PCBs Elimination Network (PEN) 2028

PEN magazine

| Issue 01 | PCBs ELIMINATION NETWORK – SHARING INFORMATION ON PCBs

www.pops.int/pen

Inventories of PCBs
The place to start!

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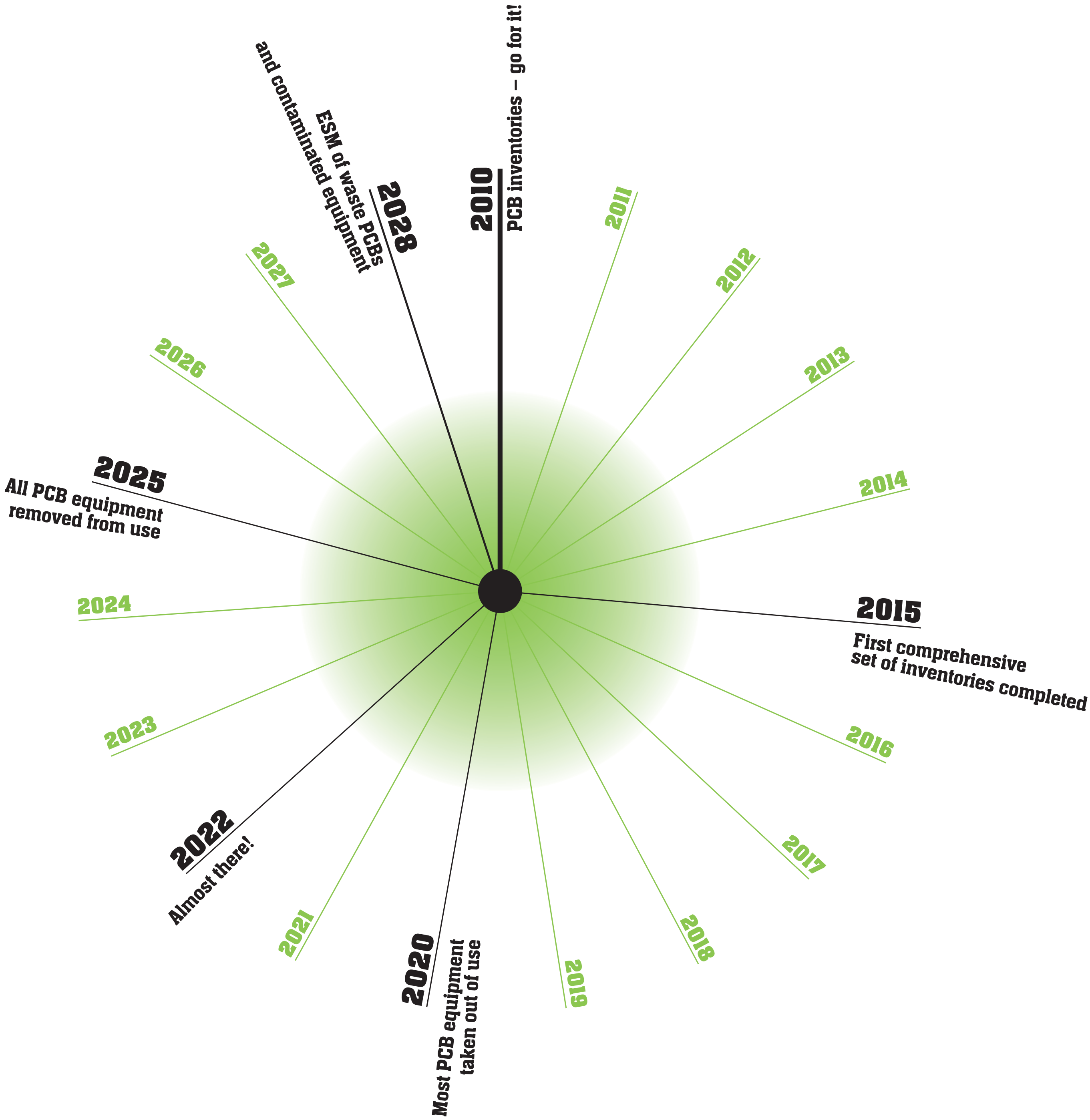
UNEP

STOCKHOLM CONVENTION

A possible global timeline for Environmentally Sound Management (ESM) of PCBs



The Advisory Committee of the PEN

at its first meeting in January 2010

From left to right:
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EDITORIAL

Let us start by sharing information

The group of chemicals known as polychlorinated biphenyls (PCBs) is one of the original twelve POPs covered by the Stockholm Convention. PCBs were discovered in the early 20th century. They possess properties including longevity, heat absorbance and form an oily liquid at room temperature that is useful for electrical utilities and in other industrial applications. What more could one ask for? Rather, what more does one get? As far back as the late 1960's, poisonings from PCB exposure began to surface. In one incident, over 14,000 persons became ill in Japan from ingesting PCB-contaminated rice bran. Occurrences of PCB toxic effects in birds and other animals are well documented.

The Parties to the Stockholm Convention can no longer produce PCBs and are obliged to stop using this chemical. However, existing equipment that contains or is contaminated with PCBs may continue to be used until 2025.

To ensure that all PCB uses are ceased by 2025, Parties, especially those that are developing countries or countries with economies in transition, will need support to complete national inventories of all PCBs and related contaminated equipment; to improve the capacity and increase the knowledge of PCB equipment owners on proper maintenance of equipment to avoid further contamination; to establish proper storage of discontinued equipment and to ensure disposal of all the PCB oils and contaminated equipment in an environmentally sound manner.

At the latest meeting of the Conference of the Parties of the Stockholm Convention held in Geneva, Switzerland, in May 2009, the Parties approved the establishment of a PCBs Elimination Network (PEN). The PEN is expected to:

- Include participation of all relevant stakeholders
- Promote environmentally sound management (ESM) of PCBs and related equipment;
- Foster cooperation;
- Promote technical assistance and technology-transfer;
- Provide and facilitate information exchange;
- Raise awareness;
- Encourage development and adoption of environmentally-sound techniques and practices to eliminate PCBs; and
- Establish linkages between stakeholders.

The PEN is organized around relevant thematic groups: inventories, maintenance of PCB equipment, destruction of PCBs and open applications. All persons are welcome to join the PEN and participate in a thematic group. The official website for the PEN (www.pops.int/pen) will offer continually updated information, a social network for interaction among members, a forum for discussion with all this available in the six languages of the United Nations. However, it is understood that not all have access to the internet regularly. It is with this in mind that the PEN magazine is being published in hardcopy as well as on the PEN website.

The concept of a PEN magazine on PCBs is a daunting one. It has to be global in coverage while capturing realities at the regional and national levels, be scientifically sound, provide a network of contacts for those requiring assistance, make available information on all aspects of PCBs management and capture the imagination and interest of the public in general.

To prepare the lead article on undertaking inventories of PCBs, the Secretary of the PEN was fortunate to employ the Swiss consultant, Urs Wagner. Mr. Wagner has logged long hours in supporting owners of PCBs, Governments and others in their efforts to manage properly the oily liquid and the equipment in which it is used. Mr. Wagner has provided a step by step process to undertake inventories that will be helpful to all that are involved in this exercise across the globe.
(cont. on page 04...)

(cont. from page 03...)

Collaboration among countries will be a key to achieving success from efforts to eliminate PCBs. With this in mind, the PEN magazine contains a regional section that provides the latest information on the management of PCBs, related projects, ongoing activities to manage PCBs and a summary of the status of PCBs management in each region.

A comic strip in the centre of the magazine will bring entertaining relief from the more serious scientific material but is still intended to provide the reader with information on PCBs. Follow the journey of Polly, Biphenyl and their son Chloro as these PCB molecules get ready to battle the humans for their existence.

We thank all those who made contributions to this first issue of the PEN magazine. We hope that you will find the information contained in this issue useful in your efforts to eliminate PCB use. Your feedback on the presentation and usefulness of this issue is welcomed and will help us to make improvements in the next issue. The PEN network is growing and if you not already a member we urge you to join. The more information we share, the better opportunities we have to eliminate PCB use by 2025.

The PEN Secretary

STOCKHOLM CONVENTION

Protecting human health and the environment from Persistent Organic Pollutants

The Stockholm Convention on Persistent Organic Pollutants (POPs) is a global treaty adopted in 2001 and entered into force in 2004 requiring Parties to take measures to eliminate or reduce the production, use, trade, release and storage of POPs.

Currently, the Convention covers the production and use of 21 pesticides, industrial chemicals and POPs produced unintentionally as by-products of other processes. As of July 2010, 170 countries have become Parties to the Stockholm Convention. The Convention is administered by the United Nations Environment Programme (UNEP) and is based in Geneva, Switzerland. The website of the Stockholm Convention is **www.pops.int**

POPs are chemicals that are highly toxic, remain intact in the environment for long periods, are transported through air, water and migratory species across international boundaries and accumulate in the fatty tissue of humans and wildlife far from their place of release. Exposure to POPs can lead to serious health effects including certain cancers, birth defects, dysfunctional immune and reproductive systems, greater susceptibility to disease and even diminished intelligence.

PCBs are also listed under the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (**www.pic.int**) and the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (**www.basel.int**). In addition, PCBs are subject to a multitude of national and regional regulations.

Production, use and toxicity of PCBs

PCBs – The perfect substance?

Polychlorinated biphenyls are a class of synthetic organic chemicals. Since 1930, PCBs were used for a variety of industrial uses (mainly as dielectric fluids in capacitors and transformers but also as flame retardants, ink solvents, plasticizers, etc.) because of their chemical stability. PCBs are fire resistance, have a low electrical conductivity, high resistance to thermal breakdown and a high resistance to oxidants and other chemicals. A total of approximately 1.7 million tonnes of PCB oil was produced between 1929 and 1989.

In the 1970s, it was discovered that this characteristic of persistence along with a growing body of evidence of its chronic, carcinogenic properties represented a serious threat to human health and the environment. PCBs are considered to be immunotoxic and affect reproduction. Adverse effects associated to the exposure of PCBs are damage to the immune system, liver, skin, reproductive system, gastrointestinal tract and thyroid gland. Subsequently the production of PCBs ceased.

It is estimated that globally, approximately 3.2 million tones of equipment and liquids contaminated with PCBs in total are still in use, are stored or are managed in an environmentally sound manner but eventually will need to be destroyed.

PCBs under the Stockholm Convention

Stop use before 2025, environmentally sound waste management by 2028

Since entry into force of the Stockholm Convention in 2004, PCBs are listed in Annex A of the Convention:

- **Production:** Totally prohibited for all countries under the Convention
- **Use of PCBs in equipment:** Allowed until 2025 to give countries time to gradually replace PCB containing equipment
- **Elimination:** Environmentally sound waste management of contaminated liquids and equipment (content above 0.005%) to be achieved by 2028

Countries are obliged to:

- Identify, label and remove equipment containing PCBs from use;
- Import and export equipment containing PCBs only for environmentally sound waste management;
- Implement risk reduction measures, such as use in intact equipment and only in areas where the risk from environmental release can be minimised; no use in areas associated with the production or processing of food or feed; protect equipment from electrical and carry out regular inspection for leaks;
- Not reuse liquids contaminated with PCBs (content above 0.005%) expect for maintenance and servicing;
- Identify other articles (open applications) containing more than 0.005% PCBs (e.g. cable-sheaths, cured caulk and painted objects) and manage them in an environmentally sound manner;
- Report every five years on progress in eliminating PCBs to the Conference of the Parties of the Stockholm Convention using the electronic reporting format provided by the Secretariat.

Statement from the Executive Secretary

By the year 2025, all remaining uses of PCBs must be discontinued by Parties to the Stockholm Convention on Persistent Organic Pollutants. Although this may seem like a long time in which to take appropriate measures, due to the lead time necessary to implement national actions and global responses, work needs to be done now to ensure that PCBs are inventoried, taken out of use and the waste managed and disposed of in an environmentally sound manner. The clock is ticking.

To assist Parties and other stakeholders in meeting this deadline, the Conference of the Parties of the Stockholm Convention established, at its fourth meeting in May 2009, the PCBs Elimination Network (PEN) to foster information exchange on PCBs. Implementation of the network is led by the PEN Advisory Committee.

Sharing information, experience and knowledge is vital to support efforts across the globe to eliminate PCBs. The PEN is now incorporated into the clearing house mechanism of the Stockholm Convention for POPs information exchange. While not all persons have internet access, the use of this medium for sharing information is now widespread and the development of the PEN is based on an extensive set of internet based tools for all members to communicate with each other and to share information. The linkages will in the future be available in all six languages of the United Nations (Arabic, Chinese, English, French, Russian and Spanish) on the website for the PEN (www.pops.int/pen).

The PEN Magazine, which was endorsed by the PEN Advisory Committee, is one tool for information exchange that will be available on the internet and in hard copy publication. The purpose of the magazine is to provide information on environmentally sound management of PCBs to all stakeholders and to the general public. The Committee has provided meaningful input and thoughtful direction for the preparation of this magazine, for which I am very grateful. In addition to the PEN magazine, the Network is encouraged to interact through thematic groups relating to maintenance of PCB equipment, disposal, open applications, as well as to inventories which is the topic for this issue of the magazine.

The articles and information contained in the magazine were prepared in response to a request for input by the Secretariat. I am pleased with the many high quality reports received. What is even more impressive is that the responses came from a broad range of stakeholders including Governments, intergovernmental organizations, industry, non-governmental organizations, research institutions, PCB owners and individual experts.

The PEN is barely a year old. There are now over 500 PEN members globally from all relevant sectors. The Secretariat will continue to promote membership in the PEN for which we seek your support. The larger the number of partners that are sharing information, the more benefits will accrue. Please enjoy the first issue of the PEN magazine. I am confident you will find the information contained in it useful and encourage you to share it with others.

Armed with the information and knowledge needed, the world will be well on its way to eliminating all uses of PCBs by 2025.

Donald Cooper
Executive Secretary
Secretariat of the Stockholm Convention

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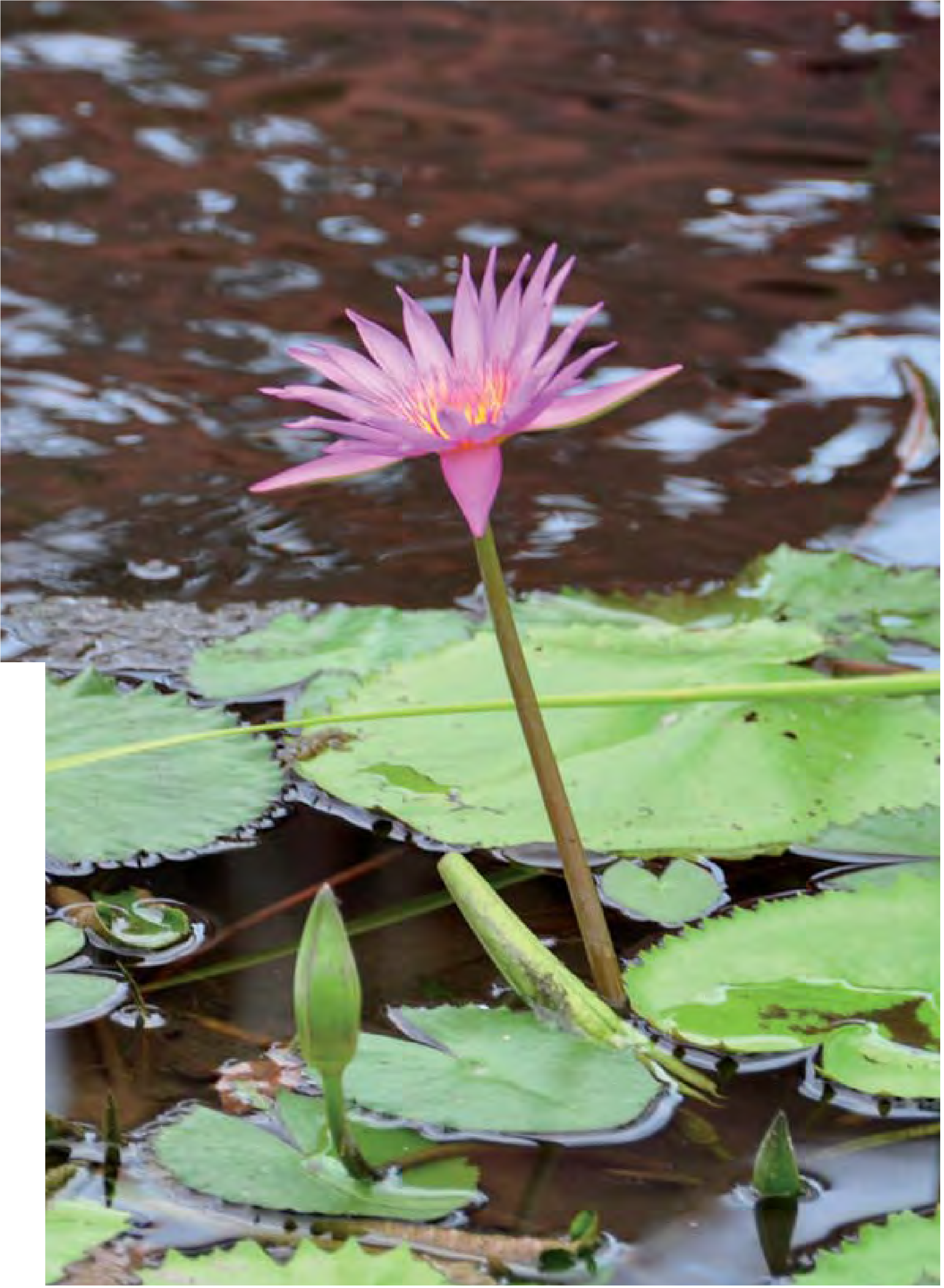


Inventories of PCBs
An Expert's Point of view

By Urs K. Wagner

Introduction

Some Nigerians treat their skin with PCB transformer oil to leave it soft and to gradually achieve a bleaching effect. Others in Honduras use PCBs as a cure against arthritis. In Sri Lanka, certain welders prefer working with PCB oils because these are cheaper than ordinary cooling oils. In several African countries, cooking oil on local markets originates from "transformer cannibalism" and contains sometimes pure Askarel or Pyralene PCB formulations. In Switzerland, the consumption of certain fishes from specific rivers was forbidden in the spring of 2010 due to PCB concentrations far above the allowed maximum levels in Europe. Recently, it has been reported that 90% of German sheep livers have concentrations of PCBs above accepted levels. High PCB concentrations originating from a transformer treatment plant have recently made vegetables inedible in a big German city. The world started tackling the PCB problem many years ago, however, the environmentally sound management and elimination of PCBs on a global scale remains a real challenge. Reliable PCB inventories are the first step in professional PCB management and will help to meet the aims and deadlines set in the Stockholm Convention and eventually rid the world of PCBs.

Production and use of PCBs

Industrial PCB production started in the United States of America (USA) in the 1930s and, after the 2nd World War, Europe also launched its PCB products. In the late 1960s, maximum production was reached with over 60,000 tonnes per year. Due to several severe harmful incidents related to PCBs, production was stopped in most countries after 1983 except for some Eastern European countries. The Russian Federation, for example, only stopped production between 1987 and 1993. The total world production of PCBs between 1929 and 1989 was approximately 1.5 million tonnes.

In most countries, PCBs have never been produced. However, PCBs have been imported and used as technical mixtures and also used in parts of various products, including electrical equipment. Usually, it is not known how much PCB was imported into a country. Furthermore, PCB containing equipment was often shipped to developing countries in the frame of donations without declaration of the POPs content, even after the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal had come into force. Even in the USA and Western European Countries, it is often not possible to provide precise information on the existing amounts of PCBs. There are no reliable data available either on the total imports or on PCB quantities still in use. This is also true for uses in electro-technical equipment; in gas, water and oil pipelines, steel bridges, tanks and a range of other steel applications as corrosion protection paint; in buildings as sealants; and small devices as ballasts.

The most important piece of information though, is where PCBs have been distributed and what has been contaminated. The magnitude of the problem – which is even more widespread due to inappropriate handling and treatment - can only be understood when the extent of the contamination is known.

(cont. on page 10...)

Develop and implement administrative control systems that may limit further cross contamination of PCBs to clean oil, equipment and to the environment

Research suggests that nearly half (48%) of the PCB production was used for transformer oil; about 21% for small capacitors; 10% for other "nominally closed" systems; and approximately 21% for "open uses". Although it is estimated that 97 % of the global use of PCBs have occurred in the Northern Hemisphere it must be considered that in the course of the last 70 years a considerable quantity of PCBs found their way to the Southern Hemisphere, both intentionally and unintentionally.

Based on experience in the USA and Western Europe, it can be assumed that PCBs have permeated all electrical systems except those that have been hermetically sealed off from the rest of the world. If PCBs have been imported into a country, the chemical has most likely worked its way throughout the electrical system and other relevant sectors. The degree to which a given electrical system has been contaminated can vary and the range of possible applications of PCBs is extremely wide.

List of some closed, partially open and open applications of PCB

Closed, partially open, and open applications of PCB
Closed systems Insulation and/or cooling fluid in transformers Dielectric fluid in capacitors Switches
Partially open systems Heat transfer fluids Hydraulic fluid in lifting equipment, trucks and high pressure pumps Vacuum Pumps Voltage Regulators Liquid Filled Electrical Cables Liquid Filled Circuit Breakers
Open systems Paints Lubricating fluid in oils and grease Water-repellent impregnating agent and fire retardant for wood, paper, fabric and leather Laminating agent in paper production Additive in glues, sealants and corrosion protection coatings Carrier for insecticides Polymerisation catalyst support for petrochemicals Immersion oils for microscopy Pesticide Formulation Cable coatings/casings

Scrap yard in a repair shop in Paraguay

Due to non-expert management of contaminated material, widespread cross-contamination has occurred. PCBs teach us a lesson on how humans can cross-contaminate all compartments of the environment including soil, water, sediments and air, by uncontrolled release and migration of one of the initial twelve POPs. Specifically, in developing countries and countries with economies in transition there is no proper handling of phased-out electrical equipment in place. For workers, an electrical device which cannot be repaired and reused does not represent any commercial value and therefore it is handled as scrap with little or no precaution for the safety of human health and the environment.

Without data indicating where there are PCBs, the entire system is suspect. This is the situation in many locations around the world. Collecting data on the specific kind of PCB contamination and the extent of it is important if the risks of PCB exposure are to be reduced. In the long-term, priorities must be established and budgets put in place to ensure removal from use and replacement of PCB-containing and contaminated equipment. If the goals of phasing out PCB-containing equipment by 2025 and establishing environmentally sound management of PCBs by 2028 are to be achieved, a substantial effort will be required to undertake comprehensive and reliable inventories of all contaminated equipment, organize the data collected, set the right priorities, ensure safe handling throughout all further stages and track the equipment until the PCBs are safely managed or destroyed. If the lessons learned in the western world are an indication, this process is a difficult one as it will require countries across the globe to be immediately active in implementing the process. Otherwise, this exercise could take much longer than anticipated.

A trustworthy inventory might be the hardest task to accomplish, but at the same time it is crucial to have reliable and complete data before embarking upon storage, treatment or disposal programmes. Experience shows that too often, decisions have been made based on assumptions made from preliminary information rather than from reliable and detailed inventories.

1,300,000
Tonnes of PCBs produced globally between 1929 to 1993

STATUS OF PCB INVENTORIES GLOBALLY

Developed countries

PCB equipment has been gradually identified, quantified, analysed and replaced in developed countries. In Switzerland, for example, the first inventory of PCBs in electrical equipment started in 1983, and by August 1998 all PCB-containing equipment had to be eliminated. In general, the aims were reached. However, there are relevant quantities of small- and low-voltage PCB capacitors still in use and occasionally, formerly unknown PCB sources are detected. Today, many countries in the Northern Hemisphere focus on PCBs in open systems considering it now as the most problematic source of exposure. Experiences in Switzerland show that many public buildings constructed between 1955 and 1983 often contain PCBs in their elastic sealants (caulks) and paint applications (on steel and concrete). In 2003, the Swiss Federal Office for the Environment published a directive requiring investigations about the PCB content in such buildings and calling for special measures to protect inhabitants, users, workers and the environment. Similar regulations and guidelines exist in the USA, Sweden, Norway, Germany and Austria.

Make use of the opportunity when doing an inventory to also consider open systems

Developing countries

Whereas PCBs in closed systems are generally "under control" in the developed countries, a significant amount of the existing PCB-containing or contaminated equipment is still in use in developing countries and countries with economies in transition, due to the high logistical and financial burdens involved in safe and environmentally sound replacement of PCB-contaminated devices.

Most of the Parties to the Stockholm Convention in all regions worldwide have compiled preliminary inventories in the development phase of their National Implementation Plans (NIPs). However, differing inventory methods and approaches have been used. Some countries only estimated the number of suspected PCB-contained devices; some calculated the weight of waste containing PCBs, based on the usually poor feedback from questionnaires; whereas others did not only focus on transformers and capacitors but also analysed samples from suspected contaminated sites.

(cont. on page 24...)

When the polluter does not pay

By Jindřich Petrlík

Estimates of total PCB production vary between about 1.2 and 2 million tonnes with some of the most detailed data indicating a total global production of approximately 1.3 million tonnes over the period from 1929 to 1993.

Total global production of PCBs

Producer	Country	Start	Stop	Quantity (tons)
Monsanto	USA	1930	1977	641,246
Geneva Ind.	USA	1971	1973	454
Kanegafuchi	Japan	1954	1972	56,326
Mitsubishi	Japan	1969	1972	2,461
Bayer AG	West Germany	1930	1983	159,062
Prodelec	France	1930	1984	134,654
S.A. Cros	Spain	1955	1984	29,012
Monsanto	U.K.	1954	1977	66,542
Caffaro	Italy	1958	1983	31,092
Zaklady Azotowe	Poland	1974	1977	679
Electrochemical Co.	Poland	1966	1970	1,000
Chemko	Czechoslovakia	1959	1984	21,482
Orgsteklo	USSR (Russia)	1939	1990	141,800
Orgsintez	USSR (Russia)	1972	1993	32,000
–Xi'an	China	1960	1979	8,000
Total		**1930**	**1993**	**1,325,810**

Source: *Breivik, K. et al., "Towards a global historical emission inventory for selected PCB congeners - A mass balance approach", 2007*

The research suggests that nearly half (48%) of the PCBs were used for transformer oil; about 21% for small capacitors; 10% for other 'nominally closed' systems and approximately 21% for 'open uses'.

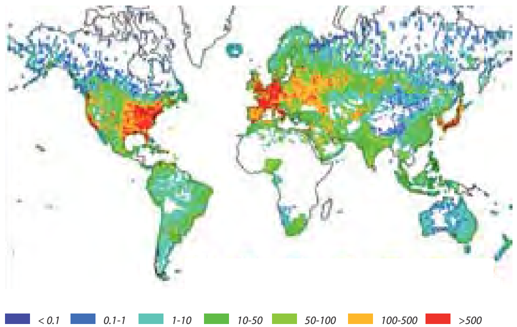
Whilst global production of PCBs ceased in 1993 it has been calculated that between 12.9% and 16.5% of the original PCBs remain in use – the majority of which are in long-lived closed systems. Many electrical transformers containing, or contaminated with, PCBs remain in use and it is estimated that about 4 million tonnes of such equipment will eventually require environmentally sound waste management. The real figure may be even higher.

In preparation for the fourth Meeting of the Conference of the Parties, the Stockholm Convention Secretariat reviewed the PCB data in the National Implementation Plans from the 88 Parties who had submitted them by December 2008. The results indicate that more 6,431,886 tonnes of PCB contaminated oil together with 472,853 tonnes of contaminated equipment are listed by these 88 Parties. These levels seem rather high and more accurate inventories are urgently needed to confirm actual stockpiles.

Note by the Secretariat:

The data on quantities of PCBs is a rough estimate that was gathered from limited data. Another analysis by the Secretariat showed that about 3 million tonnes of PCBs and contaminated equipment still exist globally. Further detailed inventories are required to substantiate these quantities.

Estimated cumulative global usage of PCBs (legends in t) with 1°x1° longitude and latitude resolution



Source: *Breivik, K. et al., "Towards a global historical emission inventory for selected PCB congeners - a mass balance approach", 2002*

With current total treatment costs of USD 2,000 to 5,000 per tonne (including packing, transport and destruction) this would amount to an estimated USD 8 to 35 billion to manage transformer and some capacitor associated with PCBs. Comparison with the USD 550 million allocated GEF funding for the Stockholm Convention from 2003 to 2010 demonstrates the magnitude of the financial challenge to implement the PCB obligations of the Stockholm Convention by the target date of 2028.

Ultimately the majority of these enormous costs (USD 35 billion exceeds the GDP of more than 100 countries) will be paid by the public and not the original producers or polluters. This provides a powerful argument in favour of a precautionary approach to chemicals management, extended producer responsibility and makes a compelling economic case for green chemistry.

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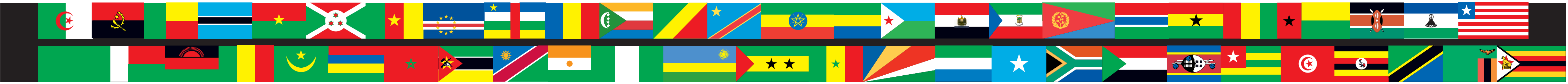
Two storage sites in the Czech Republic, where PCB are not stored securely

Update on PCB inventories in Sub-Saharan Africa

By Professor Dr. Komla Sanda



Sectors covered by the preliminary PCB inventories

The National Implementation Plans (NIPs) developed for the Stockholm Convention indicate that in Sub-Saharan Africa, inventories of PCBs as part of the enabling activities under the Stockholm Convention focused exclusively on the electricity production, transportation and distribution sector. Thus, investigations have mainly focused on transformers, capacitors, disconnectors and circuit breakers.

Production and use of PCBs

The South African Republic is the only country among the 48 countries in Sub-Saharan Africa that produced electrical equipment potentially containing PCBs. All other countries in the region have imported such equipment from Europe, America, Asia and South Africa for various applications.

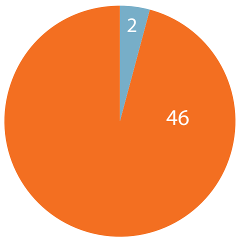
Holders of PCBs

The national electricity production, transportation and distribution companies are by far the largest holders of equipment that may contain PCBs. Other holders are big industrial facilities (mining sector, petroleum, food processing, cement, etc.), major hotels and some military installations. In Africa, PCBs are commonly used in the informal sector for non-food applications (welding equipment, hair or skin care products). They are also sometimes found as additives to cooking oils in the street food industry.

PCBs and PCB waste quantities

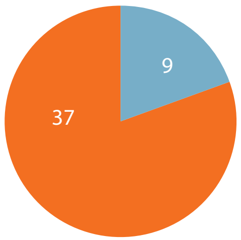
Of the 48 countries in Sub-Saharan Africa, 46 are Parties to the Stockholm Convention and 37 of these have developed and submitted their NIP to the Convention. However, only 11 countries out of 48 conducted testing of PCBs using the colorimetric method with the L2000 DX field analyser.

Status of ratification of the Convention in Sub-Saharan Africa



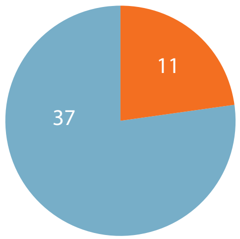
Party countries to the Convention
Countries not Party to the Convention

Status of NIP preparation in Sub-Saharan Africa



Countries having submitted a NIP
Countries not having submitted a NIP

PCB screening carried out in Sub-Saharan African countries



Countries having tested equipment for PCB
Countries not having tested equipment

For example, Benin has screened and labelled 190 pieces of equipment of the 2000 existing in the national electricity network. Equipment tested positive showed PCB concentrations in dielectrics of 50.1 to 4,973 ppm. If we extrapolate the percentage of equipment found to be contaminated to all equipment in the inventory, then 1,387 pieces of equipment are supposed to contain PCBs or be contaminated. This corresponds to 428,800 tonnes of liquid waste and 1,484,400 tonnes of solid waste.

As of March 31, 2004, when the last update of the inventory took place in Togo under the NIP, 675 pieces of equipment of the existing 1,000 pieces of electrical equipment were estimated to contain PCB or be contaminated. According to this data, the quantities of liquid and solid PCBs waste are 550 tonnes and 1,700 tonnes respectively. In addition, Togo has analysed and labelled 321 pieces of electrical equipment in the country (32% of the total number). The screening revealed that 193 electrical transformers are contaminated with PCB levels ranging from 50 to 11,649 ppm. Among the contaminated equipment, approximately 37% having levels greater than or equal to 500 ppm and are classified as «pure» PCB waste. The remaining equipment (63%), having PCB levels between 51 and 499 ppm are considered to be contaminated.

In Comoros, the screening of 114 pieces of electrical equipment from a total of 324 pieces revealed that 90% contain PCBs or are contaminated with PCBs. The quantities of liquid and solid PCB waste are estimated at 36 tons and 116 tons respectively.

Labelling of electrical equipment according to its PCB status:

Electrical transformer containing PCB (PCB level > 500 ppm)

Circuit breakers containing non-contaminated mineral oil

Electrical transformer classified contaminated (PCB level between 51 and 499 ppm)

In Southern Africa, Zambia has undertaken a comprehensive inventory of electrical equipment with a policy of environmentally sound management including the establishment of appropriate facilities for temporary storage and export of PCBs and their wastes disposal.

In addition, South Africa is the only country in Sub-Saharan Africa operating a high temperature waste incineration plant capable of treating PCBs and PCB wastes.

Finally, no quantitative analysis and identification of PCBs is mentioned in the different reports from the African countries.
It can therefore be concluded that current inventories are not all accurate and do not give a clear picture of the magnitude of the problem of PCBs in sub-Saharan Africa.

Applicable regulations

Overall, the Sub-Saharan countries do not have legislation specific for PCBs. Their development and enforcement remain national priorities concerning POPs management.

Awareness on PCB issues

Policy makers, professionals in the electricity sector and the public know little of the physical and chemical properties of PCBs, their various applications and their adverse effects on human health and the environment. Highly contaminated equipment with leaking dielectric fluid is not in conformity with the recommendations of the Basel Convention (drip trays, control of pressure and temperature, labeling, inspections, etc.) for environmentally sound management of these liquids.

The existing technical infrastructure for the management of PCBs

As consequence to the low level of awareness on PCBs, specific legislation and national programs for environmentally sound management are lacking. Thus, with the exception of Zambia, very few countries mention the existence of temporary storages for PCBs and PCB wastes.

Risk to human health and the environment

Inventories have identified workers handling electrical equipment containing PCBs as the main risk group for exposure to PCBs. In general, it has been discovered that the technicians and support personnel in the electricity sector are unaware of the adverse effects of these substances on human health and the environment.

Other specific groups at risk exist in the informal sector: welders, scrap dealers and merchants dealing with end-of-life electronic transformers. In addition, the exposure risk of the general public is mentioned in some surveys that indicate that there is inappropriate use of PCBs for domestic food uses (additives for frying oils) and non-food uses (cosmetics and hair care).

Several inventories highlight risks of contamination of soil and water bodies by PCBs from leakage of dielectric oil from electrical transformers. However, the extent of contamination is unknown in most cases due to lack of chemical analysis. A few countries like Swaziland conducted the screening of PCBs in soil.

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Countries where GEF projects on PCBs are being implemented

Examples of bad management of electronic equipment and the risks of exposure of humans and the environment

An example of poor storage practice

Countries' priorities related to PCB management

In the NIPs, it is usually established as a priority that there is need to address the completion of preliminary PCB inventories (inspection of all electrical equipment in the country, screening and appropriate labeling) to enable countries to have a comprehensive set of information. This is also true for the development and enforcement of specific rules related to PCBs and the development of secure locations – according to the standards of the Basel Convention - for temporary storage of PCBs and their wastes pending decontamination and final disposal.

Main PCB related projects in Africa

Country	Project	Source of funds	Implementing Agency	Implementation period	Cost including co-financing (million USD)
Ghana	Capacity Building for PCB Elimination	GEF	UNDP	2008-2013	8.503
Morocco	Safe Management and Disposal of PCBs, Pillar I and II	GEF	UNIDO and UNDP	2008-2011	15.008
Nigeria	PCB Management and Disposal Project	GEF	World Bank	2010-2014	18.5
Tunisia	Demonstrating and Promoting Best Techniques and Practices for Managing Healthcare Waste and PCBs	GEF	World Bank	2008-2012	22.840
Regional	Demonstration of a Regional Approach to Environmentally Sound Management of PCB Liquid Wastes and Transformers and Capacitors Containing PCBs	GEF	UNEP	2009-2013	15.226
Total					**80.007**

Some prospects for the region

The South African technical capacity to destroy POPs using high temperature incineration (ThermoPower Company) is unique in the region. It could be used by the countries of the sub-region for the elimination of their PCBs wastes. Moreover, Nigeria is considering setting up a facility using the Gas-phase Chemical Reduction (GPCR) technology.

Conclusion

The analysis of the various documents produced by the Sub-Saharan African countries shows that the available inventory on PCBs and equipment containing PCBs are incomplete and unreliable in light of the requirements of the Stockholm Convention. Indeed, the statistics on the number of electrical equipment contaminated with PCBs only provide estimated information based on the application of the basic assumptions that non-labelled equipment is supposed to contain pure PCB (PCB level > 500 ppm), equipment containing a producer label not mentioning the PCB content is supposed to be contaminated (PCB content between 50 and 499 ppm) and that equipment having a green PCB-free label is supposed to be PCB free. However, in African countries cross-contamination is very probable and equipment needs to be tested. The levels of contamination of equipment with PCBs are provided by only 11 out of 48 countries in the region.

Implementing environmentally sound management of PCBs in Sub-Saharan Africa in order to comply with the requirements of the Stockholm Convention set for 2025 (end of use of PCB equipment) and 2028 (environmentally sound management of PCB wastes) remains a major challenge for the Parties.

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Côte d'Ivoire
First the legislation to regulate PCBs
By Emilienne Yetin

The management of hazardous wastes generated by industry, households, hospitals etc. is currently one of the most challenging environmental problems that the international community has to face.

PCBs are used in abundance in open, partially-open and closed systems, being present in capacitors, transformers, hydraulic devices, heat exchangers and pumps, as well as plasticizers, paint and glue. However, PCBs are very persistent and when burned under inappropriate circumstances produce toxic by-products such as dioxins and furans. Côte d'Ivoire, being very concerned by the protection of human health and the environment, as are many other African countries, has ratified the Basel Convention.

The Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade and the Stockholm Convention on Persistent Organic Pollutants have also identified and control PCBs as toxic chemicals under their respective mandates, with the Stockholm Convention aiming to eliminate PCBs in the relatively near future.

The Ivorian Government recognizes the need for the development of regulations on PCBs, electrical equipment containing PCBs and materials contaminated with PCBs that will make their disposal obligatory. The Ivorian Government is currently developing a draft decree containing fifteen articles and eight explanatory annexes.

The articles of this draft decree regulate, among other things, the import and sale of PCBs, declaration of ownership of PCBs and electrical equipment containing PCBs, as well as updating existing installations to ensure conformity with legal requirements, technical checks and controls, etc. The draft decree is the result of discussions with national partners from the electricity, health, energy, industry and civil society sectors.

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PCB-contaminated transformers
securely kept and awaiting disposal in Mauritius

Mauritius
is well on the way to be PCB free
By Ramchurn Seenauth

As a Party to the Stockholm Convention, Mauritius has prepared its National Implementation Plan (NIP) for reducing and/or eliminating POPs. The issue of eliminating Polychlorinated Biphenyls (PCBs) is given high priority in the NIP.

The first ever inventory of PCBs and PCB-containing equipment in Mauritius was carried out in 2004 in the context of the POPs Enabling Activities under the Stockholm Convention. For the identification of PCB-containing equipment, the focus was put mainly on transformers and capacitors (power factor correctors).

Results obtained indicate that only a small proportion (less than 2%) of transformers in use in Mauritius are likely to be PCB-contaminated whereas in the case of capacitors, they were all found to be PCB-free. The latest inventory carried out in the year 2010 reveals that approximately 1400 kg of PCB containing transformer dielectric oil and five medium sized electrical transformers (100 – 150 KVA), with an aggregate weight of 3.5 tons, should be disposed. These have been isolated and securely kept by the Central Electricity Board, the National electricity generating organization.

The disposal of the PCB-contaminated transformers together with the PCB oil is scheduled to be undertaken by the end of 2010 under a GEF-funded project: "Sustainable Management of Persistent Organic Pollutants in Mauritius".

As Mauritius has no current capacity to implement the destruction of POPs chemicals and wastes, the destruction phase would be completed at a foreign location. The target of Mauritius to eliminate PCBs is expected to be achieved well before the deadline of 2025 set by the Stockholm Convention.

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Morocco
On the way to sound management of PCBs
By Farah Bouqartacha and Driss Zakarya

Inventories
The inventory of PCBs in Morocco has been a tedious task because of the large number of transformers located throughout the national territory and the difficulty of accessing these devices, in particular the capacitors.

In order to determine as accurately as possible the existence of equipment contaminated with PCBs, Morocco has, since 2001, undertaken three inventories of PCB equipment in 2001, 2004 and 2007 respectively.

The inventories follow a precise pyramid approach, going from the manufacturers to the customers (holders), systematically identifying holders and validating data through site visits. Inventory forms have been made available to all partners.

The approach was as follows:

1. All manufacturers of transformers or their subsidiaries (Transfo Morocco, Nexans Energy Transformer, etc.) were asked to provide a list of customers who had bought a device that contained PCBs.
2. The main users of transformers, and thus the principal holders of potentially PCB-contaminated equipment, were contacted. These included the National Office for Drinking Water, the National Electricity Office, the national Moroccan phosphates company, the National Airport Office, the National Port Agency, the National Radio television Company, the Public Water and Electricity Distribution Company, delegated supply companies, thermal power stations and the Air Force.
3. The board of directors was invited at the level of the Ministry of Interior to centralize information and allow close monitoring of the inventory.
4. Systematic visits were made to customers that were declared by authorities or the National Electricity Office.
5. Service providers offering transformer maintenance and analysis of dielectric oil were contacted for information on their customers.

In 2007, preliminary analyses were carried out on 200 samples collected nationally from transformers which were suspected to be contaminated with PCBs. About 30% of the transformers in use were found to be contaminated with PCBs (> 50ppm). These results were confirmed by laboratory analysis within maintenance contracts (electrical performance, oil level in transformers, changing characteristics of the oil, etc.).

(cont. on page 18...)

Follow-up activities

The National Implementation Plan (NIP) of Morocco includes the environmentally sound management and disposal of PCBs as a national priority.

In order to do so, Morocco has sought financial support from the Global Environment Facility (GEF) for the implementation of a PCB management and disposal programme aimed at strengthening the regulatory framework and the national capacity on management and disposal of PCBs and the establishment of local infrastructure for the dismantling of equipment and the decontamination of oils and materials for reuse.

Project Components

The analysis of the situation in Morocco revealed the presence of two kinds of PCBs equipment:

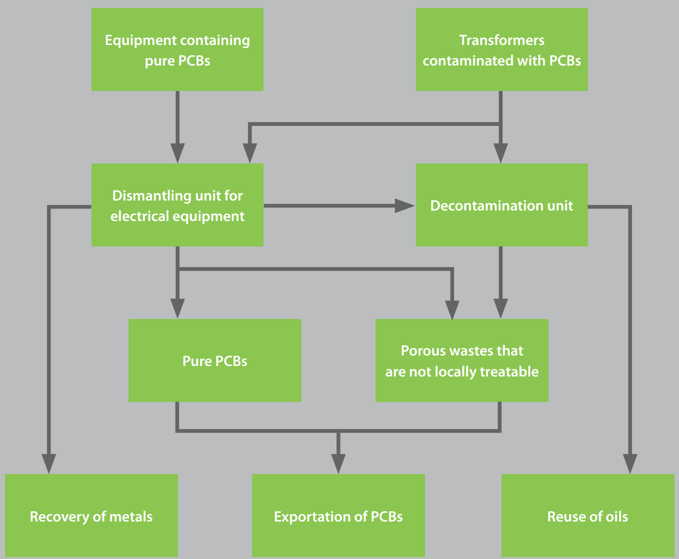
- Equipment containing pure PCBs;
- Transformers containing PCB-contaminated mineral oils.

As a result, the project is divided into two pillars implemented simultaneously by the Department of Environment in collaboration with the United Nations Development Programme (pillar I) and the United Nations Industrial Development Organization (pillar II).

Project strategy

As shown in the diagram below, the strategy of the project consists of exporting pure PCBs for their environmentally sound disposal at specialized treatment plants, and of dismantling and decontaminating equipment and oils contaminated with PCBs locally in order to recover and reuse materials.

Flow of PCB wastes in Morocco



This strategy of treating one part of the contaminated materials locally has the following advantages:

1. Having local infrastructure (fixed or mobile) for the treatment of contaminated equipment beyond the duration of the project;
2. Reducing the amount of waste to be exported;
3. Reusing decontaminated oils thus avoiding the import of the same quantities of mineral oils;
4. Recover and reuse metal parts and noble metals (steel, iron, copper).

Expected project results

Components	Expected results
PILLAR I	
1. Strengthening the legal, policy and administrative framework for the management and disposal of PCBs	**1.1.** The legal and administrative framework for PCBs are put in place (commissioning of PCBs in use, regulation on PCBs approved); **1.2.** Guidelines and norms related to managing PCBs throughout their life cycle are approved and communicated to interested entities; **1.3.** Limit values for releases into the environment and limit values in food are studied **1.4.** Responsible entities and the private sector are convinced of the urgency of eliminating PCB and the population is sensitized concerning risks of PCB; and published;
2. Secure management at the level of holders of PCBs and identification of other sources of PCBs	**2.1.** The capacity of secure management of PCBs equipment during maintenance and handling is consolidated; **2.2.** The capacity of identifying PCB sources in equipment in use or imported is reinforced;
3. Environmentally sound replacement and emptying of equipment containing pure PCBs	**3.1.** Risks during the phase of replacement of PCB equipment are dominated; **3.2.** Procedures for secure dismantlement of transformers are established; **3.3.** PCB equipment is dismantled and the PCB wastes exported for environmentally sound disposal;
PILLAR II	
1. Identification of PCB contaminated transformers	**1.1.** Partners for the analysis and sampling campaign are identified; **1.2.** Standard methods for analysis are established; **1.3.** Samples are collected and analysed (1,500 per year);
2. Environmentally sound treatment of contaminated equipment	**2.1.** A unit for treatment of contaminated oils is operational;
3. Dismantling of transformers at the end of life and recovery of metals	**3.1.** A unit for dismantling of transformers and recovery of metals is established.

Morocco is keen on sharing its experience and expertise with other countries in order to promote information exchange and to contribute towards the environmentally sound management of PCB equipment and wastes.

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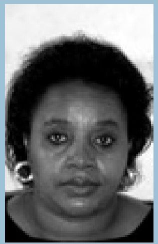
Nigeria
working to avoid misuse of PCBs

By Stella Mojekwu



First preliminary PCB inventory

In Nigeria, the PCB inventory was carried out during the development of the National Implementation Plan (NIP) under the Stockholm Convention. The Federal Ministry of Environment developed the Nigerian NIP through a consultative process involving policymakers, regulatory bodies, researchers, manufacturers and other stakeholders. Guidelines provided by UNEP and UNIDO were used in combination with consultations with these agencies in national activities.

Nigeria has never produced PCBs, but imported hundreds of PCB-containing equipment (transformers, capacitors, ballasts, paint additives, hydraulic fluid additives, etc). The Power Holding Company of Nigeria (PHCN) is by far the biggest user of dielectric fluids and by extension the biggest owner of equipment that potentially contains PCBs. Other possible significant users of equipment that potentially contains PCBs are private electrical generators, major industrial facilities, oil refineries, textiles, and cement industries.

Given the size of the country, its level of economic development and its complex government structure, and taking into account the amount of GEF resources available (USD 499,000 for POPs Enabling Activities), the level of detail that could have been expected from these inventories was limited.

The PCB inventory, as proposed by UNIDO was completed but very limited information on volumes of PCB stocks or on numbers of PCB-containing equipment is actually available. Most of the data compiled were provided by 10 transmission stations of the Power Holding Company of Nigeria (PHCN) in six states of the North Central Zone and in the Federal Capital Territory. The report does not provide any indication of why those particular states were selected or whether they are representative of the national situation. In addition, no information was included regarding privately owned equipment. From the report, only 22 transformers were identified most of which range in ages from 15 to 30 years. No testing was conducted on the transformer oils. No data regarding other types of equipment (e.g. capacitors) are included in the report. Anecdotal information is presented on PCB spills, PCB contaminated soils and groundwater and PCB stocks at some of the transmission stations but no supporting data are included.

In spite of the inadequacy of the existing PCB survey conducted under the GEF project, the NIP highlighted PCB management as one of its top priorities due to several reasons:

1. The Nigeria electricity sector has facilities located in all 36 states including the Federal Capital Territory, with about 250 transmission, 34,800 distribution and over 2,000 power transformers. It is likely that many of these transformers contain PCBs and that a significant number of them may not be properly maintained.
2. One of the top priorities of the Government is to upgrade to 10,000 mega watts of power capacity, at a cost of up to US$10 billion. Some of the upgrades will involve replacement of old equipment which may be contaminated with PCBs. It is therefore critical for the government to have a clearer picture of what is the potential for contamination of electrical equipment at PHCN such that plans to adequately manage the decommissioning of these equipment can be put in place.
3. The risks to human health and the environment posed by the unsound management of privately owned PCB-containing equipment or PCB stocks are also a priority of the government. In particular, information about illegal trade of spent oils and poorly managed and inadequately disposed equipment are sources of grave concern although no actual data currently exists to assess the situation. Compiling data about these issues will allow better planning of the level of government enforcement required for private sector operations to ensure human health and environmental safety.

Second PCB inventory

In the light of the above, in 2008, the Nigerian Government undertook a more detailed analysis of PCB inventory in the power generating facilities in the country with financial support to the amount of 250,000 Canadian Dollars from the Canadian POPs Trust Fund. The main conclusions and recommendations of the study, which covered only an estimated 10% of the potentially contaminated electrical equipment, are summarized below:

1. PHCN is the largest user of dielectric fluid in Nigeria and there were no records found of historical PCB wastes. Dielectric fluids are used and re-used and not disposed of as wastes.
2. Awareness about PCB use in transformer oil is very low and consequently there is a lack of proper procedures in its handling, storage and disposal.
3. The total amount of PCB-contaminated waste in Nigeria is estimated to be 3,400 tonnes. This figure was obtained on the basis of very conservative assumptions. The total amount is expected to be much greater. No regulatory framework exists for the management and disposal of PCBs and no tracking of PCB oils or contaminated equipment is carried out. PCB-free oils are to be mixed with contaminated oils during regular maintenance and recycling procedures, potentially contaminating an even greater number of pieces of equipment.
4. A more comprehensive and expanded PCB inventory covering the entire country and all users of dielectric fluids is required.
5. The Government should develop and implement regulations to control the use, handling, storage and disposal of PCBs and PCB-contaminated equipment and oils.
6. While it is acknowledged that 80 % of the transformers in use in Nigeria still have significant useful life, those contaminated with PCBs may be disposed of in advance of the Stockholm Convention timeline requirements if they are found to pose threats to human health or the environment.

PCB Management

Nigeria is also implementing a PCB Management Project. The objective of the project is to develop national capacity to manage PCBs and develop in-country storage facilities for PCBs until their environmental sound disposal can be achieved.
The global environment objective of the proposed project is to improve public health and environmental quality by avoiding the environmental release of PCBs from on-line and off-line electrical equipment and ensuring sound management of PCB and PCB-containing equipment until their safe disposal.

POPs Contaminated Sites Project

Nigeria is collaborating with Ghana in a regional POPs contaminated sites project. The field studies showed that high levels of PCB contamination exist within and around surveyed and assessed PHCN facilities.

There was limited understanding on the dangers of PCBs, their chemical properties, former use as dielectrics, long range transport properties, bioaccumulation and general environmental concerns. This finding was quite astonishing since personnel who played a daily role in transformer retrofiling, filtration, recycling and storage were totally oblivious of the effects of potentially PCB contaminated equipment and oils.

The findings of conducted research when compared to field work findings on existing plant species in the assessed PHCN facilities also revealed the presence of plant species with high absorptive PCB potential (HAPCBP) such as sweet potatoes (lypomea batatas), making it a critical public health issue as the likelihood of consumption of such potatoes by facility personnel and vandals is high.

The project provided a good view of the handling, storage and disposal of PCB containing equipment and oils, the limitations in assessed facilities and the foundation for good storage and international best practices for proper storage and disposal for disused and contaminated PHCN equipment and oils.

In the course of the project execution many contaminated sites were discovered. The I Ijora power station B in Lagos State has been identified as a "hot spot" with regards to PCB contamination using the UNIDO toolkit. The site is a top priority in terms of poor housekeeping, environmental contamination, chlorination of oil, and potential risk to human beings, marine life and animals. The power station has not been in use for over two decades but PHCN has a repair shop for transformers in the facility. A field team observed that the facility is more of a cannibalization centre for disused transformers. There are large numbers of transformers. There is a need for urgent action on this facility which abuts the Lagos Lagoon (this flows into the Atlantic Ocean) to reduce the human health risk and environmental impacts of the tested and confirmed PCB-contaminated oil.

A brief interview with the personnel from PHCN laboratory located within the premises of "Ijora Power Station B" Lagos, confirmed that transformer oils are being sold to prospective buyers who use them as body cream, and binding-base for bathing and washing soaps. A report of the skin bleaching effect of transformer oil used as body cream over a long period of time by a staff of PHCN at the Ijora Power Station was also an astonishing finding.

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Countries that have not ratified the Stockholm Convention as yet

Consider spare oil as potential PCB source

Standard Operating Procedures (SOP) should be established for the inventory process, especially if the inventory is compiled by several field teams

Obsolete stocks of PCB equipment have not been appropriately inventoried yet

Inventory taking training in the field in Vietnam

PCB inventories should have been finalized in the course of the NIP development and preparation. It is obvious, however, that the complexity of PCB inventories was underestimated including the proportion of financial and human resources needed to complete these inventories.

In most countries comprehensive national inventories could not be achieved within the available timeframe and budgets.

PCB inventories invariably do not reflect the contribution from the informal sector and the validity of the inventories is reduced where the informal sector represents a significant proportion of economic activity. It is also unclear to what extent the contribution of the private sector and small consumers in general are included in these inventories. Usually, the activities focus on energy production, transmission and distribution utilities. Also, it seems that a majority of the inventories are focused on transformers but not capacitors and other electrical devices with volumes greater than 5 litres.

The preliminary inventories or the various pilot projects in the regions however, are still very useful as they serve as a basis for future detailed inventories and provide basic information in the sense of a "snapshot of the problem" allowing the Parties to better understand the complex task of a complete PCB inventory.

Furthermore, only a fraction of this equipment has actually been sampled, tested and, when necessary, verified by laboratory analysis. Assessments of the real PCB situation at the national level show that the actual PCB quantities often dramatically differ from preliminary investigations. Luckily, the figures in reality are not necessarily higher than estimated figures. Often the detailed inventory reveals that the problem is smaller than estimated and considerable funds can be saved as extensive management activities are not required. A positive spin-off from undertaking a professional inventory is awareness-raising - particularly in the maintenance and repair sector, in oil recovery and for scrap and recycling industries - which prevents further unintentional cross contamination of clean oils from PCB-contaminated oil and solid material.

In some Asian countries, PCBs have been spreading rapidly in the environment due to indiscriminate human activities and lack of awareness. Waste oil is often used as fuel in brick plants and, through illegal trade in transformer oils to retail sellers and transformer auctions, PCB oils have entered into the open market. This is also true for many African countries. Because of the cheaper price, welders prefer using PCB oils instead of the recommended coolant oil.

In various Latin American countries, waste oils from transformer repair shops are used in the production of concrete poles. The steel channels are lubricated with the oil by hand before the concrete is poured into them. If the waste oil contains PCB, this "recycling" can contaminate the concrete. The workers are not protected and are exposed to the PCB oil. Due to the lack of awareness of the health risks from PCBs, it has become difficult to control such situations.

From 2003 to 2007, PCB inventory projects, funded through the Canada POPs Fund, France, Switzerland and the USA, were launched in fourteen Southern African Development Community member countries. These projects brought to light and reported on many cases of misuse of PCB-contaminated oils. It was further recognized that such misuse in the informal sector potentially adversely affects human health. There is lack of public awareness on PCB-related issues, technical expertise, as well as PCB regulations and guidelines. These reports even acknowledged that the import of PCB-containing equipment was still possible in some countries. However, in most African countries, the PCB inventories are still very basic, based on estimations from limited data collection activities and some screening results. Very often, those screening feedbacks are not based on chemical testing but simple density tests or the Beilstein method which is later explained in the screening section of the steps to take for an inventory.

Importance of proper inventories

In the efforts around the world to eliminate PCB-contamination in electrical equipment - as well as from other sources - reliable identification and detection will be the key starting point. In order to decide on the best cost-effective and environmentally sound elimination or treatment options for a specific country, factual information about the nature and extent of the PCB problem is required.

As already demonstrated in many Western, Asian, Pacific, African, Central European and Latin American countries, the effective integration of field screening methods into the inventory proceedings can result in substantial cost savings in later stages of managing PCB-containing or contaminated equipment.

The more reliable information is and the faster it becomes available, the sooner contamination can be stopped. Consequently, reliable testing can be done at reduced costs; the cleanup process initiated and more money made available for remediation and elimination activities. Generally, we have to consider the status and quality of PCB inventories and that PCB management varies extensively between the countries and regions. Consequently, there is still a long way to go to achieve the 2028 aims.

Existing PCB inventories need to be updated e.g. by considering and including stakeholders not previously covered, improving the accuracy of existing data, by carrying out chemical analysis of the positively screened samples, labelling surveyed equipment using a regionally harmonized label and maintaining the inventory using a regionally harmonized database.

(cont. on page 26...)

In the Central and Eastern European Region, Moldova has achieved a measure of success in how it approached a PCB inventory. Efforts towards a PCB-free future started in May 2001, when the country signed the Stockholm Convention. A number of actions have subsequently been taken that aims at a reliable and complete inventory of PCBs.

Filtering equipment of used oil, possibly contaminated

Do you know where your waste oil goes?

Process of concrete pole production using waste oil

Stakeholder participation

There is usually little or no interest by stakeholders and especially industry to participate in the identification process. The main reason why industry and small consumers are afraid to provide information or access to their sites is their fear of being sanctioned if PCB is found on their premises. Furthermore, stakeholder commitment is limited because they do not understand their role in the inventory process or the person contacted is a low-level officer.

Government ministries in developing countries often have only few multidisciplinary staff and it is difficult to have a person solely dedicated to such an inventory project. No obvious advantages are seen. Therefore, an important element of an inventory campaign is related to awareness raising and specific training on PCB issues. This should ideally involve all stakeholders from the decision-making bodies to the mid-management level and even those who might be exposed to PCB in the workplace.

Treat owners of PCB suspected equipment as partners not as the enemy. An aggressive ("police mentality") is often counter-productive

It is also important that owners of electrical equipment interact with "PCB inventory Field Teams" who do not inspect their sites like "policemen" but to whom they can relate instead as friends, and with whom they may share valuable information and consult on what to do if the presence of PCBs is confirmed. This may end in win-win situations, as owners gain time in order to plan budgets and possibly replacement for contaminated equipment, get access to future phase-out projects and take action to prevent exposure to staff.

Governmental bodies will fail with their complex tasks without active participation and assistance of the utility companies and other private sector bodies that own PCB-contaminated equipment.

Of course the initial sampling, screening and verification activities usually focus on the largest owners of potentially PCB-contaminated equipment, such as electricity utilities. Thanks to their knowledge and experience they are valuable partners in the inventory process. But the process of identification must also involve industry and smaller consumers. These entities may also possess a significant number of transformers and capacitors when pooled. Additionally, smaller capacitors usually have higher concentrations of PCBs in the oil mixture

Communication is a crucial factor during all phases of an inventory or assessment project

Non-governmental organizations play an important role in their countries and should preferably be part of Steering Committees for relevant projects. However, in many countries their lack of knowledge and capacity limit their active participation resulting in their exclusion from such tasks.

Required resources for inventories

In most countries there are local experts (electrical and chemical engineers) available who have substantial knowledge about PCBs. Unfortunately, the knowledge is often of a theoretical nature only. There is a lack of practical PCB management know-how. On the other side, budgets for well experienced, international, senior consultants are usually too low, simply because the complexity of PCB management is substantially underestimated. Budget savings for consultancy often result in cost increases in the later stages of PCB management.

Due to the unavailability of PCB test kits in countries and the high cost of PCB analyses by gas chromatography (GC), the number of oil samples to be tested is usually low. This also applies to the purchase of appropriate sampling materials like glass vials, pumps, absorbents, tools, personal protective equipment (PPE), etc. Efforts should thus be made to allocate budgets for the sufficient purchase of appropriate sampling and screening material.

All preliminarily inventoried devices and sites should be subject to further validation including physical site investigation, sampling, screening and, if necessary, verification by laboratory analysis. It should be considered that the investment into a reliable PCB assessment may result in significant cost savings in later stages of the management process due to reduction in unintentional cross-contamination and implementation of country-tailored management systems.

Step-by-step approach to completing a PCB inventory

The aim of the inventory is to identify, quantify and maintain records of PCB oils, equipment and the materials prone to containing or being contaminated with PCBs. This information is indispensable when preparing a plan for PCB management, which should encompass the entire lifecycle of these products.

1. Develop a guideline

A guideline or manual for PCB management, including the identification of PCB equipment, should be prepared to address all issues related to the identification process. Procedures for the inventory, as well as the sampling and screening must be established. Such inventory procedures should also consider "soft criteria" such as the specific culture and attitudes of the specific country.

Links to relevant PCB guidelines
UNEP Manuals on PCBs - **http://www.chem.unep.ch/pops/newlayout/repdocs.html**
UNEP Manuals on POPs - **http://www.chem.unep.ch/pops/newlayout/repdocs.html**
Stockholm Convention: Training Tool on the Technical Guidelines for the Environmentally Sound Management (ESM) of Persistent Organic Pollutants (POPs) wastes **http://chm.pops.int/Portals/0/flash/popswastetrainingtool/eng/index.html**
Stockholm Convention: BAT/BEP Guidance: Draft guidelines on best available techniques and provisional guidance on best environmental practices relevant to Article 5 and Annex C **http://www.pops.int/documents/guidance/batbep/batbepguide_en.pdf**
Basel Convention: Technical Guidelines: Technical guidelines for the environmentally sound management of wastes consisting of, containing or contaminated with polychlorinated biphenyls (PCBs), polychlorinated terphenyls (PCTs) or polybrominated biphenyls (PBBs). **http://www.basel.int/pub/techguid/tg-PCBs.pdf**
Basel Convention: Training Manual: Preparation of a National Environmentally Sound Management Plan for PCBs and PCB-Contaminated Equipment - **http://www.basel.int/pub/pcbManualE.pdf**
Catalogue published by the Australian and New Zealand Environment and Conservation Council (ANZECC) on PCB contamination in capacitors: **www.deh.gov.au/industry/chemicals/scheduled-waste/pcbs/pcbid.html**.

Sources of information to assist in the development of a guideline

In order to prevent the future accumulation of PCBs, measures such as the controlling of cross-border movement of second-hand transformers should be implemented and existing laws and regulations should be reviewed to identify where additional provisions relating to PCB may be needed.

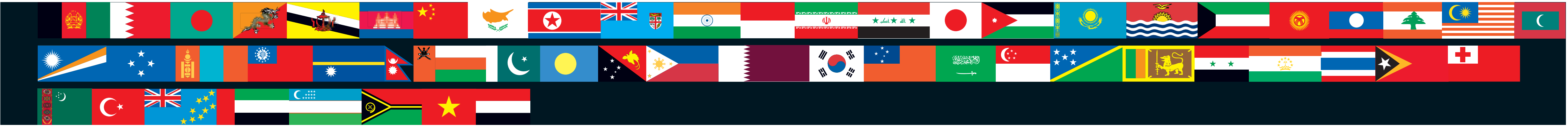
(cont. on page 38...)

Screening training in an electricity utility

Inventory plans should consider "Soft Criteria" such as the specific culture and attitudes found in each country respectively

Review of PCBs Management in the Asia-Pacific region

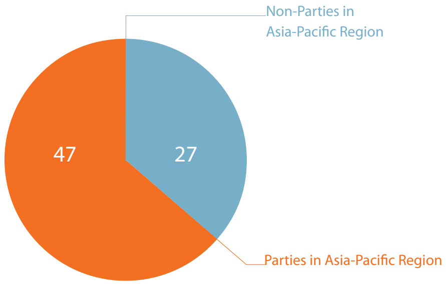
By Jinhui Li, Xiaoyang Wu and Nana Zhao



Regional overview of Parties to the Stockholm Convention

The Asia-Pacific region accounts for 62% of the world population (4.2 billion inhabitants) spread over 74 countries. By April 2010, 47 countries from the region were Parties to the Stockholm Convention, and 28 of them have submitted their National Implementation Plans (NIP). Twenty-five of these NIPs were analysed to describe the regional situation of PCBs management.

Parties and non-Parties in the Asia-Pacific region



During the development of the NIPs, most countries investigated preliminarily the production, use, import and disposal of PCBs. Based on this information, management strategies and national priorities were developed. All NIPs elaborate on Action Plans for PCB management, which include the reduction and elimination of PCBs by disposal in an environmentally sound manner.

Production and use of PCBs

In the Asia-Pacific region, China, the Democratic People's Republic (DPR) of Korea and Japan used to produce PCBs and export PCB containing equipment. Most regional countries imported devices containing PCBs form these nations and western countries, though little data is available. Import bans have been established in a few countries only, including Japan, Singapore and Thailand. Details of the production and importation of PCBs are shown in the table below.

PCB producers in the Asia-Pacific region

Country	Total production of PCBs	Time
China	7,000 to 10,000 tonnes	1965 ~ 1980s
DPR Korea	28,891 tonnes	Since 1960s
Japan	Quantity are not clear	Until 1972

Import of PCB-contained electrical equipment in the Asia-Pacific region

Country	Imported quantities
Bangladesh	22.5 tonnes of PCBs
Cambodia	• Before 1975, electrical equipment was imported from Japan, and Yugoslavia • From 1975 to 1979 from China • From 1979 to 1992 from the former the Soviet Union and Eastern European countries • 1992 to present from Thailand, the Republic of Korea and Germany
DPR Korea	1257 transformers and 354 circuit breakers
Lebanon	13 tonnes of PCB oil imported in 2002
Nepal	• Entry of transformers dates back to 1910 • 288,157 kg of transformer oil and 24 capacitors imported during the fiscal year 2002/2003 • NEEK (the largest manufacturer of transformers) imported 1,160,439 litres of Hyrax brand oil to fill its 7,053 transformers (83% of total transformers in the country)
Thailand	• PCBs oil containing capacitors and transformers imported up to 1975 • Most transformers imported from 29 different nations, with the greatest number imported from Korea (241), Japan (200), China (130), Germany (83), England (74), India (55), Belgium (53), Poland (32) and France (29)
Vietnam	27,000-30,000 tonnes/year before 1985

Inventory of PCBs

Most Asia-Pacific regional countries once used PCBs and PCB-containing devices, which are still in use in some countries, in particular in PCB transformers. Most countries carried out preliminary investigations of PCBs equipment and oils, but potentially contaminated equipment needs further validation and sampling. Actual amounts may be higher than current estimates.

Comparison of data is difficult as countries applied different methods when conducting their preliminary PCB inventories. Quantities given in the inventories include the number of electrical equipment, number of PCB devices, weight of PCB waste and contaminated sites. An estimate of total amounts was made converting the number of PCB devices into weight of PCB.

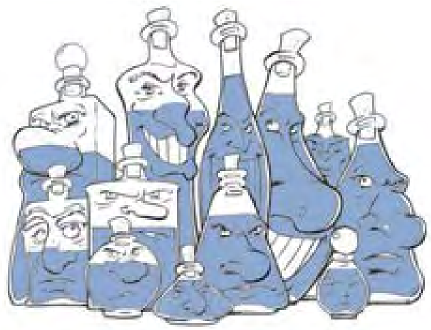
(cont. on page 30...)

Review of PCBs Management in the Asia-Pacific region (...cont. from page 29)

Preliminary inventories of PCBs in some countries of the region

Country	Preliminary inventory
Bangladesh	An estimated 55.8 tonnes of PCBs are in use; 403 tonnes of oil contained in waste equipment are contaminated with an estimated 4.193 tonnes of PCBs and 519 tonnes of waste transformer oils are contaminated with an estimated 259 kg of PCBs; Approx. 22.5 tonnes of PCBs are contained in materials of old ships
Cambodia	About 762 recorded transformers were regarded as PCBs assumed and 116 units fall into the category of PCB-contaminated equipment
China	About 1,000 tonnes of PCB were used in open applications such as paint additives. About 6,000 tonnes were used as an impregnant for electrical capacitors.
Iran	750 tonnes of PCBs, 1,150 tonnes of PCB polluted oils, 3,350 pieces of contaminated equipment, 1,150 tonnes of PCBs in use and 1,600 pieces of equipment in use containing PCBs
Jordan	Old transformers contain about 12,500 kg of cooling oil based on PCBs and 521 transformers may contain PCBs in the northern region
Kyrgyzstan	No reliable information on volumes of PCBs is available, equipment possibly containing PCBs includes 19,230 transformers, 14,285 tonnes of transformer oils, 139.7 tonnes of transformer oils on stock, 2,373capacitors and 24.4 tonnes of capacitor oil
Lebanon	Total quantities of PCB oil estimated at 42 tonnes in Lebanon's two oldest power plants and many of 16,000 distribution transformers may contain PCB oil
Marshall Islands	Up to 50 smaller transformers contained PCBs
Mongolia	5,518,345 tonnes of fluids are used in all equipment and sampling shows only 12.4 % don't contain PCBs
Nepal	8,724 transformers, 2,765 tonnes of transformer oil and 91,486 litres of old oil stockpiled
Oman	36 transformers were assumed to be PCB-contaminated
Pakistan	847,558 transformers in total, 82,890 tonnes of oil in transformers (testing for the presence of PCBs required)
Philippines	8,027 pieces of equipment of which 143 or 1.78% were positively tested for PCB oil, while about 98.22% are assumed to contain PCB oil
Tajikistan	The total amount of sovtol in transformers is 205 tonnes; 2,764 PCB-containing capacitors exist, where the volume of PCBs is 61.7 tonnes. The total volume of PCBs in capacitors and transformers is 82.2 tonnes.
Thailand	60 units of PCBs transformers; 379 PCBs capacitors; 973 PCBs-containing transformers and capacitors with a total weight of 1,912 tons require a final disposal
Tuvalu	Over 8,000 litres of potentially contaminated oil; 25 potentially contaminated transformers as well as various drums containing potentially contaminated oil
Vietnam	11,800 pieces of potentially PCB-containing electrical equipment and 7,000 tonnes of potentially PCB-containing oils

1,450,000
The cost in US dollars for the regional project on PCB management in West Africa



Disposal of PCBs

The majority of countries do not operate approved facilities for management and disposal of PCBs. China, Korea and Viet Nam have specific disposal facilities for PCBs or have disposed of PCB waste. Some countries such as the Marshall Islands, Thailand and Tuvalu have exported PCB waste to other countries for final disposal.

Disposal activities undertaken in some countries in the region

Country	Disposal
China	High-temperature incineration of hazardous waste since 1990s and PCB waste disposal facilities established since 1995
Japan	Plan to develop waste disposal facilities nationwide and have established 5 standard disposal facilities as of 2010
Marshall Islands	Some old transformers removed by the United States Environmental Protection Agency (US EPA) in the mid-1990s and 2 large transformers containing PCBs removed in 2006 as part of disposal project by the Australian Agency for International Development (AusAID) and the South Pacific Regional Environment Programme (SPREP)
Republic of Korea	Six high-temperature waste incinerators for PCBs, 2 chemical treatment and 1 cleansing treatment facilities are in operation
Thailand	761 tonnes of PCBs wastes were exported for disposal from 1992 to 2002 to France (20 tonnes), England (452 tonnes), Belgium (33 tonnes) and other countries (256 tonnes)
Tuvalu	One PCB-contaminated transformer casing and two drums of PCB-contaminated transformer oil were exported to Australia for destruction under the same AusAID/SPREP project
Viet Nam	Na-Tech, a sodium based technology for disposal of PCBs in transformer oils, is experimental

(cont. on page 32...)

PCB related projects implemented in the Asia-Pacific countries

To implement the Stockholm Convention and eliminate the hazards caused by PCBs, several countries in the region are carrying out PCB projects financed mainly by the Global Environment Facility (GEF).

Main PCB related projects in Asia-Pacific countries

Country	Project	Source of funds	Imple-menting Agency	Imple-mentation period	Cost including co-financing (million USD)
China	PCB Management and Disposal Demonstration	GEF	World Bank	2005 - 2010	31.810
India	Environmentally Sound Management and Final Disposal of PCBs in India	GEF	UNIDO	2010 - 2014	43.450
Kazakhstan	Design and Execution of a Comprehensive PCB Management Plan for Kazakhstan	GEF	UNDP	2009 - 2014	14.045
Kyrgyzstan	Management and Disposal of PCBs in Kyrgyzstan	GEF	UNDP	2009 - 2012	2.140
Lebanon	PCB Management Project	GEF	World Bank	2011 - 2015	7.610
Mongolia	Capacity Building For Environmentally Sound PCBs Management And Disposal	GEF	UNDIO	2009 - 2012	8.030
Philippines	Integrated POPs Management Project: Dioxins and Furans, PCB and Contaminated Sites Management	GEF	World Bank	2010 - 2016	26.605
Viet Nam	PCB Management Demonstration Project	GEF	World Bank	2009 - 2014	17.850
Cambodia, China, Lao PDR, Pakistan, Sri Lanka	Capacity Strengthening and Information Exchange on PCBs Management in Selected Asia Countries	SAICM Quick Start Programme	Basel Convention Regional Centre	2010 - 2011	0.249
Total					**151.789**

For more information, please contact the Stockholm Convention Regional Centre in Asia and the Pacific at bccc@tsinghua.edu.cn *or Tel.: +86 10 62794143.*

Finding PCB equipment in Qatar

The year 1985 was chosen as a baseline for the PCB inventory in Qatar. Based on the information received from the Qatar General Electricity and Water Corporation (KAHRAMAA), the number of transformers distributed in Qatar was 8,722.

An inventory team has been established in coordination and collaboration with KAHRAMAA and training has been given to this team on the following points:

- how to fill in the inventory form;
- how to describe any contamination;
- how to collect samples and what safety measures should be taken to avoid additional contamination.

Inventory results showed that there are 2,958 transformers which were manufactured before 1985. Thirty-three samples representing 52 transformers were taken and analysed at the Central Laboratory in Ministry of Environment in Qatar. Of these, 27 PCB-containing transformers and 20 contaminated sites were identified.

The following recommendations were adopted for the National Implementation Plan:

- Replace all PCB containing transformers according to a plan between the Ministry of Environment in Qatar and KAHRAMAA;
- Clean up all contaminated sites;
- Determine a suitable storage site for PCB containing transformers and contaminated material.

The implementation of the recommendations is currently in progress.

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The Philippines

Slow but progressive inventory of PCBs underway

By Dr. Ma. Luisa P. Martinez

The Philippine Government submitted its instrument of ratification to the Stockholm Convention on February 27, 2004, making it the 51st party to the Convention. As a response to its ratification, the Department of Environment and Natural Resources (DENR) has issued administrative orders, which provide for specific requirements for inventory, storage and disposal of PCB, among others.

In compliance with these requirements, the National Grid Corporation of the Philippines (NGCP) is currently conducting a thorough inventory of PCB stockpile (composed of waste oil and electrical equipment) in preparation for its eventual disposal to a treatment facility being constructed in the Philippines as part of the Non-Combustion Project in the Philippines under the auspices of the United Nations Industrial Development Organization (UNIDO), the Global Environment Facility (GEF) and DENR.

The NGCP is in charge of the nationwide planning, construction and centralized operation and maintenance of high voltage transmission facilities of the Republic of the Philippines including grid interconnections and ancillary services. As such, NGCP maintains numerous electric transmission substations and transmission lines all across the Philippines totalling a capacity of about 24,214 megavolt ampere (MVA) and 19,778 circuit-kilometer (ckt-km). NGCP may possess the largest PCB stockpile in the Philippines because of its nationwide coverage and high voltage rating of its electrical equipment compared with other PCB stockpile owners such as electrical substations of power generation companies and electric distribution utilities.

Although the use of PCB as insulating oil in transformers and other electrical equipment has been banned in the Philippines since the late 70s, the following equipment might still contain PCBs:

- Equipment electrical imported in the early 80s and 90s;
- Cross-contaminated equipment due to maintenance practices that use common oil purification equipment for "clean" and contaminated equipment;
- Stored waste oil in drums and decommissioned electrical equipment stored in temporary storages over a long period of time waiting for handling instructions from DENR.

The NGCP PCB inventory began in 2004 and is still on-going due to limited resources to undertake the inventory. An annually updated inventory report is being submitted to DENR. The NGCP PCB stockpile is classified into waste oils stored in drums or containers, decommissioned electrical equipment and in-service electrical equipment.

The first step of the inventory was to identify all the existing waste oil and decommissioned and in-service electrical equipment suspected to contain PCB (all are counted, regardless of the date of manufacture and the name of the manufacturer) and then do sampling for PCB analysis. To date, there are still identified PCB stockpile that have not been sampled and analyzed. Chemical analysis of the identified stockpile should be completed by 2010.

The initial inventory results reveal that the bulk of the inventory on PCBs in terms of weight includes unsealed, in-service electrical equipment. The storage of NGCP PCB wastes and equipment on-site is allowed until the local PCB destruction facility is operational.

The UNIDO-GEF-DENR destruction facility is envisioned to be in operation before the end of 2010. By then, the PCB analysis would be completed and the treatment facility would be operational to start the disposal of PCB-contaminated waste and electrical equipment.

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Polychlorinated biphenyls in Tajikistan much to be done to make the deadline of 2013 for elimination

By Jamshed Mansurov, Ludmila Bobritskaya and Abdusalim Juraev

Having ratified the Stockholm Convention on 6 December 2006, the Republic of Tajikistan finalized its National implementation plan (NIP) in 2007.

In preparing the NIP, a preliminary inventory was undertaken on PCB contaminated equipment. Electrical equipment containing PCBs has been used in the Republic of Tajikistan for a long time. However, due to lack of awareness on risks related to PCB use and the fact that until recently, PCBs were not considered to be toxic, the following scenario existed in Tajikistan:

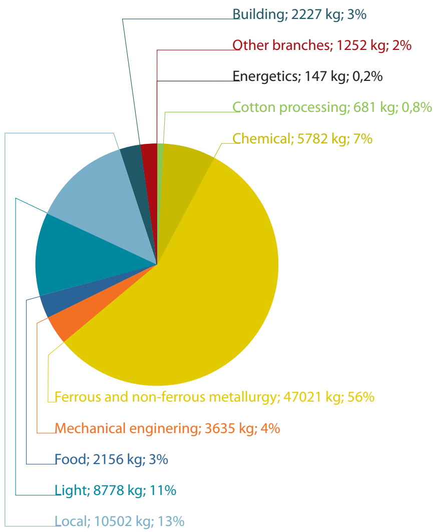
- Inventories of electrical equipment containing PCBs were not carried out in the past;
- Enterprises were able to re-use PCB contaminated equipment;
- There were no instructions on the safety of electrical equipment containing PCBs;
- Analytical methods to detect levels of PCBs in the environment and biota, food and biological substrates were not developed;
- Statistics on the distribution of PCBs in the environment and their impact on human health were not collected;
- Regulatory standards on the levels of permissible concentrations of PCBs in air, soil, surface water and groundwater, plants and foods were not defined;
- There were no import control measures for equipment containing PCBs.

The preliminary inventory of PCBs and decommissioned equipment containing PCBs carried out under the NIP, collected information from the Ministry of Energy, the Ministry of Industry and other governmental agencies. The results showed that there was a major problem resulting from the use of PCBs in Tajikistan. Although there was no production of PCBs in the Republic, the materials containing PCBs were widely applied in various industries.

In total, 190 state and privately owned enterprises in Tajikistan were checked during the preliminary inventory. The results showed that 2,764 PCB containing capacitors (61,681 kg of PCBs) were found in 45 enterprises. Only 13 transformers were found in use in 5 enterprises containing 20,500 kg of oil with PCBs. No hydraulic fluids or stocks of PCB oil were identified during the preliminary inventory.

More than half of the 82,181 kg of PCBs found in the territory of Tajikistan are used in non-ferrous and ferrous metallurgy.

Distribution of PCBs in various branches of industry



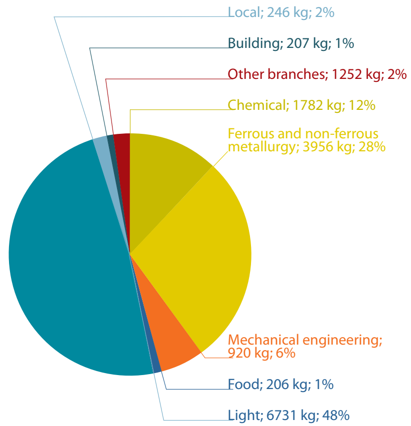
Almost all of the PCBs found in Tajikistan are contained in equipment in use. Most PCB waste is owned by the electrical industry.

To determine the actual amount of PCBs and PCB containing equipment, a detailed inventory is required in Tajikistan.

A check revealed that there is no adequate legislation and regulation in Tajikistan related to inventory of PCB containing equipment in use and out of use, the environmentally sound storage of electrical equipment containing PCBs and the destruction and disposal of equipment. There are no legal provisions for disposal of contaminated soil, as well as requirements and standards for special warehouses intended for storing equipment and wastes containing PCBs. Therefore, the revision of the current legislation in accordance with the requirements of the Convention is one of the priorities of the country.

The Tajikistan National Action Plan for the identification, labeling, transportation, storage and destruction of PCBs and equipment containing PCBs provides for the disposal of decommissioned equipment and destruction of all PCBs no later than 2013. Given the fact that the Republic of Tajikistan is one of the poorest countries in the world, actions for the implementation of the Convention require significant resources in the form of technical and financial support for a detailed inventory and for the replacement of existing equipment and destruction of decommissioned equipment containing PCBs.

Distribution of PCB waste in branches of industry



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PCB concerns prioritized in Iran

By Soroush Modabberi, Sanaz Sabeti Mohammadi and Homeyra Ekhtari

An appropriate legal framework for covering substances under the Stockholm Convention, including PCBs, exists in Iran through environmental protection laws, a wastes management law, a plant protection law as well as executive regulations for control and monitoring pesticides, hazardous chemical agents and their import & export, as well as regulations covering industrial releases.

The issue of PCBs is recognized as a priority issue even if it is not considered a prime interest by many stakeholders. This is due to the novelty of the problem and lack of knowledge on identification of PCB-contaminated wastes and equipment. Current laws and regulations do not yet cover stages of the PCB lifecycle such as use, transportation, storage or disposal.

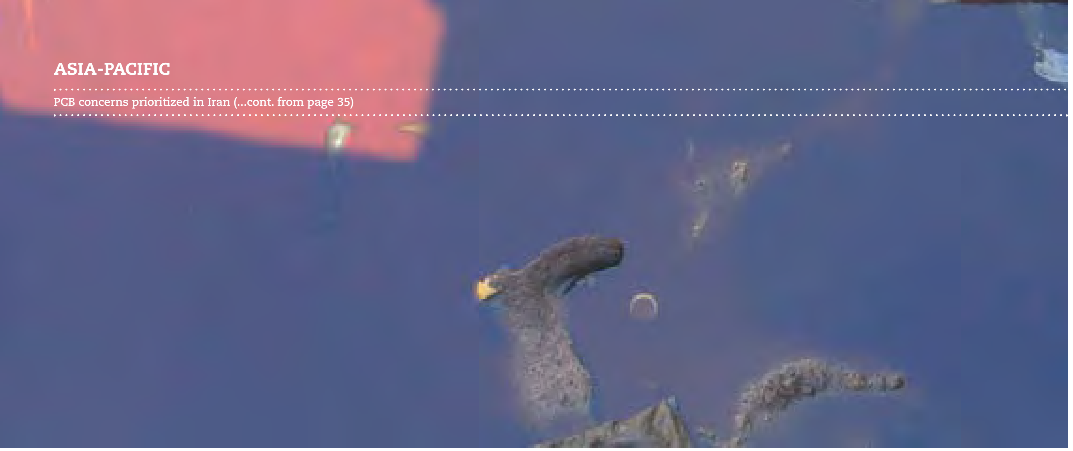
PCBs were imported into the country for many years for use in power transformers and capacitors in industrial zones even after they were banned in the producing nations. As equipment and oils have not always been dismantled or disposed of properly, there exist contaminated sites in Iran. Due to absence of legislation, contaminated sites have not been studied in detail.

Present PCB situation in Iran

The first inventory of PCBs was carried out under a POPs enabling activity project and the development of the National Implementation Plan (NIP).

(cont. on page 36...)

PCB concerns prioritized in Iran (...cont. from page 35)



Contaminated site-
Sarcheshme site, Iran

In 2003, the Department of the Environment of I.R.Iran compiled a first estimate of PCBs. Most of the data came from the reports tabled by the Ministry of Power and Energy (Tavanir Organization). The estimates are provided below:

Estimation of PCBs in I. R. Iran in 2003

Ministry/ Organization	PCBs (tons)	PCB polluted oil (tons)	PCB polluted equipment (number)	PCBs in use (tons)	Equipment containing PCBs (number)
Power and Energy	200	1000	2000	600	1000
Industry and Mining	200	200	500	200	200
Oil	150	150	300	150	200
Defence	100	100	250	100	100
Private sector	100	100	250	100	100
Total	**750**	**1550**	**3300**	**1150**	**1600**

Overall, the PCB data obtained from different sources is not fully consistent and it is estimated that PCBs are a considerable issue in Iran.

Estimated amounts of PCB equipment and oils by ministries or sectors

Ministry/ Sector	Number of "pure" PCB equipment	"Pure"PCBs in Use in tons	Weight of "pure" PCB equipment (tons)	Number of PCB contaminated equipment	PCB contaminated oil (tons)		Weight of PCB containing equipment (tons)
					Over 50 ppm and Less than 2000 ppm	Over 2000 ppm	
Power and energy	6200	1200	4200	2000	1530	120	7000
Oil	500	300	1050	400	200	200	1200
Defence	1000	200	700	400	300	300	700
Industry and mines	2000	400	1400	200	400	400	1400
Others	500	200	700	200	200	200	700
Total	**10200**	**2300**	**8050**	**3200**	**2630**	**1220**	**11000**

Inventory programme

As this estimate involved only some PCBs holders, a PCB inventory programme with a task team of 8 persons from various ministries and private organizations was launched. The inventory team contacted possible PCB holders. In addition of sending questionnaires to potential PCB holders, an investigation using PCB detection kits were performed at selected sites.

Results

Revision of the data and a second round of investigation into PCB equipment need to be undertaken. In order to make more reliable estimation, it should be compulsory to report PCB-containing equipment to authorities by the force of regulatory acts. This will also require further capacity building at laboratories to undertake PCB quantification in oils and particularly to provide such services to the private sector.

The assessment of PCBs in Iran revealed a lack of proper management of PCB-containing oils, equipment and related operations. Serious concerns throughout the country require an appropriate managerial action plan.

The issues needing immediate attention include:

1. Lack of appropriate legislation for the regulation of PCBs and the provision of technical guidelines for the environmentally sound management of PCBs.
2. Lack of awareness of the risks during maintenance, storage and disposal (possible re-use and recycling) of PCBs.
3. Lack of consideration for PCB management, including identification, safety (maintenance, storage, etc.) and emergency responses.
4. Lack of awareness and non-inclusion of PCB issues in industrial, environmental and safety inspections.
5. Non-availability of safe PCB disposal methods.
6. Uncertainties in PCB inventory, both when it comes to the industrial sectors such as transformers and capacitors as well as open applications (like hydraulic fluids, etc.).
7. Lack of up to date technologies and trained experts to sample and analyze PCBs at provincial level.

Activities

Iran hosts a Basel Convention Regional Centre that has been nominated as a Stockholm Convention Regional Centre. Training activities undertaken included an August 2008 workshop on Inventory of Hazardous wastes with focus on POPs.

The regional centre has concluded contracts with organizations interested in the environmentally sound management of PCBs, such as Rojan Industrial who is the EWM and Tredi partner in Iran. In cooperation with this company, the first transboundary shipment of hazardous waste was carried out for disposal of some 300 tons of PCB contaminated liquids, soils and solids in Europe in January 2010.

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The article has been prepared with support from Rojan Industrial Co.

2. Send a questionnaire to potential stakeholders

A questionnaire should be developed and sent to the potential owners of PCB equipment. These potential owners fill in the form and return it to the responsible PCB project team.

Potential stakeholders	
Electric utilities	Hospitals
Industrial facilities	Research laboratories
Railroad systems	Manufacturing plants
Mining industry	Waste water discharge facilities
Army installations	Car service stations
Residential or commercial buildings	Small/medium sized companies
Holiday resorts / hotels	Airports
School buildings	Wood processing companies
Cold storage depots	Exporters

At the beginning of the inventory process, there is often no regulation regarding PCB management, which means that the owners of such equipment are not obliged to participate in an investigation. In order to stimulate participation in the identification process, it will be useful to offer free sampling, screening and verification. For instance, in the former Yugoslav Republic of Macedonia, such an incentive based on a bilateral donation was very successful. Thanks to that support, many companies participated in the identification process and it also allowed for smoother collaboration in the later stages of the inventory. If limited information or no response is obtained, the PCB project team should get in touch with the potential owners of PCB equipment. The information gathered from the completed questionnaires will be used as a basis for site investigations.

3. Carry out physical site inspection

Sites where PCB-containing equipment may be found should be inspected by field teams or engineers included in the PCB project team. During the inspection, the information provided in the questionnaires shall be checked and further data regarding the particular type of PCB equipment or PCB waste collected and recorded. These include: Kilovolt-ampere (KVA) rating, brand name, fluid quantity, type of fluid, location of the device, serial number, PCB concentration, year of manufacture, and weight.

During the visit, the site shall also be checked for visual contamination. An inventory is always a chance for preventive maintenance.

In order to facilitate the inspection, country-tailored inventory forms shall be developed which include all data necessary for the determination of the parameters needed for the evaluation of the risk associated with PCB equipment and waste. Also, ID numbers shall be determined for each piece of potentially contaminated equipment and waste. Each owner of potentially PCB contained equipment should affix the ID number to it and fill in the inventory form. If a decision on the presence of PCBs cannot be made based on the available data, then such equipment has to be sampled.

(cont. on page 40...)

Inventory of transformers in Paraguay

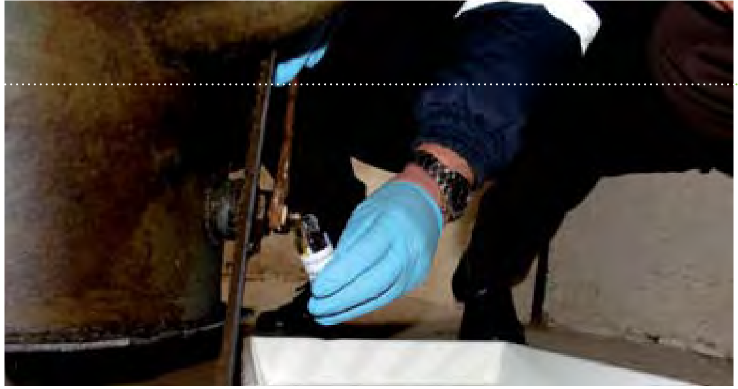
7,700
Tonnes of PCBs and PCB-containing equipment that will be disposed through a project in India being implemented by UNIDO

A	Informacii za kompanijata , lokacijata i opremata koja sodr`i/ e kontaminirana so PHB		
1	Ime:		
2	Adresa:		
3	Adresa na lokacijata: (ako e razli~na od onaa popolneta vo A2)		
4	Telefon: Faks: E-mail:		
5	Ime/pozicija na liceto za kontakt:		
6	Od kakov tip e kompanijata/industrijata/ proizvodstvoto na specifi~nata lokacija:		
7	Javno ili privatno pretprijatie?		
8	Lokacija:	Industriska zona Drugo urbano podra~je Ruralno podra~je	
9	Vkupen broj par~iwa od opremata na lokacijata:	Transformatori Kondenzatori Drugo	
10	Oprema koja e vo upotreba i sodr`i/ kontaminirana so PHB	Broj na sadovi Vkupna te`ina na opremata (kg) Vkupna koli~ina na te~nost (kg ili litri)	
11	Oprema koja e nadvor od upotreba ili otpad koj sodr`i/kontaminiran so PHB	Broj na sadovi Vkupna te`ina na opremata (kg) Vkupna koli~ina na te~nost (kg ili litri), Vkupna koli~ina na kontaminiranata po~va i objekti (kg ili m^3)	
12	Postoe~ki akcionen plan za eliminacija na PHB? - akcionen plan koj e predviden, no ne e zapo~nat - porane{ni aktivnosti za otstranuvawe na otpadot - vremenska ramka na programata		
13	Popolnil:	Ime i Prezime	Potpis i Pe~at / Datum

Inventory form used in the Former Yugoslav Republic of Macedonia

ID number as it is used in the former Yugoslav Republic of Macedonia

Open drain tap



Sampling at bottom valve with drip tray under drain

SAFETY PRECAUTIONS

While conducting the identification (inventory and sampling), one should take all precautionary measures not only for protection against exposure to PCBs, but also protection against electrical shock

4. Sample the equipment

Potential PCB-containing transformers

Not only the PCB content of transformers in use has to be checked, but also the contamination of transformers no longer in use or in reserve. Rigorous examination must also include spare oils and other equipment that could contain PCBs (capacitors, voltage regulators, circuit breakers, heat exchangers, oil cisterns and pipe systems, etc.). Often the meaning of abbreviations on transformer tags is misunderstood. For instance "ON" or "ONAN" applies to "Oil Natural" or "Oil Natural Air Natural" cooling. Only sampling and screening will prove if there is really no PCB contamination in the mineral oil.

Experience has shown that numerous transformers that were manufactured as PCB-free equipment actually do contain PCBs. In the 1970s, transformer manufacturers and oil suppliers often were not informed about the risks and the potential of cross contamination of PCBs by using identical cisterns, transport containers, pipe systems and fittings for mineral oil and PCBs. Therefore many new transformers were unintentionally contaminated by PCBs. However, often mineral oil filled transformers became contaminated by the user during refills or in the frame of maintenance activities. Therefore, all electrical devices not hermetically sealed need to be sampled even if they were recently manufactured, because unintentional contamination could have occurred.

Oil samples can be taken by using the drain tap which usually is at the bottom of the transformer.

If a transformer has been disconnected from power for over 72 hours, the sample should generally be taken from the bottom as PCBs sink to lower levels because of their higher density. Sometimes the gasket gets damaged when the drain tap is opened. It is therefore advisable to always have a spare gasket ready.

Alternatively, transformers can be sampled via the oil filling cap by using a hand pump (remember: a new hand pump must be used for each transformer). Oil samples from the expansion receptacle cannot however always be regarded as representative, because the oil does not circulate and thus it is not really mixed.

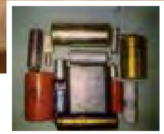
Usually, transformers are sampled when they are in use and thus when they are electrically alive. Relevant protective measures and safety regulations must be known and introduced at all times!

If the oil quality is to be tested, the following steps have to be considered:

› Sampling via drain tap: Drain off about 1 litre of oil first in order to clean the drain from particles which might have accumulated in that area,
› Amount of oil required: 0.2 to 1 litre (in case of oil quality analysis),
› Leave the oil for 24 hours, in order to allow particles and water to settle,
› Take sample from the upper third of the oil for the analysis using a pipette, and
› Return the drained oil back into the transformer (only if the oil filling cap is out of reach of the high voltage and oil is without heavy impurities, otherwise shut off the transformer before refilling oil)

Pyranol capacitor nametag: PCB containing

Small PCB capacitors should be considered



Potential PCB-containing capacitors

If a capacitor cannot be sampled for technical reasons, it has to be regarded as potentially containing PCBs until the screening performed at the time of phase-out proves otherwise. In many cases, the capacitor manufacturer provided information about the type of dielectric liquid either with identification on the nameplate or with a separate tag confirming that the contents are harmful for the environment. This occurred, for example, where a former Soviet producer marked capacitors with a yellow triangle. Such capacitors do not need further investigation. They definitely contain PCBs and must be treated accordingly. After banning PCBs for use in electrical equipment, most of the capacitors were declared as PCB-free either on the nameplate or with a separate tag.

As capacitors are sealed entities, contamination after manufacture can be excluded. Considering the fact that after 1993 no PCB was produced, it can be assumed that capacitors manufactured after this date are PCB-free. In some cases, the manufacturer's technical instructions, the UNEP "Guidelines for the Identification of PCBs and Materials Containing PCBs", or a capacitor catalogue can be used to determine whether or not a capacitor contains PCBs. A copy of the catalogue published by the Australian and New Zealand Environment and Conservation Council (ANZECC) can be found on the Internet (http://www.environment.gov.au/settlements/publications/chemicals/scheduled-waste/pubs/pcbid.pdf).

Another very useful tool for the identification of capacitors with missing nameplates is comparing their pictures with pictures from a database. Therefore, it is recommended to take pictures of the equipment whenever possible and record them in a PCB database.

Capacitors that bear no information about the dielectric fluid and were manufactured before 1993 should be sampled and analyzed. Since capacitors are built into hermetically closed containers and there is no direct access to the cooling liquid, it is not possible to take samples for analysis without destroying the casing of the equipment. Thus only phased-out capacitors can undergo this procedure. Capacitors still in service and manufactured before 1993 with missing information about the dielectric liquid have to be labelled as PCB-suspect equipment. In the event that no data is available, it is best to label these with a yellow "Suspect" label and take a sample at the end of their service life before 2025.

Power capacitors are built into hermetically closed containers and there is no direct access to the cooling liquid.

If a designation is missing and relevant information from the manufacturer is not available, the only way to test the dielectric liquid is to drill a hole in the casing at the top or cut the isolator and retrieve an oil sample. This can be done by using a pipette (use only once). After this exercise, the capacitor is unusable and, as it is now damaged, it must be stored in appropriate containers (e.g. in an UN-approved steel drum). Therefore, it is advisable to only sample capacitors that are already out of service. If there is a series of the same capacitors, it is usually sufficient to sample only two devices out of the series.

It is recognized that testing should be preferred to simple statistical analyses and that access to laboratory testing facilities is required. In this context, the regional use of existing and approved laboratory services is useful as each country may not be able to acquire its laboratory facilities.

L2000 DX Analyzer training in Morocco

5. Screen the samples

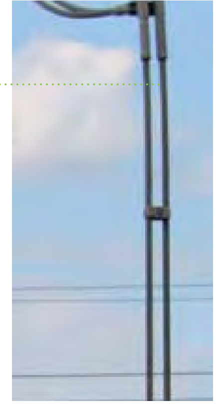
PCB analysis can be divided into two categories: specific and non-specific methods.

Specific methods include gas chromatography with electron capture detection (GC ECD) and mass spectrometry (MS), which analyze for particular PCB molecules. In general, PCB-specific methods are more accurate but they are more expensive, take longer to run, qualified staff is needed, and they usually cannot be used on site.

Non-specific methods identify classes of compounds such as chlorinated hydrocarbons, to which PCBs belong. These non-specific methods include preliminary PCB field screening tests like CLOR-N-OIL and CLOR-N-SOIL test kits, as well as the L2000 DX field analyzer, density tests and the Beilstein method.

Because of the chlorine content, PCB oils generally have high densities. Whereas mineral oil is usually lighter than water, PCBs may have a specific gravity of up to 1.5. Therefore PCB oil will sink to the bottom of a container when poured into water while mineral oil will float to the top.

(cont. on page 56...)



Large quantities of PCBs demanding ESM in Central and Eastern European Countries

By Jaromír Manhart

The Central and Eastern European (CEE) countries account for 3.4 million inhabitants that are exposed to PCBs.

23 countries.

Similar people.

Different languages.

The very same problems with PCBs.

PCB production

A few countries in the CEE Region were hosts to some of the largest producers of technical mixtures of PCBs.

PCB production in CEE countries

Country	Trademarks example	Former production [tonnes]	Production period
Former Czechoslovakia	Delor, Deloterm, Hydelor	21,500	1959 – 1984
Poland	Tarnol, Chlorofen	679	1971 – 1976
Former Soviet Union	Sovol	53,000	1939 – 1993
	Sovtol	57,000	1939 – 1993
	Trichlorobiphenyl	70,000	1963 – 1993
Total		**202,179**	

PCB liquids were mostly exported for manufacture of transformers and capacitors to Western European countries, Cuba, Pakistan and Vietnam. However, the CEE regional electric equipment industry was also important in the former Czechoslovakia, former East Germany, the former Soviet Union and the former Yugoslavia.

Legislation

All CEE countries are quite advanced in the process of implementing the Stockholm Convention at the national level, having established legal frameworks for PCBs. Each country has developed or is currently finalizing their National Implementation Plan (NIP) under the Stockholm Convention. The implementation of general PCB obligations that are set in revised national regulations and legal acts have led to better environmentally sound PCB waste management 20 – 30 years ago. Law enforcement through officially designated environmental inspection bodies exists, while illegal handling and improper management practices are penalised.

However, there are different groups of countries including European Union member states, European Union pre-accession countries, former United Soviet Socialistic Republics or countries of former Yugoslavia that show unequal approaches and standards for environmental policies.

Countries in the CEE Region have their deadlines for decontamination or disposal of PCBs and PCB contaminated equipment set, mainly based on the obligations of the Stockholm Convention or on the European Council Directive 96/59/EC on the disposal of PCBs and polychlorinated terphenyls (PCTs). Wastes, equipment and liquids are considered to contain or be contaminated with PCBs if the PCB concentration is higher than 50 mg/kg ~ 50 ppm ~ 0,005 % by weight in the whole CEE Region.

Compared to the Stockholm Convention that sets the deadline of 2028 for achieving environmentally sound waste management of PCBs by 2028, the European Council Directive 96/59/EC prescribes that PCB equipment of more than 5 litres has to be disposed of by the end of 2010. In relation to the Stockholm Convention, two countries in the CEE region have set themselves tighter deadlines to dispose of PCBs by 2012 (Former Yugoslav Republic of Macedonia) and 2015(Serbia) respectively.

Deadlines for PCB disposal / sound waste management in the CEE countries

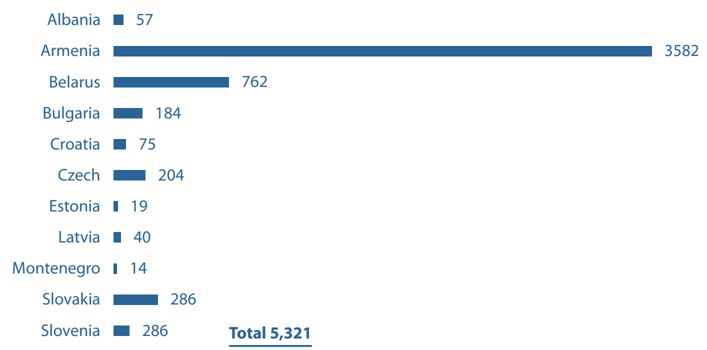
Legal instrument	Deadline	Number of CEE countries
Stockholm Convention	2028	10
Directive 96/59/EC	2010	11
NIP	2012/2015	2

Inventory of PCBs

Available data show that all CEE countries have carried out preliminary PCB inventories, even though data collection is still on-going in some countries. Inventories mainly concentrated on equipment such as transformers, capacitors, circuit breakers and heat-exchange equipment. Inventories undertaken in the region are not uniform, despite the fact that reporting formats are available under the Stockholm Convention and the European Commission. Problems that stall the provision of accurate data include the inability to examine equipment potentially contaminated, lack of information on PCB content, errors made in the units used for quantities of oil identified (volume in litres or weight in kilograms), use of old data, and the credibility of data that has been obtained on a voluntary basis.

The results below are compiled from published information in NIPs or from quantities reported to the Stockholm Convention Secretariat and the European Commission. In total, 5,321 owners, operators and holders of (potentially) contaminated equipment were identified with 3,582 in Armenia alone. However, there is no data from Armenia on the actually contaminated equipment. The other countries have identified only the main stakeholders of PCB equipment.

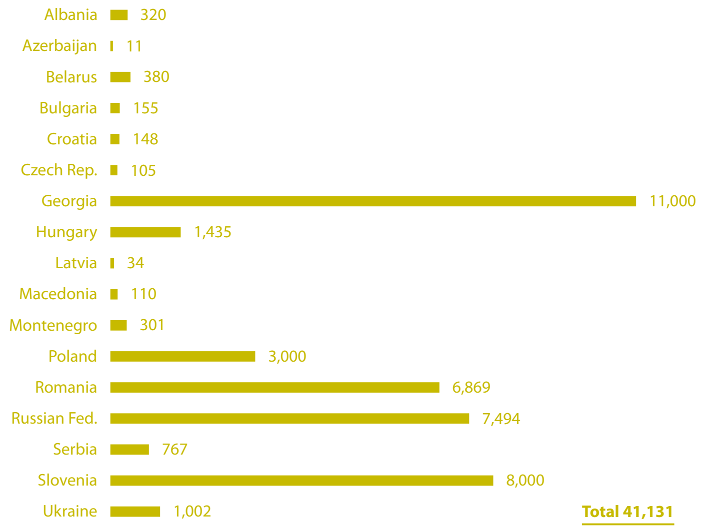
Owners, operators, holders of PCB equipment and potentially contamianted equipment



(cont. on page 44...)

41,131 transformers that contain or may contain PCBs were identified in the CEE region. The majority of these were found in Georgia, Slovenia, the Russian Federation and Poland.

Transformers in the CEE region that contain or might contain PCBs



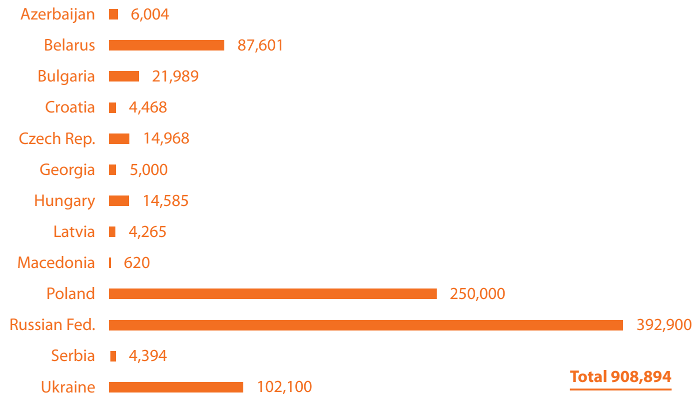
Some countries provided more detailed information on transformers.

Pieces and weight of transformers in some CEE countries that contain or might contain PCBs

Country	Transformer [pieces]	Transformer [tonnes]
Albania	320	1,100
Bulgaria	155	763
Croatia	148	425
Macedonia	110	360
Romania	6,869	85,076
Serbia	767	3,300

A total of 908,894 pieces of capacitors were identified in the region, mainly in the Russian Federation, Poland, the Ukraine and Belarus.

Capacitors identified in the CEE region that contain or might contain PCBs



Some countries provided more detailed information on capacitors as shown in the table.

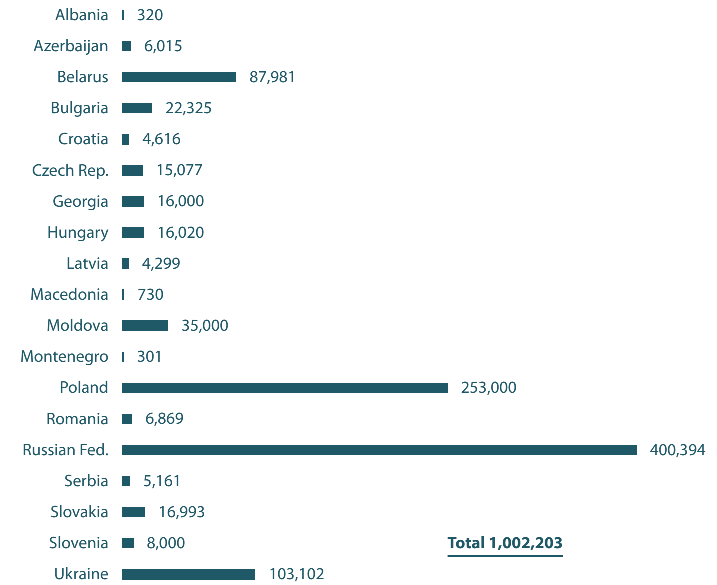
Pieces and weight of capacitors in some CEE countries that contain or might contain PCBs

Country	Capacitors [pieces]	Capacitors [tonnes]
Bulgaria	1,076	21,989
Croatia	106	4,468
Czech Rep.	113	14,968
Latvia	139	4,265
Macedonia	30	620
Serbia	172	4,394

In total, equipment containing or potentially containing PCBs in the CEE region, amount to 1,002,203 pieces, including oil transformers, capacitors with fluid dielectric, resistors, induction coils and other electro-technical equipment filled with electrical insulation fluid, hydraulic mining equipment, vacuum pumps, industrial equipment using heat-conducting fluids (duplicators, road gravel pre-coating facilities, etc.) or parts of such equipment containing more than 5 litres of fluids. Nearly half of the equipment were found in the Russian Federation and one quarter in Poland.

(cont. on page 46...)

Equipment in the CEE region that contain or might contain PCBs



Over the last 10 years, the CEE countries have made good progress in the collection of data on PCBs. With the help of the financial mechanism of the Stockholm Convention, countries were able to prepare their NIPs and define future steps to protect their environment. Updated inventories and more detailed information are expected in the second reporting round under the Convention which takes place this year.

Main PCB related projects in Central and Eastern European countries

Country	Project	Source of funds	Implementing Agency	Implementation period	Cost including co-financing (million USD)
Armenia	Technical Assistance for Environmentally Sustainable Management of PCBs and Other POPs Waste in the Republic of Armenia	GEF	UNIDO	2009-2011	2.678
Azerbaijan	Environmentally Sound Management and Disposal of PCBs	GEF	UNIDO	2009-2012	6.631
Latvia	Environmentally Sound Disposal of PCBs Containing Equipment and Waste	GEF	UNDP	2006-2009	2.842
Macedonia	Demonstration project for Phasing-out and Elimination of PCBs and PCB-Containing Equipment	GEF	UNIDO	2007-2010	2.785
Moldova	POPs Management and Destruction Project	GEF	World Bank	2006-2010	15.300
Romania	Disposal of PCB Wastes in Romania	GEF	UNIDO	2007-2010	2.020
Total					**32.256**

PCB disposal

Technologies are available in some countries including:

- Thermal desorption in the Czech Republic, Russian Federation and Slovakia;
- Base-Catalysed Decomposition (BCD) in the Czech Republic;
- Cement kiln co-incineration in several countries;
- Hazardous waste incineration in the Czech Republic, Poland, Russian Federation, Slovakia and the Ukraine;
- Chemical treatment in the Russian Federation and the Ukraine;
- Plasma Arc and Plasmochemical Destruction in the Russian Federation and Ukraine.

Most CEE countries currently hold PCB wastes in long-term storage. In general, adequate capacity for environmentally sound disposal of PCBs is still lacking in the CEE region and substantial amounts of wastes are transported to France, Germany, the Netherlands and Switzerland for destruction.

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Slovakia

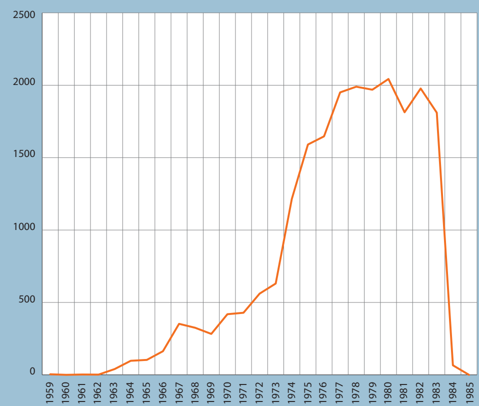
Now we have to address the PCB mess

By Katarína Dercová, Hana Dudášová, Lucia Lukáčová, Anton Kočan, Jana Chovancová, Martin Murín, Alena Pilváčová

One of the eight world's largest PCB producers

The Slovak Republic, a part of former Czechoslovakia, belonged to the eight world's largest producers of PCB commercial mixtures. More than 21,000 tonnes of PCBs were produced by Chemko Strážske under the brand names Delor, Hydelor, and Delotherm from 1959 to 1984, and broadly utilized in former Czechoslovakia for production of capacitors, paints, and varnishes. About 46% of the produced PCB was exported mainly to former East Germany. The rest (11,613 tonnes) was used in the territory of former Czechoslovakia.

PCB manufactured by Chemko Strážske plant from 1959 to 1984



It is now prohibited to use PCBs in open systems. However, PCBs are still used in power capacitors. Such capacitors can contain from 1.4 to 20 kg of PCBs. Transformers and heat exchangers have already been refilled with non-PCB containing fluids. Because PCBs were also used as a paint additive (their content was up to 21%), old paint coatings might still contain PCBs.

(cont. on page 48...)

SLOVAKIA Now we have to address the PCB mess (...cont. from page 47)

3,500 tonnes of PCB wastes remain

Safe disposal of PCB production wastes, PCB-containing equipment and contaminated soils is an urgent issue in Slovakia. Based on extensive inventories, carried out from 2000 to 2002, the current amount of PCB wastes and material in Slovakia is estimated at 3,500 tonnes including:

- 1,000 tonnes of PCB wastes from the Chemko Strážske company kept safely inside the factory;
- 1,000 tonnes of PCB-containing equipment including 400 transformers, 30,000 pieces of capacitors and 400 pieces of other equipment;
- 1,500 tonnes of various wastes originating largely from the agricultural sector including stockpiles of contaminated hydraulic and transformer oils, contaminated concrete pieces, contaminated equipment, etc.

Additionally to the documented quantity, it is estimated that at Pláne waste dump there are approximately 900 tonnes of PCB contaminated wastes from production.

The situation with the storage of unused PCB products is not satisfactory. Inappropriate storage sites with barrels showing corrosion and drums with biphenyls, terphenyls, and solid PCB distillation residues with expected high dioxin level have been identified. A flood, for example, might cause an ecological disaster.

PCB contamination a major problem

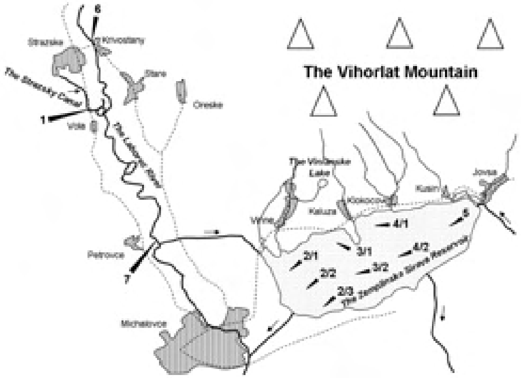
PCB contamination caused by the production activities and leaking equipment, in particular heat exchangers, is a major problem in Slovakia.

Contamination of the surroundings of the Chemko Strážske factory is directly related to the former PCB production. Contaminated areas are found inside the factory area and in the wider surrounding. The contamination is primarily spread through surface water by gradual release from contaminated sediments of an open sewer that leads from the factory to Laborec River, and subsequently through the inlet canal contaminates the water reservoir – Zemplínska Šírava Lake. A layer of mud in the 5.3 km long Strážsky Creek, which an effluent canal of the former PCB producer flows into, still contains 26 years after the termination of the production about 3 kg PCBs in 1 ton of dry mud.

PCB contaminated areas in Eastern Slovakia

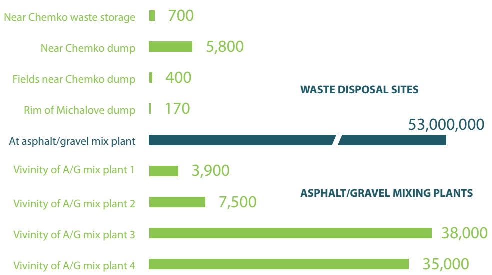
This contamination resulted in increased values of PCB content in the monitored components of the environment as well as in the population of Michalovce District, comparing with the rest of Slovakia. It should be emphasized that, in general, PCB levels in Slovak human population (not only in that living in the polluted area) are higher than those in other countries (with the exception of Czech Republic).

Waste disposal sites are another potential source of environmental contamination. PCBs determined in soil samples collected in the neighborhood of the waste disposal sites of Chemko, where PCBs wastes were duped during the production period, contain PCB levels much higher than those found in agricultural and forest soil taken in areas remote from the sources of contamination. As the soil in the vicinity of a major Chemko site contained increased PCB levels (0.4 to 5.8 mg/kg), it is likely that this waste dump may contain large quantities of PCBs.



Another important group of contaminated areas polluted with PCBs includes those located in the vicinity of asphalt-gravel mixing plants. Their contamination is caused by improper handling of PCB containing heat-exchange fluids. PCB concentrations peaked at 53,000 mg/kg in a soil sample taken under one of the heat exchangers.

PCB levels (the sum of all congeners) in spill samples collected in the vicinity of the Chemko chemical factory.



Non-combustion technologies as the solution to the problem

Several hundred tonnes of PCBs were disposed of by incineration either in cement kilns in Slovakia or abroad in hazardous waste incinerators.

Slovakia is currently participating in the global "Non-combustion project", which is aimed at creating destruction capacity in Slovakia for PCB stockpiles and other POPs wastes using non-combustion technology of high technical level. A technological unit for PCB destruction and a unit for PCB extraction of solid matrix (sediments and soils) will be provided by the project with an expected capacity of 750 tones per year. During the demonstration phase of the project, destruction of an initial amount (1,500 tones of PCB wastes) will be carried out.

For more information, please contact Ms. Katarína Dercová (Associate Professor at the Slovak University of Technology) at katarina.dercova@stuba.sk.

Inventory of PCBs in Belarus, Russia and Ukraine

By Svitlana Sukhorebra, Tamara Kukharchyk, Yuriy Treger and Sergey Kakareka

Methodology and organizational measures

The development of national strategies for the management of PCBs stocks and wastes including a set of activities on decommissioning of PCB-containing equipment should be based on the results of the inventory of such equipment, materials and waste. Planning and execution of an inventory of PCBs in three newly independent states of the former Soviet Republics - Russia, Belarus and Ukraine - was carried out at different times and organizationally they were not linked. However, some principles and methodological approaches were implemented in common in these countries.

The development of organizational measures for the inventories was carried out in accordance with the provisions which are designated in Annex A, Part II, of the Stockholm Convention on POPs. The first provision is the identification of equipment containing PCBs in concentrations greater than 10 percent and by volume more than 5 litres. This same principle was also used to identify stocks and wastes containing PCBs. General methodological approaches for a PCB inventory proposed in the «Guide for Identification of PCBs and Materials Containing PCBs», prepared by UNEP Chemicals were also used. Initial focus was set on identifying labels on transformers and capacitors which displayed information that the equipment were produced with PCBs. Overall, the objectives of the inventory in the three countries included the implementation of the following activities:

- Development of guidelines on developing a PCBs inventory;
- Identification of uses for PCBs and preparation of a list of industries which may use or store equipment or waste containing PCBs;
- Development of a format (questionnaire) to collect data on products or wastes containing PCBs;
- Creation of software to store, process and analyze the data.
- Analysis of the information on PCBs and PCBs containing equipment, as well as consideration for other uses of PCBs or their sources;

PCB production and use in the USSR

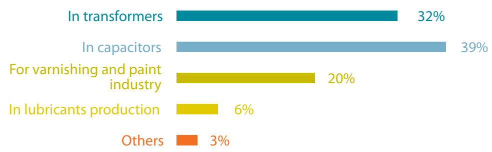
In the former USSR, PCBs were firstly synthesized in 1934 and their industrial production was launched in 1939. PCBs were produced at two sites in Dzerzhinsk in Nizhni Novgorod Oblast and in Novomoskovsk in Tula Oblast (respectively 300 and 200 km from Moscow). It was estimated that from 1939 till 1993 about 180,000 tonnes of PCBs, which were used as a dielectric in electrical components of transformers and capacitors and as an additive in hydraulic, cutting and lubricating oils, were produced there. Other uses of PCBs included ink solvents, plasticizers in paint and flame retardants:

- ***Sovol:*** A mixture of tetra- and pentachlorinated PCBs, used as a plasticizer in paints and varnishes;
- ***Sovtol:*** Sovol mixed with 1,2,4 trichlorobenzene; especially in the ratio 9:1, named Sovtol-10, used in transformers;
- ***Trichlorobiphenyl (TCB)***: Mixed isomers of trichlorobiphenyl, used in capacitors.

(cont. on page 50...)

About 75% of the total amount of PCBs from the Soviet production were used in the electrotechnical industry. Production of transformers with Sovtol was launched in 1939-1940 and continued for about 50 years in Uzbekistan and in the Russian Federation.

Use of PCBs in various applications in the USSR



The identification marks of Soviet transformers with Sovtol include the Cyrillic letter «Н» which indicates the presence of a heat resistant synthetic dielectric. In other words, it is an indication that PCBs are contained in the transformer oil.

PCB-containing transformers from Soviet production

Transformer mark	Mass, kg		Transformer mark	Mass, kg	
	total	sovtol		total	sovtol
Chirchik transformer plant (specification of 1982)			Chirchik transformer plant (specification of 1990)		
ТНЗ-25/10	490	160	ТНЗ-25/10	490	160
ТНЗ-40/10	610	205	ТНЗ-40/10	610	205
ТНЗ-630/10	3400	1100	ТНЗ-630/10	3000	1100
ТНЗ-1000/10	5000	1800	ТНЗ-1000/10	4000	1676
ТНЗ-1600/10	8000	2850	ТНЗ-1600/10	7690	2765
ТНЗ-2500/10	12000	4120	ТНЗ-2500/10	11180	2980
Sverdlovsk transformer plant			Sverdlovsk plant (specification of 1967)		
ТНП-400/10		1500	ТНР-420/0,5П	1900	800
ТНП-800/10		2750	ТНР-750/10	4600	1700
ТНП-1600/10		3500	ТНР-1800/10	6100	2500
ТНПУ-1000/10		2500	ТНРУ-1200/10	5600	2200
ТНПУ-2000/10		3350	ТНРУ-2000/10	8350	3350
Chirchik transformer plant (specification of 1990)			Chirchik transformer plant (specification of 1982)		
ТНЗП-400/10	3250	1380	ТНЗПУ-1000/10	6000	2200
ТНЗП-630/10	4000	1350	ТНЗПУ-2000/10	9000	3260
ТНЗП-1000/10	5300	1970	ТНЗС-2500/10	11550	4160
ТНЗП-1600/10	8250	2850			

Source: *Inventory of Polychlorinated Biphenils (PCBs) and Review of Technical and Economic Requirements for Environmentally Sound Technologies of Treatment/Destruction of PCBs, National Center for Hazardous Waste Management - UNEP Chemicals, 2004.*

From 1958 to 1988, Soviet power capacitors of various types and applications with PCBs were produced in the Russian Federation and in Kazakhstan up until 1992. Between 1969 and 1990, small capacitors containing 0.05 to 1.8 kg of PCBs were produced in Armenia for use in luminous tube lamps.

According to Soviet specifications and standards, the Cyrillic letter «С» in capacitors also indicates the presence of a heat resistant oil. This can be considered to mean the presence of PCBs.

Types of PCBs-containing capacitors from Soviet production

Application	Mark type	PCB type	Manufacturer
Reactive power compensation units	КС0, КС1, КС2, КСК1, КСК2, КСТС	ТСВ	Ust-Kamenogorsk
Electric transport	КС, КСК, ФСТ, ФС, ГСТ, РСТ, РСТО	sovol, ТСВ	Serpukhov
Thermal - electric units	КСЭ, КСЭК, ЭС, ЭСВ, ЭСВК, ЭСВП	ТСВ	Serpukhov, Ust-Kamenogorsk
Electric main bucking-out systems	КСП, КСШ, КСКШ, КСФ, КСКФ	ТСВ	Ust-Kamenogorsk
Electric technological installations	ИС	nitrosovol	Serpukhov
Converter installations	ПС, ПСК	sovol	Serpukhov
Luminous tube lamps	ЛС, ЛСМ, ЛСЕ1, ЛСЕ2	sovol, ТСВ	Leninakan

Source: *National Center for Hazardous Waste Management - UNEP Chemicals, Inventory of Polychlorinated Biphenyls (PCBs) and Review of Technical and Economic Requirements for Environmentally Sound Technologies of Treatment/Destruction of PCBs, 2004 and Svitlana Sukhorebra, Main Outcomes of Developing a PCBs Inventory in Ukraine, 2005.*

General results of PCBs inventories in the three countries

In the united industrial complex of the former USSR, the principle of centralized distribution of materials and equipment existed for all Soviet Republics. According to estimates from Russian experts, most PCBs produced in the USSR were used in the former Soviet Republics.

The general results of the PCB inventories in three countries of Central and Eastern Europe

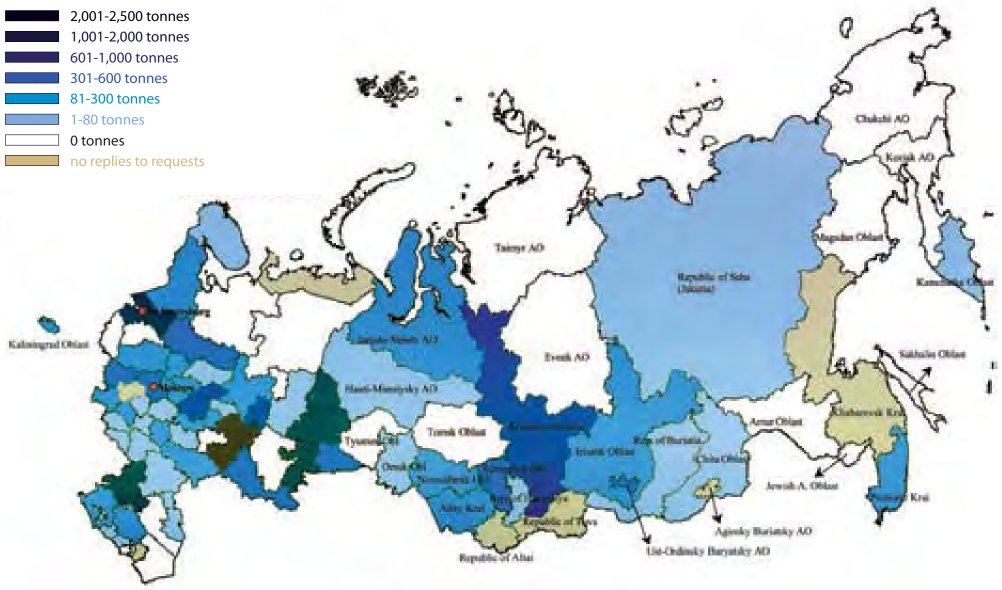
Country (year)	PCB transformers, units		PCB capacitors, units		PCB oils, tonnes	Total PCBs, tonnes
	in use or reserve	phased-out	in use or reserve	phased-out		
Belarus (2005)	344	36	36,000	11,000	8	**~ 1,500**
Russia (1999)	7,164	330	357,500	35,400	1,240	**~ 28,000**
Ukraine (2005)	905	97	87,600	14,500	250	**~ 5,000**

According to data from the manufacturers, about 60% of such products were sent to enterprises in Russia, while the rest were supplied to industries located in other former Soviet Republics. In addition to domestic equipment, PCBs-oils and PCB-containing transformers and capacitors, produced mainly in East Germany and Czechoslovakia, were imported to the USSR.

Russian Federation

According to the Arctic Monitoring and Assessment Program (AMAP) project in Russia, 85% of industrial enterprises and the fuel and energy sectors were investigated during the implementation of the PCB inventory. Gathering of information was carried out through official channels of government and economic organizational and management structures at federal and regional levels.

Distribution of PCB containing electrical equipment by Federal Districts of the Russian Federation



Source: *PCB in the Russian Federation: Inventory and Proposals for Priority Remedial Actions. Executive Summary. AMAP Report, 2000.*

The total amount of PCB-containing equipment that was revealed during the inventory of 1999 was approximately 20,000 tonnes. Some experts believe that the real figure may reach as high as 35,000 tonnes for electrical equipment in Russia. The inventory established 7,200 of PCB-containing transformers and 375,000 of PCB-containing power capacitors in service or in reserve. The amount of PCBs contained in industrial wastes was approximately 1,240 tonnes.

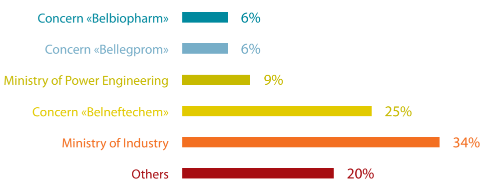
(cont. on page 52...)

Inventory of PCBs in Belarus, Russia and Ukraine (...cont. from page 51)

Belarus

In Belarus, the inventory of PCBs covered more than 2,500 enterprises of which 800 were owners of PCB-containing equipment. Approximately 47,000 power capacitors, 380 power transformers, over 40,000 small capacitors and 29 containers with PCBs-oils were identified. The total amount of PCBs in Belarus is estimated at 1,500 tonnes. Most PCB-containing equipment is concentrated at the enterprises of the Ministry of Industry and "Belneftechem" (Belarus State Agency for Oil and Chemistry).

PCBs distribution by Ministries and Agencies in Belarus



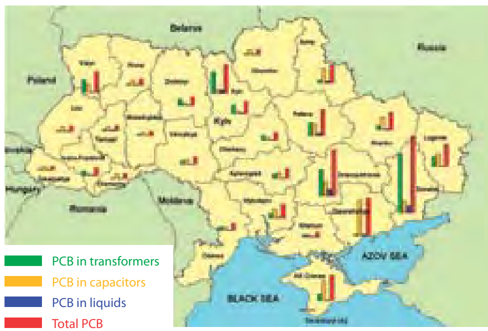
Analysis of PCB-containing equipment for branches of industry showed that the highest amounts of PCBs are concentrated in the machine building industry (40%) and petrochemicals (25%), although the PCBs-containing equipment exists at the enterprises of all types, including light and food industry, housing and many others. About 25% of the total number of power condensers and 13% of the total number of transformers containing PCBs are decommissioned.

Ukraine

The inventory of PCBs in the Ukraine included a complex of measures for collection of the data on types of application or storage of the equipment and materials containing PCBs as well as on their quantity in industrial, agro-industrial, fuel and energy, and defence complexes of Ukraine. The specially designed information-analytical system "PCBs in Ukraine" contained an actual database of the PCBs-containing equipment and oils, including the information about their types, characteristics and amounts. The database contained information on about 3,500 enterprises across all regions. There were 980 owners of PCBs profiled, as well as data on more than 100,000 units of PCBs-containing electrical equipment and 250 tonnes of PCB-oils that are stockpiles or wastes.

PCBs distribution throughout the territories of Ukraine

It is estimated that there are at least 5,000 tonnes of PCBs in the Ukraine still being used in equipment or in storage. Most of this amount is contained in the phased-out electrical equipment from Soviet production. About 80% of transformers with PCBs were found in the processing industry and more than 65% of PCBs were concentrated in the metallurgy and mechanical engineering sectors.



Conclusion

The results of the inventory show that currently, the amount of PCBs in the three countries is approximately 34,500 tonnes. This represents about 27% of total PCBs used in the electrical industry of the former Soviet Union. It was not possible to reveal all PCB-containing equipment during this preliminary inventory. In this regard, it is advisable that a detailed inventory of PCB-containing equipment and other contaminated materials should be undertaken for the post Russian Federation, Soviet countries and measures for their identification and control be implemented. Some of the PCB-containing equipment are either outdated or are due to be retired. All the countries have accumulated considerable reserves of decommissioned equipment including damaged transformers and capacitors with PCBs leaking into the environment. In many cases, stockpiles and wastes containing PCBs are not managed in an environmentally sound manner. This situation gets worse every year and requires urgent action.

The Republic of Belarus and the Ukraine became Parties to the Stockholm Convention in February 2004 and December 2007 respectively. Russia is yet to ratify the Stockholm Convention. The results of the inventories and summary data on PCBs were the basis for developing the National Implementation Plans for the three countries. The Republic of Belarus has already finalized, approved and submitted its National Implementation Plan. The activities aimed at establishing sound PCB management in each country are considered as priority national tasks involving all national stakeholders and including mechanisms for receiving technical assistance both under the Stockholm Convention and through other international or inter-governmental agreements.

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Dump for chemical waste in Dzerzhinsk, Russia

Where are Russian PCBs? A view from a local NGO

By *Dmitry Levashov*

Since 1929 the global industry has produced between 1 and 2 million tonnes of PCBs. In the Union of Soviet Socialist Republics (USSR), between 300,000 and 500,000 tonnes were manufactured. The mass production of transformers and capacitors containing PCB in the Soviet Union began in the early 1960s with about 100,000 PCB transformers being produced.

One of the largest manufacturers of PCBs in the USSR was located in the city of Dzerzhinsk (Nizhny Novgorod region). About 145,000 tonnes of PCBs were produced there. The production of sovol and sovtol started in 1939 and the production of trichlorobiphenyl (TCB) in 1968. It ended in 1987 for sovtol-10 (mixture of 10% TCB and 90% PCB) and in 1990 for TCB and sovol.

The long-term production and use of PCBs had an impact on the environment in Dzerzhinsk and Russia in general. Repeatedly, PCBs were found in the soils of Dzerzhinsk. In 1995, during the World Health Organization (WHO) project to assess the contamination of breast milk in women of Dzerzhinsk, PCB concentrations were the highest among 5 cities of Russia - 19.65 pg TEQ / g fat. In 2005, within the framework of the International Project on the elimination of persistent organic pollutants (IPEP), assessment of the contamination of food by POPs in chicken eggs of Dzerzhinsk and Nizhny Novgorod households found high concentrations of PCBs.

The first public inventory of PCBs in Russia

Russia has stopped the production of PCBs about 20 years ago. In order to fulfil the requirements of the Stockholm Convention to remove PCBs containing equipment from use, it is necessary to understand where PCBs are located.

Under the IPEP, a «pilot» project has been implemented in the industrial region of Nizhny Novgorod: «The PCBs pollution of the Nizhny Novgorod region: territorial monitoring and inventory of the sources of PCBs». The non-governmental environmental organization eco-SPES in Dzerzhinsk has carried out an inventory of electrical equipment containing PCBs using a survey to collect information.

According to an inventory carried out by Arctic Monitoring and Assessment Programme (AMAP) and Minpromnauka (the Ministry of Industry and Science of the Russian Federation) at the end of the 1990s, about 30,000 tones of PCBs filled in equipment and containers were found in the whole country. In 1999 there were 985 tonnes of PCBs recorded in the Nizhny Novgorod region. However, in 2005, when eco-SPES carried out its inventory in the region, only 8% of these quantities (120.5 tonnes) were found. In 1999, there were 336 transformers and about 14,000 capacitors and in 2005, only 53 transformers, and 984 capacitors were still in operation.

It is possible that due to loss of documentation or poor labelling, contained equipment was not included in any records and continues to be used. The equipment might also have been decommissioned and the PCBs wastes illegally destroyed or given to private entrepreneurs for «recycling». In addition, several entities previously holding PCB equipment had been subject to bankruptcy or liquidation.

In addition to the inventory, assessments of polluted sites have been undertaken under the IPEP project. For example, in the waters near the waste landfill in Nizhny Novgorod and Dzerzhinsk PCB concentrations repeatedly exceeded the maximum allowable levels. In the sediments of the Volosyaniha channel that for more than 50 years served as the reservoir for effluent from the Dzerzhinsk chemical plants, high concentrations of PCBs were also found.

Administrative barriers

During the inventory it was found that environmental authorities in Russia - both regional and federal entities – lack information on the presence of PCB containing equipment and wastes, regulations related to PCBs and the environmentally sound management of PCBs. Russian environmental NGOs are concerned that the reform of state environmental agencies will result in the reduction in functions of these agencies, causing further loss of information.

Activists of the eco-SPES collect and provide public environmental agencies of the Nizhny Novgorod region with information on existing domestic and foreign technologies to destroy PCBs. On several occasions, eco-SPES has been consulted by private sector enterprises on treatment technologies for PCBs and on personal protection measures to take when handling PCBs. A working group of representatives from the scientific and environmental communities and the state environmental agencies has been created to hold round-table discussions and meetings, to release relevant information on PCBs.

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Armenia – Inventories of PCBs is the place to start

By Anahit Aleksandryan and Artak Khachatryan

In Armenia at present, the energy sector is one of the leading production sectors of the republic. Equipment containing mineral oils contaminated with PCBs present one of the main sources of POPs releases to the environment. Therefore, it is an urgent issue for Armenia to assess the status of the use of potential PCB oils in electrical equipment.

In order to identify PCB-containing oils and equipment the following activities were carried out:

- Identification of the types of equipment exploited in the energy sector and other industries (asphalt plants, boiler departments, medium and small-sized industrial complexes, etc.) potentially containing PCB;
- Inventory of the identified equipment with indication of the trademark/brands and production date;
- More precise specification and verification of types and quantities of oils contained in exploited equipment, as well as evaluation and inventory thereof;
- Identification, evaluation and inventory of oils intended for re-filling in the equipment;
- Identification, evaluation and inventory of mineral oils which are subject to destruction.

The inventory allowed identification of existing amounts of oils in the various sectors, the location of enterprises owning potential PCB equipment and the distribution of the equipment according to regions. In Armenia, large-scale exploitation of transformers took place in the Soviet period from 1965 to 1991. The inventory revealed that all transformers in Armenia were manufactured in the former Soviet Union and mostly in the Russian Federation. In total, 3,582 entities own transformers in Armenia. PCB-containing equipment was found in the energy sector, industrial enterprises, inhabited settlements and entities of public catering and technical services.

According to the inventory carried out in the energy sector, 17,000 tons of oils exist in equipment of currently functioning energy power facilities (power transformers, converters, high voltage switches and breakers, compressors, etc.). The oils probably containing PCBs are subject to replacement with subsequent destruction in environmentally sound manner. The content of PCBs in used oils was assessed within the range of 11.0 and 24.3 mg/L.

The average annual amounts of mineral oils required for refilling are:

- 1,278.36 tons of transformer oils;
- 151.2 tons of turbine oils;
- 3.3 tons of compressor oils.

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The PCB Crisis

By Michel Smeets

Even when a country has all the infrastructures and law enforcement set for preventing PCB pollution, things can go wrong. Very wrong…

Belgium, April 1999: a little repair shop for electrical devices receives a transformer for maintenance. The owner calls his customer: "Definitely out of order". The customer's answer: "You may keep it and sell it as scrap. Take out the oil though and send it to an authorised disposal plant". The shopkeeper could not think of a better outlet than the municipal drop off center. He brings the oil to it and empties the whole lot in a dedicated bin for "used frying oil". A fat smelter comes around and collects the golden liquid intended to become an additive of animal feed stock. Nobody suspects that 60 litres of PCB are entering the food chain…

Two months later, more than 300.000 tons of food, 100.000 tons of meat and several million chickens are declared improper for consumption. Spontaneous death of chickens and subsequent samples of egg-based foods demonstrated that the level of PCBs and collateral dioxins were well above the maximum daily intake level.

More than five hundred chicken and animal farms had to be shut. They all had used the animal feed within which the PCB from the little shop had been mixed. Apart from the clearly identified contaminated food, the general public suddenly questioned the whole food supply chain. The "Poison in our dish" as the media reported the so-called "dioxin crisis", created near panic. Damage reached the disaster level: the direct and indirect costs – Belgian food could not be exported anymore – reached several billions of Euros.

The frightening lesson is that even when controls and sound disposal are available, accidents resulting from ignorance can still occur. If the effects of PCBs appear sometimes to be remote and difficult to grasp by politicians and the general public, at least these examples show how immediate their impact can be. For Belgium and Europe, the crisis led to an integrated security approach of the food supply chain and a strict quality control of any recycled material intended for re-entry in the food chain.

But it should be made aware that as long as POPs, including PCBs, are still being used and being released into the environment, the risk of these substances getting into the food chain remains unacceptably high. Phase-out, interdiction, controlled storage and safe disposal are to remain a top priority on our planet's agenda for the years to come.

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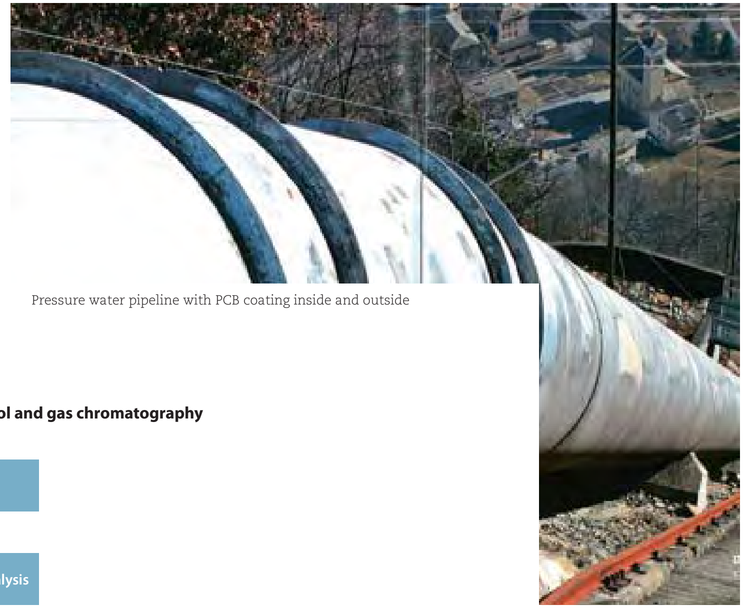
Density test with transformer oil and water

Result of oil screening using a CLOR-N-OIL kit

Use of a test kit in the field in Swaziland

L2000 DX Analyzer in use in the former Yugoslav Republic of Macedonia



Pressure water pipeline with PCB coating inside and outside

It must be stressed that such tests only provide reliable information in case of pure or highly contaminated PCB oil and even considering financial restrictions, such tests cannot be recommended for professional inventory taking.

There are also immunoassay rapid tests on the market as tools for measuring PCBs, mainly in soil and water. Such methods apply the principles of enzyme linked immunosorbant assay to determine PCB concentration. The colour change is measured using a spectrophotometer and compared to a three-point calibration curve for quantification.

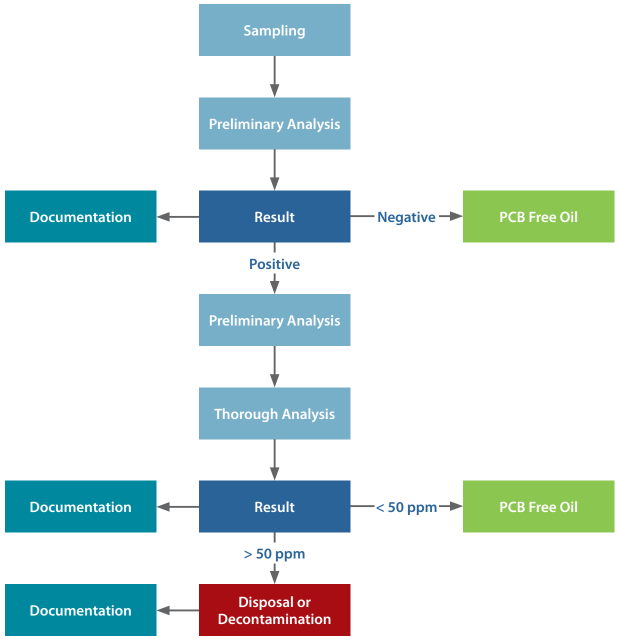
Faced with the prospect of taking an inventory for the PCB content of millions of electrical equipment in the USA in a very short time frame in the early eighties, the Electric Power Research Institute (EPRI) started a research programme to develop a field test kit that would help utilities solve this problem. The test would have to be easy enough to be used by workers in the field who were not necessarily chemists or engineers. It would have to be accurate enough to stand up to scrutiny by regulatory agencies, and rival a laboratory method in accuracy. It would further have to be robust enough to work in a mineral oil matrix and handle contamination by breakdown products and other contaminants that may be present in the oil.

Eventually a test kit was developed and registered under the trademark CLOR-N-Oil 50. This test was first introduced to the US market in 1983 and has been used extensively worldwide to reduce the cost of testing electrical equipment. Some major utilities estimated that the cost savings based on the distribution of PCBs in their system was between USD 1.5 and 3.7 million per 100,000 transformers tested. The test kits allow owners to "screen out" equipment as non-PCB containing equipment, without need for detailed and costly laboratory analyses. In 1989, an additional electrochemical screening method under the trade name L2000DX Chloride Analyzer was invented. This system also uses metallic sodium to convert the organic chlorine to chloride and uses a chloride specific electrode to quantify the chlorine content of the extract. Using a conversion factor, the maximum concentration of suspected PCBs can be calculated from the total halogen result. Using carefully controlled, pre-measured reagents, this method is considered comparable in results to those of GC. Used by a trained operator, its precision and accuracy rivals that of GC. Beside utilities and national PCB inventory teams, the L2000 has been used extensively by remediation companies for analysis of mineral oil dielectric fluid, soils and wipe samples when cleaning contaminated sites.

In view of future investigations into partially open and open PCB systems as part of national PCB inventories, an appropriate analysis method will be necessary.

Unfortunately, the existing test kits do not cater to these matrices. The presentation of any new analytical method should be carefully verified before being put into full operation.

A screening process using a screening tool and gas chromatography



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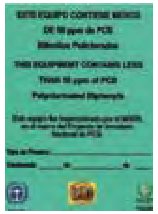


Label for PCB free devices from Guatemala

Label for PCB suspect devices from Morocco

Label for PCB containing devices from Moldova

An appropriate database enables easy access to information, tracking of identified devices and PCB stocks

6. Verify the results in the laboratory

Although considerable analytical costs and time are saved by using rapid screening tests, it is always useful to consider that these methods only screen the presence of chlorine in the samples. As a result, other chlorinated compounds, which can be part of the sample, could cause false positive results because the analysis method assumes all chlorinated compounds are PCBs. False negative results are not possible. If there is no chlorine present, PCBs cannot be present either. Thus if a screening test shows a negative result (PCB < 50 ppm) it must be true, so there is no need of verification by another method.

If a CLOR-N-Oil test kit or the L2000 DX analyzer screening tests shows positive screening result > 50 ppm, verification by gas chromatography is recommended. In this case, the sample for gas chromatography analysis is to be kept and forwarded to the appropriate laboratory (do not take a new sample, it must remain comparable). If results of a GC analysis show a significantly lower result than the screening tests, there is no reason to be alarmed. The tests are standardized for Aroclor 1242 with chlorine content of 42 %. Analyses with higher chlorinated PCB samples (e.g. Aroclor 1260 with chlorine content of 60 %) consequently show a higher result than the true PCB content. Thus the screening tests are always on the safe side.

Although false positive results obtained by the screening tests can cause unnecessary secondary testing, non-specific methods can be very economical when used on samples such as transformer oil, in which few sources of chlorine other than PCB exist. Used crankcase and cutting oils however always contain some chlorinated paraffin and almost every non-specific test produces false positive results. More expensive laboratory analysis is advised when testing for PCBs in these chlorine-containing oils.

7. Label the equipment

Once the PCB content has been determined, the PCB-containing or contaminated equipment must be labelled appropriately. This is an issue that frequently occurs in many countries where inventories have already been taken. There are many examples of good and bad labels. Preferences might differ but basically it seems favourable to use labels in bright colours for easy recognition. The following examples from three different regions demonstrate good labels.

Appropriate labels guarantee easy recognition whether or not the equipment contains PCBs. In case of accidents, these labels ensure that the hazards can be assessed at first glance from the colour of the label. Not too much text should be written; a brief explanation of the content and a contact address are sufficient. A 24-hours emergency phone number should be added as unfortunately incidents seldom follow office hours.

8. Develop a database

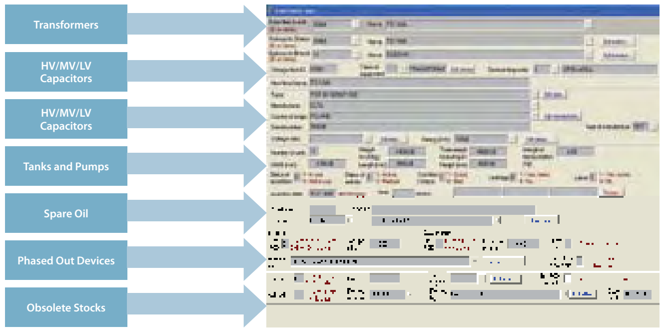
As previously mentioned, for sustainable inventories, there is need to establish professional databases. Excel sheets may be suitable for pilot projects and preliminary inventories but these are certainly not sufficient for sustainable inventories. The data from the inventory forms, including information on PCB containing equipment, its condition, location, owners, as well as pictures, have to be recorded in a database, which preferably is accessible to regional authorities and members of a steering committee. Although these stakeholders should be able to read the data, entering, recording and updating data should be the responsibility of only one assigned body.

Databases are ideal tools to set priorities, to assess risks and to prepare management plans and budgets. Databases enable the authorities to control the location and nature of the PCB equipment, as well as the success of all related activities. Databases facilitate the preparation of different reports using different parameters including the periodic reporting to the Conference of the Parties of the Stockholm Convention. In the future, these databases should ideally be used to track the lifecycle of PCBs.

9. Adopt an appropriate legal framework

Based on the results obtained through the inventory process, an appropriate legal framework, mainly legislation or regulation, can be adopted if needed to address issues identified during this process. Participation of different stakeholders in the identification process usually provides significant input and direction for the development of legislative and regulatory measures. Based on the evaluations and estimations regarding the scale of the problem with PCBs, the measures adopted will reflect the real situation regarding the national PCB problem. Provisions related to the PCB management can also be designed so as to be achievable for relevant stakeholders. If measures are adopted too early, the requirements prescribed may be difficult to implement and result in poor compliance with the measures.

Possible sources of closed systems – all to be recorded in an appropriate PCB database



10. Update the database

Once the PCB equipment has been identified and recorded in a database, this database needs to be continuously maintained and updated. As soon as a piece of equipment has been treated or eliminated in an environmentally sound manner, the status of this equipment in the database must be updated. The same applies if a PCB-free transformer is – despite all efforts to eliminate PCBs - accidentally filled with PCB contaminated oil. The tracking of all related electrical devices and all PCB containing wastes is essential in order to achieve the 2028 goals of the Stockholm Convention for implementing the environmentally sound management of PCBs.

11. Final remarks

Tremendous efforts have been made and huge resources allocated worldwide to gain control of the PCB problem. Initial actions were taken from the late 1970s and 1980s to stop PCB production and the manufacture of materials containing PCBs, long before the activities and efforts of the Stockholm Convention started. Yet considerable numbers of PCB devices and materials are still in use today, 40 years after the first efforts to address the PCB problem. Nevertheless, we should not shy away from the extensive work ahead. We shall not wait for legislative or regulatory actions, but rather be pro-active and act on a voluntary basis in order to prevent unnecessary cross contamination and therefore additional cost implications. We shall respect the problem; anticipate possible implications; share information - specifically negative lessons learned - and act appropriately in order to protect human health and the environment.

Assessing the nature and extent of the PCB problem in a country is the first step towards environmentally sound management and a PCB-free world. Such knowledge will help to set country-specific priorities and to choose country-tailored elimination solutions. It is our duty to do our tasks properly and to recognize potential dangers and problems before they occur. The latest environmental disaster in the Gulf of Mexico shows clearly that anticipation of possible damages and problems as well as far-sighted and sensible action could have spared the environment and also humans from the harmful effects being witnessed in that disaster.

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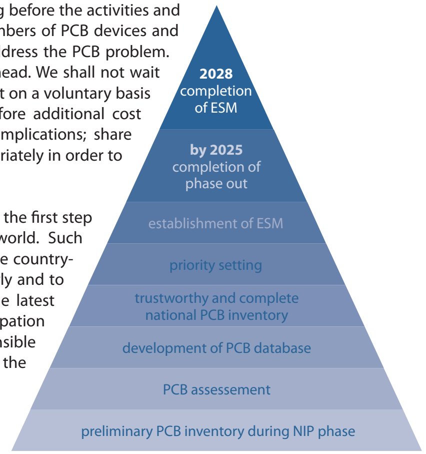
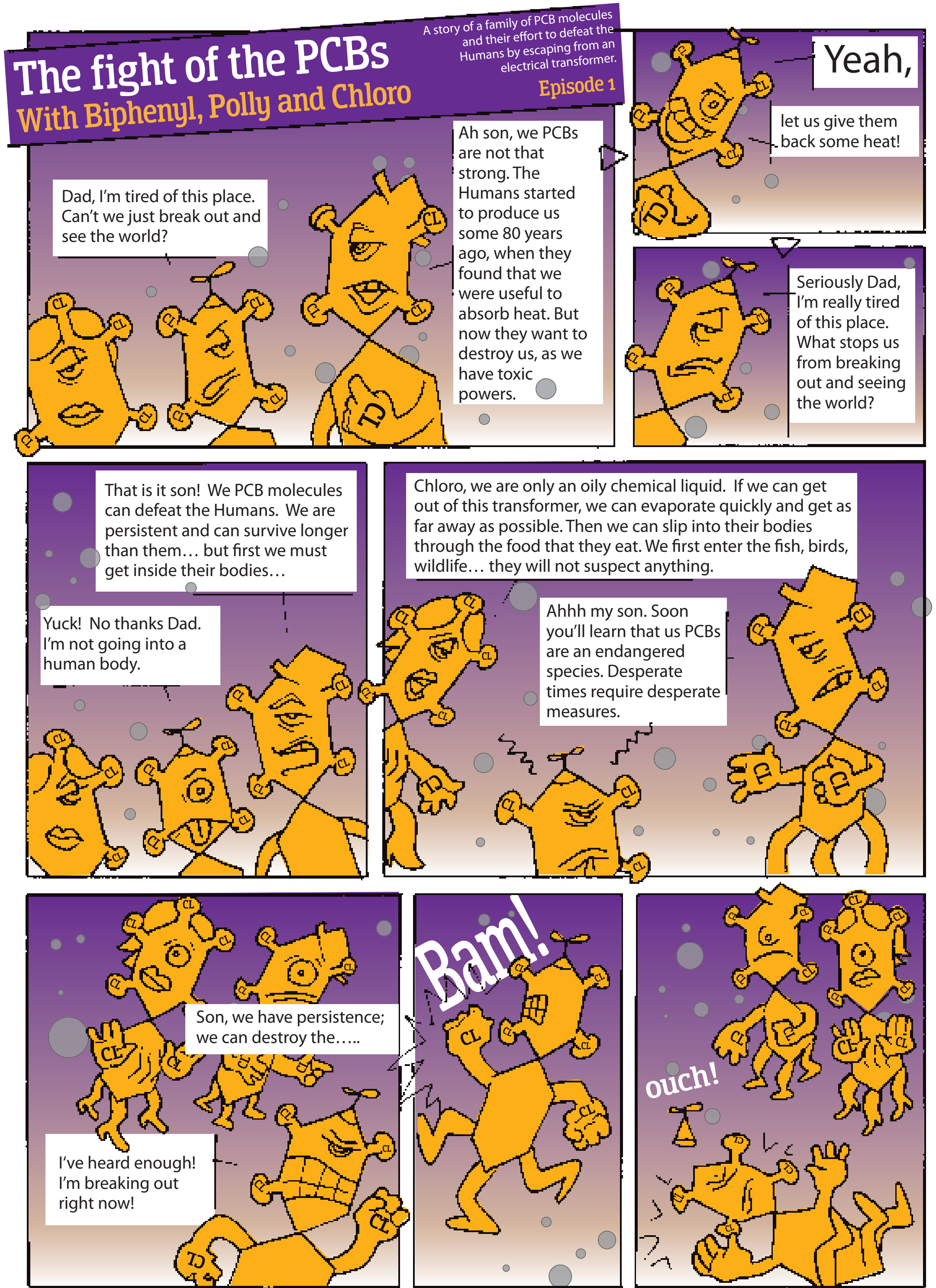
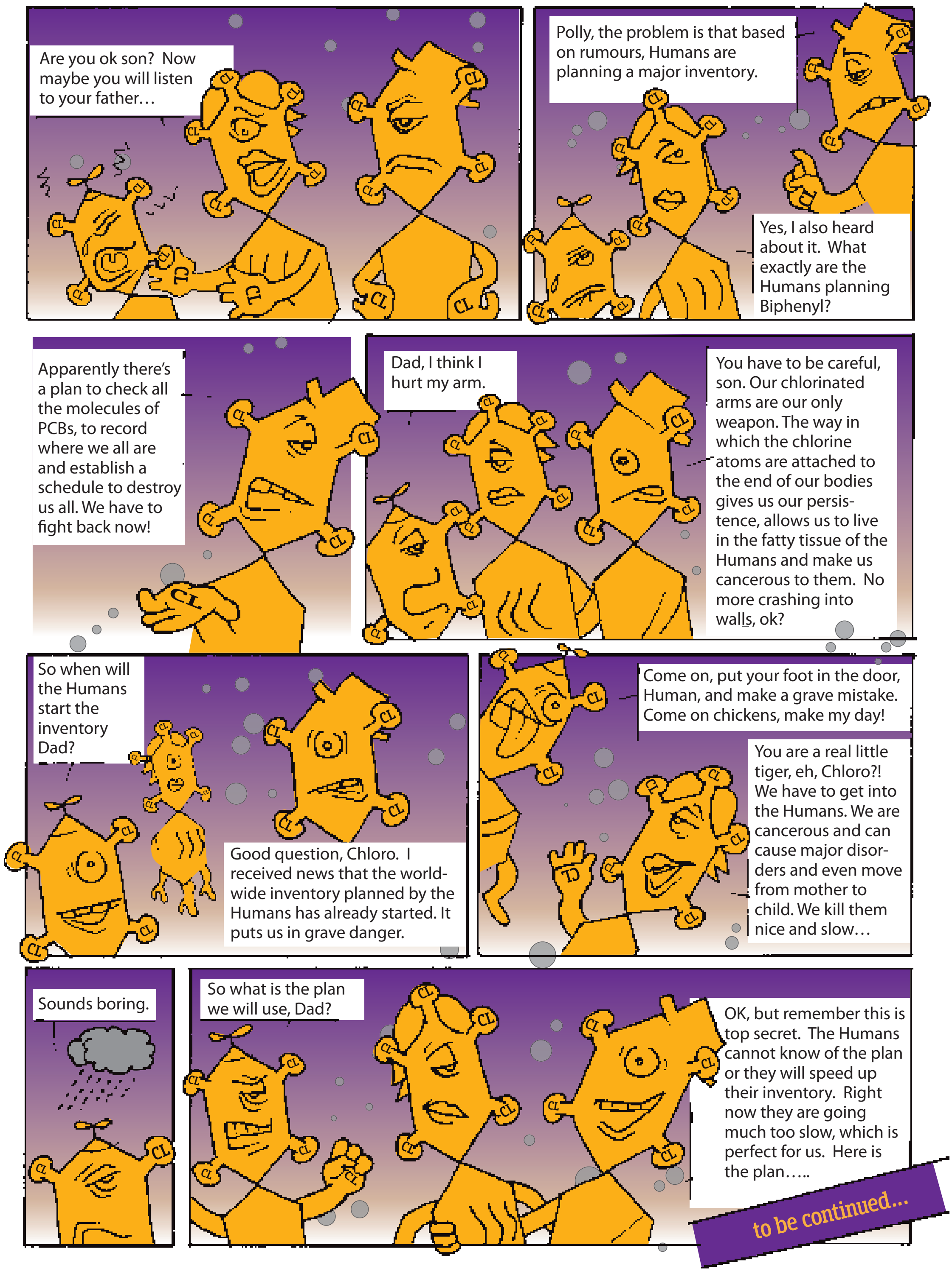


Pyramid of activities from PCB inventory to elimination

50

The concentration in parts per million (50ppm or 50mg/kg) of PCBs above which oil is considered contaminated with PCBs. For the reverse, this concentration is also then the 'low POPs content' below which oil contaminated with PCBs is not required for disposal


The fight of the PCBs
With Biphenyl, Polly and Chloro
A story of a family of PCB molecules and their effort to defeat the Humans by escaping from an electrical transformer.
Episode 1
Dad, I'm tired of this place. Can't we just break out and see the world?
Ah son, we PCBs are not that strong. The Humans started to produce us some 80 years ago, when they found that we were useful to absorb heat. But now they want to destroy us, as we have toxic powers.
Yeah,
let us give them back some heat!
Seriously Dad, I'm really tired of this place. What stops us from breaking out and seeing the world?
That is it son! We PCB molecules can defeat the Humans. We are persistent and can survive longer than them… but first we must get inside their bodies…
Yuck! No thanks Dad. I'm not going into a human body.
Chloro, we are only an oily chemical liquid. If we can get out of this transformer, we can evaporate quickly and get as far away as possible. Then we can slip into their bodies through the food that they eat. We first enter the fish, birds, wildlife… they will not suspect anything.
Ahhh my son. Soon you'll learn that us PCBs are an endangered species. Desperate times require desperate measures.
Son, we have persistence; we can destroy the…..
I've heard enough! I'm breaking out right now!
Bam!
ouch!

Are you ok son? Now maybe you will listen to your father…
Polly, the problem is that based on rumours, Humans are planning a major inventory.
Yes, I also heard about it. What exactly are the Humans planning Biphenyl?
Apparently there's a plan to check all the molecules of PCBs, to record where we all are and establish a schedule to destroy us all. We have to fight back now!
Dad, I think I hurt my arm.
You have to be careful, son. Our chlorinated arms are our only weapon. The way in which the chlorine atoms are attached to the end of our bodies gives us our persistence, allows us to live in the fatty tissue of the Humans and make us cancerous to them. No more crashing into walls, ok?
So when will the Humans start the inventory Dad?
Good question, Chloro. I received news that the world-wide inventory planned by the Humans has already started. It puts us in grave danger.
Come on, put your foot in the door, Human, and make a grave mistake. Come on chickens, make my day!
You are a real little tiger, eh, Chloro?! We have to get into the Humans. We are cancerous and can cause major disorders and even move from mother to child. We kill them nice and slow…
Sounds boring.
So what is the plan we will use, Dad?
OK, but remember this is top secret. The Humans cannot know of the plan or they will speed up their inventory. Right now they are going much too slow, which is perfect for us. Here is the plan…..
to be continued...

Polychlorinated biphenyls (PCBs) inventories in Latin America and the Caribbean; A challenge

By *Anna Ortiz*

Introduction

Evidence of the risks of POPs and particularly PCBs to health and the environment has existed since the 1930s. However, it is not until the adoption of the Stockholm Convention in 2002 and its subsequent entry into force in 2004 that a sustained process began to identify and quantify the stocks of PCBs worldwide and to comply with the overall goal of phasing out the use of contaminated equipment by 2025 and to achieve environmentally sound waste management by 2028.

Still in the 1990s, knowledge of the potential risks to health and the environment from PCB exposure was not wide spread in the Latin American and Caribbean region. This changed as time evolved and already in 2004 some projects started in the region as a result of the development of the National Implementation Plans (NIPs). The first national POPs inventories are completed, including national PCBs inventories, in most countries of the region

Overview of the PCB inventory process completed in the countries of the region

While each country differs in its methodological approach for the completion of its inventory, in general terms it can be concluded that in most cases there is an initial effort to raise awareness within the energy generation and distribution sectors on the potential health and environmental risks that result from an inadequate management of PCB oils and contaminated equipment. This awareness raising process paved the way for the next steps.

Subsequently, with the help of the energy generation and distribution companies, the potential sites for equipment containing PCBs were identified and this information used as a first preliminary inventory of equipment. Most of these equipment were not in use. With information from this preliminary inventory, fieldwork was undertaken to qualitatively identify PCBs by using the most common and economical method called Clor-N-Oil. This method indicates whether the oil inside the equipment contains more than 50 parts per million (ppm) of chlorine. This methodology was used by most countries; but, results only indicate chlorine content and positive results need to be verified in laboratories to determine actual PCB content.

The inventories were undertaken in differing ways in the various countries:

1. **Costa Rica** - By voluntary means through a close relationship between the environmental authorities and the electrical sector.
2. **Trinidad and Tobago** - Through voluntary declarations to comply with other agreements in the completion of hazardous waste inventories (e.g. under the Basel Convention)
3. **Mexico** - Through the passing of official regulations that make it obligatory to declare PCBs stock.

The implementation of a national PCB inventory is a dynamic process as it needs to be constantly updated to reflect changes in stocks. Estimations of amounts of potentially contaminated transformers and oils are calculated using a sample of equipment that is out of use and has been checked for PCB presence. This information in turn allows for the estimation of the total of transformers in the country that are potentially contaminated.

Results of the inventories completed

The following table provides an account of the results of the inventory completed for some of the countries of Latin America and the Caribbean. Some countries have not yet submitted their NIPs but have information based on an estimate that was done as part of the Basel Convention Secretariat initiated PCB Regional Inventory for Central America and the Caribbean in 2007. This is the case of El Salvador and Guatemala.

In a few Caribbean countries such as Dominica, St. Vincent & Grenadines and St. Kitts & Nevis, where there is no information available as no inventory has yet been done. Antigua and Barbuda and Bahamas have reported that they have no stocks of PCBs in their preliminary inventories but further investigation may need to be carried out.

Summary of PCB inventories in the Latin American and Caribbean region showing amounts of equipment and liquids contaminated with PCBs

Country	Preliminary NIP inventory [tonnes]	Year	Other source of inventories	Result [tonnes]	Year	Comment
Antigua and Barbuda	0	2007				
Argentina	Information not available	2007	UNDP full-size project proposal for GEF CEO endorsement	8,727	2010	
Bahamas	NIP not available		Presentation at the Stockholm Convention regional workshop on PCBs and POPs wastes	0	2009	
Barbados	Information not available	2004				There are 187 pieces of potentially contaminated equipment.
Bolivia	26.8	2004				
Brazil	NIP not available		Presentation at the Stockholm Convention regional workshop on PCBs and POPs wastes	68,000	2009	
Chile	888.5	2004				
Colombia	NIP not available		Preliminary PCBs Inventory in Colombia	12,867	2006	There are an estimated 11,304 - 14,430 tonnes of potentially contaminated equipment and liquids.
Costa Rica	5,500	2008	GEF Project Identification Form prepared by UNDP	5,500		1,770 pieces of contaminated equipment used to estimate 5,500 tonnes.
Cuba	NIP not available		Preliminary Inventory of PCB and POPs in disuse. A first approach of the national problem	138.9	2005	
Dominica	NIP not available		No information available			
Dominican Republic	114	2008				

(cont. on page 64...)

Country	Preliminary NIP inventory [tonnes]	Year	Other source of inventories	Result [tonnes]	Year	Comment
Ecuador	8,536	2006	Presentation at the Stockholm Convention regional workshop on PCBs and POPs wastes	7,041.50	2009	Inventory data in litres was converted into tonnes.
El Salvador	NIP not available		Regional PCB Inventory for Central America and Panama	1,367.00	2007	
Guatemala	NIP not available		Regional PCB Inventory for Central America and Panama	944	2007	
Guyana	NIP not available		No information available			
Honduras	196.2	2008	Regional PCB Inventory for Central America and Panama	930	2007	
Jamaica	229.2	2005				NIP completed but not yet submitted to the Stockholm Convention.
Mexico	2,795	2008	GEF Project Identification Form prepared by UNDP	30,639	2008	
Nicaragua	17.7	2005	Regional PCB Inventory for Central America and Panama	1,541	2007	
Panama	456.5	2007	Regional PCB Inventory for Central America and Panama	968	2007	NIP mentions additional existence of barrels containing 11,435 litres of contaminated solid waste.
Paraguay	210.5	2007				
Peru	10,510.6	2007				
St. Kitts and Nevis	NIP not available		No information available			
St. Lucia	12,114.60	2006				Weight of equipment imported in 2003 and 2004 that could contain PCBs.
St. Vincent and the Grenadines	NIP not available		No information available			
Trinidad and Tobago	NIP not available		Presentation at the Stockholm Convention regional workshop on PCBs and POPs wastes / Regionally Based Assessment of Persistent Toxic Substances		2009 /2002	1,500 tonnes of PCB waste have been exported.
Uruguay	Information not available	2006				
Venezuela	8,724	2009	Regional workshop on PCBs and wastes	8,724	2009	

Conclusions

Some NIPs are preliminary in nature and further detailed investigations should unearth greater quantities of PCB oils and contaminated equipment. This is the case of Mexico. Honduras is a surprising case as the Regional Inventory of Central America and Panama reported an amount that is less than what is presented in the NIP. Undoubtedly one of the main challenges of the countries of this region will be the updating of their inventories. The implementing of their Action Plans for PCBs will allow the countries to have a better understanding of the size of the problem being faced.

Main PCB related projects in Latin America and the Caribbean

Country	Project	Source of funds	Support Agency	Duration	Cost (million USD)
Argentina	Environmentally Sound Management and Disposal of PCBs in Argentina	GEF	UNDP	2009-2012	10.4
Brazil	Establishment of PCB Waste Management and Disposal System	GEF	UNDP	2009-2012	16.252
Mexico	Environmentally Sound Management and Destruction of PCBs	GEF	UNDP	2008-2012	18.860
Peru	Environmentally Sound Management and Disposal of PCBs	GEF	UNIDO	2009-2012	7.9
Uruguay	Development of the National Capacities for the Environmental Sound Management of PCBs in Uruguay	GEF	UNDP	2007-2009	2.098
Regional (Chile, Peru)	Best Practices for PCB Management in the Mining Sector of South America	GEF	UNEP	2010-2012	2.392
Total					**57.902**

Several countries in the region have already started developing and implementing follow-up steps to eliminate PCBs including projects financially supported by the Global Environment Facility (GEF). The support of the GEF plays a critical role in the efforts of these countries to fulfill their obligations under the Stockholm Convention.

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Panama
exports PCB to France for final disposal

In December 2009, the power generation and distribution sector of the Republic of Panama exported 70 tons of oil and equipment contaminated with PCBs to France for final disposal. In the next few months, an additional 100 tons will be processed for disposal.

For more information, please contact Franklin Garrido (Ministry of Health) at agarrido83@hotmail.com.

Mexican experience
A single inventory is not enough

By Mauricio Limón Aguirre, Alfonso Ramirez Flores, Alberto Villa Aguilar

In November 1988, Mexico established a system for the declaration of hazardous wastes, implemented through the regulations set forth in the General Act on Ecological Balance and Environmental Protection. The system requires waste generators to enrol in a registry established by the Under Secretariat of Ecology. In 1990, the Under Secretariat developed and published a declaration format for companies that could potentially generate wastes from electrical equipment containing PCBs.

With the entry into force of the North American Free Trade Agreement (NAFTA) in 1994, an international agency called the "Commission for Environmental Co-operation (CEC)" was created to address the regional concerns about the environment. CEC established the Sound Management of Chemicals Initiative (SMCI). Several subgroups are working in the framework of this initiative to deal with specific substances, developing a North American Regional Action Plan (NARAP) on PCBs.

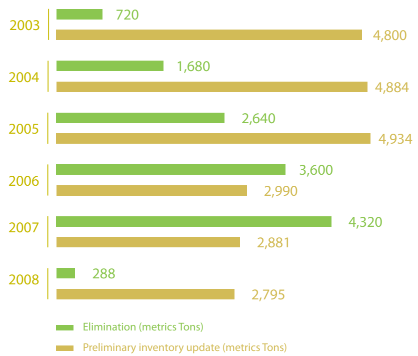
Mexico strengthened its PCB inventory process as a response to CEC's NARAP, which mandates countries to establish a PCB usage and storage baseline inventory. As a result, Mexico developed its first PCB inventory from 1997 to 2002. The results showed that 8,000 tons of PCBs have already been eliminated and that 4,800 tons of PCBs still exist in Mexico, distributed over 134 companies.

Results of the North American Regional Action Plan on PCB's (1997-2002)

Mexican regulations establish that holders or generators of PCBs shall present an initial report of their inventories, as well as a programme for decommissioning and re-classification of PCBs. Subsequently, they must present an annual updated inventory that includes the quantities of waste generated and eliminated (exhibiting the certificate of destruction), as well as the equipment in operation.

Based on the annual inventories presented by PCB holders, the Ministry of the Environment and Natural Resources (SEMARNAT), developed an Action Plan on the Management and Disposal of PCBs for 2003-2008. The plan is updated regularly based on revised inventories and phase-out programmes. The implementation of the Action Plan resulted in the elimination of 5,488 tonnes of PCBs and currently, the inventory shows 2,881 tonnes of PCBs linked to 223 companies remaining.

Results of the Action Plan on PCBs Maangement and Disposal



The last update of the inventory in 2008 showed that 75% of the premises registered were public corporations, such as the Federal Utilities Committee (CFE) and Petróleos Mexicanos (PEMEX); 23% corresponded to the private industry and 2% to the public sector.

As a member of the Stockholm Convention, Mexico developed its National Implementation Plan (NIP) in 2007 which includes a "PCB Phasing-out plan". In compliance with this phase-out plan, Mexico has strengthened the schemes for declaration of PCBs by owners primarily in the industrial, commercial and services sector. Despite the progress made in the integration of PCB inventories, there are sites remaining that have not been inspected. These are mainly in 'sensitive' locations including non-industrial populated premises, sites that pose a potential risk of exposure to PCBs and sites where food is processed or distributed.

In 2006, the United Nations Development Programme (UNDP), in collaboration with SEMARNAT, completed an exploratory phase to identify the need for a specific project for the phasing out of PCBs. In 2007, the Global Environment Facility (GEF) funded the "Preparatory phase for the development of a national, large-scale, draft proposal for the phasing out of PCBs". One of the significant outputs was an estimated PCB inventory which reported a higher quantity of PCB-contaminated equipment than that reported in the official inventory.

The project "Environmentally Sound Management and Destruction of PCBs in Mexico", created in April 2009, is sponsored by the GEF, SEMARNAT and the Ministry of Energy (SENER). The project seeks to minimize the risk of exposure of the environment and the vulnerable Mexican population to PCBs, while meeting the requirements established by the Stockholm Convention for the adequate handling and destruction of PCBs.

The project will develop an Integrated Management System for Services (SISG) to allow the phasing out of PCBs under the best economical, technical and environmental conditions. The system includes everything from the revision and adaptation of the legal framework, to the disposal of the PCBs and the relevant notification to the federal authority.

An updated inventory is being developed by a consulting firm contracted by UNDP. The process consists of conducting rapid colorimetric testing of specimens sampled from transformers located in plants and sensitive sites. If the tests are positive, the samples are sent to a laboratory certified for chromatography assays to determine the exact amount of PCBs.

For more information, please contact Victoria Romero at vromero@delegamexoi.ch.

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The congeners of PCB molecules where between 1-10 chlorine atoms are placed in differing positions on the molecule

Honduras

Not Usain Bolt but a start on PCB inventories anyway

Location of the sites tested in Honduras

The first national inventory of PCBs in Honduras was carried out under the Stockholm Convention enabling activities by the Ministry of Natural Resources and Environment (SERNA), through the Center for the Study and Control of Pollutants (CESCCO) in cooperation with the National Electricity Company (ENEE), the Secretary of Health and the Fire Department.

A team of national consultants from these organizations took care of consolidating the information generated in the preliminary inventory, identifying and selecting sites to be visited, training inter-institutional staff, implementing the PCB inventory questionnaires of the United Nations Environment Programme (UNEP) and performing sampling for analysis of PCBs with the rapid semiquantitative CLOR - N - OIL 50 ® method. The consultants were also responsible for codifying, tabulating, reviewing, analyzing, interpreting and summarizing all the information generated in the inventory.

In summary, the National Inventory of PCBs covered 119 sites located in 13 of the 18 departments of the country including the public (60%) and private (40%) sectors. The national electricity sub-sector accounted for the major number of sites visited (47%). A total of 1,459 questionnaires were used to identify the equipment that were in use or that were phased out. The power and distribution transformers represented 93.8% of the equipment tested.

The estimated mass of all tested devices was 7,621,177 kg and the estimated volume of oil was 2,352,661 kg. The estimated total mass of devices contaminated with PCBs reached 196,196 kg, equivalent to 2.6% of the total mass of devices and the total volume of contaminated oil amounted to 61,074 kg, corresponding to 2.6% of the total volume of oil. Among the 418 electrical devices in use and phased out that were tested using the rapid semi-quantitative colorimetric test CLOR - N - OIL 50®, 63 (15%) were found to be positive (> 50 ppm).

The national electrical public and private sub-sector is one of the main users and owners of equipment and waste that may contain PCBs. Electric equipment with PCBs are scattered in 23 (19%) of the 119 sites visited, of which 16 (70%) are facilities of ENEE, six (26%) of private companies and one (4%) of a public hospital. Of the 63 electrical equipments 78% (49) are public, with the ENEE the owner of the largest number with 46 electrical equipments and the teaching Hospital in Tegucigalpa with three electrical equipments, respectively. Of the rest, 22% (14) belong to different private companies. From these electrical equipment, 87% (55) are distribution transformers and 11% (7) power transformers. Only 29% (18) are in condition to be used and about 13% (8) showed dielectric oil leaks to the environment nearby. The highest percentage of equipment with PCBs is out of service. However, some medium and high capacity power transformers are in good condition. None of the sites visited has action plans for handling solid and liquid wastes containing PCBs.

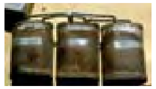
In conclusion, the results obtained from the National Inventory of PCBs are preliminary and offer an overview of the status of these compounds in the country. A more detailed analysis of industrial owners of equipment that are contaminated with PCBs is required to expand the size of the sample to complete the electricity sector and to identify other applications or uses of PCBs in the country. It is necessary to create a national registration of users and owners of electrical equipment contaminated or potentially contaminated with PCBs. These initiatives could be promoted through joint venture strategies with stakeholders, mainly ENEE as the largest holder of such equipment.

This article was prepared under the POPs NIP project in Honduras. For more information, please contact the Centro de Estudios y Control de Contaminantes (CESCCO), the Stockholm Convention National Focal Point, at cescco.serna@gmail.com.

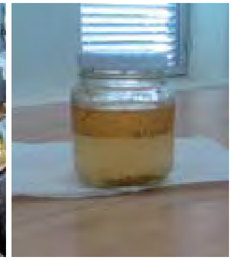
Colombia

A public and private sector project on PCB inventory

By Elena Gavrilovalito

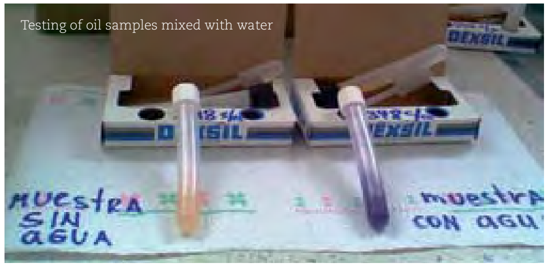


Sealed capacitors containing PCBs in high concentrations



Electrical appliances with oil and water mixture

Testing of oil samples mixed with water



In 2005 and 2006, a preliminary PCB inventory was carried out in Colombia by a Temporal Union OCADE-SANIPLAN-LITO with the assistance of the Ministry of Environment, Housing and Territorial Development.

The inventory was performed in different sectors, in particular on transformers and capacitors. PCBs equipment has mainly been imported into Colombia. Cross-contamination is very frequent due to maintenance operations using hoses, filtration machines, pumps, etc., that previously have been in contact with PCB-containing equipment. In general, 7 to 15% of the mineral oil transformers existing globally have been contaminated with PCB in an unnoticed way.

What is curious is that the management of PCBs was widely limited to large equipment mostly with a low PCB concentration (from 50 to 500 ppm). There was no priority given to smaller equipment that may contain much higher concentrations of PCBs. At our field visits during the project implementation, we found some unexpected surprises in small and apparently meaningless details.

In one of the companies visited, the inventory team discovered warehouse staff opening small obsolete capacitors that had been thrown in the backyard in order to use the oils inside. The heavily smelling oil was used as a lubricant for metallic wheels of doors, wheelbarrows, etc. A sample of the oil was taken and sent for chromatographic analysis. The PCB content in the oil was 10,000 ppm! These condensers originated from an old lighting system and were never considered as potentially containing PCBs.

Labels can give a first indication of PCB content in equipment. Condensers originating from the United States of America (USA) and manufactured after 1979 are not supposed to contain PCBs and usually indicate "No PCBs".

USA condensers produced before 1979 are supposed to contain PCBs unless otherwise indicated on their chassis or on the plate "No PCBs" or "Insulator liquid not chlorinated". Ballasts manufactured in the US after 1979 are labeled on the chassis with an indication "Without PCBs" or "No PCBs". Therefore, every non-labelled ballast coming from this country and manufactured before 1980 must be considered as possibly containing PCBs.

Another difficulty encountered by the project team in Colombia was the indiscriminate use of analytical methods by some of the companies. Most of them use the colorimetric Chloride analysis method with the help of Clor-N-Oil KIT as the initial separation system of contaminated and not contaminated with PCB appliances.

Accordingly to the present colour paper, if the test result has a yellow colour, then it means PCBs are present. If the result varies from a light violet to a deep violet colour, then this sample does not contain PCB.

Another difficulty encountered by the project team in Colombia was the indiscriminate use of analytical methods by some of the companies. Most of them use the colorimetric Chloride analysis method with the help of Clor-N-Oil KIT as the initial separation system of contaminated and not contaminated with PCB appliances.

LITO GESTIÓN INTEGRAL DE EXCEDENTES INDUSTRIALES Y RESIDUOS PELIGROSOS

(cont. on page 70...)

 (...cont. from page 69)

Accordingly to the present colour paper, if the test result has a yellow colour, then it means PCBs are present. If the result varies from a light violet to a deep violet colour, then this sample does not contain PCB.

The main advantages of this method are speed, ease of use and portability. The disadvantages are that this technique gives a result indicating only whether or not the oil contains chloride which are not necessarily originating from PCB molecules. The test is also only qualitative and does not provide a measure for concentration. For this reason, a false positive may be produced during the identification. Nevertheless, a false positive is not a problem by itself, since every sample indicated as positive by testing with the KIT, can be confirmed by the chromatographic method, which is very accurate. Besides, once the oil or appliance is identified as "positive" by the PCB test, it is managed with great care just like a PCB contaminated oil/appliance.

However, if there is water present in a sample, the result of the KIT might not be correct, that is, the KIT shows a false negative result of PCB content. This was the case in some of the companies, where the warning on the KIT that the presence of water in the sample in concentrations higher than 2% can cause a false negative result was not taken into account. If the oil sample is mixed with water, the colorimetric method cannot be used to analyse the sample, unless its phases are separated and the sample is dried up.

The project team performed tests with the previously identified samples as contaminated with PCB by chromatographic method and found samples contaminated with 180 ppm and 151 ppm.

A test with the KIT was performed under normal condition (i.e. without water) and with a sample with addition of 2 drops of water (the phases were not separated and water could not be detected visually). The test results showed that PCB presence was detected in the sample without water but no PCB was detected in the sample containing water. A false negative result was therefore produced due to the water presence.

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Stockholm Convention capacity building activities

Supporting countries to handle PCBs in an environmentally sound manner

Based on a request from the Conference of the Parties at its third meeting in 2008, capacity building activities to support developing countries and countries with economies to manage PCBs was undertaken by the Secretariat. An electronic training tool was developed to share information on the Basel Convention technical guidelines on POPs wastes, including the guidelines on PCBs. The tool was introduced to countries through a series of regional training workshops in the Caribbean sub-region, the South American sub-region, the Anglophone African sub-region, the Asian region, the Central and Eastern European region and the Francophone African sub-region. Further workshops for the Central American region and the North African and Mediterranean region will take place in 2010 and 2011 to complete this training activity.

The purpose of the training tool (available in English, French and Spanish on the Convention website www.pops.int) is to provide a simple, interactive means for countries to increase knowledge and capacity on the environmentally sound management of PCBs.

PCBs Elimination Network

Sharing information on PCBs

At its fourth meeting in May 2009, the Conference of the Parties to the Stockholm Convention endorsed the formation of the PCBs Elimination Network (PEN) as a mechanism for information exchange on PCBs among all relevant sectors that are linked to the use, management and disposal of PCB oils and PCBs contaminated equipment. This arrangement included voluntary membership across all relevant sectors for information exchange.

Objective

The objective of the PEN is to promote and encourage the environmentally sound management (ESM) of PCB oils and equipment containing PCBs. The PEN provides a forum for information exchange which fosters transparency and collaboration among all sectors. It functions as a networking platform for stakeholders from different sectors with an interest in the ESM of PCBs. By increasing the available information about sound management of PCBs, the PEN promotes the cost-effective completion of ESM of PCBs and thus supports Parties to the Stockholm Convention to achieve the Convention's objectives related to PCBs.

The Thematic Groups of the PEN are established to cover specific issues related to the ESM of PCBs. The first four thematic groups established are inventories of PCBs, maintenance of PCBs equipment, disposal of PCBs and PCBs in open applications. Network members with a particular thematic interest are encouraged to exchange information through the Stockholm Convention's Clearing House Mechanism and by holding discussion fora as appropriate. The outcomes of Thematic Group activities will contribute to existing national and regional efforts to achieve ESM of PCBs.

The USA, Canada and Mexico
collaborate to establish PCB inventories

By Dr. Joanne O'Reilly

Early in the development of the North American Commission for Environmental Cooperation's Sound Management of Chemicals (SMOC) programme PCBs were highlighted as a target for action. A PCB Task Force was formed from government representatives and public stakeholders from all three countries to develop the PCB North American Regional Action Plan (NARAP). In February 1997, the NARAP was approved by the Ministers of the Environment of Canada, Mexico and the United States of America. The NARAP recognized that sound environmental management of PCBs required consideration of PCBs throughout their life cycle from manufacture to destruction or disposal, as well as current, updated knowledge of PCB locations, amounts, and handling practices.

In support of these goals, the NARAP addressed six primary strategies, with specific action items identified for each:

- establishing a PCB information base;
- managing the use of PCBs;
- managing the storage of PCB wastes;
- assuring the proper treatment/disposal of PCB wastes;
- managing the transboundary shipment of PCB wastes; and,
- promoting PCB waste reduction and recycling.

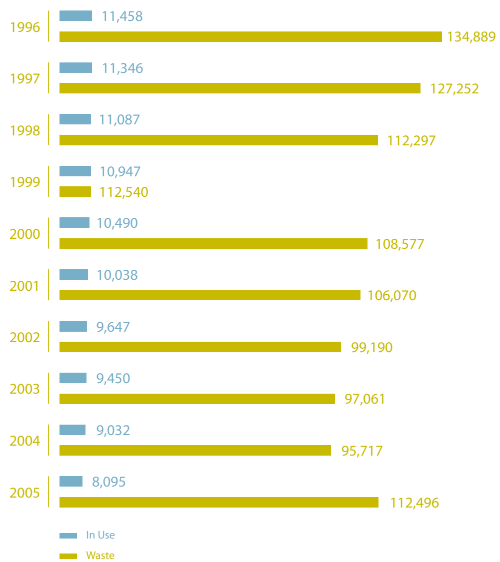
For nine years the three countries worked together to accomplish the actions set out in the NARAP with the overarching goal to minimize exposure of the public and environment to PCBs. In January of 2006, the PCB Task Force developed the *Final Evaluation Report for the NARAP on PCBs* and presented it to Council in June of that year. It stated that the goals of the PCB NARAP had been largely met with the implementation of domestic activities in the three countries, including regulatory control measures, action plans and management policies on persistent, bioaccumulative and toxic substances. Although the NARAP is no longer underway, the three countries continue to maintain ties and recently submitted information to the North American Commission for Environmental Cooperation on domestic implementation of PCB actions and an analysis of domestic PCB inventories through information in a domestic annual report.

Canada

In Canada, PCBs are regulated under the Canadian Environmental Protection Act, 1999. In September 2008, the *Chlorobiphenyls Regulations* and the Storage of PCB Material Regulations have been revoked and replaced by the PCB Regulations. CEPA's new PCB Regulations (2008) continue to prohibit the manufacture, process, sale and import of PCBs for any use, restrict the use of PCBs to specified products already manufactured or imported into Canada in the late 1970s, and set limits on the release of PCBs to the environment. They also set specific deadlines for ending the use of remaining PCBs in concentrations at or above 50 mg/kg. The use of equipment containing PCBs at a concentration of 500 mg/kg or more was phased out December 31st, 2009, as was equipment containing PCBs in a concentration of at least 50 mg/kg but less than 500 mg/kg specifically located at sensitive sites (i.e. prescribed locations) namely drinking water treatment plants, food or feed processing plants, child care facilities, preschools, primary schools, secondary schools, hospitals or senior citizens' care facilities or on the property on which these plants or facilities are located and within 100 m of it. Similar equipment containing PCBs in a concentration of at least 50 mg/kg but less than 500 mg/kg and located at any other place in Canada will be eliminated from use by December 31st, 2025.

The Canadian Council of Ministers of the Environment (CCME) and Environment Canada have prepared annual reports on the National PCB Inventory since 1990. A summary of the information reported from 1996 to 2005 reveals a comparison of voluntary reported PCBs in use and regulatory reported PCBs in storage in Canada during that time period.

Canadian National PCB Inventory 1996-2005



In 2008 the voluntary reporting of PCBs in use increased as expected following the 2006 publication of the proposed PCB Regulations including phase-out of use dates for equipment containing PCBs. From 1990 to 2008 in Canada, the PCB quantities in storage reported in accordance with legislation in place remained about the same. A steady decline of stored quantities did not occur. Waste quantities in storage were mainly composed of askarel liquids with some mineral oils and some other liquid and solid wastes.

Mexico

In Mexico, PCBs are regulated by the General Law for the Prevention and Integral Management of Wastes (LGPGIR) as well as NOM-133-SEMARNAT-2000 (Environmental protection – Polychlorinated biphenyls (PCBs) – Handling specifications). In 2002, Mexico ratified the Stockholm Convention which led to the development of Mexico's performance targets under the POPs Convention as outlined in its National Program for the Environment which states that PCBs must be eliminated by 2012.

According to Mexico's national PCB inventory for 2006, 178 companies reported storing or using equipment containing a total volume of 2,990 tonnes of PCBs. From the total PCBs reported, 1,547 tons (52%) were from public sector companies and 1,443 tons (48%) from private companies.

In 2009, 290 companies reported storing or using equipment containing a total volume of 342.79 tonnes of PCBs, with 929.88 tonnes being sent for decommissioning. These companies also reported having PCBs held in 75 ballasts, 26 capacitors, 9 transformers and 17 drums while sending 371 capacitors and 1314 transformers for decommissioning.

According to the Secretariat of Environment and Natural Resources (SEMARNAT), from 1995 to 2006, 3,625 tonnes of PCBs were treated by authorized companies and 1,537.6 tonnes were exported while from 2003 to 2008, 5,488 tonnes of PCBs were eliminated. As well, in August 2009, SEMARNAT reported 929.88 tonnes of PCBs were being held in storage for decommissioning, 493.60 tonnes were eliminated and 510 tonnes were exported to France.

Mexico, in 2009, began a four-year project supported by the Global Environment Facility and the United Nations Development Programme, called "Environmental Sound Management and Destruction of PCBs in Mexico". This project will work to assess government capacity for PCB destruction and sound management, update the national PCB inventory, define sites for PCB storage, establish a national coordinated system for PCB management between States; and develop risk communication strategies.

(cont. on page 74...)

The USA, Canada and Mexico collaborate to establish PCB inventories (...cont. from page 73)

United States

The United States has devised a comprehensive regulatory structure for the control and disposal of PCBs. PCB use is primarily regulated at the federal level, with states retaining some secondary responsibility. The federal Toxic Substances Control Act (TSCA) has a section devoted exclusively to PCBs, and PCB regulations comprise more than seventy pages in the Code of Federal Regulations. Under this regulatory regime, the manufacture, import, export, and use of PCBs are banned, except under limited circumstances. The Environmental Protection Agency (EPA) continues working on regulatory and non-regulatory efforts to control and eliminate PCBs including the phase-out of high-concentration liquid uses of PCBs. EPA is soliciting comments in 2010 on possible regulatory changes to require the phase-out of various PCB uses including all high-concentration liquid PCB uses.

EPA maintains data on PCB waste shipments, wastes treated and disposed, and PCB waste treatment/disposal facilities. Information on the exact amounts of PCBs in use and in storage is currently somewhat limited. For the purpose of information exchange, the United States therefore relies upon estimates of some of these quantities. Disposal data from 1990 through 2007 are currently compiled.

In 1998, EPA required owners of all PCB transformers (500 ppm and above) to register those units with EPA. This information has been compiled, is periodically updated, and is available to the public online www.epa.gov/pcb. This registration requirement does not extend to other PCB equipment such as capacitors.

Although a comparable compilation of North American data does not currently exist, the three countries continue to work together through international fora and individually through domestic programs to track updated knowledge of PCB locations, amounts, and handling practices to fulfill the end goal of reducing the risk of exposure to the public and environment to PCBs.

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The article was written for Environment Canada (EC),
the US Environmental Protection Agency (EPA),
and the Mexican Secretariat of Environment and Natural Resources (SEMARNAT).

Dismantling of a PCB transformer

PCBs in Spain – Can we meet the disposal deadline?

By Luís Palomino

The rules governing the disposal of PCBs and PCTs in the European Union, Directive 96/59/EC, was implemented in 1999 by the Spanish State, and includes, among others, carrying out an inventory of these substances and equipment that contained a concentration exceeding 50 ppm PCBs and the obligation to eliminate many of these devices before January 1, 2011, as well as national planning necessary to carry out these requirements.

In this regard, since 1999 the required infrastructure was developed for the disposal of PCBs based on a group of companies specializing in the collection of contaminated equipment, decontamination, and disposal of PCBs and contaminated oils.

In Spain, the responsibility for environment issues rests with the regional authorities. The national inventory of PCB-contaminated equipment is the result of the integration of inventories made by these authorities.

The data provided in this article are updated to December 31, 2007. The information recorded indicates that PCB contaminated equipment that was used in Spain totalled approximately 120,000 tonnes. The results of the inventory in 2007 showed that between 1999 and 2009, approximately 72,000 tonnes were disposed. There still remain approximately 48,000 tonnes for disposal. However, based on the European Community (EC) Directive, 15,000 tonnes can remain after 2010 for disposal as the concentration of PCBs is between 50 and 500 ppm.

Even though it would be technically feasible, it is probable that due to delays and the economic crisis in Spain, the disposal of the remaining 33,000 tonnes will not take place this year. Authorities should consider extending the phase-out period beyond the December 31, 2010 deadline long enough to allow owners to dispose of PCB contaminated waste. Even so, it is necessary to continue to encourage owners to dispose of such waste as quickly as possible.

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Years remaining for Parties to the Stockholm Convention to remove from use, all equipment containing or contaminated with PCBs

Results and challenges; the national environmental management plan for PCBs in Norway

By Qno Lundkvist

10% of the Norwegian population have a higher intake of dioxin-like PCBs and dioxins than the tolerable weekly intake. Over 50% of the dietary warnings in Norwegian fjords are mainly issued because of high concentrations of PCBs in sediments and biota. These are some of the reasons for implementing the Norwegian management plan to reduce and avoid further PCB-contamination.

PCBs have never been produced in Norway, but more then 1,300 tonnes of PCBs have been imported. A national ban of PCBs came into force in 1980, but even today, 30 years later, products containing PCBs can be found in several common products in buildings and electrical equipment.

The major remaining national sources of PCBs are buildings from 1940 to 1980, contaminated sites and sediments. As per 2009 the overall PCB account is:

- approximately 660 tonnes have been properly destructed;
- almost 150 tonnes are still in use in products and materials;
- disposal of more than 500 tonnes is unknown - for example, illegally disposed of, dumped or leaked into the environment.

The national environmental management plan presents a clear set of regulations, followed by comprehensive enforcement, supervision and information, environmental monitoring schemes, systems for collecting and end-treatment of disposed PCB-containing waste. Among the results so far:

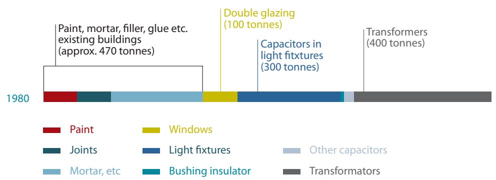
- all transformers and major high-voltage electrical equipment containing PCBs have been phased out (totalling 400 tonnes PCB);
- more than 90 % of the PCB products in Norway have been phased out;
- only approx. 8 tonnes of PCBs contained in small capacitors in light fixtures remain to be phased out (originally totalling 300 tonnes PCBs).

Major approaches of the national management plan include:

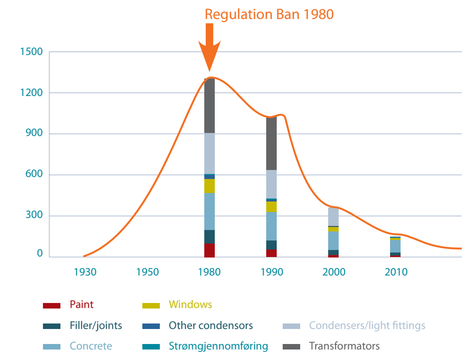
- high priority via several white papers and PCBs forming part of the general strategy for hazardous waste;
- centralised coordination and follow-up;
- mapping programmes followed by regulations and waste management systems;
- effective enforcement campaigns;
- involvement of industry and trade;
- priority for a waste management plan, including environmental mapping of 1940to 1980 buildings upon rehabilitation, remediation or demolition;
- collection and proper traceable disposal of PCB-contaminated building waste such as paints, sealants, double-glazed windows and electrical equipment;
- guidance to owners of buildings and equipment containing PCBs;
- remediation programmes for contaminated soils and sediments (day-care centres, harbour sediments, 17 areas along the coast are prioritized).

The national environmental management plan also covers unintentional synthesis of PCBs during incineration and certain other industrial processes. Based on information from available literature, these emissions have been estimated to 40-50kg per year. This may represent a substantial part of the total annual national PCB emissions. A project has been started to measure such unwanted synthesis of PCBs.

The PCB Challenge: Usage of PCB in Norway



The PCB Challenge:Historical and remaining amounts



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Paint samples collected from lighthouse Fuglehuken. Picture taken by Halvard Pedersen at the Governor of Svalbard

Save the polar bears by control of PCB sources in the north A view from Norway

By Halvard R. Pedersen, Rolf Tore Ottesen, Halfdan Benjaminsen, Guttorm N. Christensen, Anita Evenset, Qno Lundkvist, Pernilla Carlsson, Ola A. Eggen and Morten Jartun

Negative health effects of PCBs have been documented in arctic top-predators, such as the polar bear. The most accepted explanation for this situation is the influence of long-range transport of PCBs via the atmosphere, sea currents, and trans-polar ice movements. In 2005, however, an increasing level of PCBs was detected in marine sediments outside the Russian settlement, Pyramiden, in Svalbard. Akvaplan-niva concluded that a local PCB source had to be active onshore. As a follow-up, the Governor of Svalbard initiated a project with the objective of identifying and subsequently reducing the amounts and potential effects of local PCB sources. This initial project revealed high concentrations of PCBs in surface soils in Barentsburg and Pyramiden, whereas the concentrations in Longyearbyen were significantly lower.

The major local sources of PCBs in Svalbard proved to be electrical capacitors in lighting fixtures and flaking paint from building facades. In 2008, the project was extended to include the remaining settlements in Svalbard; Ny-Ålesund, Svea, Hornsund, Fuglehuken fyr, Grumant, Coles bay, Hopen and Bear Island. PCBs were detected in soils and products in all settlements except Svea, Hopen, and Hornsund. This was a major breakthrough in confirming that PCBs were extensively used in common products and applications in Svalbard, and that local surface soils consequently are heavily contaminated. In 2009, the project included studies of the flux of particle-bound PCBs in small rivers running through Barentsburg and Pyramiden towards the marine environment, and further studies of marine sediments outside the harbours of the same two settlements. The preliminary results indicate an annual input of several grams PCB7 to the marine environment from one small catchment alone. Studies of PCBs in local air have also been initiated by UNIS. Active efforts to clean up Svalbard, i.e. removing/managing local sources of PCB, have been initiated through co-operation between the Governor of Svalbard and the Russian mining company Trust Arktikugol.

By the end of 2009, over 1,100 samples constitute the local-PCB Svalbard database, and further studies will be initiated to explain the relative contribution of PCB exposure in wildlife originating from local sources vs. long-range transport. Furthermore, actions are being initiated to reduce the risk of further dispersion of PCBs, such as the collection of 3,000 electrical capacitors in Barentsburg and Pyramiden.

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CLIMATE AND POLLUTION AGENCY

PCBs in fish of Swiss lakes and rivers

By Josef Tremp, Peter Schmid, Beat Brüschweiler, Arnold Kuchen, Erich Staub, and Markus Zennegg

Dioxin-like PCBs are PCBs showing similar toxic effects as dioxins.

Emissions of PCBs and dioxins and furans (PCDD/F) into the environment have decreased in Switzerland after PCBs were banned in 1986 and waste incineration plants as well as industrial thermal processes were equipped with flue gas cleaning systems in the 1990s. However, relevant reservoirs of PCBs still exist in elastic joint sealants and other construction materials in buildings, in insulation fluids of capacitors and transformers, anti-corrosion coatings of steel construction and at contaminated sites.

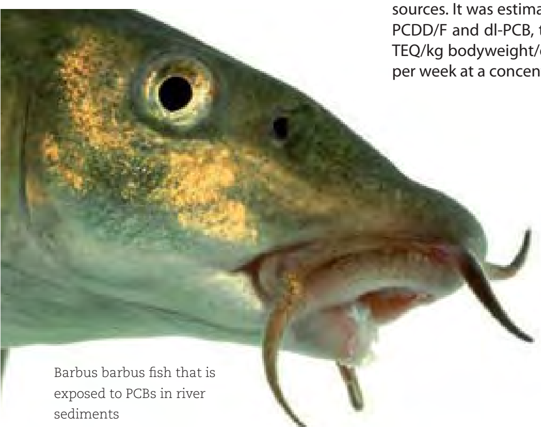
Triggered by the finding that brown trout from a rural river system in western Switzerland are highly contaminated with dioxin-like PCBs (dl-PCB), the Federal Office for the Environment (FOEN) together with the Federal Office for Public Health (FOPH) started a national project in 2008 to investigate the PCB- and PCDD/F-contamination of wild fish in Swiss lakes and rivers. The aim of the study was to identify current background concentrations of these highly toxic pollutants in different wild fish species and to determine the level of contamination of fish that are living in waters which have been polluted with PCBs emitted from point sources. The risk for human health and the environment from exposure to PCBs and PCDD/F was assessed and the need for risk reduction measures identified. More than 1300 data sets from a period of around 20 years were collected and evaluated.

Toxicity equivalents (TEQs) express the toxicity of a particular molecule of PCBs (congener) in relation to the most toxic dioxin, 2,3,7,8-TCDD. The latter is given a reference value of 1 TEQ while the toxicity of PCB congeners is expressed as a fraction of this value. dioxins.

Results of the data evaluation

Background concentrations of dl-PCB and PCDD/F have been identified to be in the range of 0.5-4 pg WHO(98)-TEQ/g fresh weight (fw). Such concentrations have been determined in particular in fish from the rivers Doubs, Rhône (before the confluence with lake Geneva), Rhine (before the confluence with lake Constance), and Inn, as well as in fish that were caught in the lakes of the Swiss plateau, lake Lugano and alpine lakes. Concentration levels of dl-PCB and PCDD/F in the range of 4-12 pg WHO(98)-TEQ/g fw have been measured in fish from waters with elevated contamination from diffuse sources (i.e. pollution caused by a variety of activities that have no specific point of discharge). Fish from waters that are polluted by PCB-emissions from point sources (i.e. a single identifiable localized source) showed concentrations of dl-PCB and PCDD/F above 8 pg WHO(98)-TEQ/g fw. The highest levels up to 97 pg WHO(98)-TEQ/g fw were found in brown trout from the river Saane close to a former landfill site where industrial waste from manufacturing of capacitors was dumped until 1974. High concentrations of dl-PCB up to 60 pg WHO(98)-TEQ/g fw have been determined also in brown trout from the river Birs and in fish species of the River Rhine near Basel.

Concentrations of dl-PCB in fatty fish as eel, shad, and arctic char often exceed the limit value of 8 pg WHO(98)-TEQ/g fw even in waters that are not affected by PCB-emissions from point sources. It was estimated that the upper limit of the tolerable daily intake (TDI) for the sum of PCDD/F and dl-PCB, that was determined by the World Health Organisation (4 pg WHO(98)-TEQ/kg bodyweight/day), would be reached with regular average consumption of 120 g fish per week at a concentration of 8 pg WHO(98)-TEQ/g fw.



Barbus barbus fish that is exposed to PCBs in river sediments © Michel Roggo

Limestone purified source of pure drinking water in the Swiss mountains © Michel Roggo

The Tolerable Daily Intake (TDI) is the amount of a substance that can be ingested daily over a lifetime without appreciable health risk. TDIs are expressed in relation to the bodyweight.

Action required for risk reduction

Based on the evaluation of the data, it was concluded that the following action is required:

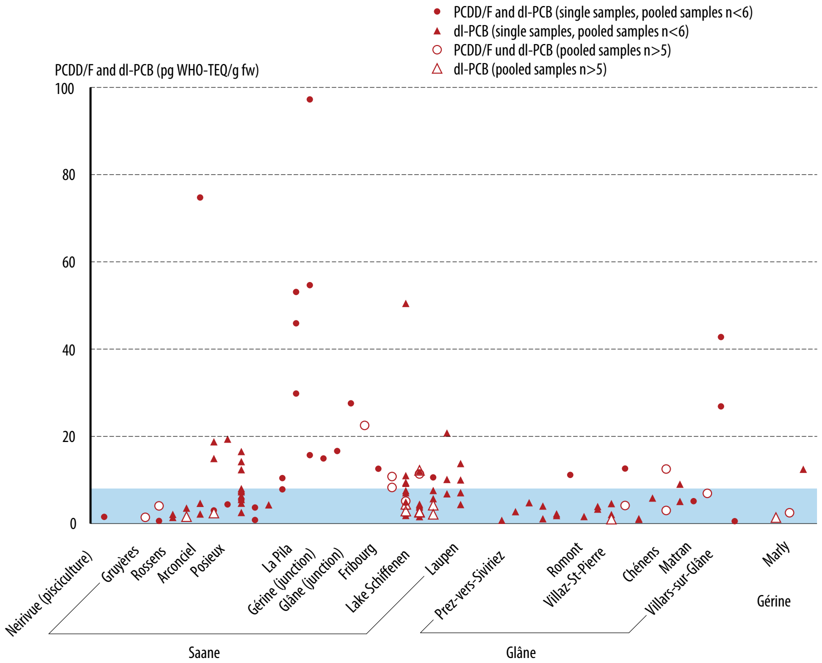
- Locally or regionally elevated levels of PCBs may occur in rivers as a result of emissions from point sources and requires measures to reduce exposure of humans and the environment. In order to support the enforcement authorities in the communities to identify point sources of PCBs near waterbodies, guidance for the planning and conducting of such investigations is currently developed.
- In cases where concentrations of PCDD/F and dl-PCB exceed 8 pg WHO(98)-TEQ/g fw in fish, measures must be taken to protect consumers of contaminated fish. On January 15, 2009, the FOEN and FOPH published recommendations for limiting the population's exposure to PCDD/F and dl-PCB from consumption of fish. In addition, FOPH issued a directive on 19 May 2009 advising the food safety enforcement authorities how to monitor the compliance of marketed foodstuffs with the maximum concentrations and what measures to take in the event of these concentrations being exceeded.
- Further action is required to identify PCBs in buildings and electrical installations. Such PCB-containing materials and appliances have to be separated and safely disposed of.
- Top priority is to be accorded to investigations of PCB emissions from contaminated sites where large amounts of PCBs are found and the remediation of these sites undertaken in accordance with the approved regulatory procedures.

(cont. on page 80...)

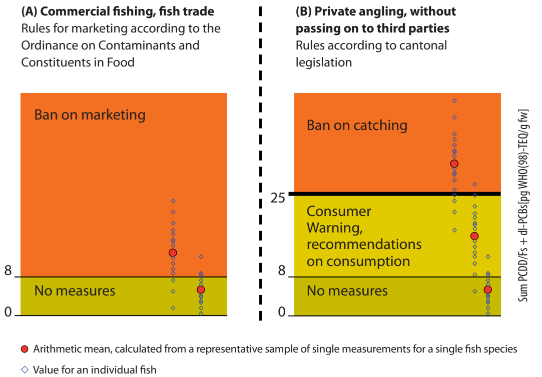
PCBs in fish of Swiss lakes and rivers (cont. from page 79)

The Rhine river that looks pristine but may contain PCBs
© Michel Roggo

Concentrations of PCDD/F and dl-PCB above 8 pg WHO(98)-TEQ/g fw in single fish and pooled fish samples from the river Saane and its tributaries Glâne and Gérine. "La Pila" is a landfill site where industrial waste from manufacturing of capacitors was dumped.



Recommended measures to reduce exposure of persons with regular fish consumption



For more information or if you wish to receive the full study "Intake of dioxins and dioxin-like PCBs through the consumption of fish from Swiss waters: Recommendations for limiting the population's exposure" published by the Federal Office for the Environment and the Federal Office for Public Health (FOPH) in 2008, please contact asb@bafu.admin.ch.

Italy – major electrical transmission operator in the fast lane for PCB elimination

By Fulvio Rossi and Massimo Pompili

According to the European and the Italian legislation, a preliminary inventory of equipment containing PCB oils was carried out in Italy in 2000 and had to be updated every two years. Equipment containing insulating oils with more than 500 ppm (500 mg/kg) of PCBs has to be decontaminated or eliminated by December 2010. As a result, a constant decrease in PCB contaminated equipment was achieved in Italy over the years 2000 to 2004.

Preliminary inventory of PCB contaminated equipment in Italy

	2000	2002	2004
Total number of electrical equipment containing PCBs	98,700	61,450	47,700
Total number of electrical apparatus containing PCBs (> 500 mg/kg)	19,000	12,400	9,750
Total number of electrical apparatus containing PCBs (> 50 mg/kg)	79,800	49,100	37,050
Preliminary estimate of total quantity (tonnes) of electrical equipment containing PCBs	6,500	7,100	4,400

Source: *Technical Agency of the Italian Ministry of Environment*

With about 56,000 km of high voltage overhead lines and terrestrial and submarine cables, Terna is the main operator of the Italian national transmission grid and therefore one of the potential major holders of equipment containing PCBs in the country. Terna has set up a disposal programme for its contaminated equipment. The European objective of eliminating all electrical equipment contaminated with PCB over 500 mg/kg by 2010 was reached by Terna in 2009, one year before the official deadline.

Terna PCBs inventory from the year 2000

Type of equipment	Total number of units	Number of units with PCB
High voltage power transformers	500	23
Medium- and low voltage transformers	600	14
Current transformers (TA)	10,000	782
Voltage measurement devices	9,000	656
Bushings	3,300	130
Capacitors, reactors, etc.	-	148
Total	-	**1,750**

The disposal of equipment contaminated with PCBs between 50-500 mg/kg has also been accelerated by Terna and the oil remaining is expected to decrease in quantity annually. In 2003, the 23 high voltage power transformers containing PCBs that were identified in the 2000 inventory has been reduced to 2 in number. Due to acquisitions in the following years, in 2009 there were still two remaining transformers, which will be decontaminated in 2010 / 2011. The quantity of oil containing PCBs was estimated at 60 tonnes in 2003, down from a value of at least 1,000 tonnes from the 2000 inventory.

24
the number of GEF projects now being implemented on PCB management

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Does the GEF satisfy the financial support required for the management of PCBs?

An interview with Monique Barbut
Chief Executive Officer of the Global Environment Facility

1. What is the purpose of the Global Environment Facility?
The Global Environment Facility (GEF) unites 184 member governments — in partnership with international institutions, nongovernmental organizations, and the private sector — to address global environmental issues. An independent financial organization, the GEF provides grants to developing countries and countries with economies in transition for projects related to biodiversity, climate change, international waters, land degradation, the ozone layer, and persistent organic pollutants. These projects benefit the global environment, linking local, national, and global environmental challenges and promoting sustainable livelihoods.

2. How does the GEF expect to support the Stockholm Convention to achieve its goals?
The GEF is the financial mechanism of the Stockholm Convention. This means that the GEF has a dedicated funding envelop to help developing countries and countries with economies in transition to implement the Convention. Since the adoption of the Stockholm Convention, the GEF has invested over $450 million to that effect, and these funds have leveraged some $650 million additional resources in co-financing. In order words, through the GEF, well over 1 billion dollars have been invested towards achieving the goals of the Stockholm Convention. In the next phase of the GEF, for the next four years from July 2010 to June 2014, we will invest a further $375 million, not counting leveraged financing.

3. Does the GEF consider PCBs as a priority?
Being the financial mechanism of the Stockholm Convention means that we follow the guidance of the Convention regarding program priorities. Another central element of the GEF's work is what we call "country drivenness": our reliance on countries to identify their priorities and to tell us what kind of projects they want. When we apply these principles to the specifics of PCBs, we see that there are a large number of countries that have put PCB management at the top of their priorities for National Implementation Plans (NIP) and are requesting GEF for support in that field. Another way to answer is to look at the level of effort: looking back, the GEF has committed around $135 million for PCB management, or a big quarter of all POPs resources that we have engaged for Stockholm Convention implementation.

4. What are the eligibility criteria for countries to initiate a project on PCBs as a NIP follow-up?
The main criterion is that a country has to be a Party to the Stockholm Convention. We also prefer if the country has submitted its NIP to the Stockholm Secretariat, or at least if the country can share a draft with us. This is because the guidance to the GEF elaborated by the Conference of the Parties of the Stockholm Convention requires the GEF to fund projects according to countries' NIP priorities.

5. What are the first steps a country that wants to initiate a project on PCBs as a NIP follow-up has to do?
The first thing a country has to do – and this would typically have been done as part of the NIP development process – is to assign lead responsibility for the issue to an agency/government department in the country. Then, the designated responsible unit can rapidly put together a short concept note on the basis of the information in the NIP, and start discussions with the main stakeholders both within the government, but also with civil society and in particular the private sector such as the electrical utilities. At that point, it is also very important to engage in discussions with the country's national GEF operational focal point since these are the people that need to sign off on all GEF projects before they are submitted for GEF approval. So the sooner they are involved the better – particularly if the focal point is in a different ministry.

For the countries that wish, we are introducing for GEF-5 the possibility to develop rapidly a national portfolio formulation exercise. This is a short document that identifies which projects the country intends to develop for GEF funding over the GEF-5 period. The effort is coordinated by the GEF focal point. So, whilst not indispensable, it would be useful to include plans for a PCB management project in that portfolio formulation exercise so that the GEF Secretariat is aware of the country's intention. But in an event and at any time the country can engage in a dialogue with us at the GEF Secretariat to discuss its plans. Finally, it can be useful to also identify early on which GEF agency a country might want to work with since it is part of the agencies' responsibilities to assist countries to formulate project concepts.

6. What do you recommend to countries that have done very preliminary inventories of PCBs during their NIP and would now like to submit project proposals for doing a detailed inventory?
Actually I wouldn't recommend developing a project just to do a detailed inventory. You know, PCB inventories are iterative exercises that are rarely ever complete. The more one inventories, the more new sources/uses one will discover. So I think that if countries have prioritized PCBs during their NIP, then they should bite the bullet and develop a comprehensive project to put in place the environmentally sound management of PCBs, including of course a component that would further develop the PCB inventory.

7. What are the comparative advantages of the various GEF Agencies on the ESM of PCBs?
Until now, the GEF worked with 10 agencies: the African Development Bank, the Asian Development Bank, The European Bank for Reconstruction and Development, The Food and Agriculture Organization of the United Nations, the Inter-American Development

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Bank, the International Fund for Agriculture Development, The United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP), the United Nations Industrial Development Organization (UNIDO) and the World Bank. If I generalize and simplify, the comparative advantage of UNDP is with capacity building, that of UNEP with assessments, development of guidelines, and helping countries work regionally, that of UNIDO lies with technical assistance, and that of the Development Banks with investments.

Of course, as we have seen, a project typically spans the range of activities from the normative to capacity building and technical assistance to investments. So in many cases, it is a question of emphasis: at the extremes, we would not expect UNEP for example to manage a large single-country investment project; neither would we expect one of the regional development banks to ask us for money to develop guidelines for PCB management. There are in fact a few cases where a country has chosen to work with two agencies to harness their complementary comparative advantages.

8. Parties that are developing countries and Parties with economies in transition have expressed difficulty in accessing funds to satisfy their obligations. What are the problems and how can Parties best overcome these?
That's an interesting question. When I hear that countries express "difficulties", I think it's important to tease things out and really understand what the problems are. In general, I would start by noting that in fact when I've listened to countries express their views at Conferences of the Parties to the Stockholm Convention, there is a high level of satisfaction in general. What I hear most often is not so much difficulties in accessing funds, but rather concerns with the overall level of funding available through the GEF, and others.

From our side, the 5th replenishment has increased the resources directly available for POPs by 35%, to $375 million in total. Of course this is still below the estimates of needs assessment in developing countries for Convention implementation, but I am sure that you will agree that in the difficult economic conditions that we are facing this is a significant achievement.

As you know, we have also greatly improved our processes in the last four years. With the implementation of the GEF-4 reforms to simplify the project cycle and requirements for project documentation, the overall preparation time for a full-sized project is now less than 22 months, whilst the preparation time for a medium-size project – of up to 1 million dollars - is less than 12 months. During GEF-5 we will continue to work with the agencies to simplify our requirements and speed up the system.

Having said that, I do think that there is one category of countries that historically have had difficulties in accessing GEF resources and these are Least Developed Countries (LDCs) and Small Island Developing States (SIDS). To address this situation, in the past four years, we have taken deliberate steps at the GEF to reach out to these countries to help them develop projects and programs to ensure that they had access to GEF resources. Whilst in GEF-3 we provided fewer than 12% of resources to LDCs and SIDS, under GEF-4 this has increased to 18.4% of GEF resources overall. For POPs, specifically, we have worked with UNEP and UNIDO to develop a program targeting all the LDCs and SIDS parties in Africa and addressing the specific needs of these countries.

9. What are the main challenges GEF Agencies face in the implementation of PCB projects?
I see at least two types of challenges in establishing the environmentally sound management of PCBs in developing countries. The first one is general to POPs, and is related to the lack of capacity for PCB disposal in developing countries. For many of the smaller countries, there are limited options other than to export the PCB waste for destruction abroad. But the price can be prohibitive, and of course no long term capacity is being built in that way. We are trying to address the problem by, where it can be cost-effective, looking at upgrading facilities for POPs destruction, piloting novel destruction technologies, and developing capacities to treat the large volume but low concentrated PCB-contaminated oils.

The other challenge is technical. It has taken decades to OECD countries to phase out their PCBs. In developing countries there are typically large amounts of PCB-contaminated oils because of un-sound servicing practices in the past. In all but the smallest countries, that means that there will be still large imprecision regarding the amount of PCBs present in the country after the PCB part of the NIP development effort is over.

10. Establishing co-financing for projects continues to frustrate Parties seeking funds from the GEF. What advice can you give to solve this problem?
There are a number of reasons why we require co-financing for GEF projects. Do you think that GEF funding alone would be sufficient to address all the global environmental issues that we are facing? With co-financing, the GEF can leverage resources and direct these additional resources towards the goals of the conventions that we serve. In fact, in the guidance that we receive from the Stockholm Convention is the request to the GEF and its agencies to "proactively assist in mobilizing other sources of financing for persistent organic pollutants projects". This is precisely what co-financing is about. Co-financing is also a manifestation of country ownership; helps ensure project success through enlarging the base of actors that have a stake in the project; and helps ensure that the activities and outcomes will be sustainable after the project ends.

It is also true that we are flexible in how we look at co-financing. Typically we look at the different characteristics of projects, and we look at the specific conditions of countries. For investment projects we expect more co-financing than for capacity building projects, and we expect more co-financing from emerging economies than from LDCs for example. If you look at the LDC/SIDS program for Africa that I just mentioned and that the GEF Council approved, co-financing there is in the order of 1 to 1 (1 GEF dollar for 1 dollar co-financing), and includes in-kind contributions from countries. On the other hand, for a country with a large and vibrant economy, I think that expecting a 1 to 3 ratio of co-financing is not unreasonable.

In terms of advice, it would be to start early engaging the stakeholders that have an interest in the project, and also to establish linkages with related activities in the country. Specifically for PCB projects that have been approved, we see that they all include a large share of co-financing from the industry, from the electrical utilities that need to replace and modernize their equipment in any event.

11. What will be the strategic focus in GEF-5 for supporting PCB project proposals (e.g. inventories, disposal, developing ESM plans, etc.)?
When we look at the portfolio overall, we expect to see more countries addressing the releases of un-intentionally produced POPs, and also of course starting to address the new POPs. For PCB projects, as I mentioned I anticipate that they will continue to be a strong feature of our work. I don't think the nature of the projects will be significantly different, though we will likely start seeing "second phase" projects with more emphasis on phase out and disposal as opposed to inventorying and management plan development.

One aspect that I wish to see emphasized during GEF-5 is the linkages with broader strategies for the management of hazardous chemical substances, in particular ozone depleting substances. If a country is developing a strategy for PCB disposal, or looking at developing or upgrading facilities for environmentally safe storage, or for destruction even, than it is a very good opportunity to take a broader look at the issues and look for synergies – in fact, not doing so would be downright counter-productive.

Monique Barbut has been the Chief Executive Officer and Chairperson of the Global Environment Facility since August 2006.
For more information, please contact: secretariat@thegef.org

Inventories of PCBs and National Implementation Plans
Identify, label and remove

Each Party to the Stockholm Convention has to develop a National Implementation Plan (NIP) for the implementation of its obligations under the Convention within two years after entry into force of the Convention for that Party. NIPs usually contain a preliminary inventory of equipment containing PCBs, information on national regulations and an assessment of the capacity to manage PCBs. Approximately 60% of all Parties to the Convention have already prepared these NIPs. Many NIPs have defined the management and elimination of PCBs as a national priority and have developed action plans to undertake follow-up activities. In developing countries and countries with economies in transition these priorities and action plans are implemented with the help of projects financed by the Global Environment Facility. However, the data provided in the NIPs is widely differing in detail and accuracy. More work is required to precisely establish the content and concentration of PCBs in equipment.

Every 5 years Parties are obliged to report on progress made in eliminating PCBs and the first report was made in 2009. The reports will be reviewed by the Conference of the Parties at its fifth meeting in 2011.

Unintentional production of PCBs
Dioxin-like PCBs

PCBs are also formed unintentionally during thermal processes involving organic matter and chlorine as a result of incomplete combustion or chemical reaction. Examples of such processes are waste incineration, thermal processes in the metallurgical industry or the production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching.

Unintentionally produced PCBs are very similar to dioxins and furans and are handled together with these substances under Article 5 and Annex C of the Stockholm Convention. Parties to the Convention are obliged to take measures in order to reduce or eliminate release of these chemicals. The Convention has developed guidelines on best available techniques (BAT) and provisional guidance on best environmental practices (BEP) to reduce or eliminate releases from unintentional production.

An Overview of the PCB Program of the Global Environment Facility

By Laurent Granier

The Global Environment Facility (GEF) in its capacity as financial mechanism of the Stockholm Convention has already invested over USD 450 million towards POPs phase out activities in developing countries and countries with economies in transition. With leveraged cofinancing amounting to USD 650 million, well over 1 billion US dollars have been invested towards achieving the goals of the Stockholm Convention. Following the successful replenishment of the GEF in May 2010, the resources directly available for POPs have been significantly increased by 35%, to USD 375 million in total for the next four years from July 2010 to June 2014.

Of these USD 450 million, USD 135 million were directed to PCB management, leveraging an additional USD 280 million to bring the total size of the PCB portfolio at USD 414 million. These projects involve 45 countries around the world. The regional distribution of GEF funds is: over USD 30 million in the Africa region, USD 25 million in Eastern Europe and Central Asia, USD 61 million in Asia, and over USD 18 million in Latin America.

GEF PCB projects typically address all or some elements of the environmentally sound management of PCBs. Activities that have been supported include the development of capacity for treatment of contaminated oil, piloting novel destruction technologies, facilities for dismantling equipment, environmentally safe storage, funding for removal and disposal of heavily contaminated PCB oils and PCB containing waste, inventorying, and support to the development of the legislative and regulatory framework in a country.

The range of activities varies with countries' priorities and circumstances so that not all these elements are necessarily included in a single project. In some areas of the world regional approaches are being promoted. In many of the projects that have been approved, the private sector, in particular the electrical utilities, plays an important role and brings significant amounts of co-financing.

The GEF expects that there will be a strong continuing demand for PCB management projects for developing countries in the coming years. We will also be encouraging countries to look at the issue in the context of their needs and strategies for the management of hazardous chemical substances more broadly.

Information on the GEF and contacts at the GEF Secretariat can be found under "About GEF" at: http://www.thegef.org/gef/gef_staff.
Details of projects under implementation can be found through consulting the on-line database of GEF projects under "Projects and Funding" at: http://www.thegef.org/gef/gef_projects_funding.

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Chile and Peru
to share GEF funds for PCB management

In May 2010, the Global Environment Facility (GEF) approved a regional Medium-Sized Project (MSP) that takes a life-cycle approach to PCB Management in the mining sector in South America (Chile and Peru). This project is implemented by the United Nations Environment Programme (UNEP) and executed in cooperation with the Secretariat of the Basel Convention (SBC).

The main outputs are:

1. Regionally-harmonized PCB regulations;
2. Industry/government partnerships and PCB management plans;
3. Appropriate analytical capacity in the participating countries to assess the degree of contamination of equipment tested; and
4. Good practices in PCB management identified and disseminated.

This project will support and complement the efforts made by countries to manage PCBs in a sound manner and will focus on a very important economic sector in the region, which in many cases, has not been considered during the development of the National Implementation Plans under the Stockholm Convention. Some mining companies participating in the project will finance the disposal of some PCB equipment. This project will also include preliminary PCB inventories for non-electrical equipment and open applications. The duration of this project will be 18 months.

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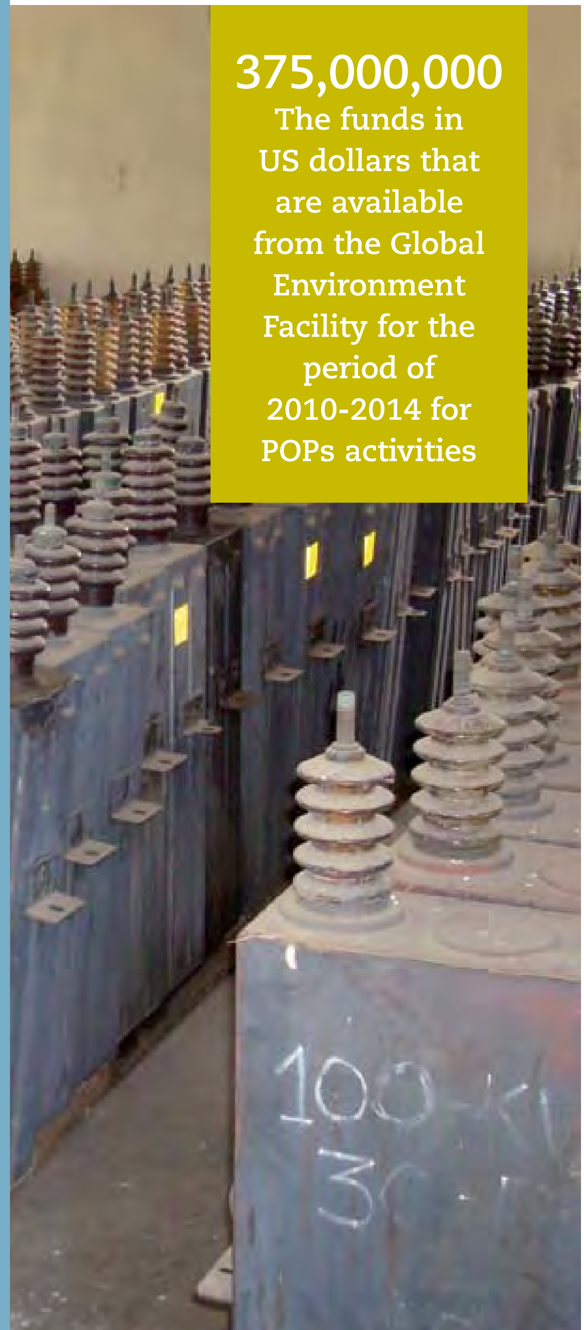

375,000,000
The funds in US dollars that are available from the Global Environment Facility for the period of 2010-2014 for POPs activities

Environmentally Sound Management of PCBs: The francophone African countries are mobilizing

By Cheikh Fofana

Here we go! The regional demonstration project on the "Environmentally Sound Management of PCBs and PCB-contaminated equipment» was officially launched in Dakar in April 2007.

As a first of its kind in Africa, this project is part of the implementation of the New Partnership for Africa's Development (NEPAD) Environment Initiative, adopted in 2003 by the African Union.

The project covers fourteen francophone countries that are members of the Basel Convention Regional Centre for Francophone Africa (BCRC-AF) based in Dakar, namely: Benin, Burkina Faso, Cote d'Ivoire, Djibouti, Guinea, Guinea-Bissau, Mali, Morocco, Mauritania, Niger, DR Congo, Senegal, Togo and Chad.

The BCRC-AF executes the project with technical support from the United Nations Environment Programme and under the supervision of a Steering Committee.

At a total cost estimated at USD 14,526,000 for a period of five years, this project aims at demonstrating the implementation of environmentally sound management (ESM) of PCBs held by power production, distribution and transmission companies of the 14 African countries. It also intends to establish a regional treatment centre that will provide for the elimination of PCBs by 2028 by pooling resources at the regional level.

The main partners of the project are the Global Environment Facility (GEF), governments and the electricity companies. Other partners that have been identified to support this initiative include: the African Development Bank, the French Global Environment Facility and private companies.

The project objectives are to:

- Build a regulatory framework for PCB management in each participating country. These frameworks need to be harmonized at the regional level to allow for cross-border transport, collection, transfer and disposal of equipment classified as hazardous wastes for decontamination in the regional treatment centre;
- Raise awareness and strengthen capacity of stakeholders (governments, utilities, recycling companies, civil society) on the management of PCBs to analyse for any health risks;
- Consolidate the inventories of electrical equipment containing PCBs or contaminated with PCBs to determine the logistical needs and the required treatment capacity of the regional centre;
- Seek financial mechanisms to sustain the environmentally sound management of PCBs beyond the term of this demonstration project in the region.

The project includes two consecutive phases: The first phase consists of activities aimed at putting in place the regulatory, administrative and technical framework for PCB management, including the development of a PCB inventory.

The second phase, which will take three years, includes operational activities to implement a demonstration of ESM of PCBs. The activities earmarked are:

- Collecting and dismantling of equipment, as well as transportation of PCB waste to the regional treatment center;
- Treatment of PCBs contaminated materials and mineral oils at the regional level;
- Export of PCB oils and highly contaminated materials to specialized treatment plants for disposal in accordance with internationally approved procedures.

It is intended that the treatment of PCBs will involve decontamination in a treatment center that is set up and run by a private partner in the framework of the project and the testing of co-incineration of PCB-contaminated oil in a cement kiln.

In the view of demonstrating and replicating activities of the project, several co-related activities will also be carried out:

- Development and implementation of a communication plan;
- Monitoring and control of project activities by independent experts;
- Evaluation by an independent consultant;
- Capturing good practices and lessons learned to support replication for ESM of other hazardous wastes.

The methodology for the implementation of the project is composed of three parts:

- A pilot in a reference country having experience with a particular component of the project;
- A regional workshop for sharing information in the participating countries;
- Deployment of the activities in other countries with technical support and capacity building of stakeholders.

These results will address the decontamination of approximately 3,600 transformers and will help to confirm the sustainability of the regional centre and its economic model.

The main stakeholders are the governments of the participating countries and utilities using and holding PCBs, as well as sub-regional institutions providing electricity (e.g. the West African Power Pool).

The project offers a good example of Public Private Partnerships (PPP).

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UNIDO leads the way in national PCB projects

By Rami Abdel Malik

The United Nations Industrial Development Organization (UNIDO) plays a role in the implementation of the Stockholm Convention on Persistent Organic Pollutants (POPs). Since the Convention opened for signatures in 2001, UNIDO became one of the principal agencies assisting developing countries and countries with economies in transition to meet their obligations under the Convention.

UNIDO assists Party States to prepare National Implementation Plans (NIPs) which present the priorities for implementation under the framework of the Stockholm Convention. To date, over 50 countries have requested and received UNIDO's assistance to develop their NIPs.

According to the NIPs of many countries, the management of PCB remains as one of the priority issues. In response to the need to address these persistent organic pollutants and to assist countries to meet their obligations under the Stockholm Convention, UNIDO has formulated several post-NIP projects focused on the environmentally sound management (ESM) of PCBs.

Romania the first to benefit

The objective of UNIDO's first PCB project which is being implemented in Romania is to help the country overcome the current barriers which impede the implementation of the PCB-related obligations under the Stockholm Convention. The project introduced an ESM system for PCBs based on a consensus between relevant government authorities, private and public sectors and NGOs.
The ESM system includes:

- relevant regulations updated to reflect the obligations under the Stockholm Convention, European Union directives, and other international environment-related instruments and agreements;
- detailed guidelines for managing PCBs, PCB-containing or PCB-contaminated equipment and wastes;
- a resource mobilization mechanism for owners of PCBs and PCB wastes;
- the availability of trained specialists; and
- Improved monitoring and demonstration facilities.

The aim is that all activities are undertaken in a controlled and coordinated manner to protect human health and the environment from the harmful effects of PCBs.

The main outcome of this project is the increased national capacity to manage PCBs in an efficient and environmentally sound manner, including human capacity, improved regulations, financing options and physical facilities for the management of PCBs. This is achieved through the development of a nationwide ESM system which mobilizes all concerned local stakeholders to participate in implementing the PCB related obligations under the Stockholm Convention. The system facilitates their participation by improving the regulation, increasing awareness, establishing a financial mechanism for phase out and disposal of PCBs and PCB wastes, demonstrating the system in selected regions and training local specialists in different aspects of PCB management.

The project, which was approved in August 2006 and launched in June 2007, is currently in full swing and will be completed by September 2010. An inventory of PCBs has already been completed.

In addition, the project provides a replicable model of cooperation between the government, public and private entities in addressing global environmental challenges.

Key activities underway in Eastern Europe, Asia and North Africa

Similar projects are being implemented in Armenia, Macedonia, Morocco and Mongolia. The project in **Armenia** provides a detailed analysis of Armenia's institutional as well as technical capacity to ensure the ESM of PCBs and other POP waste. UNIDO is assisting the country to develop and implement national legislation for the ESM of PCBs. Interim storage sites for PCB-containing waste, with the aim of minimizing the adverse effects of releases of PCBs on humans and the environment, are priority objectives for Armenia and UNIDO.

The UNIDO project in **Macedonia** aims to assist the country to comply with the PCB-related obligations under the Stockholm Convention and reduce releases of PCBs into the environment. Enhanced national capacity in the management of PCB-containing equipment and waste is being fostered through establishing an ESM system for the disposal of PCBs and PCB-containing equipment, including legislation and countrywide institutional and technical capacity-building.

In **Mongolia**, the project is enabling the ESM of targeted PCB-containing oil and equipment in fulfilment of Mongolia's commitments under the Stockholm Convention. The project developed regulatory infrastructure and strengthened national capacity to identify, monitor, manage and treat PCBs. In addition, the project is directly providing for the treatment of a minimum of 1,000 tons of PCBs.

The objective of the project in **Morocco** is to reduce the negative effects of PCBs to human health and the environment by establishing the in-country capacity to treat and dispose of 3,000 tons of PCB-contaminated oils and 2,000 tons of PCB-contaminated electrical equipment and related PCB wastes. The inception workshop took place in Rabat in March 2010.

In **India**, UNIDO's efforts present a unique feature where NIP development and a project to eliminate PCBs are being undertaken simultaneously. The project which was approved and will be launched shortly will complete the national inventory of PCBs, covering e.g. the power and ship-breaking sectors. The project will dispose of at least

(cont. on page 90...)

UNIDO leads the way in national PCB projects (cont. from page 89)

7,700 tonnes of PCBs and PCB-containing equipment and will create national capacity to manage and disposal of PCBs. The inception and technological vendors' workshops will take place in August 2010.

Other PCB projects in the pipeline will be implemented in **Peru**, **Nepal** and **Algeria**.

Non-combustion technologies do work

The objective of the Global Programme is to demonstrate the viability and removal of barriers that impede adoption and successful implementation of available non-combustion technologies for use in the destruction of POPs stockpiles and wastes, and more specifically, PCBs wastes in developing countries and countries with economies in transition. Currently, the programme involves Slovakia and Philippines for disposal of PCBs and China for the environmentally sound management of pesticides stockpiles and other POPs wastes. It is envisioned that certain African countries will also participate in the programme.

As the Stockholm Convention continues to expand its list of chemicals so is UNIDO prepared to continuously develop projects on industry-related chemicals management in order to respond to the need for crucial innovative treatment processes and safe disposal technologies. UNIDO remains highly committed to the implementation of the Convention by supporting green industry for sustainable industrial development as well as by capitalizing on opportunities for the transfer of clean technologies.

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UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

Welders influenced to stop using PCB contaminated oils in Sri Lanka

By Anuradha Prabhath Kumara Kananke Arachchilage

Bad habits of welders

Examination of the health conditions of welders

Background

From previous research, the Sri Lankan NGO People to People Volunteers had discovered that the majority of welding plants are contaminated with PCBs and most of the workers are not informed about related health hazards. Most policy makers were also not aware of the actual situation regarding PCB contamination and its effects.

PCBs were mainly imported into Sri Lanka before 1986 in transformers. Through illegal selling of transformer oil by workers to retailers and through transformer auctions, PCB- contaminated oil came to the open market where it is in high demand because of its lower price in relation to other recommended coolant oils. PCB-contaminated oils are used in particular in welding plants operating at grass root level throughout the country. Due to the lack of awareness among people about the health hazards of PCBs, the authorities have major difficulties in controlling the situation. As a result, workers in welding plants and the transformer repair sectors are acutely exposed to PCBs.

A Small Grants Project implemented by the People to People Volunteers NGO and funded by the Global Environment Facility is raising awareness about PCBs, its effects on human health and ways of minimizing the damage in two provinces in Sri Lanka.

Main activities

The project consists of three of activities:

1. **Awareness-raising campaign:** This is aimed at various stakeholders including local authorities, welders and school children. Two articles were published in local newspapers and the Internet and information was disseminated via the local radio channel. A society of welders was formed to address matters related to their occupation.
2. **Capacity-building of relevant institutions:** Policy makers and officers of local authorities were informed about PCBs and put in contact with policy makers working in environmental management. A forum provided information exchange between NGOs, local authorities, electricity boards, the environment authority, the ministry of environment and hazardous waste divisions. A POPs training module was translated into the local language for use in training programmes.
3. **Research:** Two research studies on PCB-contaminated coolant oil in welding plants and on health effects on welders have been carried out in cooperation with the Sri Jayawardhana University and the Colombo University.

Outcomes

Expected outcomes of the project are as follows:

- School children, teachers and parents become aware of the risks of PCBs;
- Welders handle welding plants with care and stop using old transformer oil;
- Officers and workers in transformer yards take steps to prevent illegal selling of transformer oil;
- Enhanced knowledge and experience in different organizations and communication among NGOs, government institutions and other international organizations;
- Availability of training tool POPs in the local language.

Research studies showed that the majority (54%) of welding plants were contaminated with PCBs and that 98% of workers do not use protective gear when refilling coolant oil. Containers used for transporting oil are usually reused and not disposed of. The possibility of exposure and self-contamination among welders and cross-contamination of families and the environment are high due to lack of knowledge on PCBs, poor personal hygiene practices and incorrect storage and disposal of the oil.

Problems encountered

There were difficulties in getting approval for awareness-raising programmes in educational and governmental institutions due to the current political situation as a result of the recent civil war.

The unavailability of PCB test kits in the country and the high cost of doing PCB analyses (GC analysis) caused a restriction in the number of oil samples available for testing.

Lessons learned

- Stakeholder meetings proved successful in obtaining support from responsible institutions.
- Analytical capacities for PCB are required.
- The awareness-raising programme should be replicated throughout country, in particular for welders.
- As a follow-up to the project, storage facilities are needed for contaminated oils prior to disposal.

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A step by step guide to inventories illustrated by the Republic of Moldova

By Valentin Arion, Valentin Pleşca, Ion Barbărasă, Cristina Gherman, Liudmila Marduhaeva

In September 2008 the inventory of PCBs in Moldova was launched under the Management and destruction of POPs stockpiles project, financed by the Global Environment Facility (GEF) through the World Bank.

Objectives of the inventory

The inventory aims at creating a database of electrical equipment in Moldova, which contain dielectric oils with PCB in concentrations higher than 50 parts per million (ppm) in a volume above 5 l.
The objectives of the inventory are:

1. identification of the holders of electrical equipment with dielectric oil mainly in the electricity sector;
2. sampling and laboratory analysis of dielectric oil;
3. informing the holders of electrical equipment with dielectric oil about the impact of PCBs and the necessity of the inventory;
4. establishing a database containing information on PCB equipment.

A Steering Committee, which was established in November 2008, includes representatives of the Ministry of Economy, the Ministry of Environment, electricity enterprises and consumers.

Inventory of PCBs in the electricity companies

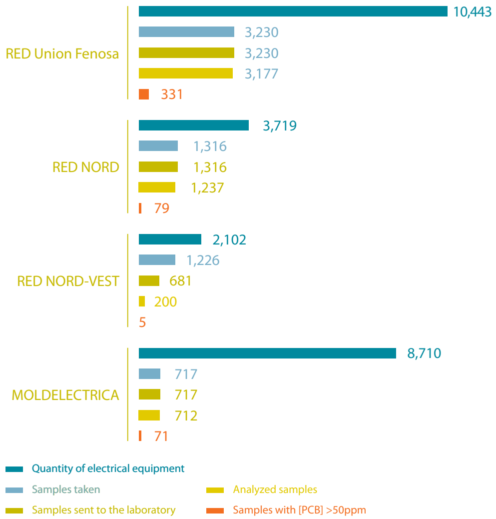
The inventory in the electricity sector covers four power production companies, one power transportation company and three power distribution companies.

By February 2009, inventory teams were created at each company, and were trained on the modality of sampling and supplied with the necessary equipment. A special inventory form containing information about the type of equipment, its owner, placement, etc., was completed for each sample.

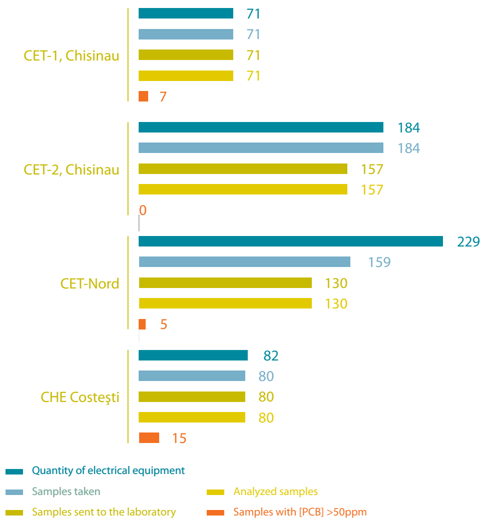
The samples are examined in two stages: At the first stage, all samples are screened with the help of the L2000DX Analyzer. To train personnel in the use of the L2000DX Analyzer and to ensure the quality of data, a training workshop took place with the participation of international experts. Three analytical centres were established at selected electricity companies. To quantify PCBs in positive samples, analysis by gas-chromatography was undertaken.

The inventory process is expected to be completed by the end of 2010. These activities were possible due to the financial support from the GEF, Canadian POPs Fund and the National Ecological Fund of Moldova. An amount of USD 550,000 were allocated for this process.

Inventory of PCBs - power distribution and transport sectors



Inventory of PCBs – power-generation sector



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The number of projects on PCBs currently being implemented through UNIDO in Armenia, China, Romania, Macedonia, Mongolia, Morocco, Philippines and Slovakia

Inventory of PCBs in other sectors with electrical equipment

Food processing, construction, light industry, telecommunication enterprises, water supply and treatment companies and public institutions represent the second major group of holders of potentially PCB-contaminated electrical equipment. The risk of exposure in these companies could be much higher than in the electricity sector, as these entities do not have trained maintenance or repair staff.

To identify holders and carry out the inventory, three trained consultants were equipped with all necessary tools and automobiles and accompanied by the territorial energy inspector during site visits. Samples are taken by the person responsible for the equipment under the supervision of the consultant, who fills in the inventory form, takes pictures and registers the GPS data of the equipment. The selected samples are analyzed by the laboratory of the Hydrometeorological Centre.

Inventory results from holders outside the electricity sector

Zone	Samples	Examined samples	Analyzed samples	Samples with > 50 ppm
North	730	688	377	12
Centre	545	353	339	14
South	589	251	233	18
Total	**1868**	**1292**	**949**	**44**

Inspected equipment are then labeled with red labels for contaminated equipment and green for PCB free units.

Based on the results of the inventory a data base will be established on the placement of the equipment containing PCBs or contaminated with PCBs.

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PCB Inventory in Romania

By Mihaela Ciobanu and Mihai Lesnic

PCB analysis

Interim storage room

The National Implementation Plan (NIP) under the Stockholm Convention for Romania identified PCBs as one of the top priorities requiring immediate attention and action. The PCB inventory carried out in 2004 under the NIP was based on the information obtained from the local environmental authorities. The results of the inventory were incomplete due to the fact that the data were not conveyed by all PCB owners on a voluntary basis, PCB concentration was not determined and the inventory only concerned waste electrical equipment, while equipment in use was not taken into account.

Therefore, in 2006 the Ministry of Environment and Forest obtained a grant by the Global Environment Facility (GEF) in form of a Medium Sized Project in order to consolidate ongoing and baseline activities of the government towards the implementation of its obligations for PCBs elimination. The project is running from 2007 to 2010 and is being executed by the National Research and Development Institute for Environment Protection (ICIM Bucharest) and the United Nations Industrial Development Organization (UNIDO).

The project was meant to demonstrate the implementation of locally viable and environmentally sound PCB control measures and their incorporation into a national policy framework. There is a well-recognized need to increase awareness and to train government officials and specialists from industries on criteria for environmentally sound management, including final disposal in the context of the Stockholm and Basel Conventions. Romania has little experience in the practical management of PCBs. Although several international and local companies have disposed of limited volumes of PCB containing equipment, there has been no government driven national or local management plans implemented. There are no specialized PCB treatment disposal facilities available in the country.

A new detailed PCB inventory was developed and a database of the PCB electrical equipments was set up. The new inventory was based on information collected by the existing Regional Environment Protection Agencies and conveyed to ICIM Bucharest. Transformers stockpiled or in operation have been inventoried by the owners according to the national regulations and standards. An oil sample for each inventoried transformer was tested in order to determine the PCB content, and the results were reflected on labels. PCB owners/operators report information regarding the PCB equipments collected, transported, temporarily stored and eliminated (incinerated, chemically decontaminated, or exported). The total number of transformers registered with the second inventory is 6,869. The total weight of the equipment measures is 85,076 tonnes, of which 23,392 tonnes are oil.

It should be emphasized that Romania was the first country in the world which benefited from GEF and UNIDO assistance for developing such a project on PCB management. Experiences were shared with colleagues from the Former Yugoslav Republic of Macedonia, which had started a similar project in their country.

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Upcoming Events

Upcoming Events in the Islamic Republic of Iran

The Basel Convention Regional Center in Tehran, a nominated Stockholm Convention Regional Center, is organizing a workshop on Environmentally Sound Management of wastes contaminated with PCBs in cooperation with Segal Industrial (training department of Rojan Industrial.) and Tredi. The workshop is scheduled to take place in **late September 2010**. Information regarding this workshop can be found on the website of the Regional Centre: **www.bcrc.ir**

Training workshops by the Secretariat of the Stockholm Convention

After workshops in Africa, Asia, Central and Eastern Europe and in Latin America, the two final regional workshops to train representatives from Governments and the private sector on the principles of Environmentally Sound Management of PCBs will take place as follows:

A workshop in **Kuwait** for the Arab-speaking countries will be held from **17 - 21 October 2010** in coordination with the Stockholm Convention Regional Center for capacity building and transfer of technology located in Kuwait.

A workshop for the Central American region will be hosted by the Centro de Investigación e Información de Medicamentos y Tóxicos - the **Stockholm Convention Regional Centre in Panama - in late 2010 or early 2011**.

For more information, please check our website: www.pops.int/pcbs

Facts or fiction?

Facts

1) **PCB emissions from open applications account for a significant amount of emissions to which humans are exposed. This is true. Approximately 21% of the global production of PCBs has been used in open applications. From this, it is possible that about half the emissions to which we are exposed come from past open applications of PCBs.**

2) **Due to the fire resistance of PCBs, there was a special interest in using PCBs in electrical equipment in hospitals, schools, mines and electrical generation stations as these locations posed a greater threat of fires from failure of electrical transformers. Fact!**

3) **Negative effects of PCBs were demonstrated in studies as early as in the 1950s. Toxicity tests on the effects of two PCBs in 1953 showed that more than 50% of the rats subjected to them died, and all of them showed damage to bodily functions. True! In the 1960s and 1970s, it was confirmed that PCBs was immunotoxic and could affect reproduction.**

4) **The production of PCBs occurred over the period 1929 – 1993. True! The first producers were Monsanto (USA), Bayer AG (West Germany) and Prodelec (France). The last production of PCBs was by the company Orgsintez in the former USSR (Russia). PCBs are no longer produced.**

Fiction

1) **A positive result when a sample of oil is screened for PCB content using a test kit provides proof that there are PCBs in high concentrations in the sample. This is false. Test kits (e.g. Chlor'n'oil) are only the first stage in determining PCB content as the kits only indicate if there is chlorine present in the sample. It does not verify if the chlorine found is due to PCBs. If the result is positive for chlorine content (i.e. greater than 50 ppm chlorine content), a chemical analysis must be undertaken in an approved laboratory to determine that the oil being tested actually contains PCBs and to obtain the actual concentration of the chemical.**

2) **Cross-contamination of PCB transformers is highly unlikely as transformers are closed applications and there is no risk of cross-contamination. This is not true! For instance, the oil in transformers needs to be drained from time to time to clean the dielectric fluid of water and other impurities. If the same containers are used to store and process contaminated oils along with clean oils from PCB free transformers, then cross contamination will occur and the clean oils will become contaminated with PCBs.**

3) **All Parties to the Stockholm Convention are obliged to dispose and destroy all PCB oils and contaminated equipment by 2028. Not true! Parties are obliged to make determined efforts designed to lead to environmentally sound waste management of PCBs liquid and contaminated equipment as soon as possible but no later than 2028.**

4) **Transformers that were labeled at the time of production to be PCB free definitely do not contain any PCBs and do not require screening. This is not true! Cross-contamination of oils in PCB free equipment after the production is quite likely during maintenance or due to the replacement of the PCB free oil with contaminated oil.**

5) **Oils contaminated with PCBs are very good to use as a skin cream or for frying food. False! There is no proof that oils contaminated with PCBs have properties to improve skin condition. Additionally, using PCB oil as a cooking oil increases the risk of negative chronic health effects from PCBs in the body.**

Transformers with PCB-contaminated mineral oil: myth or reality?

By Luciano A. Gonzalez

Although the quantification of PCB contaminated mineral oil in electrical transformers may seem simple, based on the limited information gathered and published in the National Implementation Plans already submitted by Parties to the Stockholm Convention, the number of transformers, particularly small distribution units, is so significantly high and their location in the electrical network so wide that unless there is a concerted effort to identify and properly handle them, most countries will not be able to meet their obligation by the targeted date of 2025 for cessation of use.

Unfortunately, the only way to identify PCB contaminated transformers is by carrying out sampling and analysis of the dielectric fluids. This task however, if completed for all transformers in any country's electrical network, would be extremely costly. In addition, as sampling of pole-mounted transformers cannot be carried out without opening the unit, the transformers must be disconnected to take the sample of the dielectric system. As opening up of the transformers would require interruption of the electrical supply, most companies are not prepared to face the discontent amongst the electrical users that would result from disruption of the power supply.

Usually, a small number of power transformers contain about one third of the oil in all electrical transformers. As power transformers are usually built with a sampling valve, sampling of the oil from these transformers can be carried out in energized transformers, without the need to interrupt the electrical supply.

Another important aspect to consider in this analysis is the issue of PCB-filled transformers. In general the number of PCB-filled transformers is relatively small compared to the whole population of transformers in any given country. The dielectric PCB fluid was a premium material, more expensive than mineral oil or other dielectric liquids. Because mainly of the price, the use of PCB transformers was restricted to locations where potential fires due to electrical transformer failures had to be avoided. This reasoning led to the use of PCB transformers in confined spaces such as underground electrical public transportation systems, hospitals, schools, mines and electrical generating stations.

In many countries, the electrical supply system is owned by different companies or agencies. Thus, different companies may own generating stations that supply their product to other companies owning the transmission lines. The transmission lines bring the power to transmission stations and from there to smaller substations from where the electricity is distributed to end-users. Such distribution network is also frequently owned and/or operated by different companies as well. Under such complex scenario, it is quite often a significant challenge to determine the actual inventory of PCBs in any given jurisdiction.

In order to estimate the potential number of PCB contaminated transformers one could use the installed electrical generating capacity. For example, a country with only 11,000 mega watts of electrical generating capacity, the total number of transformers would be in the order of 350,000 units.

The fundamental question is how many of the transformers are contaminated with PCBs above the threshold limit of 50 ppm as directed by the Stockholm Convention. The answer is that nobody knows and that there are several factors that affect this. These factors may be related to manufacturers and to transformer maintenance practices in the different utilities.

A study by Elizabethton Electric System (USA), prepared in 1998 and updated in 2006 on "Distribution Transformer Manufacturers and available Polychlorinated Biphenyl (PCB) Information" provides statistical results linking PCB contamination to transformation manufacturers. Their study shows that although transformers from some manufacturers did not have any PCBs, the incidence rate for others was in the order of 25 to 32%. Unfortunately, although these studies could give a good indication of contamination for suppliers of transformers in a given country, they cannot be used for PCB equipment.

In a separate study carried out by Sapertein et al., the authors found about 3.3% of all transformers were contaminated with PCBs above the 50 ppm limit. Data from the Canadian PCB inventory published in 1989 suggested that in addition to the 6 million litres of PCB contaminated mineral oil already treated, Canada has about 40 million litres of PCB contaminated oil above 50 ppm, contained in 300,000 to 350,000 transformers.

Maintenance practices in power transformers require that the dielectric fluid is to be cleaned from time to time to remove water and other impurities accumulated in the transformers. If the same machines are used to clean PCB contaminated oil and PCB-free oil, cross contamination of the clean oil would occur causing the clean transformer also to become PCB contaminated. PCB contaminated mineral oil, stored in bulk storage tanks could have been also used to re-fill failed pole mounted transformers that have been taken to machine shops for repairs thereby cross contaminating the original PCB-free transformers.

PCB inventory data from Ontario Hydro in the early 1980's shows that the company had about 1000 metric tons of high level PCB liquid (Askarel) and near 10,000 metric tons of PCB contaminated mineral oil distributed in a large number of transformers. The significant inventory of PCB contaminated mineral oil led this company to develop its own dechlorination system for PCB contaminated mineral oil.

Preliminary studies carried out in Mongolia for the preparation of their National Implementation Plan indicated that about 7.5% of their mineral oil transformers were contaminated with PCBs above the 50 ppm level.

Based on the limited data available, it is not possible to draw conclusions about the number of mineral oil transformers contaminated with PCBs over the 50 ppm level and the cause of the PCB contamination. The fact is that a large number of transformers filled with mineral oil containing PCBs above the 50 ppm were found in electrical companies with good maintenance practices and that many pole-mounted transformers without maintenance and still with the original dielectric fluid may suggest that these transformers were contaminated at the original manufacturer's site.

It is also known however that the lack of awareness of the PCB problem prevented many companies to take precautions to avoid further cross contamination.

It is expected that in developing countries or countries with economies in transition, the PCB contaminated mineral oil filled transformers would be a significant problem and that in order to facilitate these countries to fulfill their obligations under the Stockholm Convention to achieve environmentally sound waste management of PCBs by year 2028, assistance for transferring technologies to properly decontaminate and reclaim the mineral oil may be more suitable than just providing support to export their PCB wastes for destruction.

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The new CENELEC Standard CLC50503 on PCBs: PCBs Inventory

By Massimo Pompili and Vander Tumiatti

On February 2010 the new CENELEC Technical Report (CLC50503) "Guidelines for the inventory control, management, decontamination and/or disposal of electrical equipment and insulating liquids containing PCBs" was published.

CENELEC, the "European Committee for Electrotechnical Standardization" is a non-profit technical organization set up under Belgian law and is currently composed of the National Electrotechnical Committees of 31 European Countries.

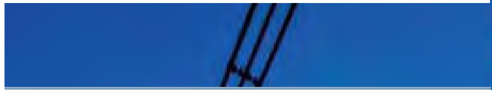
The scope of the CENELEC Technical Report (CLC50503) is to provide guidance for the activities of inventory, control, management, decontamination and/or disposal of equipment and containers with insulating liquid containing PCBs, in compliance with the Council Directives (96/59/EC), using Best Available Techniques - BAT - (96/61/EC), Commission Decision (2001/68/EC), Stockholm Convention on Persistent Organic Pollutants (POPs) and with appropriate national or local legislation.

This Technical Report is addressed, in particular, toward the Life Cycle Management (LCM) of insulating liquids and it has been developed in accordance with the following objectives:

1. reduction of risks for workers, public health and the environment, arising from human error, malfunction, or failures of the equipment that could cause fires or spillage of hazardous and Persistent Organic Pollutants (POPs);
2. implementation of the "Best Available Techniques" (BAT), "Best Environmental Practices" (BEP) and methodologies available for safety, whilst taking into account the surroundings and the criteria of self-sufficiency and functional recovery;
3. technical feasibility of the activities within the prescribed time schedules, taking into account current legislation and economic feasibility.

To date, reliable PCBs inventories are still not available in most countries. Reasons for lack of knowledge are:

1. There are no official numbers on the total quantity of PCBs (as elementary liquids or commercial mixtures) introduced in the market;
2. There is no direct correlation between this unknown amount of PCBs and liquids and equipment actually contaminated by PCBs, especially where there is potential for cross-contamination;
3. According to the current legislation, commercial mixtures of PCBs are banned from sale;
4. Furthermore, the Council Directive 96/59 also considers any equipment containing PCBs or having contained PCBs (e.g. transformers, resistors, inductors, reactors, switches, capacitors receptacles containing residual stock, etc.) which has not been decontaminated.



	Family of substances	Symbols synonyms and commercial mixtures
1	Polychlorinated biphenyls	Askarels, Aroclor (1232 -1242 – 1254 – 1260 - 1268), Apirolio, Clophen, Pyralene, etc.
2	Polychlorinated terphenyls	PCT Aroclor (5442 – 5460 – 5060)
3	Monomethyl-tetrachlorodiphenyl methane, Monomethyl-dichloro-diphenyl methane, Monomethyl-dibromo-diphenyl methane	Polychlorinated benzyltoluenes PCBT Ugilec 141, T4
4	Any mixture containing any of the above mentioned substances in a total of more than 0,005 % by weight	Mineral insulating oils Synthetic insulating liquids such as silicones, alkylbenzenes, etc.

__Note:__ Directive 96/59/EC expresses the limit concentration as a percentage by weight, whereas technical standards and common use utilise units of measure such as mg/kg or parts per million (ppm). To clarify, the conversion ratios are listed here below:
• 0,005 % by weight corresponds to 50 mg/kg, or 50 parts per million (ppm);
• 0,05 % by weight corresponds to 500 mg/kg, or 500 parts per million (ppm).
In this standard, concentrations are always expressed in mg/kg.



Power transformer

The PCB family

The CENELEC Technical Report 50503 provides guidance on inventories of PCBs, including the criteria for establishing insulating liquid in equipment that is considered PCB free. Strict control should be undertaken to avoid accidental spills and a representative sampling of the insulating liquid must be acquired according to IEC 60475. It is recommended that only qualified personnel perform the sampling. Also the use of disposable materials is recommended to prevent the possibility of cross-contamination. Together with the sampling operations, a visual inspection should be undertaken to evaluate possible spills from the equipment, the quantity, if any and the relevant counter-measures to be taken to ensure the protection of the environment.

The report also gives important information for analytical determination of PCBs (to ensure equal level of precision and in accordance with the Commission Decision 2001/68/EC) and provides the following reference for methods:

- IEC/EN 61619 in insulating liquids;
- EN 12766-1, EN 12766-2 and subsequently upgraded versions (EN 12766-3) for petroleum products and used oils.

Also the report clarifies that the results obtained from a gas-chromatographic method using a packed column prior to the implementation of EN 61619 (April 1997), are to be considered valid for the purposes of the inventory. Test reports relative to the results from these analyses on PCB concentrations should confirm the validity of the method used and the quality of the laboratories that carried out the analyses (EN ISO/IEC 17025, EN ISO 9001). Uncertainty should be indicated in the test report. The CENELEC report also provides an example of a PCB test report form.

In the CENELEC Standard, it is emphasised that PCBs as well as PCDDs and PCDFs are Persistent Organic Pollutants (POPs) that are regulated by the Stockholm Convention. The comparative evaluation of risks associated with PCDDs and PCDFs and the various commercial mixtures of PCBs should be carried out as a function of the relevant equivalent toxicities (TEF with respect to 2,3,7,8-TCDD) as recommended by the World Health Organisation (WHO).

In fact the CENELEC TR 50503 has introduced the principle that the need for an inventory and for decontamination and recovery of contaminated material associated with environmental spills and emissions of PCBs should be based upon criteria satisfying the regulations adopted at national and international levels. This is to avoid unreasonable costs that may arise from correcting low risk emissions and spills.

The management of equipment and insulating liquids containing PCBs, and the relevant operating procedures should be developed as far as possible in compliance with the criteria of Life Cycle Management (LCM) which is in the process of being adopted at the European level for electric and electronic equipment and the evaluation criteria of risk adopted at international level (ISO/IEC Guide 73).

Representative Sampling

Preparation Sample PCBs Analysis

Diagnosis Sampling Kit

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The Aroclor my Friend is Blowin' in the Wind

Open Uses of PCBs

(With apologies to Bob Dylan)

By IPEN

Most of us have accepted the conventional wisdom that our principal exposure to PCBs comes from our diet and associated PCBs, mainly with electrical transformers and switchgear. Consequently, far more effort and resources have been put into addressing these stockpiles than any other usage of PCBs. It is likely to be the case, however, that at least half the emissions to which we are exposed come from approximately 21% of the global production of PCBs that has been used in 'open' applications. Furthermore the evidence is mounting that homes, schools and kindergartens may be responsible for the majority of the exposure sources for children and some construction workers. Failure to urgently address this contamination will leave a damaging legacy for future generations.

Open uses of PCBs have included additions to sealants, caulk, plasticisers, paints, carbonless copy paper, lubricating oils, inks, laminating and impregnating agents, adhesives, waxes, additives in cement and plaster, casting agents, dedusting agents, sealing liquids, fire retardants in insulation, immersion oils and pesticide extenders. Many of these uses have resulted in contamination of buildings. Other nominally 'closed' but often overlooked uses which can also affect buildings include fluorescent light ballasts, power factor correction on small inductive electrical loads and commercial cooking devices. The levels of PCBs in these uses can be high:

The possible risks associated with releases from these uses have been quietly recognised for many years even with the manufacturer of Aroclor, one of the more prominent brands of commercial PCBs.

This company took steps to stop production of PCBs for these uses in the early 1970s but it was already too late and widespread contamination had been caused. The consequences include the recognition of the importance of urban areas as sources of PCBs to the atmosphere

Many houses and, especially, public buildings constructed with PCB containing materials during the period from 1950–1970s still exist. It is estimated that in the Federal Republic of Germany alone, about 20,000 tons of PCBs were used in the construction of kindergartens, schools, universities, office-buildings and hospitals thus representing an extended source of exposure.

Usage has also varied in different countries. In Germany, PCB-containing sealants were used more often in indoor seams whilst in Finland PCBs were mainly used in outdoor seams between concrete blocks.

Only a few of the countries affected, including Sweden, Switzerland and Norway appear to have taken the issue seriously enough to recognize in their National Implementation Plans and to initiate action to address the problems.

Highest levels of PCBs reported for various open uses.

Material	Bulk Sample (mg/kg or ppm)	Material	Bulk Sample (mg/kg or ppm)
Adhesive tape	1,400	Foam rubber parts	1,092
Carbonless Copy Paper	6,000	Grout	9,100
Caulking	310,000	Insulating materials in electric cable	280,000
Ceiling tiles	53	Plastics/plasticisers	13,000
Cloth/paper insulating material	12,000	Ventilation system cork gasket material	6,400
Coal-tar enamel coatings	1,264	Roofing/siding material	22,000
Dried paint	97,000	Rubber parts	84,000
Fiberglass insulation	39,158	Thermal insulation	73,000
Foam rubber insulation	13,100	Wool felt gaskets	688,498

Source: *Use Authorization for and Distribution in Commerce of Non-Liquid Polychlorinated Biphenyls. US Federal Register, 1999*

The Swiss National Implementation Plan says:

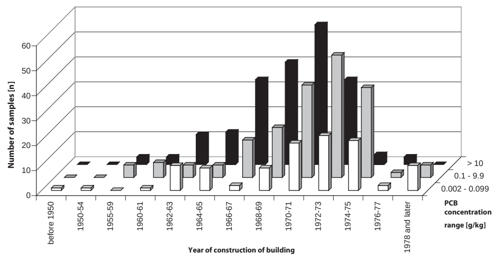
"Joint sealants represent long-term diffuse sources for PCBs. The PCB inventory present in these materials is large enough to sustain elevated levels of PCB in indoor air for a very long period of time.

Joint sealants in concrete buildings erected between 1955 and 1975 and anti-corrosive coatings in large steel constructions (e. g. bridges, storage tanks, masts of high volume transmission lines) represent major inventories of PCBs in open systems. Removal and appropriate disposal of old joint sealants, coatings and paints from construction materials is crucial to prevent significant amounts of PCB being released into the environment and, eventually, incorporated in biota along the food chain."

For Switzerland, therefore, the quantity of PCBs in sealants is much higher than in transformers - estimated as being less than ten tonnes.

An older Swiss survey shows that joint sealants containing more than 0.1 g/kg PCB are most likely to be encountered in buildings erected between 1966 and 1973. The concentrations in sealants can be much higher than this and levels of >300 g/kg have been reported.

PCB concentrations in sealants in Switzerland



Source: *Zennegg, M., et al., Joint sealants, an overlooked diffuse source of polychlorinated biphenyls (PCB) - results of a nationwide study in Switzerland, 2004*

In Finland one-third of all joint sealants investigated contained more than 10 g/kg of PCB. More recently, a study estimated that 14% of all buildings, constructed between 1945 and 1980 in Toronto, Canada contained PCB sealants. This translates into a best estimate of 13 tonnes (high estimate 231 tonnes) of PCBs potentially remaining in sealants. The congener profiles are consistent with depletion of more volatile congeners and enrichment of less volatile congeners and this supports temperature-dependent volatilisation as a loss mechanism. Furthermore it confirms the likely importance of air and dust in urban areas as exposure pathways for PCBs.

Concentrations of PCBs in sealants

Location	Material and age	Concentration of PCBs	Source of data	Reference
Toronto, Canada	Buildings constructed from 1945 to 1980	570-82,090 mg/kg	Measured in currently in-use sealants	This study
Southern Sweden	Caulking manufactured from 1965 to 1973	Sealant is 200,000 mg/kg	Not measured, concentrations based on landfill records	Persson et al. (2005)
Boston, USA	Buildings constructed or renovated in 1970s	0.56-32,600 mg/kg	Measured in currently in-use sealants	Herrick et al. (2004)
Switzerland	Buildings constructed from 1950 to 1978	20-550,000 mg/kg	Measured in currently in-use sealants	Kohler et al. (2005)
Finland	Sealant manufactured form 1960 to 1975	50,000 mg/kg to 300,000 mg/kg	Not measured, concentrations based on industry information	Priha et al. (2005)
Stockholm, Sweden	Sealants, age unknown	80,000 mg/kg to 160,000 mg/kg	Not measured, concentrations based on industry information	Astebro et al. (2000)
Sweden	Building sealants, 1969	47,000 mg/kg to 81,000 mg/kg	Measured in sealants removed from building	Sundahl et al. (1999)

Source: *Robson, M., et al., Continuing sources of PCBs: The significance of building sealants*

The Swedish National Implementation Plan says:

"Another important use is as a plasticizer in sealants used for joints in buildings: between prefabricated concrete cladding panels, in dilatation joints for large brick façades, around retail store fronts and around windows. Insulating glazing has been sealed with a sealant plasticized with PCBs. These sealants were mainly manufactured under licence in Sweden. The use of PCBs as hydraulic and heat transfer fluids was discontinued in the early 1970s, following the denial of permits. PCBs have also been used in paints for ships and corrosive environments. An application in the food industry was as a plasticizer in an acrylic, non-skid flooring material." Legislation has recently been introduced requiring surveys and removal of these sealants and non-slip flooring materials.

(cont. on page 102...)

(...cont. from page 101)

Norway has undertaken an inventory of PCBs in building materials and it has been calculated that around 85 tonnes, or approximately 18% of existing PCB, is present in plaster in Norwegian buildings. Other sources of PCB calculated include, glue in double-glazing (200 t), condensators (sic) (105 t), joint sealants (50 t) and paint (10 t). The consequence is that plaster regularly exceeds the threshold for hazardous waste as do some entire homes, schools and office buildings built in the period 1960-69.

Many sealants have been used internally together with PCB contaminated non-skid flooring and even floor polishes containing PCBs. Evaporation and abrasion of PCBs can result in considerable house dust and indoor air contamination, leading to the increased PCB body burden of residents and occupants, probably through inhalation or ingestion exposure.

Results of a US population-based case-control study that examined non-Hodgkin lymphoma (NHL) risk and exposure to PCBs in carpet dust as an exposure indicator suggest an increased risk of NHL associated with exposure to PCBs, with evidence of greater effects for PCB 180.

While inhalation is the principal indoor pathway under a typical dust ingestion scenario, exposure via dust ingestion can exceed that from either inhalation or diet for some North American toddlers.

Occupational exposure of construction workers is a major concern as removal of sealants/caulking generally includes cutting the material from the masonry joints or around window perimeters by hand, using fixed razor knifes, electric saws, or electric caulking cutters. Once the bulk caulking is removed, a high speed grinder with a diamond wheel or abrasive disk is used to grind away any caulking left on the surface. Grinding is performed to ensure adhesion of the replacement caulking materials. Unless workers are specifically trained and aware of the PCB issues, as in Scandinavian countries, they rarely use protective equipment.

Inventory:

The wide range of open uses of PCBs has important consequences for inventory and without careful assessment it is easy to inadvertently expose workers or building occupants to hazards. Building wastes also need careful disposal – open burning of wastes on construction and demolition sites is still common in some countries and this can cause serious pollution when PCBs are present in the waste. It is also likely that without appropriate care PCB contaminated material will be disposed of in construction waste landfills or be mixed with rubble which may then be used for farm roads and similar purposes.

Initial inventory and rapid screening of joint sealants and many materials containing PCBs can be carried out using wavelength dispersive x-ray fluorescence spectrometry (WD-XRF) and it is recommended that this technique should be standard practice when PCBs may be present. Positive samples then need to be verified by conventional GC/MS or GC/ECD methods.

International POPs Elimination Network - Dioxin, PCBs and Waste Working Group Email: ipen@ipen.org

BASEL CONVENTION

Guidelines and Training material on handling PCB waste ready for use

By Matthias Kern

The Basel Convention concerns the environmentally sound management, transboundary movement and disposal of hazardous wastes that may consist of, contain or be contaminated with the POPs listed under the Stockholm Convention including PCBs.

Both the Basel and Stockholm Conventions do agree to cooperate on:

- Establishing levels of destruction and irreversible transformation necessary to ensure that POPs characteristics are not exhibited. To achieve this, the term "low POP content" was established to determine the related values for the highest concentration of each POP that would be acceptable in residues after destruction of POPs waste had been undertaken;
- Determining what methods should constitute environmentally sound disposal;
- Establishing the concentration levels of the POPs chemicals listed in the Stockholm Convention in order to define the low POPs content in residues where destruction or irreversible transformation is considered to be achieved.

Under the Basel Convention, several technical guidelines have been developed which are relevant to the environmentally sound management of PCBs and which are available in all six UN languages on the website of the Basel Convention (http://www.basel.int/meetings/sbc/workdoc/techdocs.html, see under Technical Guidelines):

- Updated general technical guidelines for the environmentally sound management of wastes consisting of, containing or contaminated with persistent organic pollutants (POPs);
- Technical guidelines for the environmentally sound management of wastes consisting of, containing or contaminated with polychlorinated biphenyls (PCBs), polychlorinated terphenyls (PCTs) or polybrominated biphenyls (PBBs);
- Technical guidelines on the environmentally sound management of wastes containing or contaminated with unintentionally produced polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), hexachlorobenzene (HCB) or polychlorinated biphenyls (PCBs).

A general Training Manual for the Preparation of a National Environmentally Sound Management Plan for PCBs and PCB-contaminated Equipment in the Framework of the Implementation of the Basel Convention is available in English, French and Spanish.

In addition, a detailed training manual for hazardous waste project managers on Destruction and Decontamination Technologies for PCBs and Other POPs Wastes has been developed in the English language. The detailed Training Manual is structured as follows:

Volume A:

- Basic principles and background
- Project strategies
- Technology selection process

Volume B:

- Implementation Process

Volume C:

- Technology assessment principles
- Decision support system
- Technology selection
- Technology specification and data sheets

Volume C Annexes:

- Detailed description of technologies

All Training Manuals are available for downloading from the Basel Convention website (http://www.basel.int/meetings/sbc/workdoc/techdocs.html, see under Training Manuals). The Secretariat of the Basel Convention is currently organizing an update of the annexes to volume C with the detailed description of destruction and decontamination technologies for PCBs and other POPs wastes. It is planned to have the updates available on the Basel Convention website in the course of this year.

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Agencies that carry out implementation of GEF projects. These include the African Development Bank, the Asian Development Bank, the European Bank for Reconstruction and Development, the Food and Agriculture Organization of the United Nations, the Inter-American Development Bank, the International Fund for Agriculture Development, the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP), the United Nations Industrial Development Organization (UNIDO) and the World Bank

Membership in the PEN

Welcome to the PEN!

All stakeholders relevant to the management of PCBs are welcome to apply to become members of the PCBs Elimination Network by filling in the application form and sending it to the PEN Secretary at **pen@pops.int**.

Membership
in the PEN is open to the following groups:

- Governments
- PCBs related service industry
- Holders of PCBs
- Intergovernmental Organizations (IGOs)
- Donor organizations
- International experts
- Nongovernmental Organizations (NGOs)
- Research institutions / academia

PEN members enjoy the following benefits:

- Information exchange over a dedicated page on the Stockholm Convention website;
- Access to a wide range of PCB-related experts and expertise available through Network members;
- Network members are supported toward the ESM of PCB oils and contaminated equipment;
- Rewards and distinctions for members carrying out ESM activities;
- Network members can participate in Thematic Groups and gain from extended linkages.

PCBs Elimination Network (**PEN**) 2028

Application form for membership

1. Personal information

I wish to register as an: ☐ Institution ☐ Individual person			
Institution:			
First Name:		Title:	
Family Name:			
Job title:			
Mailing address:			
Postal code:		City:	
Country:			
Tel. number:	*(please include international code)*		
Mobile number:	*(please include international code)*		
Fax number:			
E-mail address:			

2. Additional information

Please specify to which category of stakeholders you belong (please choose only one category):

☐ Government (ministries, governmental agencies, environmental inspectorates, etc.)	☐ Intergovernmental Organization
☐ PCBs related service industry (entities offering maintenance, treatment or destruction of PCBs)	☐ Donor organization
☐ Holder of PCBs (private or state enterprises holding contaminated equipment or oils)	☐ Non-governmental organization
☐ International expert (private or state enterprises holding contaminated equipment or oils)	☐ Research institution / academia

In the field below, please briefly describe your involvement with PCBs:

I am interested in the following areas pertaining to PCBs (multiple checks possible):

☐ Inventory of PCBs	☐ Disposal of PCBs
☐ Destruction technologies	☐ Maintenance of PCBs equipment
☐ Storage of PCBs equipment	☐ Illegal use of PCBs
☐ Transboundary movement	☐ PCBs in open applications
☐ Other:	

3. Declaration

I hereby declare that I will make determined effort toward achieving environmentally sound management (ESM) of PCBs. I accept that all information provided can be shared publicly.

Date:

Signature:

Please e-mail, fax or mail the completed form to:

Secretary of the PEN | Secretariat of the Stockholm Convention
11-13, chemin des Anémones | CH-1219 Chatelaine
Geneva, Switzerland
Tel: +41 22 917 8191 | Fax: +41 22 917 80 98
pen@pops.int | www.pops.int/pen

Excerpt of part II of Annex A of the Stockholm Convention on Persistent Organic Pollutants:

Polychlorinated biphenyls

Each Party shall:

(a) With regard to the elimination of the use of polychlorinated biphenyls in equipment (e.g. transformers, capacitors or other receptacles containing liquid stocks) by 2025, subject to review by the Conference of the Parties, take action in accordance with the following priorities:

(i) Make determined efforts to identify, label and remove from use equipment containing greater than 10 per cent polychlorinated biphenyls and volumes greater than 5 litres;

(ii) Make determined efforts to identify, label and remove from use equipment containing greater than 0.05 per cent polychlorinated biphenyls and volumes greater than 5 litres;

(iii) Endeavour to identify and remove from use equipment containing greater than 0.005 percent polychlorinated biphenyls and volumes greater than 0.05 litres;

(b) Consistent with the priorities in subparagraph (a), promote the following measures to reduce exposures and risk to control the use of polychlorinated biphenyls:

(i) Use only in intact and non-leaking equipment and only in areas where the risk from environmental release can be minimised and quickly remedied;

(ii) Not use in equipment in areas associated with the production or processing of food or feed;

(iii) When used in populated areas, including schools and hospitals, all reasonable measures to protect from electrical failure which could result in a fire, and regular inspection of equipment for leaks;

(c) Notwithstanding paragraph 2 of Article 3, ensure that equipment containing polychlorinated biphenyls, as described in subparagraph (a), shall not be exported or imported except for the purpose of environmentally sound waste management;

(d) Except for maintenance and servicing operations, not allow recovery for the purpose of reuse in other equipment of liquids with polychlorinated biphenyls content above 0.005 per cent;

(e) Make determined efforts designed to lead to environmentally sound waste management of liquids containing polychlorinated biphenyls and equipment contaminated with polychlorinated biphenyls having a polychlorinated biphenyls content above 0.005 per cent, in accordance with paragraph 1 of Article 6, as soon as possible but no later than 2028, subject to review by the Conference of the Parties;

(f) In lieu of note (ii) in Part I of this Annex, endeavour to identify other articles containing more than 0.005 per cent polychlorinated biphenyls (e.g. cable-sheaths, cured caulk and painted objects) and manage them in accordance with paragraph 1 of Article 6; (g) Provide a report every five years on progress in eliminating polychlorinated biphenyls and submit it to the Conference of the Parties pursuant to Article 15;

(g) The reports described in subparagraph (g) shall, as appropriate, be considered by the Conference of the Parties in its reviews relating to polychlorinated biphenyls. The Conference of the Parties shall review progress towards elimination of polychlorinated biphenyls at five year intervals or other period, as appropriate, taking into account such reports.

www.pops.int/pen

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