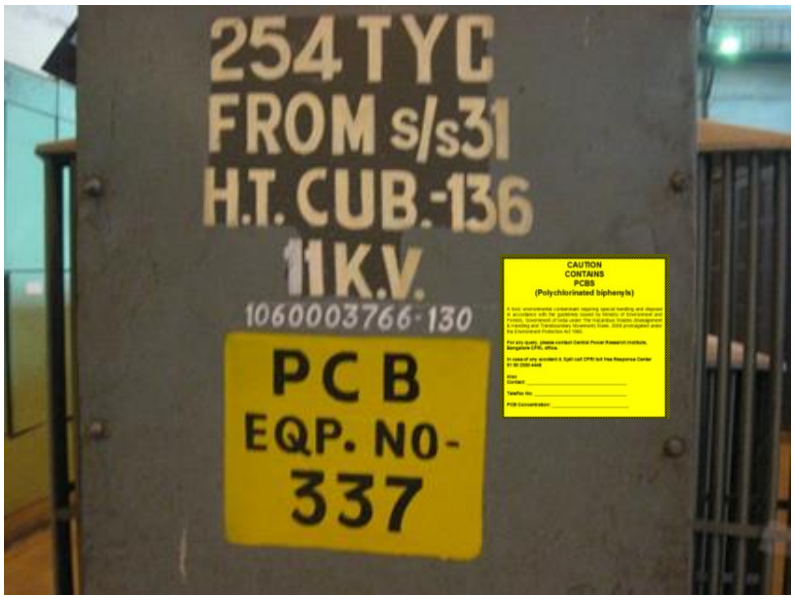
2015

Guidelines for PCBs Waste Identification, Tracking and Record Keeping



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1. FOREWORDS

The main purpose of this document is to provide practical indications for the identification and labeling of electrical equipment containing PCBs in India. This activity is a part of the UNIDO/GEF funded project "Environmentally Sound Management and Final Disposal of PCBs in India"

The results and lessons learned during the first round of PCBs inventory in India, carried out under the project "Development of National Implementation Plan (NIP) in India as a First Step to Implement the Stockholm Convention on Persistent Organic Pollutants (POPs)", have been taken into consideration.

The purpose of this document is:

- To provide practical guidance to relevant Indian stakeholders and authorities to extend the PCBs inventory by conducting further questionnaire survey and to adopt a more formalized approach
- To propose a simple and effective system for labeling, tracking and record keeping of PCB-contaminated equipment
- To upgrade the inventory with those equipment and industrial sectors that was not taken into account in the first PCBs inventory.

2. INTERNATIONAL CONVENTIONS ON POPS AND HAZARDOUS WASTES

2.1. STOCKHOLM CONVENTION

India is a party to the Stockholm Convention on Persistent Organic Pollutants (POPs).

In the Stockholm Convention, Annex C (Unintentional Production),

Part IV (Definitions) defines Polychlorinated Biphenyls as:

"Polychlorinated biphenyls" means aromatic compounds formed in such a manner that the hydrogen atoms on the biphenyl molecule (two benzene rings bonded together by a single carbon-carbon bond) may be replaced by up to ten chlorine atoms".

Part II in Annex A (Elimination) of this Convention specifies

The measures to be taken to eliminate the use of PCBs in equipment (e.g., transformers, capacitors or other receptacles containing liquid stock) by 2025 and to reduce exposures and risk to control the use of PCBs.

2.2. BASEL CONVENTION

India is a Party to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal.

The overarching objective of this Convention is to protect human health and the environment against the adverse effects of hazardous wastes. Its scope of application covers a wide range of wastes defined as "hazardous wastes" based on their origin and/or composition and their characteristics (Article 1 and Annexures I, III, VIII and IX), as well as two types of wastes defined under "other wastes" (household waste and incinerator ash; Article 1 and Annexure II).

The provisions of the Convention center around the following principal aims:

- the reduction of hazardous waste generation and the promotion of environmentally sound management of hazardous wastes, wherever the place of disposal;
- the restriction of transboundary movements of hazardous wastes except where it is perceived to be in accordance with the principles of environmentally sound management; and
- a regulatory system applying to cases where transboundary movements are permissible.

Annex I of the Convention summarizes the Categories of Waste to be controlled.

List A1 and A3 in the Annex VIII of the Convention lists the Metal and Metal-Bearing Wastes and the Wastes Containing Principally Organic Constituents which may contain Metals and Inorganic Materials respectively, and A1180 and A3180 describes the one applicable to PCBs, PCTs or PBBs.

2.3. GLOBALLY HARMONIZED SYSTEM OF CLASSIFICATION AND LABELLING OF CHEMICALS (GHS)

The Globally Harmonized System of Classification and Labeling of Chemicals (GHS) is a logical and comprehensive approach to define health, physical and environmental

hazards of chemicals; creating classification processes that use available data on chemicals for comparison with the defined hazard criteria; and communicating hazard information as well as protective measures on Labels and Safety Data Sheets.

The Ministry of Environment and Forests, Government of India has published the Hazardous Substance (Classification, Packaging and Labeling) Rules, 2011 (draft) to keep in-line with the GHS rules.

3. INDIAN LEGISLATION ON POPS AND HAZARDOUS WASTES

The Indian Legislation on POPs and Hazardous Waste is drafted by the Government of India in the Ministry of Environment and Forest in the Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008.

Procedure for the Handling Hazardous Wastes is covered in Chapter II while the Import and Export of Hazardous Wastes is established under Chapter IV and Chapter VI deals with Packaging, Labeling and Transport of Hazardous Waste.

The Hazardous Waste Rules, 2008 requires that *the hazardous waste are packaged and labeled, based on the composition in a manner suitable for safe handling, storage and transport as per the guidelines issued by the Central Pollution Control Board from time to time* (Chapter VI, Article 19).

For the movement of hazardous waste within the country, the hazardous waste is subjected to the Manifest System (Chapter VI, Article 21).

Under Schedule VI, rule 13(4) of the Hazardous Waste Rules, 2008, for Hazardous Wastes Prohibited for Import and Export, *the import and export of Waste, Substances and articles containing, consisting of or contaminated with polychlorinated biphenyls (PCB) and/or polychlorinated terphenyls (PCT) and/or polychlorinated naphthalenes (PCN) and/or polybrominated biphenyls (PBB) or any other polybrominated analogues of these compounds is prohibited.*

4. GUIDELINES ON IDENTIFICATION OF PCBS CONTAINING EQUIPMENT AND WASTES

The fundamental literature reference documents considered for the guidelines on identification of PCBs containing equipment and wastes are:

- UNEP, Guidelines for the identification of PCBs and materials containing PCBs, 1999
- UNEP, Inventory of PCB-Containing Equipment, 2002
- James Willis, PCB Inventories: Approaches to Compiling Inventories of PCBs, PCB-Containing Equipment. Proceedings of the Sub regional Workshop on Identification and Management of PCBs and Dioxins/Furans, La Habana, Cuba, April 23-26, 2001

4.1. THE PCBS INVENTORY IN INDIA

For planning the extension and updation of the inventory, the geographic area of country was divided into five regions: North, South, East, West and Central.

A list of addresses of various utilities and energy intensive industries covering different sectors like steel, cement, fertilizer, paper etc., was compiled and a total of 1800 letters and inventory forms were sent to them throughout the country. And around 1500 responses were received.

Based on the Inventory areas, the list of industries where PCBs were found are reported in Table 1

Table 1: Based on Inventory Areas, the Industries where PCBs were found

Inventory areas	**Industries where PCBs were found**
North: Jammu and Kashmir, Punjab, Haryana, Uttar Pradesh, Jharkhand	Uttar Pradesh: Panki Thermal Power Station; Paricha Thermal Power Station; Harduaganj Thermal Power station; Hindalco Ind. Ltd;
	Haryana: Heidelberg Cement Power House
	Uttarakhand: Uttarakhand Jal Vidyut Nigam Ltd
West: Rajasthan, Gujarat, Maharashtra	Gujarat: Digvijay Cement ltd; IFFCO Kalol unit; Ultratech Cement
	Maharashtra: Nashik Thermal Power Station; Nuclear Power Corporation of India Ltd; Mahatransco; Pudumjee Pulp & Paper mills ltd
Central: Andhra Pradesh, Madhya Pradesh, Chhattisgarh	Andhra Pradesh: Kesoram Cements; Hindustan Petroleum Corporation; APGENCO, Nuclear Fuel Complex

Table 1: Based on Inventory Areas, the Industries where PCBs were found	
Inventory areas	**Industries where PCBs were found**
	Bhilai and Bokaro (SAIL) steel plant, TATA Steel, Jamshedpur
East: Orissa, Bihar, West Bengal and North Eastern States	Assam: Nagaon Paper Mill and Cachar Paper mill of Hindustan Paper Corporation
South: Karnataka, Tamil Nadu, Andhra Pradesh and Kerala.	Tamil Nadu: Ennore Thermal Power Station; Neyveli Lignite Corporation, Neyveli; Tamil Nadu Electricity Board;
	Kerala: Kerala State Electricity Board

Based on the Industrial sector, the list of industries where PCBs were found are reported in Table 2.

Table 2: Based on Industrial Sector, the Industries where PCBs were found.	
Industrial sector	**Industries where PCBs were found**
Electric Power	Uttar Pradesh: Panki Thermal Power Station; Paricha Thermal Power Station; Harduaganj Thermal Power station; Hindalco Thermal Power Station Uttarakhand: Uttarakhand Jal Vidyut Nigam Ltd Maharashtra: Nashik Thermal Power Station; Mahatransco; Andhra Pradesh: APGENCO; Tamil Nadu: Ennore Thermal Power station; Tamilnadu electricity board; Kerala: Kerala State Electricity Board.
Paper Mills	Andhra Pradesh: Andhra Paper Mills, Rajahmundry. Assam: Nagaon Paper Mill; Cachar Paper mill Maharashtra: Pudumjee pulp & paper mills
Cement	Andhra Pradesh: Kesoram Cements; Gujarat: Digvijay Cement ltd; Ultratech Cement; Haryana: Heidelberg Cement Power House
Iron and steel & Non Ferrous	Bhilai and Bokaro (SAIL) steel plant, TATA Steel, Jamshedpur, Visveswaraiah Iron and Steel CO, Karnataka
Fertilizers	IFFCO Kalol unit;
Chemical	Hindustan Petroleum Corporation;
Nuclear Power Plants	Maharashtra: Nuclear Power Corporation of India; Andhra Pradesh: Nuclear Fuel Complex

Based on the Industrial sector, the number of questionnaires sent to various industries where PCBs were found is listed in Table 3.

Table 3: Questionnaire sent to industries where PCBs were found.

Industrial Sector	Inventory forms sent	Industries with PCBs
Defense	44	-
Fertilizers	72	1
Pulp and Paper	68	4
Petrochemicals	12	1
Pharmaceuticals	46	-
Railways	34	-
Ship Breaking / Recycling	151	-
Electric power generation and distribution	250	11
Cement manufacturers	88	4
Iron and steel and Non-ferrous	146	4
Nuclear Power plants	14	2
TOTAL	925	27

The response to the letters and inventory forms was analyzed and the following procedures were adopted for the estimation of PCBs:

- If the nameplate declared that the transformers were filled with PCBs, the quantity of PCBs was estimated from the data available on the nameplate.
- In case of transformers installed before 1985, oil samples were collected and tested for PCBs content, and the quantity of the PCBs contaminated oil was estimated.
- Transformer oil samples are tested whenever 1) it is not declared as a pure PCB containing transformer, or the density test is negative; 2) the transformers originate from a foreign country known to have produced PCBs.
- Only those transformers have been tested which were installed before 1990. Cross contamination in transformers installed after 1990, or mineral oil transformers were not checked for PCBs content.

Main outcomes of the first inventory were as follows:

- PCBs have never been produced in India. However, some Indian transformer companies were licensed by foreign companies for the production of PCBs containing transformers.
- The inventory data shows that around 2500 tons of pure PCBs still exist in the country (additional 7500 tons, washings of pure PCBs equipments). Large number of transformer oil samples were drawn from power utilities, major industries both public and private sector and analyzed for PCBs content. Most of the transformers were found to contain high concentrations of PCBs.
- A total of 1340 PCBs transformers are found, of which 1098 are pure PCBs transformers, of which 976 are pure PCB containing transformers (identified by nameplate but not tested), 58 have a PCB concentration of greater than 500 ppm, and the remaining 253 have a PCB concentration between 10 to 500 ppm.
- The shipbreaking activity could represent as another source of PCBs, where the ocean liners imported for ship-breaking contained PCBs material.

However, the following aspects still need a more thorough approach:

1. The PCBs inventory only covered PCBs transformers. Majority of them were online transformers, while offline or stored transformers were identified only in a few cases.
2. The relative number of industries covered by the inventory is low, when compared to the number of industries that exists in the country. Several states were not covered in the PCB inventory.
3. Capacitors and other PCBs containing electrical equipment were not considered in the inventory.
4. The PCBs equipment identified in the inventory does not ensure traceability of the inventoried equipment, since the labeling of the PCBs containing equipment was either not performed or performed only in a limited way.

This document is aimed at providing a general methodology for the extension and updating of the PCBs inventory in India, starting from the information provided in the first inventory, and addressing its limitations.

4.2. PERFORMING A PCBS QUESTIONNAIRE SURVEY

4.2.1. GENERAL DESCRIPTION OF THE QUESTIONNAIRE FORMS

The PCB Inventory form (UNEP 2002) has been adopted as the reference form for the inventory of PCBs wastes and PCBs contaminated sites. Section A and B of the form have been slightly modified, while Section C remains as given in the standard form. These forms have been modified in to an electronic worksheet for the purpose of record keeping, post elaboration and also for a more standardized use of terms, as most of the terms would be selected from a standard dropdown list. The hardcopy can be used for recording data during field survey. The forms contain a Site Univocal Code which is the same for all the forms pertaining to a particular site.

Descriptions related to some of the fields in the proposed forms are:

Section A

- **Record Number**: A Univocal Numeric Code for identifying the site.
- **Geographical coordinates:** In addition to the address
- **Type of company, industry type at the specific site:** The Industry is classified according to the Indian National Industry Classification – 2008 (Central Statistical Organization – Government of India). The NIC-2008 list of industrial classification adopted is reported in Annex 1.
- **Location:** Industrial zone: Urban area, Rural area, Park, or Natural Land, Others**.**

Section B

- **Record Number:** Same as in Section A
- **Type of equipment:** Step Up transformer, Power Transformer, Distribution Transformer, Capacitor, Switch, Other.
- In addition to power rating, minimum and maximum voltages of transformers are to be mentioned
- **Size (length, width and height):** Not considered a mandatory requirement. It may be roughly estimated from the power rating and weight.
- **PCB concentration in the dielectric oil:** In ppm

- **Operational status of the equipment:** In use, Stand-by, Under maintenance, Decommissioned.
- **Condition of the equipment:** Good, Rusty / Overheated, Damaged but not leaking, Leaking.
- **Storage:** Open air; Open air / Locked; Indoor; Indoor / locked.

Section C

- **Record Number:** Same as in Section A
- **Type of waste:** Information on the Univocal Identification of the type of waste, as per the Basel Convention Classification Code and the Indian Waste Classification code.
- **Packaging modality:** None, Plastic or Steel drums, Paper or Plastic bags, Large containers. ADR code if available.
- **Storage:** Open air; Open air / Locked; Indoor; Indoor / locked.
- **Geographical coordinates**
- **Land use of the site and of the surroundings:** As per the Indian classification of land uses.

4.2.1.1 FORM "A": INFORMATION CONCERNING THE SITE AND THE PCB OWNER.

Site Record info	Site code	(to be repeated in form "B" and "C")
	Date	
	Inspector	
Information about the company	Company name	
	Company type (NIC-2008)	*
	Public / Private	
	Headquarter address	
Site Contact and Address Information	State	*
	Site address	
	Geo ref. (°)	
	Location features	*

	Contact person's name	
	Contact person's position	
	Phone	
	Fax	
	Email	
Site Information	Number of Staff at the site	
	Number of Transformers	
	Number of Capacitors	
	Number of other equipment	
	Electricity Consumption at site (KWh)	
	PCB Elimination plan?	

Fields marked with * will be selected from a dropdown list in the electronic format of the forms

4.2.1.2 FORM "B": INFORMATION CONCERNING THE EQUIPMENT.

Equipment identification	Site Code	(same as in A)
	Label Code	(univocal code for each equipment, to be placed on the label)
	Name of the Manufacturer	
	Country of origin	
	Equipment Type	*
	Serial Number	
Equipment description	Power rating	
	High Voltage (V)	
	Low Voltage (V)	
	Manufacturing date	

	Equipment weight, including dielectric oil (Kg)	
	Oil Weight (Kg)	
	Trade name of the dielectric oil or insulating oil	
	PCB content in the liquid (ppm)	
	PCB analysis performed	*
	Information source	
Equipment condition	Operational status	*
	Condition of the equipment	*
	Storage	*
	Retro filled (Y/N)	*
	Retro filling date	
	Retro filling liquid	
	Maintenance company	

Fields marked with * will be selected from a dropdown list in the electronic format of the forms

4.2.1.3 FORM "C". INFORMATION CONCERNING WASTE AND CONTAMINATED SITES.

	Site Code	(same as in A)
PCBs Waste identification	Type of Waste including Basel code and Indian Waste Classification code	
	Estimated quantity (kg)	
	Packaging modality	*
	Are containers leak proof?	
	Storage conditions	*
	Geographical coordinates	
	Site Name	
	Land use of the site and of the surroundings	

PCB contaminated Site Identification	Monitoring report if available (attach documents)	
	Clean-up plan if available (attach documents)	
	Clean-up report if available (attach documents)	

Fields marked with * will be selected from a dropdown list in the electronic format of the forms

4.2.2 STEPS INVOLVED IN PERFORMING THE QUESTIONNAIRE SURVEY

The following picture outlines the general arrangement and steps involved in carrying out the PCBs inventory.

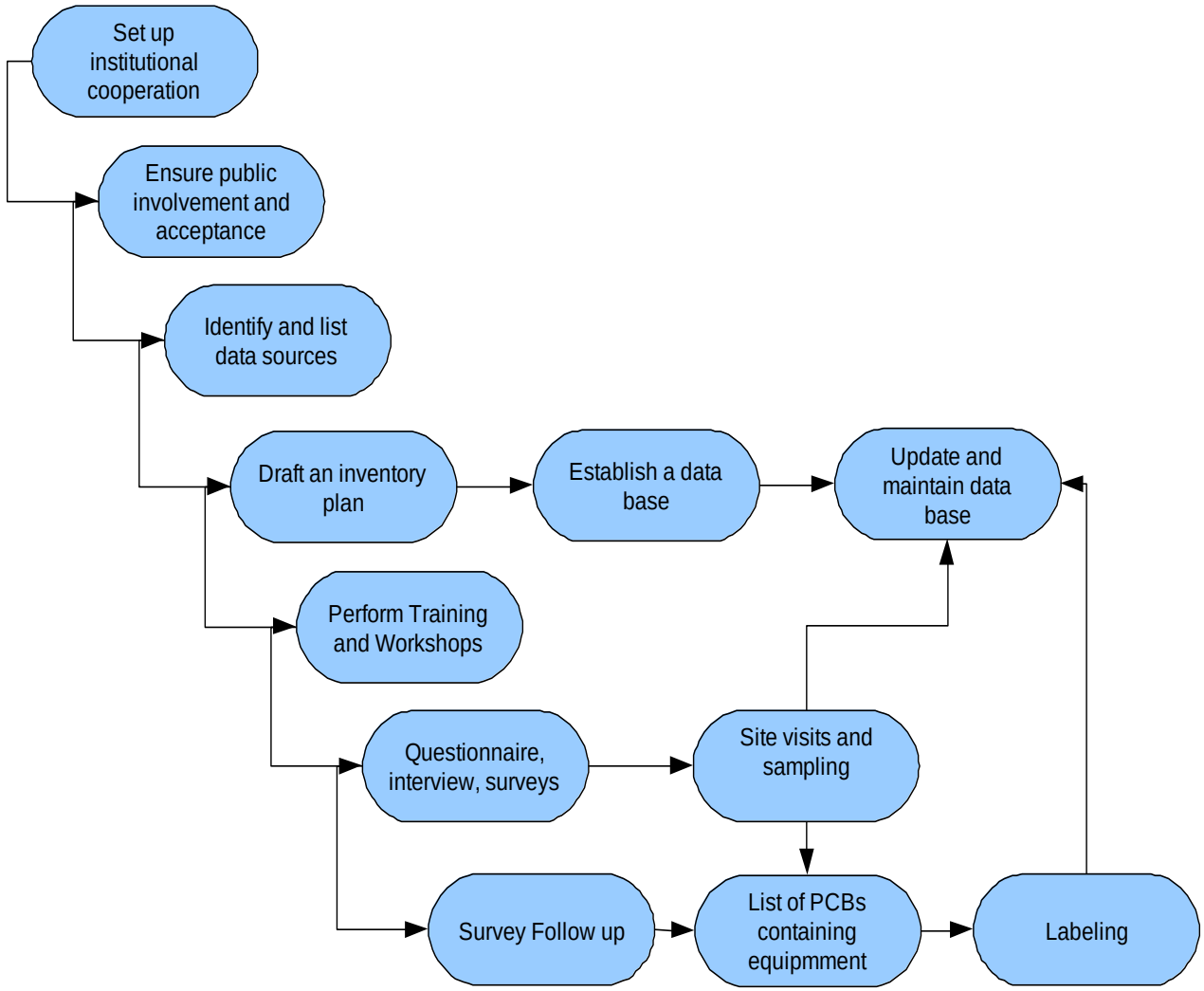


Table 4 describes the steps involved in carrying out the PCBs inventory in detail.

Table 4: Steps involved in performing a PCBs questionnaire survey	
Description	**Status of the existing PCB inventory**
1. **Establish a proper institutional collaboration**. Electric power institutions and state and local level environmental authorities (like the Pollution Control Boards) are the key actors for performing a successful inventory. The electric power institutions provide important information about the owner of the electric equipment (on electricity production and consumption); while the Pollution Control Boards have important information on environmental monitoring, waste storage sites, environmental conditions of industries or electrical facilities, etc. It is important to secure the cooperation of industrial associations and industries to guarantee that the information concerning the use or end life of the electrical equipment is provided	**Status of the preliminary inventory with reference to Step 1:** Nodal officers have been identified for the project at State Electricity Board and Pollution Control Boards
2. **Identify and select the relevant industrial sectors** where PCBs equipment and PCBs containing waste can be found. UNEP (2002) suggests considering the following industrial sectors as main candidates for the PCB inventory • Electric utilities; • Industrial facilities (Aluminium, copper, iron and steel, cement, chemicals, plastics, synthetics, petroleum refining industries). • Railroad systems; • Underground mining operations; • Military installations; • Residential and commercial buildings (including hospitals, schools, households, offices and stores)	**Status of the preliminary inventory with reference to Step 2:** In India, the following sectors were selected as relevant sectors for the PCBs inventory: • Defense • Electric power generation and distribution • Fertilizer • Pulp and Paper • Petrochemicals • Pharmaceuticals • Railroad systems • Ship Breaking / Recycling • Cement manufacturers • Iron and steel and Non-ferrous • Nuclear Power plants

• Research laboratories.	
3. **Draft an inventory plan and establish an inventory database, starting from the addresses of the industries.** A database containing information listed in the inventory form A, sections "Site Record info"; "Information about the company ", and "Site Contact and Address Information" should be established.	**Status of the preliminary inventory with reference to Step 3:** A first database of industries (around 1000 addresses) was established. This database has not been entered in a standardized database file, and need to be re-organized by following the requirements of form "A"
4. **Training.** Training is a fundamental step to ensure that the staff performing the inventory is clear with the objective and criteria, and shares the same standards and methodology. Workshop sessions aimed at informing the representatives of all the possible PCBs owner sectors, relevant stakeholders, and operators should be held	**Status of the preliminary inventory with reference to Step 4:** More than 45 awareness meetings / workshops have been held since Jan. 2009, of which 27 were held after the starting of the project. Most of the meetings / workshops have been addressed to the electric power sector, Pollution Control Board & the Steel industry.
5. Dispatch of all the inventory forms. The dispatch of inventory questionnaires should be performed by the most effective means: email, fax, post, depending on the infrastructure available.	**Status of the preliminary inventory with reference to Step 5:** Around 1000 inventory questionnaires were sent to various industries.
6. **Interviews and follow up.** After sending inventory questionnaires to the industries, a follow up activity should be conducted. The follow-up should include: a. Establishment of direct contact (by phone or mail) with the addressees of the questionnaires to verify the receipt of the forms / questionnaires and to assist them in the compilation of the questionnaires if required; b. Site visit to relevant number of potential owners of PCBs containing equipment and wastes	**Status of the preliminary inventory with reference to Step 6:** Only 26 industries out of around 1000 contacted have reported the presence of PCBs equipment (always PCB contaminated transformers) in their premises. Follow up conducted in a limited amount of cases**.**

7. **Sampling and analysis**. Sampling and analysis of the dielectric oil in a relevant statistical sample of transformers or other electrical equipment, including mineral oil transformers, distribution transformers, and stored equipment should be performed.	**Status of the preliminary inventory with reference to Step 7. A**ll the tested transformers are online transformers. Only those transformers have been tested which were installed before 1990. Cross contamination in transformers installed after 1990, or mineral oil transformers were not checked for PCBs content
8. Labeling. State level authorities should assign Univocal Codes to the inventoried PCBs equipment and deploy them to the owners of the PCBs containing equipment; this activity is further explained under the Labeling section in this document.	**Status of the preliminary inventory with reference to Step 8.**Labeling of PCBs contaminated equipment and the consequent traceability of the equipment were not ensured in the course of the first PCBs inventory**.**

4.3 PCBS USES

PCBs applications can be classified under: closed, partially closed and open applications.

4.3.1 CLOSED APPLICATIONS

A closed application is defined as “an application in which the PCBs are held completely within the equipment”. In normal conditions the exposure of the PCBs contained in the closed application to the environment or humans is nil. However, exposure may occur under circumstances like maintenance, operations, damage to the equipment due to aging of the equipment or misuse.

Step up transformers	Power plants
Distribution transformers	Power plants, transformer substations, electricity distribution networks, large industrial plants, railways, large ships, hospitals
Power capacitors	Electricity distribution networks, large industrial plants
Lighting ballasts	Offices, large buildings, hospitals
Switches	Transformer substations, electricity distribution network, large industrial plants, railways, large ships

4.3.2 PARTIALLY CLOSED APPLICATIONS

In partially closed applications, PCBs is not directly in contact with the environment. However, emission to the environment may occur during typical use, leading to significant releases of PCBs in some cases. A typical example is the PCBs contamination in the gas pipes due to the release of PCBs present in the compressor oil of "compressor blow-by". Two major PCBs accidents in the world (the Yusho accident in Japan in 1968, and the Yu Cheng accident in Taiwan ten years later) were caused by the contamination of rice oil due to an accidental release of PCBs after a leak in the heat exchanger.

Heat transfer fluids	Chemical industry; petroleum refineries.
Hydraulic fluids	Any industrial process requiring hydraulic fluids. Mining equipment; ferrous and Non-ferrous metal industry.
Vacuum and compressors pumps	Natural gas transfer substations and pipes; any industrial facility requiring large compressors or vacuum pumps.

4.3.3 OPEN APPLICATIONS

PCBs have been used as an additive in paints, flame retardant in surface coatings, plasticizers in chlorine based plastic and rubber like PVC and neoprene.

Lubricants	Immersion oil for microscopes; brake linings; cutting oils; lubricating oils
Casting waxes	Pattern waxes for casting
Surface coatings	Paints (including the ones used for ship painting); surface treatment for textiles; carbonless copy paper; flame retardants;
Plasticizers	Gasket sealers; filling materials; PVC; rubber sealers

4.4 PCB CONTAMINATED TRANSFORMERS: BRAND NAME AND PRODUCTION YEAR

Table 5 provides a list of the trade names of PCBs containing transformers as obtained from the first PCBs inventory in India.

Table 5: PCB contaminated transformers: Brand name and production year

Transformer Brand Name	Produced from	Produced until
A.C.E.C Belgium	1939	1939
AmbarnathX”mers	1988	1988
ANDREW YULE	1985	1985
APEX	1977	1977
APEX	1988	1999
APEX Electrical	1974	1974
Ashok TRF	1977	1978
ASKAREL	1985	1985
BBL/INDIA	1987	1991
BHARAT BIJILEE	1960	1986
BHEL	1977	1992
BHEL/INDIA	1985	2003
Canadian Gl. Ele	1966	1966
CEM	1968	1968
CEM France	1968	1968
CG India	1972	1972
CGL	1975	1981
Crompton	N.A.	N.A.
Crompton Greaves	1966	1988
Crompton Parkinson	1966	1966
CZECH	1980	1980
EARCS	1979	1979
ECE	N.A.	N.A.
Economy	1968	1968
Electric Factory TRF S.E.C	1939	1939
EL-TRA	1977	1979
EMCO	1962	1996
EMCO TRF	1980	1980
ETE	1975	1986
ETEA	1977	1977
GANZ Hungary	1967	1967
GCE	1971	1993
GEC Alstom	1997	1997
HACKBRIDGE-HEWTTIC & EASUN (HHE)	1960	1992
HBB	1968	1972
HEL	1968	1968

Table 5: PCB contaminated transformers: Brand name and production year

Transformer Brand Name	Produced from	Produced until
HHE Madras	1968	1968
Hind Rectifiers	1961	1961
Hindustan Electric	1964	1976
IMP	1998	1998
IND Coil	1979	1985
Indian	1973	1973
INDOTECH	2006	2006
Johnson & Philips	1955	1966
Johnson Elect Co	1972	1972
KAVIKA	N.A.	N.A.
KEC	1984	1984
KEC India	1977	1984
KEL	1986	1986
Kirloskar	1962	1962
KIRLOSKAR/INDIA	1983	1984
M/S Bharat	1972	1972
M/s Bharat Bijlee	1983	1996
M/s BHEL	1984	1985
M/S BHEL Bhopal	1989	1989
M/s NGEF	1983	1990
M/s TELK	1984	1984
Marsons Electricals	N.A.	N.A.
MERLIN GERIN ELECTRO/FRANCE	1980	1980
Metro Pollition Vickers, England	1932	1937
Mitsubishi	1962	1962
National elecInd	1967	1967
Nelson Electricals Bombay	1981	1981
NGEF	1973	1984
NGEF Licence AEG,India	1974	1974
NGEF/INDIA	1991	1991
P&CT L,	1971	1971
PARCS	1980	1980
Power Lite	1979	1980
Radio & Electricals Ltd	1969	1969
RUSSIAN	1957	1981
Star Delta Electrical	1977	1977

Table 5: PCB contaminated transformers: Brand name and production year

Transformer Brand Name	Produced from	Produced until
T&R	2004	2004
TELK	1970	1980
TELK/INDIA	1983	1989
Thane Electric Supply	1981	1981
The National Electrical Industries Ltd, Bombay	1975	1975
TR & SWITCH GEAR Ltd	1962	1977
Volt Amp	1972	1984
VOLTAS	1977	1984

In Table 6, the percentage of PCB contaminated transformers with respect to the production year as obtained from the first PCBs inventory is reported. More than 95% of the PCB contaminated transformers were produced before the year 1990. It then becomes reasonable to assign the highest priority to those transformers which were manufactured before 1990, even though it cannot be ruled out that the transformers manufactured after 1990 may be cross contaminated by PCBs.

Table 6: Percentage of PCB contaminated transformers produced based on year

Production Year		Percentage
Before	1950	1.2
From 1950	To 1960	12.9
From 1960	To 1970	13.4
From 1970	To 1980	39.1
From 1980	To 1990	29.5
From 1990	To 2000	2.6
After	2000	1.4

4.5 TRADE NAMES OF PCBS

In Table 7, the list of the trade names of the dielectric oil containing PCBs inventoried in the first PCBs inventory in India is provided. In around 25% of the cases, there was no information available regarding the brand name of the dielectric oil. Hence, while

extending and updating the PCBs inventory, the prime focus is not on the transformers containing pure PCBs oil alone.

Table 7: Trade name of dielectric oil found in PCBs contaminated transformers in India.

Dielectric Oil Trade Name (in bold the pure PCB oils)	Percentage of transformers in the inventory
CLOPHEN	33.5
SOVTOL	18.7
Mineral insulating oil	11.9
Trf Oil	3.2
Power oil	2.8
Naphthenic	1.4
Insulating Oil	0.9
R-Temp	0.9
Askarel	0.6
Electrol	0.6
Silicon Oil	0.1
N.A.	25.5

4.6 PCB CONTAMINATED CAPACITORS: BRAND NAME AND PRODUCTION YEAR

The first PCBs inventory in India did not cover either capacitors or switches. It should be noted that any PCB equipment with an internal volume less than 0.05 liters is not subjected to the obligation of the Stockholm Convention, while a PCB equipment with an internal volume between 0.05 and 5 liters is subjected to identification and removal from use, and need not be inventorized.

PCB capacitors with an internal volume greater than 5 liters fall within the scope of the Stockholm Convention (identification, labeling and phasing out) and should be considered in the PCBs inventory.

In Table 8, a list of trade names of power capacitors containing (or suspected to contain) PCBs and their production year is provided.

Table 8: Power capacitors containing PCBs: Brand name and production year (Modified after ANZECC, 1997)	
Brand name of the capacitors	Production year
AEg Hydra, Berlin	Until 1982, all the capacitors labeled with "CD", "CPA", "Clophen"
Arcotronics, Italy	All until 1977
AseaKabel, Sweden	All until 1981, all the capacitors labeled with "Askarel"
Asea – Lepper (or Dominit or Brilon D)	All until 1980
Baugatz Ludwig, Berlin	All until 1983
BaugatzKondensatorien, Austria	All until 1982
BICC Capacitors LTD, Helsby England (subsequently commercialized as ABB capacitors)	All capacitors until 1982, except dry capacitors
Brandt W. Gmbh, Leopoldstadt, Lippe	All capacitors
CAF Kondensatoren, Duisburg – Hamborn	All capacitors
ComarCondensatori, Italy	All until 1981
Cond. Fribourg,	All until 1983
Detron Stein	All until 1981
Dubiler, England	All until 1982
Ducati EnergiaSpA, Italy	All until 1982
Egra KG,	All capacitors
Elcontrol spa, Italy	All until 1984
ElectroniconGmbh	All until 1985
Elektrica (F.Kucera)	All capacitors
ElkondaGmbh, Germany	All capacitors
Felten + Guilleaume, Energietechnik, Cologne, Germany	All until 1982
Frako, Teningen	All until 1983
General Electric, Usa	All until 1980
Grunow Ernst KG, Monaco	All capacitors
Haefely SA, France and Germany	All until 1984
Hitachi, Japan	All until 1982
Hunts, England	All until 1982
I.B.M, Usa	All until 1979
ICar – Slimotor	All until 1981
Internally, USA	All until 1979
IskraSemic, Yugoslavia	All until 1985
IsokondGmbh, Germany	All until 1985

Table 8: Power capacitors containing PCBs: Brand name and production year (Modified after ANZECC, 1997)	
Brand name of the capacitors	Production year
Italfarad Spa, Italy	All until 1981
Jensen Tobias, Denmark	All with the letter "C…" or "O…", until 1982
Otto Junker, Gmbh, Germany	All until 1983
Kapsch&Sohne, Austria	All until 1982
KD Kondensatoren, Monaco, Germany	All until 1982
Knobel, Emenda GL	All until 1982
Konig, Vienna	All until 1982
Leclanché, SA, France	All until 1975
Liljeholmens, Kabel AB, Stockholm, Sweden	All until 1981
Leopold Vlk, Pocking Niederbayern	All capacitors
Lorenzetti, Brasileira	All until 1982
Mallory Capacitors, USA	All until 1979
Mikafil AG, Switzerland	All until 1977
NCC	All until 1982
Neuberger Gmbh	All capacitors
Neuko, Germany	All until 1982
Nokia Capacitors, Finland	All until 1982
Pressey TCC, England	All until 1982
Rectiphase SA, France	All until 1982
Richmont	All until 1982
RoedersteinGmbh	All until 1983
Ruppel& Co, Germant	All capacitors
Saarland Kondensatorenbau	All capacitors
Si Safco Colombes, France	All capacitors
Siemes AG Dynamowerk, Berlin	All until 1982
STR Standard Telephon + Radio	All capacitors
SükoHerrsching D	All until 1982
System Electric Gmbh	All until 1983
Tesla, Czechoslovakia	All until 1986
Thomson	All until 1982
UnitraTelpod, Polski	All until 1986
Varilec SA, France	All until 1984
Varo S.R.L, Italy	All until 1982
VA-RU Kondens, **Eckernförde D**	All capacitors
Vauka MPKO GmbH	All capacitors

Table 8: Power capacitors containing PCBs: Brand name and production year (Modified after ANZECC, 1997)	
Brand name of the capacitors	Production year
Vlk Leopold, Pocking	All capacitors
Wegowerke, Rinkling + Winterhalter,Freiburg / Breisgau D	All until 1982
Wico, Japan	All until 1982
Xamax AG, Embrach	All until 1984
Zeh Wilhelm KG, Freiburg / Breisgau	All capacitors
Zellweger, Uster ZH	All capacitors

4.7 INDUSTRIAL SECTORS WHERE PCBS CONTAINING CAPACITORS ARE USED

In general, capacitors are used to compensate for the inductive reactive power required by the electrical load. Power capacitors can therefore be found in:

- Buildings: Administrative buildings, Hospitals, Museums, Railway Stations, Shopping Centers and large buildings, in general (including the old buildings planned for demolition)
- Workshops and Industrial Manufacturing units;
- Wastewater treatment plants
- Power generation and power distribution substations;
- Refrigeration facilities;
- Research institutions.

5. SAMPLING AND ANALYSIS OF ELECTRICAL EQUIPMENT

5.1. SAMPLING DIELECTRIC OIL FROM PCB TRANSFORMERS

Sampling of the dielectric oil from the electrical equipment usually requires temporarily shutting down and fully de-energizing the equipment, so that the risk of electrical shock to the operators can be minimized. Transformers (except the very small ones) are usually provided with one or more dielectric oil drainage valves from which the oil can be sampled. While sampling from small transformers which are not equipped with circulation pump, it is important to drain the oil present in the drainage

valve and pipes before taking the sample. All countermeasures to avoid spilling of PCBs oil on the soil should be adopted, and operators should wear proper Personal Protective Equipment (PPE). Oil sampling should be preferentially undertaken from the drainage valve at the bottom of the transformer instead of the expansion tank at the top. The following procedure should be followed for sampling from transformer:

- Obtain a clear plastic tubing (Tygon).
- Attach one end of the tube to the electrical equipment sampling outlet valve and place the other end of the tube in an overflow bucket or pan.
- The tubing between the transformer and the bucket should be as short as possible to avoid leakage potential.
- Drain some quantity of oil through the sample valve and tubing into the overflow bucket or pan to ensure that no contaminants are present in the sampling line. Close the sample valve.
- Place the tubing in a sample container or bottle.
- Open the sample valve of the transformer and fill the sample container or bottle.
- When the sample container or bottle is filled with the required quantity of oil, close the sampling valve.
- Secure the cap of the sample container or bottle tightly.
- Label the sample container or bottle with the appropriate information or details. Ensure that the label clearly addresses all the categories or parameters.
- Complete all the chain-of-custody documents and record them in the field logbook

5.2. SAMPLING DIELECTRIC OIL FROM PCB CAPACITORS

Since PCB capacitors are sealed equipment, it becomes necessary to drill a small drainage hole for sampling oil at low speed and to avoid overheating of the capacitors body with possible burning of PCBs oil. Hence, it is mandatory to put the capacitor offline and completely de-energize it before starting the sampling procedure. All countermeasures to avoid spilling of PCBs oil on the soil should be adopted, and the

operators should wear proper PPE. Once these capacitors are drilled for sampling, they cannot be used anymore. Thus, sampling of PCBs capacitors cannot be carried out if the equipment is still in use. After the completion of the drilling operation, the sampling procedure is performed in the same way as described for the transformers.

5.3. LABELING AND STORING SAMPLES

Wide-mouth glass jars with PTFE caps must be used for storing samples. Sample volume must be sufficient enough to perform several analyses: a volume of at least 500 ml is recommended.

During the sampling activity, at least one person responsible for the analytical work should be present, in order to detect any sampling anomalies that could affect the analytical work, and to verify the sample code. The sampled equipment should neither be moved nor any further maintenance operation carried out until analytical results are confirmed, and till the need for further sampling is excluded. If, for some unforeseen reasons, the need to move or carry out maintenance activity of the equipment arises before analytical results, the analytical laboratory must be immediately informed. The analytical lab must inform the equipment owner on the analytical results without delay.

Samples must be immediately sealed and labeled. On the label, the following information should be written: sampling date and time, equipment serial number (the same entered in Form “B”), sampling serial number, operator's name and reference. Digital photo of the sampled equipment should be taken. The above information, including the digital photos, should be recorded in the data base, which will also contain sampling results, for future reference. PCBs are persistent substances not expected to degrade significantly. However, certain isomers can degrade more quickly when directly exposed to light. Hence, it is recommended to store the samples in a cold place at low temperature, and to perform analysis within one or two week after sampling.

5.4. PERSONAL PROTECTIVE EQUIPMENT (PPE) TO BE USED DURING SAMPLING

Before starting the sampling operation, a complete survey of the workplace should be conducted to identify and assess possible hazards. If no significant hazards are identified, other than the PCBs in the dielectric oil to be sampled, the PPE to be

adopted during sampling operation can be limited to a disposable suite, goggles and a proper chemical resistant glove. Wearing respiratory mask is not necessary as the risk of inhalation during sampling is limited. However, if the survey identifies possible PCBs contamination of the site, the operator should also wear protective shoes, respiratory mask and a protective suite. Wearing helmet is generally mandatory in workplaces. It is recommended that a certain amount of different PPE in compliance with the OSHA standards be made available to the sampling team before carrying out the sampling campaign.

5.5. PRELIMINARY ANALYSIS BY FAST KITS AND PORTABLE EQUIPMENT

While selecting the proper screening method for preliminary analysis of PCBs oil on field, the risk of false positive and false negative outcome should be carefully considered. Colorimetric or ion specific electrode methods based on the detection of chlorine – and subsequent normalization on the basis of the expected chlorine content in the PCB mixture – may be affected by a high false positive outcome if the dielectric oil contains other chlorinated compounds (for instance, Chlorobenzene) instead of PCBs. In such cases, recent evaluation trials performed by US-EPA on chlorine-based determination and on immunoassay methods indicate that the second is more apt for performing the screening analysis for PCBs content in oil.

5.6. LABORATORY ANALYSIS OF PCBS

It is possible to detect and quantify all the different PCB congeners in a mixture by using the following analytical method EN 12766 part 3, or the US EPA 1668 and the modified 1668A .These methods are recommended whenever there is the need to quantify specific PCB congeners, like dioxins.

In compliance with the Stockholm Convention requirements, another analytical method which is suitable is - US EPA 8082, if the Aroclor number of the PCBs oil to be analyzed is known. This method will provide the overall amount of PCBs in oil.

While selecting the analytical method, it is important to verify the capability of the analytical laboratory for performing the specific method. Under GLP (Good Laboratory Practice), it is recommended to establish a ring test inter-calibration exercise among the participating labs to verify that the results obtained from different labs are comparable.

6. LABELING, TRACKING AND RECORD KEEPING OF PCBS CONTAINING EQUIPMENT AND WASTES

6.1. BASICS OF LABELLING

The objective of Labeling is to *inform* about the possible risk, *prevent* the outcome of an accident or PCBs release and *track* the status and position of the PCBs equipment. And the purpose of placing a label on the PCBs containing equipment is to facilitate the identification of PCBs containing equipment properties which are not immediately evident from the observation of the equipment itself. A label with a Serial Number and a Database ensures traceability.

The purpose of labeling is:

1. To know if the PCBs containing equipment is still being used in a factory;
2. To ensure that the operators and general public are informed (including, emergency operators during an accident) about the existence of PCBs containing equipment in their factory, so that they can adopt suitable management measures as required;
3. To track the status (put offline or disposed) and movement (within or from the factory) of PCBs labeled equipment.

Labeling and tracking are therefore strictly interrelated activities.

Constantly updating the Centralized Database based on the labeled equipment, clearly assigning the responsibilities in distributing and serializing labels, updating inventories and monitoring the labeled objects ensures "traceability" of the PCBs containing equipment.

Labeling and tracking of PCBs containing equipment would be based on the rationale listed in Table 9:

Table 9: Rationale for PCBs Labeling and Tracking

SL No.	PARAMETERS	REQUIREMENTS	DESCRIPTIONS
1.	Target Identification	Intended addressee of PCB labels	General Public
			Operators

2.	Responsibilities	Establish Labeling standards	Establishment of Labeling standards is done considering International standards like GHS norms
		Authority to control compliance with Labeling standards and obligation	Enforcement of PCB labeling by Local authorities
			a. Pollution Control Board
			b. Ministry of Environment & Forest (MOEF) and Central Pollution Control Board (CPCB)
			c. State Pollution Control Boards (SPCB) and regional offices
			d. PCB owners and industries
3.	Regulatory Implication	Allowed uses of the PCBs labeled equipment	Subjected to restriction to sell, buy, dismantle, export PCBs labeled equipment
			Subjected to obligation to inform authorities about change of status, movement outside or inside the factory, maintenance, etc.
		Criteria to establish if a particular object needs to be labeled or not	Clear rules to be established for labeling of equipment "possibly" contaminated by PCBs, since it is not possible to analyze all the equipment possibly contaminated by PCBs in a short time
4.	Information	Information to be printed on the label	Decided in accordance with the target needs, International standards and technical features of the tracing system.
5.	Printing and Distribution	Printing and Distribution of labels	Production of PCBs labels by PCB owners or a 'label factory'
			Labels must be more durable than the labeled equipment themselves
			Establishment of a system for the distribution of Univocal Serial number for PCB labels
6.	Database	Building and maintaining a database for the PCBs labeled equipment	Establishment of a bi-univocal relationship between the PCBs labeled equipment and the Database
			Maintaining the Database at the local as well as the national level
			Assignment of proper resources

7.	Enforcement	Enforcement of the labeling system	To define a clear system of sanctions and incentives
			To assign responsibilities
			To inspect the following:
			a. Labeling of PCBs equipment in due time
			b. Compliance of PCBs label with labeling standards
			c. Management of the PCBs labeled equipment with respect to the rules and requirements

Each of the above 7 requirements is further discussed in detail in the sections below.

6.2. LABELING OF PCBS CONTAINING EQUIPMENT

6.2.1. TARGET IDENTIFICATION

- Labels must include information about the person in-charge of emergency response. This would help in adopting correct countermeasures in case of an accident (fire, leakage, etc.)
- Labels must include information about the person in-charge of handling, transporting and disposing PCB waste. This would help in reducing further risk to the environment by adopting suitable technical rules for handling, transporting and disposing of waste.
- Labels must inform the general public that the labeled equipment / waste may present some danger to health and also to the environment.
- Labels must contain contact reference (names, telephone numbers) for emergency and normal operation of PCB equipment.
- Labels should contain univocal reference numbers / codes for the control authorities.

6.2.2. CLEAR ASSIGNMENT OF RESPONSIBILITIES

As Party of the Stockholm Convention, the Government of India is in-charge of identifying, labeling and removing PCBs from use and MoEFCC (Ministry of Environment, Forests and Climate Change) is the GEF focal point for the Stockholm

Convention on POPs, and is therefore in-charge of drafting the bills concerning the management of PCBs (including inventory, labeling, disposing), and enforcing the legislation once issued. The following should be considered while arranging the inventory and labeling tasks:

1. The Pollution Control Board of each state in India should be in-charge of coordinating the identification of PCBs in its territory. The Central Pollution Control Board should co-ordinate with the State Pollution Control Board (SPCB) to provide them with technical guidance and standards, and to collect and store at central level the information gathered at the State level.

2. The Ministry of Environment, Forests and Climate Change and the Central Pollution Control Board should:

   a) Draft and circulate standard methodologies and documents for the identification and analysis of PCBs equipment and waste.

   b) Design, build and maintain a Web Based PCB database, which would exchange information with the State database of PCB inventory.

   c) Elaborate the standards for the labeling of PCBs equipment.

   d) Provide technical assistance to the State Pollution Control Board on the PCB identification and labeling issues

   e) Provide training to the State Pollution Control Board on PCBs inventory and labeling issues.

   For the above purposes, a permanent organization should be established at the Central Pollution Control Board.

3. The State Pollution Control Boards or the regional offices should perform the tasks listed below:

   a) List the industries and economic activities who are more likely to be users or owners of PCBs equipment

   b) Identify the contact point of each industry / company by coordinating with the relevant State Chamber of Commerce or equivalent organization;

   c) Perform awareness training and dissemination;

   d) Perform questionnaire survey by sending appropriate forms to the industries;

e) Confirm doubtful results by telephone call, site visits, sampling and analysis;

f) Distribute Univocal label serial numbers to the owner of PCBs contaminated equipment for the labeling of PCBs containing equipment;

g) Store information on PCBs equipment on a Web-based PCBs inventory database.

4. PCB owners and industries should:

a) Fill the PCB inventory forms in the correct format with the information required, by using hardcopies or electronic forms provided by SPCB;

b) Label PCBs equipment with standard labels with the serial number provided by the SPCB, in compliance with the rules established for the PCBs inventory and labeling system;

c) Adopt any safety measure prescribed by the State Pollution Control Board;

d) Report on any variation concerning the PCBs equipment listed (for instance, decontamination, maintenance, transportation to another site, transportation for disposal etc.,) to the local authority in-charge of updating the PCBs database;

e) Comply with the requirement established by the India Hazardous Waste Rules, 2008 with special reference to the handling and transportation of PCBs containing waste.

6.2.3. REGULATORY IMPLICATION OF LABELING

A list of proposed rules for the management of PCB labeled equipment is proposed below:

1. Labels would have the legal meaning of a certificate issued by the local or central authority on the basis of the information provided by the owner of the equipment.

2. In general, three different PCBs labels would be used:

a. "PCBs containing equipment" label: Serialized and to be placed on the equipment which is certainly contaminated by PCBs over 50 ppm;

b. "Equipment potentially contaminated by PCBs" label: Serialized and to be placed on the equipment which, based on available information, is probably contaminated by PCBs over 50 ppm;

c. "PCB Free" label: NOT serialized as traceability is not necessary for non PCBs equipment and to be placed on the equipment which after analysis has been found to be free from PCBs contamination.

3. Once identified as PCBs or PCBs suspected, the equipment must be labelled without delay.

4. After sampling and analysis, if it is found that the PCBs concentration of a labeled PCBs equipment is below 50 ppm, the authority must be provided with a copy of the analytical certificate, and the PCBs label can be removed and replaced with a "PCB free" label.

5. After sampling and analysis, if the measured PCBs concentration of a suspected PCBs equipment is found to be above 50 ppm, the authority must be provided with the analytical certificate, and the equipment must be labeled with a "PCBs containing equipment" label.

6. Equipment labeled as "Equipment potentially contaminated by PCBs" should be subjected to sampling and analysis for PCBs content within a set deadline.

7. Each label serial number will be associated to a unique PCBs containing equipment; hence each PCB containing equipment will be identified by its specific label serial number. If, due to the equipment size, more labels are necessary for labeling a PCBs containing equipment, these labels will have the same serial number.

8. Instructions printed on the label are mandatory and must be fulfilled by the person in-charge.

9. Labels cannot be removed, deteriorated, hidden or replaced with other labels. In case labels are lost, deteriorated or destroyed by accidental causes, they must be replaced without delay.

6.2.4. INFORMATION TO BE PRINTED ON THE LABEL

The UN Global Harmonized System (GHS) for substance classification and labeling and packaging should be adopted as reference standard.

Substance Identification	Name: Polychlorinated Biphenyls; PCB	CE Number: 215-648-1 CAS Number: 1336-36-3
Hazard classification and category codes:	STOT RE 2*	May cause damage to respiratory system through prolonged or repeated exposure
	Aquatic Acute Aquatic Chronic	Hazardous to the aquatic environment, chronic and acute
Hazard statement (code)	H373**	May cause damage to respiratory system through prolonged or repeated exposure
	H400	Very toxic to aquatic life
	H410	Very toxic to aquatic life with long lasting effect
Pictogram and sign warning codes	GHS08 GHS09 Wng	
Hazard statement (code)	H373**	May cause damage to respiratory system through prolonged or repeated exposure
	H410	Very toxic to aquatic life with long lasting effect
Supp. Hazard Statement		
Specific Conc. Limit	STOT RE 2 H373: C ≥ 0.005 %	
Note	C	Supplier must state on label if the substance is a specific isomer or a mixture of isomers

1. Label of PCBs containing equipment should clearly indicate the following information, or equivalent :
   a. The word “Warning” followed by “This equipment contains PCBs (Polychlorinated Biphenyls)
   b. The serial number and the barcode of the serial number, if feasible.
   c. Labeling date

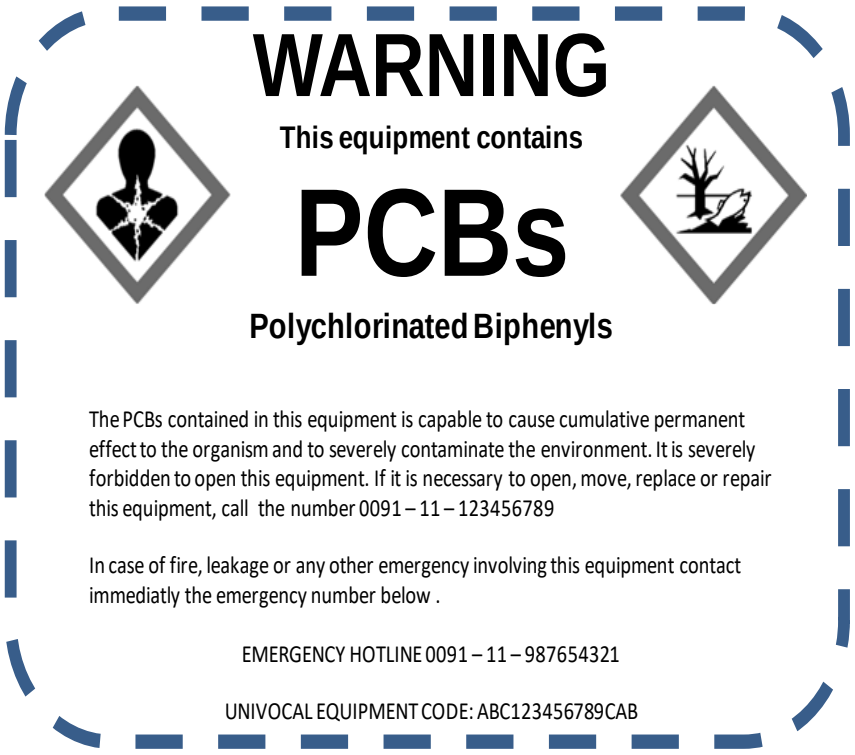
d. Last Maintenance date of the Equipment

e. Information on the type of hazard and health effects, with respect to UN classification and labeling.

f. A sentence reminding that "It is severely forbidden to open this equipment. If it is necessary to open, move, replace or maintain this equipment, call the person in-charge at the number "xxxxxxxx"

g. A phone number to be called in case of leakage, fire or any other emergencies

2. On the basis of the above indication, a possible example for a PCB label is reported below



6.2.5. PRINTING, DISTRIBUTING AND PLACING LABELS

Once the equipment has been identified as containing PCBs, the owner of the equipment shall without delay contact the relevant authority for a PCBs serial number for each PCBs containing equipment

After receiving an application for one or more PCBs serial number, the authority shall send without delay to the owner of PCBs equipment, by fax or by mail, a list of PCBs serial number label and the specification for the PCBs label.

A temporary label could be used until the final label is ready.

After receiving the relevant serial numbers from the authority, the owners of PCBs containing equipment shall place the labels in a prominent position on the exterior of a PCBs containing equipment so that it can be easily read.

The design criteria for labels are: high visibility (for instance, a black text over a yellow background); high durability of the material as well as the printed text (both must last at least as long as the equipment itself, even if exposed to the rain and sun) and proper size.

With reference to the label sample provided above, a suggested size for the label could be in the order of 150x150 mm, as from USA and Canadian standards.

6.2.6. BUILDING AND MAINTAINING THE DATABASE

Each label must be associated with a record in the centralized database owned and managed by the relevant authorities to ensure traceability. Two levels can be contemplated: databases at the State level and National level database containing all the databases provided by the States.

The database shall have the same structure as that of the PCBs Inventory form.

6.2.7. ENFORCEMENT

A suitable supervision plan shall follow the implementation of the labeling system. Supervision shall be performed at 2 levels:

1. Supervision carried out by a Central authority on the activities of Provincial authority: The objective is to ensure that the system implemented by the Provincial authority is in place, and is in compliance with the technical specification and the national legislation.
2. Supervision carried out by a Local authority on the activities of the PCB owners: The objective is to ensure that a) the equipment that must be labeled has actually been labeled; b) conformity between the information reported on

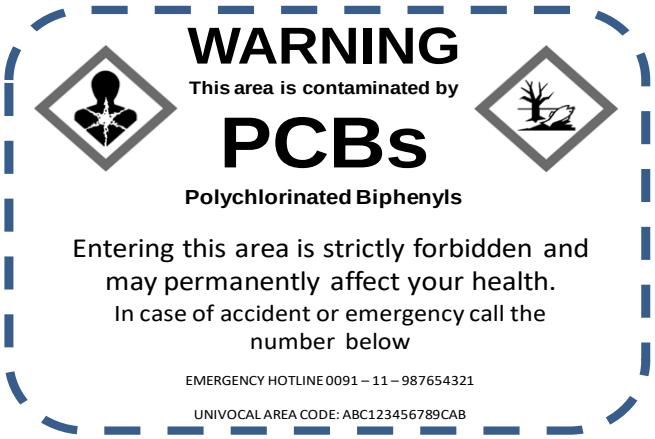
the labels and the properties of the labeled equipment and c) that the labeled equipment is used as indicated in the regulation requirements.

6.3. LABELING OF PCB CONTAMINATED AREAS (SIGNALING)

The main objective of signaling contaminated areas is to prevent people from being exposed to the contaminant present in the area and also to mark the PCB storage area or PCB contaminated area for future reference. In case of contaminated areas, traceability is not required. But the PCB waste generated from the contaminated area should be traceable. Moreover, PCB contaminated areas should be inventoried, possibly by using a Centralized or a Web based Database. In case these sites are not permanently attended, signals and fences must be maintained and inspected at regular intervals.

Signals should clearly indicate:

- strict prohibition to enter the site
- nature of the hazard (PCB)
- number to be called in case of emergency or accident
- The univocal area code. A tentative example for a warning signal is shown below.



7. ANNEX 1. NIC-2008 CLASSIFICATION OF INDUSTRIES

Section A Agriculture, Forestry and Fishing

Division 01 Crop and animal production, hunting and related service activities
Division 02 Forestry and logging
Division 03 Fishing and aquaculture

Section B Mining and Quarrying

Division 05 Mining of coal and lignite
Division 06 Extraction of crude petroleum and natural gas
Division 07 Mining of metal ores
Division 08 Other mining and quarrying
Division 09 Mining support service activities

Section C Manufacturing

Division 10 Manufacture of food products
Division 11 Manufacture of beverages
Division 12 Manufacture of tobacco products
Division 13 Manufacture of textiles
Division 14 Manufacture of wearing apparel
Division 15 Manufacture of leather and related products
Division 16 Manufacture of wood and products of wood and cork, except furniture;
Division 17 Manufacture of paper and paper products
Division 18 Printing and reproduction of recorded media
Division 19 Manufacture of coke and refined petroleum products
Division 20 Manufacture of chemicals and chemical products
Division 21 Manufacture of pharmaceuticals, medicinal chemical and botanical products
Division 22 Manufacture of rubber and plastics products
Division 23 Manufacture of other non-metallic mineral products
Division 24 Manufacture of basic metals
Division 25 Manufacture of fabricated metal products, except machinery and equipment
Division 26 Manufacture of computer, electronic and optical products
Division 27 Manufacture of electrical equipment
Division 28 Manufacture of machinery and equipment n.e.c.
Division 29 Manufacture of motor vehicles, trailers and semi-trailers
Division 30 Manufacture of other transport equipment
Division 31 Manufacture of furniture
Division 32 Other manufacturing
Division 33 Repair and installation of machinery and equipment

Section D Electricity, gas, steam and air conditioning supply

Division 35 Electricity, gas, steam and air conditioning supply
Group 351 Electric power generation, transmission and distribution
35101 Electric power generation by hydroelectric power plants
35102 Electric power generation by coal based thermal power plants
35103 Electric power generation by non-coal based thermal (e.g. diesel, gas)
35104 Electric power generation and transmission by nuclear power plants
35105 Electric power generation using solar energy
35106 Electric power generation using other non-conventional sources
35107 Transmission of electric energy
35109 Collection and distribution of electric energy to households, industrial, commercial and other users n.e.c.
Group 352 Manufacture of gas; distribution of gaseous fuels through mains
Group 353 Steam and air conditioning supply

Section E Water supply; sewerage, waste management and remediation activities

Division 36 Water collection, treatment and supply
Division 37 Sewerage
Division 38 Waste collection, treatment and disposal activities; materials recovery
Division 39 Remediation activities and other waste management services

Section F Construction

Division 41 Construction of buildings
Division 42 Civil engineering
Division 43 Specialized construction activities

Section G Wholesale and retail trade; repair of motor vehicles and motorcycles

Division 45 Wholesale and retail trade and repair of motor vehicles and motorcycles
Division 46 Wholesale trade, except of motor vehicles and motorcycles
Division 47 Retail trade, except of motor vehicles and motorcycles

Section H Transportation and storage

Division 49 Land transport and transport via pipelines
Division 50 Water transport
Division 51 Air transport
Division 52 Warehousing and support activities for transportation
Division 53 Postal and courier activities

Section I Accommodation and Food service activities

Division 55 Accommodation
Division 56 Food and beverage service activities

Section J Information and communication

Division 58 Publishing activities
Division 59 Motion picture, video and television programme production, sound recording and music publishing activities
Division 60 Broadcasting and programming activities
Division 61 Telecommunications
Division 62 Computer programming, consultancy and related activities
Division 63 Information service activities

Section K Financial and insurance activities

Division 64 Financial service activities, except insurance and pension funding
Division 65 Insurance, reinsurance and pension funding, except compulsory social security
Division 66 Other financial activities

Section L Real estate activities

Division 68 Real estate activities

Section M Professional, scientific and technical activities

Division 69 Legal and accounting activities
Division 70 Activities of head offices; management consultancy activities
Division 71 Architecture and engineering activities; technical testing and analysis
Division 72 Scientific research and development
Division 73 Advertising and market research
Division 74 Other professional, scientific and technical activities
Division 75 Veterinary activities

Section N Administrative and support service activities

Division 77 Rental and leasing activities
Division 78 Employment activities
Division 79 Travel agency, tour operator and other reservation service activities

Division 80 Security and investigation activities
Division 81 Services to buildings and landscape activities
Division 82 Office administrative, office support and other business support activities

Section O Public administration and defence; compulsory social security

Division 84 Public administration and defence; compulsory social security

Section P Education

Division 85 Education

Section Q Human health and social work activities

Division 86 Human health activities
Division 87 Residential care activities
Division 88 Social work activities without accommodation

Section R Arts, entertainment and recreation

Division 90 Creative, arts and entertainment activities
Division 91 Libraries, archives, museums and other cultural activities
Division 92 Gambling and betting activities
Division 93 Sports activities and amusement and recreation activities

Section S Other service activities

Division 94 Activities of membership organizations
Division 95 Repair of computers and personal and household goods
Division 96 Other personal service activities

Section T Activities of households as employers; undifferentiated goods - and services producing activities of households for own use

Division 97 Activities of households as employers of domestic personnel
Division 98 Undifferentiated goods and services producing activities of private

Section U Activities of extraterritorial organizations and bodies

Division 99 Activities of extraterritorial organizations and bodies