g.** Exempli gratia / for example
**ESM** Environmentally Sound Management
**ETI** Environmental Technology International Ltd. / Switzerland
**EU** European Union
**FAO** Food and Agriculture Organization of the United Nations
**GC** Gas chromatography; Procedure for the determination of evaporating substances
**GEF (GEF)** The Global Environment Facility is an international financial entity with 177 countries as members
**GHS** Globally harmonized system of classification and labelling of chemicals
**GPCR** Gas-phase chemical reduction
**GTO** Gate turn-off thyristor
**HV** High voltage
**IATA DGR** IATA regulations on the transport of dangerous goods / transport by air
**IBC** Intermediate Bulk Container
**ID (number)** Identification (number)
**IGBT** Insulated-gate bipolar transistor
**IMDG** International maritime dangerous goods code / transport by sea
**ISO** International Organization for Standardization
**kV** Kilovolts
**kVA** Kilovolt ampere
**kVAR** Kilovolt ampere reactive
**kW** Kilowatt
**LBS** Land based sources and activities Protocol
**LV** Low voltage (230/400 V)
**MAP MEDPOL** Programme for the Assessment and Control of Marine Pollution in the Mediterranean
**µg** Microgram
**mg/kg** Milligram per kilogram
**MS** Mass spectrometry
**MV** Medium voltage (Normally in the range between 11 and 66kV)
**MVA** Megavolt ampere
**ng** Nanogram (1000 ng = 1 µg)
**NGO** Non-governmental organization

**Open Systems**
Applications where PCB is consumed during its use or not disposed of properly after its use or after the use of the products that contain PCB;
Open systems emit PCB directly in the environment (e.g. softeners in PVC, neoprene and other rubbers containing chloride)

**PBB** Polybrominated Biphenyls
**PCB** Polychlorinated Biphenyls
**PCDD** Dibenzo-p-dioxins or dioxin; Highly toxic by-product of PCB
**PCDF** Dibenzofurans or furan; Highly toxic by-product of PCB
**PCT** Polychlorinated Triphenyls
**PE** Polyethylene
**PE-HD** High-density polyethylene
**PE-LD** Low-density polyethylene
**PEN** PCB Elimination Network of UNEP Chemicals
**Persistent** Very slightly degradable in the environment
**PIC** Prior Informed Consent
**POP** Persistent Organic Pollutants
**PPE** Personal Protective Equipment
**ppb** Parts per billion
**ppm** Parts per million (mg/kg)

**Primary source**
A product to which PCB was added voluntarily to influence the product's characteristics (e.g. cooling fluids for transformers like Sovol, Sovtol, Askarel, Pyralene, Clophen, etc.); Such products emit PCB continuously

**RC** Rotterdam Convention on the Prior Informed Consent Procedure (PIC) for certain hazardous chemicals and pesticides in international trade
**RID** Regulation for the international transport of hazardous goods / transport by rail
**SAP-MED** Strategic Action Programme to address pollution from land-based activities in the Mediterranean Region
**SBC** Secretariat of Basel Convention
**SC** Stockholm Convention Persistent Organic Pollutants (POPs)
**SCWO** Supercritical water oxidation
Secondary source A product that originally was free of PCB, but later contaminated by PCB emitting from primary sources (e.g. by emission from primary sources or use of contaminated pumps, hoses, etc.) Such products also emit PCB
**SNV** Swiss Association for Standardization
**SPCC** Spill Prevention, Control and Countermeasure
**TDI** Tolerable daily intake
**TEQ** Toxic equivalency factor

**Transformer**
Equipment used to increase or reduce voltage; PCB containing transformers are usually installed

in sites or buildings where electricity is distributed.

**TTCB** Tri-tetrachlorobenzenes

**UN-approved** Equipment that fulfils the specific United Nations testing procedures

**UNDP** United Nations Development Programme

**UNEP** United Nations Environment Programme

**UNIDO** United Nations Industrial Development Organization

**UNITAR** United Nations Institute for Training and Research

**US EPA** United States Environmental Protection Agency

**WHO** World Health Organisation



# INTRODUCTION

## 1.1. Polychlorinated Biphenyls (PCBs)

Persistent Organic Pollutants (POPs) have been identified by the international community for immediate international action by means of the Stockholm Convention. The pesticide DDT, highly toxic Dioxins and Furans (unintentionally formed by-products as a result of incomplete combustion or chemical reactions) as well as PCBs count among the POPs.

PCBs have serious health and environmental effects, which can include carcinogenicity, reproductive impairment, immune system changes, and effects on wildlife causing a loss of bio¬logical diversity (Carpenter 2006, Hotchkiss et al. 2008, Wirgin et al. 2011). PCBs bio-accumulate in the fatty tissue of humans and other living organisms. The chemical is transported over long distances to regions where it has never been used or produced before. This process of evaporation, movement with the air streams, condensation and deposition on the ground is known as the "grasshopper effect".

PCB production started in 1929. PCBs were manufactured by a number of companies in many industrialised countries, and maximum production was reached in the late 1960s. After 1983 production was stopped in most countries, except for some Eastern European countries and Russia, where manufacture ceased between 1987 and 1993.

PCBs were mostly used in closed applications for example as cooling and isolating agents in transformers and capacitors, in heat transfer systems and hydraulic systems, in particular in mining equipment. PCBs mixtures were, however, also widely used in open and partially open applications, for example in caulks/sealants, paints, anti-corrosion coatings, surface coatings, cables and cable sheaths, small capacitors, etc.

From the technical point of view, the characteristics of PCBs were quite advantageous, thus they found a wide range of applications as mentioned above.

The Stockholm Convention on Persistent Organic Pollutants (POPs) counts PCBs among the substances targeted for worldwide elimination. The existing PCBs and all equipment contaminated with PCBs have to be eliminated in an environmentally sound manner without producing hazards for humans or the environment by 2028. PCB treatment or disposal technology must comply with the highest safety and environmental standards and must be capable of reducing the PCB contamination level of those pieces of equipment suitable for re-classification below the legally permitted level of 50 ppm as well as assure