UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

Project of the Government of the Republic of India

PROJECT DOCUMENT

Project number:	GF/IND/08/X02
Project title:	Environmentally Sound Management and Final Disposal of PCBs in India
GEFSEC Project ID:	3775
Starting date:	January 2010
Duration:	5 years
Project site:	India
Government Co-ordinating agency:	Ministry of Environment and Forests (MOEF)
Counterpart:	Ministry of Power (MOP)/Central Power Research Institute (CPRI)
Executing Agency/ cooperating agency:	Central Power Research Institute (CPRI)
Project Inputs:	
GEF grant:	**US$ 14,100,000** excluding PPG of US$ 350,000
	US$ 14,450,000 including PPG
Support costs (10%):	*US$ 1,445,000*
***UNIDO inputs** (in-kind):*	*US$ 150,000*
Counterparts input:	
MOEF	*US$ 7,500,000*
Stakeholders (CPRI)	*US$ 21,350,000*
Total co-financing	***US$ 29,000,000***
Total project cost	**US$ 43,450,000 (excluding support costs)**

Brief description:

The Republic of India signed the Stockholm Convention on POPs on 14 May 2002 and ratified it on 13 January 2006. The Global Environment Facility (GEF)-funded project entitled "*Development of a National Implementation Plan (NIP) in India as a First Step to Implement the Stockholm Convention on Persistent Organic Pollutants (POPs*)" was approved on 14 June 2007. By the Government of India's notification, the Ministry of Environment and Forests (MOEF) was assigned as the National Focal Point (NFP) for the Stockholm Convention on POPs. The GEF Operational Focal Point in India signed the project document on 8 November 2007 and the Inception Workshop for the development of NIP was held on 6 May 2008. The NIP is being prepared and foreseeable to be completed by November 2009 covering reviews of particular POPs issues, considering the provisions of relevant international commitments, developing detailed strategies and action plans, including timetable of implementation and measures of success as well as resource requirement.

The MOEF has selected the environmentally sound PCBs management and disposal as one of the first priorities of post-NIP program. The reason to give priority to the PCBs sector was that its implementation timeframes was clearly defined by the Stockholm Convention. The project will complete and make the national inventory of PCBs sustainable covering power sector, ship-breaking sector and other sectors including non-electrical equipment such as those with hydraulic fluids. The project will dispose of at least 7,700 tones of PCBs, PCB-containing equipment, PCBs-containing mineral oil and wastes and through it will create national capacity to manage and dispose of PCBs countrywide.

The project addresses national priorities such as to improve legislation on POPs chemicals, to eliminate PCB-containing equipment, to reduce PCBs releases from industrial wastes and sewages, to improve environmental performance in power sector, to improve environmental performance in industry sector, and to identify PCBs wastes and contaminated sites and their environmentally sound and safe management.

It is a unique feature of this project that it will be implemented simultaneously with the development and formulation of the relevant parts of the NIP, also as a GEF-funded FSP. The national executing agency of this project is the Central Power Research Institute (CPRI) and CPRI is the government entity that develops and formulates the PCB-related chapters in the NIP. It has the advantage that CPRI can coordinate the work better and there would be no overlapping and double accounting between these two projects.

Approved:

	Signature:	**Date:**	**Name and title:**
On behalf of			
The Government of the Republic of India:	_____	_____	_____
UNIDO:	_____	_____	_____

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LIST OF ACRONYMS AND ABBREVIATIONS

AFR	Alternative Fuels and Raw Materials
APCD	Air pollution control device
APCS	Air pollution control system
APR	Annual Project Report
AWP	Annual Work Plan
BAT	Best available techniques
BEP	Best environmental practices
BMW	Biomedical Waste
CBWTF	Central Biomedical Waste Treatment Facility
CEMS	Continuous Emission Monitoring System
COP	Conference of Parties
CPBC	Central Pollution Control Board
CPRI	Central Power Research Institute
CTA	Chief Technical Advisor
DCP	Department of Chemicals and Petrochemicals
DIPP	Department of Industrial Policy and Promotion
ECD	Electron Capture Detector
EIA	Environmental Impact Assessment
EMB	Environmental Management Branch
ESM	Environmental Sound Management
FAO	Food and Agriculture Organization
FSP	Full-sized Project
GC	Gas chromatography
GEF	Global Environment Facility
GOI	Government of India
HCB	Hexachlorobenzene
HSMD	Hazardous Substance Management Division
IR	Inception Report
ITRC	Indian Toxicology Research Centre
IW	Inception Workshop
M&E	Monitoring and Evaluation
MIS	Management Information System
MoA	Memorandum of Agreement
MOAC	Ministry of Agriculture and Cooperation
MOEA	Ministry of External Affairs
MOEF	Ministry of Environment and Forests
MOF	Ministry of Finance
MOHFW	Ministry of Health and Family Welfare
MOP	Ministry of Power
MS	Mass spectrometry
NFP	National Focal Point

LIST OF ACRONYMS AND ABBREVIATIONS

Ng	Nanogram
NGOs	Non-governmental Organizations
NIOH	National Institute for Occupational Health
NIP	National Implementation Plan
NPC	National Project Coordinator
NPD	National Project Director
NPTI	National Power Training Institute
NSC	National Steering Committee
NTA	National Technical Advisor
OP	Operational Program
PBB	Polybrominated biphenyls
PCB	Polychlorinated biphenyls
PCDD/PCDFs	Polychlorodibenzo-para-dioxins and polychlorodibenzofurans
PCT	Polychlorinated terphenyls
PCW	Project Completion Workshop
PET	Project Expert Team
PIR	Project Implementation Review
PIU	Project Implementation Unit
PM	Particulate matter
PMU	POPs Management Unit
POPs	Persistent Organic Pollutants
POPRC	Persistent Organic Pollutants Review Committee
ppm	Parts per million
PPLI	Prasadha Pamunah Limbah Industry
PSC	Project Steering Committee
PTR	Project Terminal Report
RCC	Regional Coordination Committees
RENPAP	Regional Network on Pesticides for Asia and the Pacific
SC	Stockholm Convention
SCMC	Supreme Court Monitoring Committee on Hazardous Wastes
SMART	Specific; Measurable; Achievable and Attributable; Relevant and Realistic; Time-bound, Timely, Trackable and Targetable
SPCB	State Pollution Control Board
TCU	Technical Coordinator Unit
TEQ	Toxic Equivalent (dioxin releases)
TOR	Terms of Reference
TPR	Tripartite Review
TTPR	Terminal Tripartite Review
UNIDO	United Nations Industrial Development Organization
UP-POPs	Unintentionally produced POPs
UT	Union Territories

SECTION A. CONTEXT

A.1 Context/History

a. Overview

1. The Stockholm Convention (SC) on persistent organic pollutants (POPs) recognizes that POPs including polychlorinated biphenyls (PCBs) "possess toxic properties, resist degradation, accumulate and are transported through air, water and migratory species, across international boundaries and deposited far from their places, where they accumulate in terrestrial and aquatic ecosystems". Exposure to PCBs is of a major public health concern, in particular impacts upon women and, through them, upon future generations.

2. The Republic of India signed the Stockholm Convention on POPs on 14 May 2002 and ratified it on 13 January 2006. The Global Environment Facility (GEF)-funded project entitled "*Development of a National Implementation Plan (NIP) in India as a First Step to Implement the Stockholm Convention on Persistent Organic Pollutants (POPs*)" was approved on 14 June 2007. By the Government of India's notification, the Ministry of Environment and Forests (MOEF) was assigned as the National Focal Point (NFP) for the Stockholm Convention on POPs. The GEF Operational Focal Point in India signed the project document on 8 November 2007 and the Inception Workshop for the development of NIP was held on 6 May 2008. The NIP is being prepared and foreseeable to be completed by November 2009 covering reviews of particular POPs issues, considering the provisions of relevant international commitments, developing detailed strategies and action plans, including timetable of implementation and measures of success as well as resource requirement.

3. Aiming at strengthening the institutional framework, the POPs Management Unit (PMU) was established in the MOEF in 2008. The Joint Secretary of the Ministry has been assigned as National Project Director (NPD) and the Director has taken the position of the National Project Coordinator (NPC). The Director is also the member of the 31-member Persistent Organic Pollutants Review Committee (POPRC) appointed by the Conference of the Parties (COP) of the Stockholm Convention. In addition, two assistant project coordinators assist the PMU.

4. There is a need for development and extensive targeted capacity building enhancing the decision-making, managerial, and technical capabilities of government officials to implement the NIP provisions and provide guidance to public and private enterprises in environmentally sound PCB management and other priorities. NIP implementation at the country level requires the development of adequate capacities at central and local levels. The number of qualified human resources for the enforcement of the existing and future regulations avoiding non-compliance of legislations and improper management of PCBs should also be enlarged. Human and technical capacities for PCBs monitoring, especially the proper laboratory services for PCBs analysis has to be strengthened as well. The introduction of internationally accepted analytical testing methodology, national standards and accreditation procedures shall also be strengthened.

b. PCB-containing equipment and oil

5. The Central Power Research Institute (CPRI) in Bangalore, Karnataka, which was established in 1960, is an important player in the power sector of India through testing and consultancy in the area of electrical equipment and related materials. CPRI was selected to execute the PCB-related activities of the NIP as well as post-NIP activities due to their vast experience in environmental sound management (ESM) of PCBs oil and other PCB-containing hazardous materials.

6. PCBs were never produced in India and its import was banned in 1998. The survey carried out by CPRI from 2004 to 2008, which included the establishment of a preliminary inventory on PCB-containing electrical equipment and the evaluation of India's capacity for the ESM and disposal of PCBs, partially assessed the PCB situation in India. In all 28 states and 7 union territories of India, an estimated total number of about 45,000 power and about

3,500,000 distribution transformers exist. While the total amount of imported PCB-oils as well as PCB-containing equipment is unknown, the estimated quantity of pure PCB-oils and PCB-containing equipment in India according to the initial inventory amounts to 7,700 tons that will be disposed of in the proposed Full-sized Project (FSP). The initial inventory will be expanded and improved through the implementation of the NIP project, which preliminary inventory will be used as baseline for planning purposes implementing the provisions of the Stockholm Convention.

7. While no states or Union Territories (UT) (each state or UT is subdivided into districts for administration purposes – as of 2008, India has 610 districts) will be excluded, the proposed FSP will target the 4 regions, in particular 3-4 states in each region (altogether 13 states) as follows: ***Northern Region***: Delhi, Punjab, Rajastan and Uttar Pradesh; ***Western Region***: Gujarat, Madhya Pradesh and Maharashtra; ***Eastern Region***: Bihar, Orissa and West Bengal; and ***Southern Region***: Andhra Pradesh, Karnataka and Tamil Nadu. Three criteria were used in identifying the states, in addition to the geographic/regional distribution, namely: the total power consumption, the total number of electrical installations and the level of electrical infrastructure of the states. These 13 states achieved the highest industrial development in India prior to the promulgation of the Environment (Protection) Act, 1986. This way, the project will cover approximately 80% or more of the PCBs oil and PCB-containing equipment and wastes found in India, leaving the rest for the replication strategy that would also be defined in the project.

8. Three disposal facilities will be set up: one stationary unit to be installed at Vapi, Gujarat and two mobile units to be placed in Delhi and Bangalore, Karnataka. The disposal facilities will be located in such a way that would enhance them to service all 13 selected states based on geographical and logistical considerations.

9. Main owners of PCB-containing equipment and PCB oils in the public sector are the power generation and transmission companies (state electricity boards) and in the private sector the mining, lubricant and ship-breaking industries, etc.

10. Awareness on the harmful effects that PCBs pose on human health and the environment is generally low. Technical staff and workers have direct contacts with electric equipment and materials containing contaminated fluids without knowing the associated health risks.

11. Statistical data on quantities of out of service PCB-containing electrical equipment are not available. Most of the broken down transformers are recycled and reused. The out of service capacitors are stored at the facilities of their owners. However, the PCB-containing equipment and oil is not managed as hazardous waste in an environmentally sound manner. The lack of proper management may result in social costs for the health of population, deterioration of the environment and excessive expenditures for late mitigation measures. The assessment of such costs is crucial for government decision-making. Capacity for economic and social costs/benefits assessments concerning POPs-related measures is currently not available and needs to be created.

12. The basic reference cost of the disposal has been obtained from the experience of CPRI, who is the leading institution in India handling PCBs. Moreover, the current disposal fee for medical waste incineration by a private service provider in Karnataka is Rupee 375 per 2.5 kg that is equivalent to about US$ 3,000/ton[1]. It is expected that through local dismantling of transformers and reducing the volumes (by approx.55-60%) for export to a qualified incinerator, it will be possible to keep the disposal costs within US$ 3.0-3.5/kg of the pre-separated PCB wastes.

13. The proposed FSP will focus on the reduction and elimination of PCBs in the power sector through (a) development of appropriate legislation, (b) provision of capacity building for key stakeholders, (c) development of an ESM system for PCBs, PCB-containing electrical equipment and waste and incorporating it into a national policy framework, (d) gradual phase-out of PCB-containing equipment (transformers and capacitors), (e) disposal of all PCBs,

[1] Exchange rate is US$ 1 = Rupee 50 (April 2009)

PCB-containing equipment and wastes, (f) strengthening environmental monitoring capacities and (g) identifying the most appropriate mitigation measures to reduce social costs of complying with the Stockholm Convention. In addition, the project will start to create a national inventory of non-electrical equipment and other articles containing more than 0.005 percent of PCBs as required by the Stockholm Convention.

14. Project operations will create the required adequate laboratory capacity, labelling system as part of the environmentally sound PCBs management and will complete the inventory for PCB-containing electrical equipment. The PCB-containing equipment and wastes will be collected at two workshops/temporary storage facilities where they will be separated for PCB-containing oil (approx.30-35% by weight, depending on the transformer's size), PCB-containing wastes (paper and wooden parts of transformers –approx.10% by weight) and other parts, which could be recycled (ferrous and non-ferrous metals– approx.55-60% by weight). The phasing out and dismantling of at least 7,700 tons of PCB-containing equipment and final disposal of PCB-containing wastes is planned to eliminate a significant portion of PCBs from the electrical network. According to statistics of the number of electrical transformers (the principal location for PCB-contaminated oils), total contaminated equipment and oil in India far exceeds this amount (please see table below). The project has however been structured to create the sustainable capacity in India to continue treatment of these remaining wastes after the completion of the project, allowing for their complete elimination by 2028, as specified in the Stockholm Convention.

Table 1. Estimated Number of PCB-containing Electrical Transformers

Size of transformers	Number	Oil (liter/unit)	Contaminated oil (tons)	Contaminated equipment (tons)	Total contaminated material (tons)[2]
Power transformers	**45,000**				
Small	31,500	2,000	5,418	8,127	13,545
Medium	11,250	5,000	4,838	7,256	12,094
Large	2,250	30,000	5,805	8,708	14,513
Distribution transformers	**3,500,000**				
Small	1,167,000	50	4,967	7,450	12,416
Medium	1,167,000	100	9,933	14,900	24,833
Large	1,166,000	200	19,866	29,799	49,665
Total transformers	**3,545,000**		**34,766**	**52,148**	**86,914**

15. The project will enable the Government of India to duly report on the progress in eliminating PCBs pursuant to Annex A, Part II, subparagraph (g) of the Convention according to Part C of the format reporting under Article 15 of the Stockholm Convention (Annex to Decision SC-2/18 of the Conference of the Parties).

c. Regulatory context

16. The Constitution of the Republic of India covers the principles of environmental protection. The State's responsibility with regard to environmental protection has been laid down under Article 48-A of the Constitution, which reads as follows *"The State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country"*. Environmental protection is a fundamental duty of every citizen of this country under Article

[2] PCB-contaminated oil and equipment weight is estimated based on 10% contamination rate, conservative by international developing and developed world standards.

51-A(g) of the Constitution which reads as follows *"It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures*."

Table 2: Subjects related to environment in the Seventh schedule of the Constitution

List	Entries	
Union list		
	52	Industries
	53	Regulation and development of oil fields and mineral oil resources
	54	Regulation of mines and mineral development
	56	Regulation and development of inter-State rivers and river valleys
	57	Fishing and fisheries beyond territorial waters
State list		
	6	Public health and sanitation
	14	Agriculture, protection against pest and prevention of plant diseases
	18	Land, colonisation, etc.
	21	Fisheries
	23	Regulation of mines and mineral development subject to the provisions of List-I
	24	Industries subject to the provisions of List-I
Common or Concurrent List		
	17A	Forests
	17B	Protection of wild animals and birds
	20	Economic and social planning
	20A	Population control and family planning

17. **The Environment (Protection) Act, 1986** was introduced as an umbrella legislation that provides a holistic framework for the protection and improvement to the environment. In terms of responsibilities, the Act and the associated Rules requires for obtaining environmental clearances for specific types of new/expansion projects (addressed under Environmental Impact Assessment Notification, 1994) and for submission of an environmental statement to the State Pollution Control Board (SPCB) annually. Environmental clearance is not applicable to hydropower projects. Environmental Impact Assessment (EIA) has to be carried out for all projects as a standard management procedure as laid down in The Environment (Protection) Act, 1986 and also functions within permissible standards of ambient air quality and noise levels as prescribed by national laws and international regulations.

18. The **Pollution Control laws** in India are as follows:

- The Water (Prevention and Control of Pollution) Act, 1974
- The Water (Prevention and Control of Pollution) Rules, 1975 – Schedules
- Central Board for the Prevention and Control of Water Pollution (Procedure for Transaction of Business) Rules, 1975
- The Water (Prevention and Control Of Pollution) CESS Act, 1977
- The Water (Prevention and Control of Pollution) CESS Rules, 1978 and Annexures
- Central Water Laboratory
- The Water (Prevention and Control of Pollution) Cess (Amendment) Act, 2003
- The Air (Prevention and Control of Pollution) Act, 1981

- The Air (Prevention and Control of Pollution) Rules, 1982 and Schedules
- The Air (Prevention and Control of Pollution) (Union Territories) Rules, 1983 and Form
- The Environment (Protection) Act, 1986
- The Environment (Protection) Rules, 1986 and Schedules
- The Environment (Protection) Third Amendment Rules, 2002
- Rules for the Manufacture, Use, Import, Export and Storage of Hazardous Micro Organisms Genetically Engineered Organisms or Cells, 1989
- Hazardous Wastes (Management and Handling) Rules, 1989
- The Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989
- Manufacture, Storage and Import of Hazardous Chemical (Amendment) Rules, 2000, Draft Notification
- Bio-Medical Waste (Management and Handling) Rules, 1998
- Hazardous wastes (Management and Handling) Amendment Rules, 2000
- Hazardous Wastes (Management and Handling) Amendment Rules, 2002
- S.O.979(E), [27/8/2003] - Amendments to S.O.763(E) dates 14/9/1999 Dumping and disposal of fly ash discharged from coal or lignite based thermal power plants on land
- Municipal Solid Wastes (Management and Handling) Rules, 2000
- Battery (Management and Handling) Rules, 2000
- The Noise Pollution (Regulation and Control) Rules, 2000
- The Noise Pollution (Regulation and Control) Rules, May, 2002
- Re-cycled Plastics Manufacture and Usage Rules, 1999
- Re-cycled Plastics Manufacture and Usage Amendment Rules, 2002
- The Recycled Plastics Manufacture and Usage (Amendment) Rules, 2003
- Ozone Depleting Substances (Regulation) Rules, 2000

19. Some **important notifications** are as follows:

- Delegation of Powers to the Central Pollution Control Board
- Environmental Impact Assessment Notifications
- Public Hearing Notifications
- The Coastal Regulation Zone Notifications
- Coastal Regulation Zone Notification dated May 21st 2002
- Aquaculture Authority – Notifications
- Eco-labeling Notifications
- Notification Concerning Open Burning Oil
- Notification Concerning Ban on Import of Hazardous Wastes
- Constitution of Appellate Authorities

20. **The Hazardous Waste (HW) Rule, 1989**, issued under the provision of Environmental (Protection) Act, 1986, controls and regulates the import of the hazardous wastes into the country. As per Rule 11 of the Hazardous Waste Rule, import of waste from any country to India shall not be permitted for dumping and disposal. However, the import of such wastes is allowed for processing and re-use as raw material, after the State Pollution Control Board (SPCB) has examined each case on its merit. The HW Rule was amended in 6 January 2000 to improve its applicability and implementation. The Hazardous Wastes (Management and Handling) Amendment Rules, 2003 classify used mineral oil as hazardous waste that requires proper handling and disposal. Organization will seek authorization for disposal of hazardous waste from concerned SPCBs as and when required. For further details on the Amendment Rules, 2003, see Annex 4: Baseline analysis on PCB management.

21. India is a party to the Basel Convention. It signed the Convention on 15 March 1990, ratified it on 26 June 1992, and acceded to the Convention on 22 September 1992. Ratification of this instrument represents India's commitment to solving, in a collective manner through

international cooperation, the problem of transboundary movement and disposal or dumping of dangerous and unwanted hazardous wastes. The Supreme Court Monitoring Committee on Hazardous Wastes (SCMC) has initiated return of hazardous wastes that have been wrongly imported in India. For example, it directed the return of PCB-contaminated old transformer components to Germany.

22. PIL 657/95 (filed on 18 September 1995) deals specifically with the import of hazardous wastes into the country in violation of the provisions of the Basel Convention. Despite the Convention, traders and industrial units in the country have been importing, for several years, large quantities of hazardous and non-hazardous wastes, and the mixture of both, for purposes of dumping instead of recycling for their own use. All hazardous wastes listed under Annexure VIII of the Basel Convention are banned for import as per the order dated 5 May 1997 of the Supreme Court in the above-mentioned petition. As per section 11 of the HW Rules, 1989, the MOEF is responsible for the overall control of hazardous wastes import and the import applications for import are processed by the concerned SPCB. MOEF and SPCB are also responsible to oversee the environmentally sound and safe handling at the time of off-loading of hazardous wastes through the appropriate port authorities.

23. In spite of the fact that PCBs were banned for import by MOEF Notification dated 13 October 1998, which act was further reconfirmed by Schedule – 8: Hazardous Waste Prohibited for Import and Export of the Hazardous Wastes (Management and Handling) Amendment rules, 2003, their import might still happen.

24. Waste oils are regarded as hazardous wastes as they may contain toxic heavy metals, PCBs, chlorinated solvents, etc. PCBs are added to waste oils by intentional or accidental mixing. Because their oily appearance and mineral oil miscibility, they are mixed with other waste oils. In many cases, PCB owners deliberately mix PCBs with other waste oils intended for recovery, in order to hide PCBs, thus saving expenses for the disposal of PCBs as hazardous wastes. Based on a letter dated 22 August 1997 from the MOEF, the Department of Revenue, Ministry of Finance (MOF) of the Government of India, has recommended by circular No.60/97-CUS that if on sampling, the concentration of PCBs in the imported waste oil is >5mg/l, the consignments can be released to the importers on submission of required details in Form 6 (HW Rules, 1989).

25. Similarly, importing ocean liners for ship-breaking can release several hazardous materials such as asbestos, PCBs, etc. Reports from the ship-breaking yards of Alang, Gujarat State notified in several occasions that imported vessels had hundreds of tonnes of materials contaminated with PCBs. It is estimated that each ship may contain PCB-containing wastes in the range of 200-800 kg. One of the last incidents was reported in 2006 by an inspection team consisting of a Technical Committee team from MOEF, Central Pollution Control Board (CPCB) and Gujarat Maritime Board officials. The inspection team confirmed the presence of PCBs. Such incidents show that the technical capacity to manage such dangerous materials and protect their workers should be strengthened.

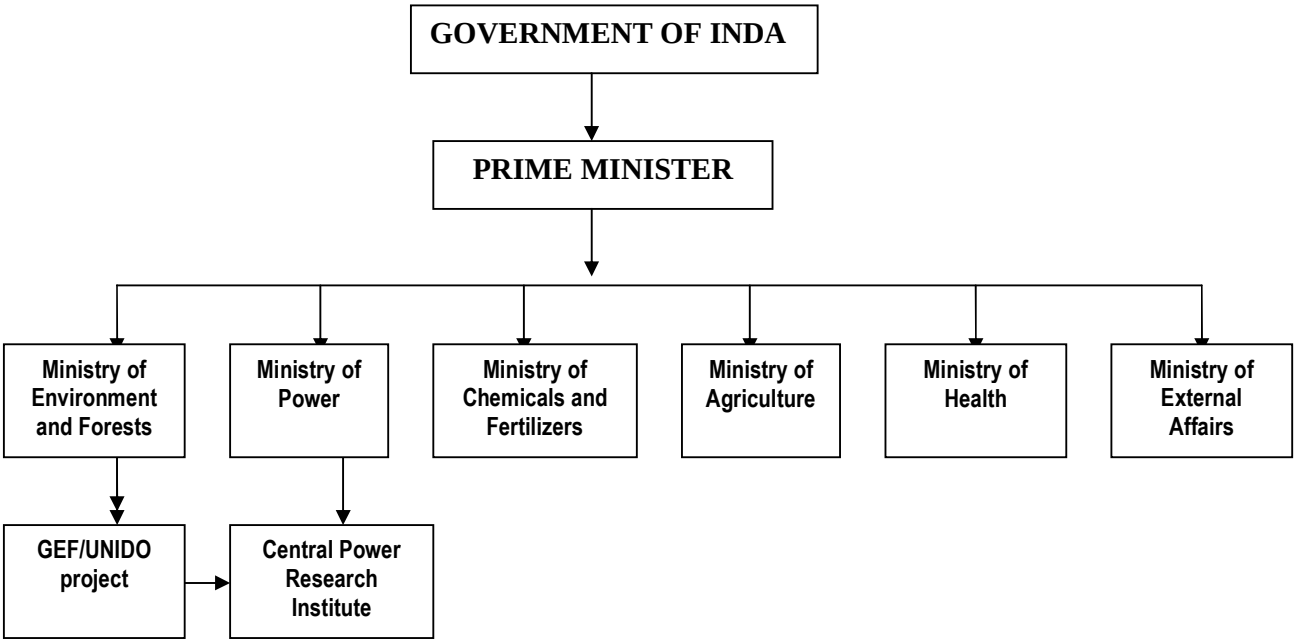
d. Institutional settings

26. The MOEF is the government coordinating agency for the project. In addition, two key stakeholder agencies play crucial roles in the project. The first is the Ministry of Power (MOP), the counterpart agency, which is responsible for assisting in the implementation of the activities and measures for limitation, elimination and monitoring of import and use of PCB-containing equipment and reduction of unintentional production of POPs chemicals. The other key stakeholder is the CPRI, which is the national executing agency/cooperating agency for the project. The National Power Training Institute (NPTI) will organize and carry out all capacity building activities related to technicalities of the environmentally sound PCBs management of the PCB-containing electrical equipment in the country. Further important stakeholders are the CPCB and SPCB. For more details, see Annex 5: Identification and responsibilities of stakeholders.

27. To give advice and guidance in the development and formulation of the NIP of the Stockholm Convention on POPs, the National Steering Committee (NSC) was set up in 2007. The NSC

will plan, guide and monitor all activities, will assess existing institutional infrastructure and its capacity to meet the requirements and will provide a platform to closer interactions of all stakeholders in implementing the provisions of the Stockholm Convention. Its tenure will be for a period of 3 years or until further reconstitution. The composition of NSC is as follows: Secretary of Ministry of Environment and Forests (MOEF) – Chairperson; Joint Secretary of MOEF – Secretary and member of NSC; 10 members: Secretary or his nominee, Department of Chemicals and Petrochemicals (DCP); Secretary or his nominee, Ministry of Agriculture and Cooperation (MOAC); Secretary or his nominee, Ministry of Health and Family Welfare (MOHFW); Secretary or his nominee, Ministry of External Affairs (MOEA); Secretary or his nominee, Department of Industrial Policy & Promotion (DIPP); Additional Secretary, Hazardous Substances Management Division (HSMD), MOEF; Additional Secretary and Financial Advisor, MOEF; Director, India Toxicology Research Centre (ITRC); Director, National Institute for Occupational Health (NIOH); and Head, Environment Division, India Habitat Centre.

ORGANOGRAM



28. A Sub-Committee of NSC was established to assess, review and advise and plan in all financial issues related to the implementation of the Stockholm Convention. The composition of the Sub-Committee is as follows: Additional Secretary of MOEF – Chairperson; the five members are the representative of Additional Secretary and Financial Advisor of MOEF; Joint Secretary, HSMD, MOEF; Director of MOHFW; Director, Plant Protection, MOAC; and Director, HSMD, MOEF.

29. A Technical Committee of NSC was also established to review the progress of work and recommend release of payment based on the delivery. The Technical Committee is comprised of: Joint Secretary of MOEF – Chairperson; the five members are Secretary of CPCB; Industrial Advisor, DCP; Director, MOHFW; Director, Plant Protection, MOAC; and Director, HSMD, MOEF.

30. The POPs Management Unit (PMU) was established in the MOEF in 2008. The Joint Secretary of the Ministry has been assigned as National Project Director (NPD) and the

Director has taken the position of the National Project Coordinator (NPC). Two assistant project coordinators assist the PMU.

e. Disposal of PCBs wastes

31. The major users of PCBs were power generation units and state electricity boards. There are at least 95 state electricity boards, transmission and distribution companies as well as at least 123 private sector utilities, power generating companies and independent power producers. These users do not store transformer oil. They have contracted service and maintenance of transformers and capacitors to local parties. Hence, they do not have PCBs storage facilities. Users of capacitors are large units not into manufacturing of capacitors. Therefore, such units do not have stock of PCBs in their premises. Further, PCB-containing oils that need to be replaced from time to time are collected by local agents. These local agents in turn sell them to oil reprocessing units wherein the moisture content is removed. It is then repacked and sold in the market. The electricity companies auction the old and defunct transformers. Agents then buy these transformers and use them for reprocessing activities.

32. Currently there are no standard and established disposal practices for the out-of-operation PCB-containing equipment and wastes. According to a survey carried out by CPRI, about 60% of PCB-containing equipment, oil and wastes are stored at the PCBs owners' yards and about 40% disposed of in an environmentally unsound manner. PCB-containing oil is mostly dumped by draining into the soil and such a way it ends up in the waterways. The equipment carcasses may also be dumped or sold as scrap.

33. Incineration plants for disposal of hazardous wastes including PCBs do not exist in India. Incineration is one of the biomedical waste treatment and disposal technologies that are covered by India's Biomedical Waste (BMW) Rules of 1998 (amended twice in 2000). However, the status of operating incinerators at health care facilities in India was not in compliance with the BMW Rules. Accordingly, CPCB issued a draft guidelines allowing incineration only at Central Biomedical Waste Treatment Facilities (CBWTFs), unless a special permit for onsite incineration is obtained from them. The draft guidelines for BMW incinerators specify the design criteria for the incinerator and the associated air pollution control device (APCD) as well as the minimum requirements in terms of training, personal protection equipment and emergency procedures for the incinerator operator. Since the 1998 BMW Rules have no specifications on the design of incinerators (only mentioning that incinerators have to be double chambered and the emission criteria), hence there arose a need for guidelines to ensure selection/installation of better incineration system. Some cement industries have recently shown interest to get involved in PCBs disposal, however, they are not equipped in co-incinerating hazardous wastes. Therefore they would require a substantial amount of investment in terms of both human and financial resources before entering in such a venture. In the states like West Bengal, Orissa, Andhra Pradesh and Karnataka, cement industries are functional and utilization of these facilities may be explored.

34. The selection of the disposal facilities will be based on the updated PCB inventory and on the assessment of the total power consumption, the total number of electrical installations and the level of electrical infrastructure of the states. Three disposal facilities will be set up covering altogether 13 states in 4 regions as detailed in paragraphs 7 and 8.

35. At the planning stage of setting up 3 disposal facilities, at least the following technical, economic and financial aspects pertaining to the establishment and operation of these facilities will be assessed:

- business model for various technology options, including operation modalities such as formation of consortia;
- services provided, including removal, packaging, transport and storage of PCBs;
- responsibilities of various partners in operating the facilities;
- investment strategies of private sector technology providers;
- use of GEF funds;

- private sector engagement;
- analysis of cost-effectiveness and sustainability of disposal facilities; and
- end of project scenario.

36. PCBs create environmental hazards therefore they have to be destroyed. The development of domestic PCBs disposal techniques and capabilities is a key task for India to implement the requirements of the Stockholm Convention. However, great gap exists between India and international advanced level of PCBs disposal technologies in many aspects such as the central control of incineration system; on-line monitoring of incineration tail gas; characteristics, identification and analysis of factory entry wastes; operators safety and emergency response; and most importantly lack of non-incineration technologies such as chemical decontamination. Other difficulties also exist in performing the obligation of the Convention as lacking corresponding technical and logistical supports in PCBs collection, transportation and safe storage. Aiming at present situation of PCBs disposal techniques in India, improving and developing PCBs disposal techniques (including environmentally sound collection, transportation, safe storage, etc.) and establishing the relevant disposal capabilities are among the top priority activities of implementing the Convention.

A.2 Barrier Analysis

37. The proposed project has been designed to address a variety of barriers in order to ensure its successful implementation and the achievement of project objectives. These barriers, listed in the order of project outcomes, include:

a) Lack of understanding of specific legal and regulatory requirements to implement Stockholm Convention

38. The project stakeholders in power generation, transmission and distribution as well as some large facilities, where environmental department exist have limited information on the Stockholm Convention. Smaller facilities are completely lacking information on POPs in general and PCBs in particular. Awareness campaigns have not yet been provided to disseminate Convention related information to the concerned. Due to the fact that the Government of India has ratified the Convention and the NIP development process has already started, policy makers at the environment sector have the required information on POPs and the Convention. However, the management of the power sector organizations and companies lack the full understanding of the legal and regulatory requirements related to PCBs to meet the requirements of Convention. Further the specific risk groups and the population at large are not aware on the potential health and environmental impacts of PCBs.

b) National laws and regulations not fully consistent with Stockholm Convention

39. The Government of India enacted the laws to ban the import of PCBs and regulate the handling of PCBs as hazardous waste in line with the requirements of the Basel Convention. However, legislation has not been promulgated to regulate the labeling requirements of the Convention. Hence, raising awareness for the health hazards of PCBs burden even in the most vulnerable groups such as the maintenance service providers of transformers cannot be successfully implemented. Further, the Convention requires reducing exposures and risk by controlling the use of PCBs only in intact and non-leaking equipment. This statement reflects more a wishful thinking than the reality as likely most of the mineral oil based PCB-containing transformers are leaking being not closed systems.

c) State legal and regulatory framework not fully consistent with Stockholm Convention

40. At state and territory level (28 states and 7 union territories with their 610 districts) the Convention related legislation has the same shortcomings as it is found at the national level.

d) Pollution prevention and management of PCB-containing equipment and waste not in consonance with ESM guidelines

41. The power generation units and state electricity boards, major users of PCBs do not have PCBs storage facilities, hence do not store transformer oil. Instead they contract servicing and maintenance of transformers and capacitors to local parties. Further, users of capacitors are

large units, which are not into manufacturing of capacitors. Therefore, such units do not have stock of PCBs in their premises. Local agents collect the PCB-containing oils that need to be replaced from time to time. These local agents in turn sell them to oil reprocessing units wherein the moisture content is removed. It is then repacked and sold in the market. The electricity companies auction the old and defunct transformers. Agents then buy these transformers and use them for reprocessing activities. The environmentally sound disposal practices for the out-of-service PCB-containing equipment and PCB-containing wastes have not been established. According to a survey carried out by CPRI, about 60% of PCB-containing equipment, oil and wastes are stored at the PCBs owners' yards and about 40% disposed of in an environmentally unsound manner. The PCB-containing oil is mostly dumped by draining into the soil and such a way it ends up in the waterways. The equipment carcasses may also be dumped or sold as scrap. Most of the trade of the PCB-contaminated materials is in the hands of the informal sector, street vendors or micro- or small-scale backyard industries.

e) Lack of institutional capacity for ESM of PCB-containing equipment and wastes

42. As the PCB-containing out-of service equipment and PCB-containing wastes are mainly handled by the informal sector, ESM could not be introduced yet. The PCBs waste management should be regulated in a practical, reasonable manner in order to make it appealing to the private sector. Then the ESM can be introduced and its implementation can regularly be audited.

f) Key stakeholders lack capacity to implement Stockholm Convention requirements

43. According to Annex A Part II of the SC, PCB-containing equipment need special maintenance. Phase out of such equipment should be completed not later than 2025 and the PCB-containing wastes should be disposed of in an environmentally sound manner not later than 2028. The Government of India does not currently have PCBs phase-out plan for the in-service PCB-containing equipment. Private companies, which own PCBs, lack the capacity to gradually replace PCB-containing electrical equipment. Oil recycling equipment is used to polish mineral oil in transformer for further use. Due to lack of SOPs for PCBs management, PCB-containing equipment maybe treated with the same recycling device, thus there is a potential risk of transformer oil cross contamination. Appropriate infrastructure is not yet available for the interim storage facilities of PCB-containing equipment. The required human resources are also missing for operating the interim storage facilities in accordance with international standards.

g) No national tracking and record keeping system for PCB inventories

44. The development and formulation of NIP in India covering among others the inventory of PCBs oil and PCB-containing equipment and wastes has commenced. This exercise will result in the preliminary PCBs inventory. The information to be collected during the inventory process will be compiled in the inventory report. The inventory data has to be entered into a centrally available database, which could serve as a baseline and also as the basis for further data input. Consequently the data has to be available for reporting and informational purposes. However, such a national database is not yet available.

h) Lack of sampling, analysis, and monitoring capacity

45. Due to the preparation of the PCBs inventory and the PCBs phase-out plan, the requirements for monitoring (sampling and analysis) will significantly increase. Therefore the capacity of accredited analytical laboratories for PCBs testing should be enhanced and if required new laboratories should be involved in the PCBs testing network to timely cope with the increased tasks.

i) Lack of awareness of PCB risks

46. The environmental contamination level is well documented by the scientific literature in India and reported PCBs concentrations in human and animal tissues as well as in different compartments of the environment (water, sediment, etc). The result of these efforts, however, has not yet been consolidated. When the national PCBs database will be available, these

data should be collected and entered in the database. Due to the lack of repository of POPs and PCB-related information, the general awareness on PCBs risks is low.

j) Lack of dedicated environmentally sound maintenance capacity for PCB-containing equipment

47. CPRI provides maintenance services to power transformers. But transformers outside of the state electricity boards have not been provided with regular maintenance services, particularly not in an environmentally sound manner. Oil containing transformers are partially closed systems. They need to be regularly checked for conductivity, moisture and level of oil. From time to time the oil needs to be topped up. Though there is an internal procedure at the PCB owners as to how maintenance and servicing of equipment should be carried out, it is likely that substations having PCB-containing transformers may cross-contaminate PCB-free transformers. The maintenance of transformers is carried out after samples are taken and sent to CPRI for testing of oil quality and PCBs content. CPRI then advises the substation on the necessity of maintenance. However, it may happen that the substation has only one pump for filtering and de-moisturizing the transformer oil for both PCB-free and PCB-containing transformers. Out of operation transformers from which the oil is drained but PCBs were not decontaminated are sold to local workshops, where they are taken apart and sold as scrap metal. Through these environmentally unsound practices PCBs can also enter the environment and pose health risks to local population.

k) No management system for identification, tracking, collection, packaging, transport, interim storage, record keeping, and disposal of PCB waste

48. As it has been mentioned earlier, no management system exists in the country for identification, tracking, collection, packaging, transport, interim storage, record keeping and disposal of PCBs wastes. High-temperature incineration plants for disposal of hazardous wastes, including PCBs do not exist in the country. Some cement industries have recently shown interest to get involved in PCBs disposal, however, they are not equipped in co-incinerating hazardous wastes. Therefore they would require a substantial amount of investment in terms of both human and financial resources before entering such a venture. Some small private incinerators are in operation but their operation temperature is only around 950 ^{0}C, therefore these facilities cannot be used for co-incineration of PCBs.

l) Lack of capacity for safe transport and storage of PCB-containing materials

49. There are neither specialized hazardous waste transport vehicles nor interim storage facilities that would meet the requirements of ESM and best environmental practices (BEP). This infrastructure has to be established by the proposed project.

m) Lack of capacity for safe treatment of PCBs, PCB-containing equipment, and PCB-contaminated oil and wastes

50. India has not yet developed the capacity for environmentally sound and safe treatment and disposal of PCBs, PCB-containing equipment and waste.

A.3 Local, Regional and Global Benefits

51. The global benefit of the Project is to protect human health and environment from harmful impacts of PCBs through prevention of future releases of PCBs wastes to the environment and from improper environmentally unsound management of PCB-containing equipment. The project will remove at least 7,700 tones of PCBs, PCB-containing equipment and PCB-containing oil and waste by environmentally sound containment, storage and final disposal.

52. Oil containing transformers are partially closed systems. They need to be regularly checked for conductivity, moisture and level of oil. From time to time the oil needs to be topped up. Though there is an internal procedure at the PCBs owners as to how maintenance and

servicing of equipment should be carried out, it is likely that substations having PCB-containing transformers may cross-contaminate PCB-free transformers. The maintenance of transformers is carried out after samples are taken and sent to CPRI for testing of oil quality and PCBs content. CPRI then advises the substation on the necessity of maintenance. For example, if the conductivity is high, the transformer oil needs to be replaced. It is an environmentally unsound practice that cross-contaminates transformers if the same pump were used for both PCB-containing and PCB-free transformers. It can happen in cases in which the substation has only one pump for filtering and de-moisturizing the transformer oil. It still may happen in cases in which separate pumps are used for PCB-containing and PCB-free equipment by simple overlook or mistake if the maintenance is carried out in the same workshop. It would therefore be advisable to set up separate maintenance workshops for PCB-free and PCB-contaminated transformers. Out of operation transformers from which the oil is drained but PCBs were not decontaminated are sold to local workshops, where they are taken apart and sold as scrap metal. Through these unsound practices PCBs can also enter the environment and pose health risks to local population.

53. The project will develop and implement environmentally sound transformer maintenance and service practices as part of the ESM system, which will eliminate further cross-contamination of transformers. Consequently, the risks to human health and environment will be reduced.

54. According to national experts, PCB containing oils that need to be replaced from time to time are collected by local agents. These local agents in turn sell them to oil reprocessing units wherein the moisture content is removed. It is then repacked and sold in the market.

55. In 1986, the Ministry of Petroleum had formulated a policy that requires all public sector undertakings to sell their used oil to registered re-refiners but its actual implementation needs to be verified. Moreover, no steps were taken to compel the major oil companies to buy back a certain percentage of the re-refined oil. Hence, the policy remained only on paper. The result was that the buy back system never took off, and the re-refining industry also had to fold up for a variety of reasons. (It is estimated that out of 60 registered re-refiners in India today, only 3-4 are functional. The rest have been shut down because of the non-availability of used oil and lack of support from various quarters). Because of the failure of the policy, the used oil went back into the hands of the *kadaiwallahs* (street vendors), like in the used lead acid battery sector, where lead processing returned to backyard smelters.

56. The project will remove and dispose of 7,700 tons of pure, concentrated PCBs, PCB-contaminated decommissioned equipment, PCB-containing oil and wastes, thus eliminate the risks to human health and environment from PCBs exposure.

57. Occupational health and safety of those who are engaged in transformer maintenance and service is also limited. Protective gears are seldom used thus PCBs exposure is high. As part of ESM system, personal safety measures will be implemented thus human exposure of PCBs will be minimized. Through training workshops, the project will significantly increase the knowledge and awareness of workers and managerial personnel as it is requested in paragraph 1 (e) of Article 10 of the Stockholm Convention. It will also create human resources for emergency responses in relation to handling PCB-containing equipment, oil and wastes.

58. The co-financing of the project is 2:1 over GEF resources, which indicates strong national commitment and provides for the efficient use of international financial resources.

59. ESM of PCBs will reflect national efforts to advance sound management of chemicals recognizing by Principle 7 of the Rio Declaration on Environment and Development. The project will assess and where necessary adopt appropriate policies at the national level including economic instruments that will leverage the cost of PCBs phase out and disposal.

60. By creating appropriate policy framework for environmentally sound PCBs management, existing institutions will be able to carry out their respective duties in a coordinated manner. Responsibilities of each authority will be clearly developed and understood. The Stockholm

Convention and other chemicals related conventions will be better understood and India will be able to play a more active role in their implementation and management at the international level. India ratified the Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal on 24 June 1992 and accessed to the Rotterdam Convention on Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade on 24 May 2005.

61. The project will provide an innovative way for PCBs disposal through promoting stationary and mobile disposal technologies and will allow for environmentally sound recovery of valuable metals from transformers. It will enhance the international experience in the applicability of non-incineration technologies for PCBs destruction and it will provide further reference to environmentally sound management and disposal of PCBs for other developing countries and countries with economies in transition.

A.4 Special Features

62. The MOEF has selected the environmentally sound PCBs management and disposal as one of the first priorities of post-NIP program. The reason to give priority to the PCBs sector was that its implementation timeframes was clearly defined by the Stockholm Convention. The project will complete and make the national inventory of PCBs sustainable covering power sector, ship-breaking sector and other sectors including non-electrical equipment such as those with hydraulic fluids. The project will dispose of 7,700 tones of PCBs, PCB-containing equipment and PCB-containing oil and wastes and through it will create national capacity to manage and dispose of PCBs countrywide.

63. The project addresses national priorities such as to improve legislation on POPs chemicals, to eliminate PCB-containing equipment, to reduce PCBs releases from industrial wastes and sewages, to improve environmental performance in power sector, to improve environmental performance in industry sector, and to identify PCBs wastes and contaminated sites and their environmentally sound and safe management.

64. It is a unique feature of this project that it will be implemented simultaneously with the development and formulation of the relevant parts of the NIP, also as a GEF-funded FSP. The national executing agency of this project is CPRI, which is the government entity that develops and formulates the PCB-related chapters in the NIP. It has the advantage that CPRI can coordinate the work better and there would be no overlapping and double accounting between these two projects.

65. The experience gained and lessons learned by the government authorities through the implementation of the Regional Network on Pesticides for Asia and the Pacific (RENPAP), a 17-country regional project executed by UNIDO and having its Secretariat in New Delhi, India would be applied in PCBs waste collection and disposal operations and built up an effective and sustainable system countrywide in the fields of: (i) environmentally sound management of existing waste disposal sites; (ii) building-up operational, management and communication capabilities; (iii) rollout of collection services; and (iv) data collection, processing for creating a comprehensive inventory system. One of the major activities of RENPAP is comprised of management and disposal of hazardous wastes. RENPAP Technical Coordinator Unit (TCU) that deals with this specialized area is hosted by the Government of Indonesia. The question of the choice of appropriate technology for the disposal of hazardous POPs waste was discussed in the Expert Group Meeting (EGM) on Obsolete POPs Pesticides and PCBs Stocks Management and its Safe Disposal held in Bangkok, Thailand on 7-9 July 2007, which was followed up by a full fledged workshop in Bogor, Indonesia on 29-31 May 2008. The disposal unit in Bogor managed by PT Prasadha Pamunah Limbah Industry (PPLI) had been active for about a decade and in the process developed technologies for the disposal of POPs pesticides and PCBs using incineration procedure in the cement kiln facilities. The successful experience has been shared by the member countries and the owners of the establishment extended all their cooperation to set up similar facilities in the RENPAP member countries. The TCU of RENPAP in Indonesia along with PPLI has been providing training and is willing

to sponsor more such workshops/training to assist the member countries of RENPAP in Asia and the Pacific in the safe management of toxic wastes of POPs (PCBs). This valuable linkage would help in establishing appropriate technology for the disposal of PCBs targeted in the project for India. Based on the experience and capabilities of PPLI and Holcim PT, general guidance and critical requirements for BAT/BEP could be outlined.

66. The destruction and removal efficiency was measured to be better than 99.9999% and demonstrated that co-processing of hazardous chemicals can be done in an irreversible and environmental sound manner in a local cement kiln under developing country conditions. The Stockholm Convention on persistent organic pollutants (POP's) requires "*complete destruction and irreversible transformation*" of POPs and POPs waste as well as minimisation and avoidance of emissions of dioxins, furans, PCBs and Hexachlorobenzene (HCB) during disposal. The test burn showed that all these compounds were below the detection limit and that the destruction had been complete and irreversible, i.e. no new formation of dioxins, furans or PCBs.

67. The drivers for the very large long-term investment in the use of alternative fuels and raw materials are (a) decrease in the environmental impacts of wastes; (b) safe disposal of hazardous wastes; (c) decrease in greenhouse gas emissions; (d) a decrease in waste handling costs and (e) lowering costs in the cement industry.

68. The project also envisages promoting in line with the BAT/BEP guidelines and guidance the introduction of alternative non-incineration technologies in managing and disposing of POPs wastes.

SECTION B: REASONS FOR UNIDO ASSISTANCE

69. UNIDO is committed to assist its developing country Member States in accordance with Article 12 of the Stockholm Convention. UNIDO has significant experience in implementing Enabling Activities for the development of the NIPs including India that has opted to have a FSP to develop and formulate its NIP. In addition, UNIDO is executing or developing a range of demonstration and capacity building projects geared to support Stockholm Convention implementation in a wide range of developing countries and countries with economies in transition. These activities are compatible with UNIDO's mandate and corporate strategy and will lead towards the Millennium Development Goals.

70. India is one of UNIDO's largest recipients of technical cooperation assistance. Activities undertaken in India by UNIDO include a range of measures related to investment, industry efficiency and waste management. It is noteworthy to mention that India host the UNIDO RENPAP programme that has a strong element of pesticide waste management. The experience gained in these projects will be of relevance in the proposed project in India.

71. UNIDO's in-kind contribution to the project will comprise the establishment of a project focal point and the provision of the part-time assistance of senior staff within its Environmental Management Branch (EMB) to ensure the effective implementation of the project and to support project implementation as well as the part-time assistance of the UNIDO RENPAP Regional Coordinator.

72. In addition, UNIDO will continue to seek co-financing or associated financing for activities that further the objectives of the project and of implementation of the Stockholm Convention in India.

SECTION C: THE PROJECT

C.1 OBJECTIVE OF THE PROJECT

Overall Objective of the Project

73. The overall objective of the project is to reduce and eliminate the use and releases of PCBs to the environment through promotion of measures to minimize exposures and risks by introducing environmentally sound management and disposal of PCBs, PCB-containing equipment and PCB-containing mineral oils and wastes aiming at the final and virtual disposal of all PCBs inventory in India by 2025 and 2028, respectively.

Immediate Objective of the Project

74. The immediate objectives of the project are to:

- Strengthen the legal and regulatory framework for environmentally sound management (ESM) and disposal of PCBs, PCB-containing equipment and PCB-containing mineral oils and wastes;
- Improve institutional capacity at all levels of PCBs disposal management;
- Removal of 7,700 tones of PCBs, PCB-containing equipment and PCB-containing mineral oils and wastes from targeted sites and transport them to disposal unit; and
- Disposal of 7,700 tones PCBs, PCB-containing equipment and PCB-containing mineral oils and wastes in an environmentally sound manner

75. The objective will be achieved through a combination of strategies, including legislative and regulatory assessment, capacity building, public education, technology transfer, technology dissemination, technical training, technical support and introduction of new advanced environmental risk assessment tools.

C.2 THE UNIDO APPROACH

Project Implementation Arrangements

76. **UNIDO** will be the GEF Implementing Agency (IA) for the project. A project focal point will be established at UNIDO to assist project execution. This focal point will consist of dedicated core staff, supplemented by support from support staff colleagues on a part-time as required basis, supervised by a senior professional staff engaged in the management and coordination of UNIDO's Stockholm Convention Program. UNIDO will make these services available as part of its in-kind contribution to the project.

77. ESM of PCBs management and disposal involves a wide spectrum of stakeholders in India. While environmental sector stakeholders will undertake the principal responsibilities, power sector stakeholders will also play an important role in the project. The project management structure is given below.

78. The **Ministry of Environment and Forests (MOEF)** is the nodal agency for planning, promoting and coordinating environmental programmes including the management of chemical disasters in India. The Ministry is mandated to protect the land, air and water systems and is responsible for the prevention and control of pollution including hazardous substances. The MOEF is the GEF and Stockholm Convention focal point in the country, which coordinates activities and cooperation between relevant stakeholders of the NIP. MOEF is empowered to promulgate rules under the Environment Protection Act and is responsible for ensuring effective implementation of legislation, monitoring and control of pollution (including pesticide levels in soil and water), environmental clearances for industrial development projects, promotion of environmental education, training and awareness, and coordination with concerned agencies at the national and international level. MOEF establishes standard for the quality of the environment, including emissions and/or discharges of environmental pollutants from various sources. It has powers to establish procedures and safeguards for the prevention of accidents that may cause environmental pollution. MOEF

can issue direction for the closure and prohibition or regulation of an industry, operations or processes.

79. MOEF entrusted the **Central Power Research Institute (CPRI)** to be the national executing agency of this project. CPRI shall be responsible for the following issues:

- Coordinate legislative activities while recommending amendments and additions to relevant legislation and regulations as well as develop guidelines for PCBs related activities;
- Facilitate cooperation and coordination between stakeholders and provide the stakeholders with management tools;
- Conduct inventories of production and utilization of PCB-containing equipment and PCB-containing oils and wastes;
- Establish a database and an information sharing network;
- Provide individuals, agencies and companies with PCB-related information;
- Organize capacity building activities such as trainings, workshops and seminars; and
- Monitor and assess the implementation of responsibilities and duties of stakeholders and regularly report to relevant governmental authorities.

80. **National Focal Point (NFP).** An effective mechanism for implementation of the Stockholm Convention was introduced by establishing the National Steering Committee and its Sub-Committee and Technical Committee. The NFP will plan, guide and monitor all activities, will assess existing institutional infrastructure and its capacity to meet the requirements and will provide a platform to closer interactions of all stakeholders in implementing the Stockholm Convention including this project. NFP is located and operated at the MOEF. NFP is adequately staffed and budgeted.

81. **POPs Management Unit (PMU)**. The Joint Secretary of the Ministry has been assigned as National Project Director (NPD) and the Director has taken the position of the National Project Coordinator (NPC). In addition, two assistant project coordinators assist the PMU.

82. Project Steering Committee (PSC). PSC consists of a representative of MOEF, a representative of Central Electricity Authority (CEA) on behalf of the Ministry of Power (MOP), a representative of CPCB, representatives of major stakeholder utilities (state electricity boards), representative of CPRI as the national executing agency, the NTA, the CTA, and the UNIDO project manager.

83. **Project Expert Team (PET)**. The project will recruit an international **Chief Technical Advisor (CTA)**, a **National Technical Advisor (NTA)**, policy experts, PCBs management and disposal industry experts, chemists, monitoring & evaluation experts and other technical experts as required. These experts will form the PET to assist CPRI and report to MOEF (and MOP if decided to do so) on the following activities:

- Management and coordination of all project activities;
- Provision of technical support for policy framework, institutional strengthening, demonstration activities, technology selection, awareness raising and education, results and experience dissemination, and project monitoring and evaluation; and
- Periodic project implementation progress appraisal.

84. Detailed description of the work to be performed by the project expert team is given in Annex 6 - Terms of References.

85. Private industries and entrepreneurs can be roped in to establish the common facilities for disposal of PCBs. Private sector stakeholders and other potential project participants will be actively recruited and integrated into the project, as follows:

- Owners of PCB-containing in-service equipment will be educated on EMS, risk minimization and avoidance, supported by new guideline documents and programs;
- PCBs waste owners will be provided with technical assistance and financial support, if needed, on a cost-sharing basis to adopt ESM in PCBs management and disposal; and

- PCB-containing equipment and oil transporters and disposal facilities will be provided with technical assistance and capacity building support to ensure implementation of environmentally sound PCBs waste management requirements.

C.3 RATIONALE FOR GEF INTERVENTION

86. Legislation and regulations are in place for PCBs management in India, however, there are serious shortcomings in implementing and enforcing these regulations. It is partly because the PCBs wastes have been accumulating as PCB-containing equipment has become obsolete and their repair would not be feasible any more and partly because India has to meet its obligation related to BAT/BEP in disposal of PCBs. In addition the old equipment leaks and continuously contaminates their sites posing health and environmental hazard.

87. Environmentally unsound storage conditions at these sites entail high risk of PCBs release, with concomitantly high risk of PCBs contamination of soil and ground water. Capacity does not currently exist to dispose of obsolete PCB-containing equipment, oil and wastes in an environmentally sound manner. The regulatory requirements are in place however they have to be implemented and their implementation has to be enforced. The waste disposal facilities have to take ESM practices and Stockholm Convention and Basel Convention requirements into consideration.

88. In May 2001, the Stockholm Convention on Persistent Organic Pollutants (POPs) was adopted with the aim of protecting human health and the environment from POPs. The GEF became the principal financial mechanism by the decision of the Conference of Parties (COP). In October 2002, the GEF Assembly approved the addition of POPs as a new GEF focal area, and in November 2003, the GEF Council approved a GEF Operational Program on POPs – OP 14.

89. Article 13.2 of the Convention provides that developing countries Parties and Parties with economies in transition will have access to new and additional financial resources to enable them to meet the agreed full incremental costs of implementing measures that fulfill their obligations under the Convention. Therefore, insofar as a Party is obliged to require best available techniques under the well-defined circumstances specified in the Convention, the Party should receive access to the agreed full incremental costs of implementing this obligation.

90. Article 5 of the Stockholm Convention addresses measures that Parties shall take measures to reduce releases of unintentionally produced POPs listed in Part I Annex C with the goal of their continuing minimization and, where feasible, ultimate elimination. Part II of Annex C is a list of source categories that "*have the potential for comparatively high formation and release of these chemicals to the environment*" and the *"waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge"* is the first source in the list. It is an important point as the traditional disposal technology for PCBs is waste incineration and co-incineration in cement kilns.

91. For new sources listed in Part II (including any new or any substantially modified facility for treatment of POPs contaminated wastes), Parties are required to use best available technology. This requirement is to be "*phased in as soon as practicable but no later than four years after entry into force of the Convention for the Party.*" The Convention entered into force for India on 13 January 2006, on the ninetieth day after the date of deposit of its instrument of accession. It means that waste incinerators and cement kilns firing hazardous wastes built or modified on or after 13 January 2007 would be required to adopt BAT/BEP by 13 January 2008. Furthermore, in all existing facilities, India is required by the Convention to promote BAT and BEP.

92. When a Party implements this obligation, it should assure that priority consideration is given to alternative processes, techniques or practices that have similar usefulness but which avoid the formation and release of chemicals listed in Part I of Annex C. Subparagraph (f) in Para. A Part V Annex C provides: "*When considering proposals to construct new waste disposal facilities, consideration should be given to alternatives such as activities to minimize the generation of municipal and medical waste, including resource recovery, reuse, recycling, waste Separation and promoting products that generate less waste. Under this approach, public health concerns should be carefully considered.* "

93. Project activities eligible for funding under GEF OP 14 include: strengthening human and institutional capacity; strengthening and harmonization of the policy and regulatory framework for integrated and cross-sectoral approaches to POPs management; strengthening monitoring and enforcement capacity to ensure compliance with regulatory controls; developing capacity to access technologies and management practices; developing and implementing public awareness/information/environmental education programs; and facilitating dissemination of experiences and lessons learned, and promoting information exchange (GEF/C.22/Inf.4 dated 28 October 2003).

94. Pursuant to POPs focal area Strategy and Strategic Programming 1 and 2 for GEF-4 (2007-2010) approved by the GEF Council in September 2007, the GEF will co-finance projects aiming at strengthening capacities for NIP implementation in order to meet the country's obligations under the Stockholm Convention including POPs reduction measures, and partnering in investments in NIP implementation that sustainably reduce POPs production, use and releases through phase-out, destruction in an environmentally sound manner, and use of substitute products and alternative practices that lead to reduced environmental and health risks caused by POPs. The project will support this work by application of ESM in the management and disposal of PCB-containing equipment, oil and wastes.

95. For a detailed review of the project rationale and approach, please see Annex 1 (Project Logical Framework). The project will facilitate assessment of PCBs, PCB-containing equipment and wastes and systematically manage integrated predisposal activities and processes such as waste characterization, collection, packaging, labeling, waste transportation and interim storage. The ultimate generic management and disposal options are illustrated in the Tables 3 and 4 below where the relative environmental risks, feasibility and costs of each option are weighted. Within each generic component of PCBs management and disposal there are many individual technologies. However, the commercially available technologies suitable for transformation and irreversible destruction of the PCBs waste matrices, needs to be closely verified. It should be noted that India has not yet exported PCBs waste and has little experience in an alternative technology, namely in the supercritical water oxidation at laboratory scale.

96. The project will strengthen the management and disposal of PCBs, PCB-containing equipment and wastes in an environmentally sound manner and eliminate the risk of PCBs to human health and the environment in India, in the South Asia region and globally. Methodologies for PCBs waste site risk assessment, handling, clearance, collection, labeling, packaging, transportation, interim storage, disposal, and emergency response procedures will be developed according to strict internationally accepted technical standards and guidelines including those developed by COP to the Basel Convention. The emphasis will be put on the cost-effectiveness and sustainability of the proposed measures.

97. The expected global environmental benefits to be delivered include the complete irreversible destruction and transformation of a minimum of 7,700 tons of PCBs and PCB-containing equipment and wastes in an environmentally sound and cost-effective manner.

Table 3: Risk Assessment Matrix

Generic management options	Handling	Collection	Packaging	Labeling	Storage	Transportation	Disposal	Overall risk rating
Baseline scenario	H	H	H	H	H	H	H	H
Temporary storage facility	H	H	M	L	M	M	NA	M
Traditional technology scenario (incineration)	H	H	M	L	M	M	H	M
Mobile technology based alternative scenario	H	H	M	L	L	L	L	L

Legend: H = High risk, M = Moderate risk, L = Low risk, NA = Not Applicable

Table 4: Conceptual Illustration/Feasibility Assessment Matrix

Generic management options	Convention requirement	National policy and institutional support	Infrastructure	Stakeholder transaction cost	Pre-disposal cost	Disposal cost	Application potential through innovation, R&D, and joint ventures	Global environmental benefit	Overall feasibility and cost
Baseline scenario	1	1	1	3	1	1	1	1	10
Temporary storage facility	1	2	2	3	2	2	2	2	16
Traditional technology scenario (incineration)	3	4	3	4	4	4	5	2	29
Mobile technology based alternative scenario	5	4	3	4	4	4	5	5	34

Legend: 1 = Least feasibility, 5 = Highest feasibility

98. The GEF-4 Strategy and Strategic Programming in POPs focal area also states that coordination and synergies with countries' responses to related multilateral environmental agreements addressing chemicals issues will be encouraged. The design of activities regarding BAT/BEP demonstration and replication has taken into account "Updated 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)" issued by the Secretariat of Basel Convention.

99. The GEF intervention can be justified as follows:

- Project objectives, outcomes and outputs meet the goals and objectives of GEF Strategic Programs 1 and 2 in POPs focal area for GEF-4;
- The co-financing ratio is 2:1;
- Project outcomes are in line with the requirements of the Stockholm Convention and follow Basel Convention Technical Guidelines;
- Project applies ESM and BAT/BEP in management and disposal of PCBs, PCB-containing equipment and wastes that poses a major public health and environmental threat; and
- Project will ensure the sustainability and replicability of its outputs, significantly increasing global benefits.

C.4 RBM CODE AND THEMATIC AREA CODE

RBM code: CE17 Stockholm Convention
Thematic Area Code: FG50 Environment

C.5 EXPECTED OUTCOMES

100. Five substantive outcomes have been developed to achieve the project objectives.

Outcome 1 will result in a stronger legal and regulatory framework for environmentally sound management (ESM) and disposal of PCBs, PCB-containing equipment and wastes. The Government of India enacted the laws to ban the import of PCBs and regulate the handling of PCBs as a

hazardous waste in line with requirements of the Basel Convention. However legislation has not been promulgated to regulate the labeling requirements of the SC. The project will work with legislative and regulatory agencies to update existing laws and regulations and, where necessary, develop new regulatory approaches to specifically address PCBs management.

Outcome 2 will result in improved institutional capacity at all levels of PCBs, PCB-containing equipment and waste disposal management. PCBs waste generators and contaminated site owners are often unaware of the potential environmental, legal, and human health risks that their current and past operations entail. In addition, waste generators and owners lack the managerial and technical capacity to manage POPs wastes in an environmental sound manner.

Outcome 3 will increase capacity of PCB owners in India to properly manage PCBs, PCB-containing equipment and wastes.

Outcome 4 will establish a regional capacity to treat and dispose of PCBs, PCB-containing equipment and wastes.

In addition to the above substantive activities, project proponents will provide ongoing project management, monitoring, and evaluation under Outcome 5, including establishment of a Project Steering Committee composed of national and local stakeholder agencies, establishment and staffing of the project management team at the national and local levels, recruitment of national and international consultants, execution of a management training program for project staff (particularly at the local level), and ongoing monitoring and reporting of project activities.

Innovativeness of Approach

101. The project will mainly address electrical equipment, particularly PCB-containing transformers, introducing technological innovative mobile processing system for the dechlorination and reclamation of the contaminated dielectric fluids.

102. The project will introduce a dechlorination system for the decontamination of PCB contaminated mineral oil and the destruction of pure PCB liquids.

103. Dechlorination of PCB-containing mineral oil is a standard practice in used in the USA, Canada, Europe and other countries. A general description of the dechlorination process for PCB-containing mineral oil is given below:

Dechlorination of PCB-containing mineral oil

104. There are several chemistries used for the dechlorination process and the effectiveness and maximum concentration of PCB in the oil that can be treated by this technique varies. Nevertheless, the general steps are consistent amongst the several techniques. The steps are as follows:

- determination of the PCB level in the PCB-containing mineral oil;
- degasification (water removal) of the PCB-containing oil;
- loading the PCB-containing mineral oil into the reaction vessel;
- heating the oil to desirable reaction temperature;
- loading the proper volume of reagent into the reaction vessel;
- sampling and analysis of reaction mixture;
- neutralization of excess reagent; and
- centrifugation and discharge of PCB-free decontaminated oil

105. The dechlorination of the PCB-containing oil is followed by the oil polishing stage where the PCB-free oil is restored to its original dielectric characteristic of transformer insulator.

106. Transformers generally have about 30 years of operating life. During the regular maintenance, when the condition of a transformer is found that is no longer compatible with the requirements of environmentally sound management (as described in the regulations or standards), it is necessary to examine the different options that are available for addressing the problem.

107. There can be two basic reasons for reclassification of a transformer:

a. The transformer is found to have higher PCBs content than those levels set up by the regulatory standards, but the equipment is still in a satisfactory electrical and mechanical condition justifying its continued use. In such cases, retrofilling of the transformer with new or cleaned oil has to be considered.

b. The transformer is not complying with the specifications related to its use, for example due to poor electrical performance, poor mechanical condition or leaks. In these cases, the transformer must be repaired or if not feasible, be replaced by a new unit and be dismantled by methods permitted by the relevant guidelines and regulations.

Retrofilling of in-service PCB transformers

108. The practice of retrofilling PCB-containing transformers is used for medium and large size transformers (distribution, transformer and generating electrical stations), which contain PCBs in the oil at a level up to about 5000 ppm.

109. The treatment of in-service PCB-containing equipment will be based on the application of retrofilling, a well established practice that consists of the following steps:

- Disconnection of the PCB-containing transformer from the electrical system;
- Drainage of the PCB-containing oil from the transformer;
- Dechlorination of the PCB-containing mineral oil;
- Polishing of the dechlorinated mineral oil (which means, filtration in Fuller's Earth column, degasification of oil and replenishing of the anti-oxidant, if required);
- Retrofilling of the drained transformer with PCB-free mineral oil (usually reclaimed from the dechlorination and polishing of the original PCB-containing oil); and
- Connection of the transformer to the electrical network.

110. As some of the PCBs in the contaminated transformer are absorbed by the porous material and the residual mineral oil in the transformer, some of these PCBs will leach back into the mineral oil phase. Depending on the level of PCBs in the original oil, the partition of the PCBs between the oil and the porous material will reach a new equilibrium level. This new equilibrium level could be above or below 50 ppm. If the equilibrium level is below 50 ppm, then the transformer is considered decontaminated and can be reclassified. If however the new equilibrium is still above 50 ppm, the retrofilling process can be repeated after 90 days to achieve the decontamination of the transformers. Based on practice, the application of one retrofilling stage for transformers with PCB levels below 500 ppm will achieve the target level of less than 50 ppm.

111. For surplus PCB-containing transformers, the project will provide a within the country decontamination solution where these transformers will be dismantled and properly decontaminated to yield PCB-free recyclable metals. This process is further described below:

Dismantling and decontamination facilities for surplus transformers

112. Once the surplus transformers are received at the established decontamination facilities, they will be temporarily stored in the dedicated rooms until they are taken out for processing. The processing of these transformers will consist of the following steps:

- Final draining of the residual oil;
- Dismantling and separation of the transformer components, segregating porous materials such as wood spacers, papers from metallic components such as steel casing, copper wiring, steel plates, etc.
- For mineral oil transformers, the porous materials and metallic components will be separately cleaned using hot mineral oil, while the components from Askarel transformers will be cleaned using a more aggressive solvent.
- After completing the cleaning stage, samples will be taken to ensure the cleaned components meet the target level. If analytical results show that these components

are still contaminated, the cleaning process will be repeated until satisfactory results are obtained.

- Cleaned metallic components, such as copper and steel, will be recycled and the residual value recovered.
- Cleaned porous material will be disposed of in approved disposal facilities.

113. The mineral oil used to decontaminate the solid components will be dechlorinated in the dechlorination unit.

114. The solvent such as perchloroethylene used to decontaminate the solid components will be distilled and reused in the system, while the concentrated PCB liquid residue resulted from the distillation of the spent solvent, will be destroyed also in the dechlorination unit.

115. The project will provide an overall approach of chemical destruction of the PCB material, decontaminating in-service PCB contaminated transformers and reclaiming and recycling metallic components as the proper environmental and economical approach to deal with the vast PCB problem that India is facing.

116. In addition to the environmental and economical benefits of implementing this project in India, the project would also provide a social benefit by the creation of new and sustainable jobs.

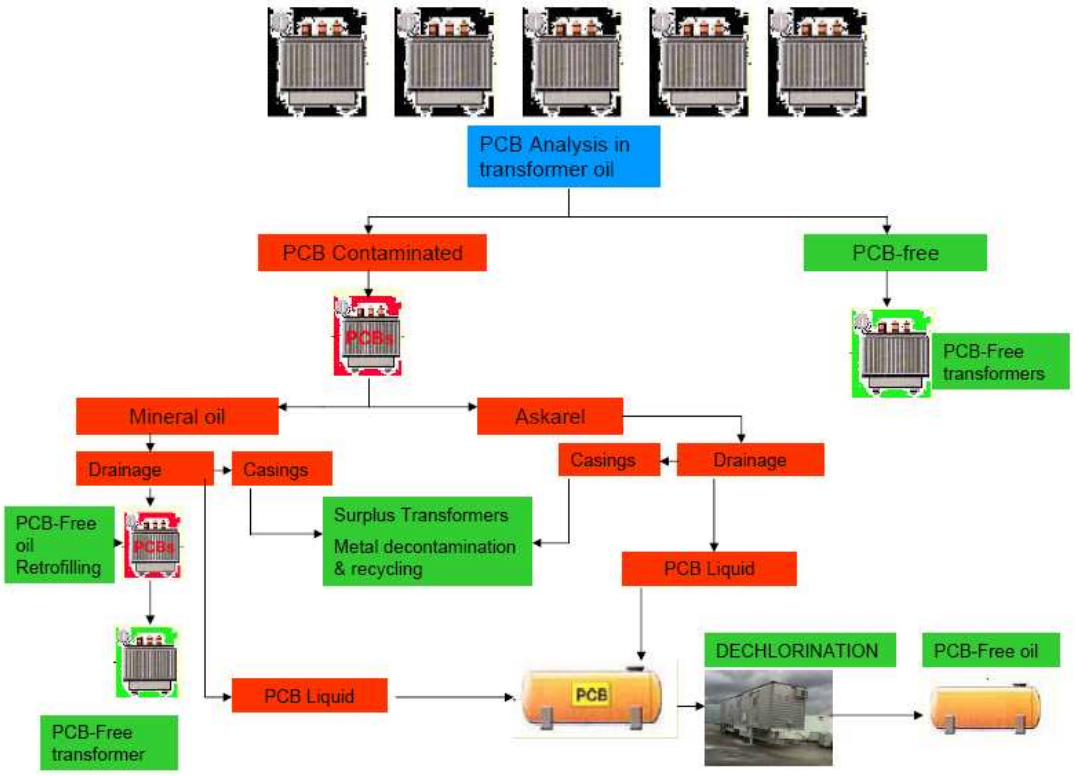


Fig. 1: Transformer analysis and process

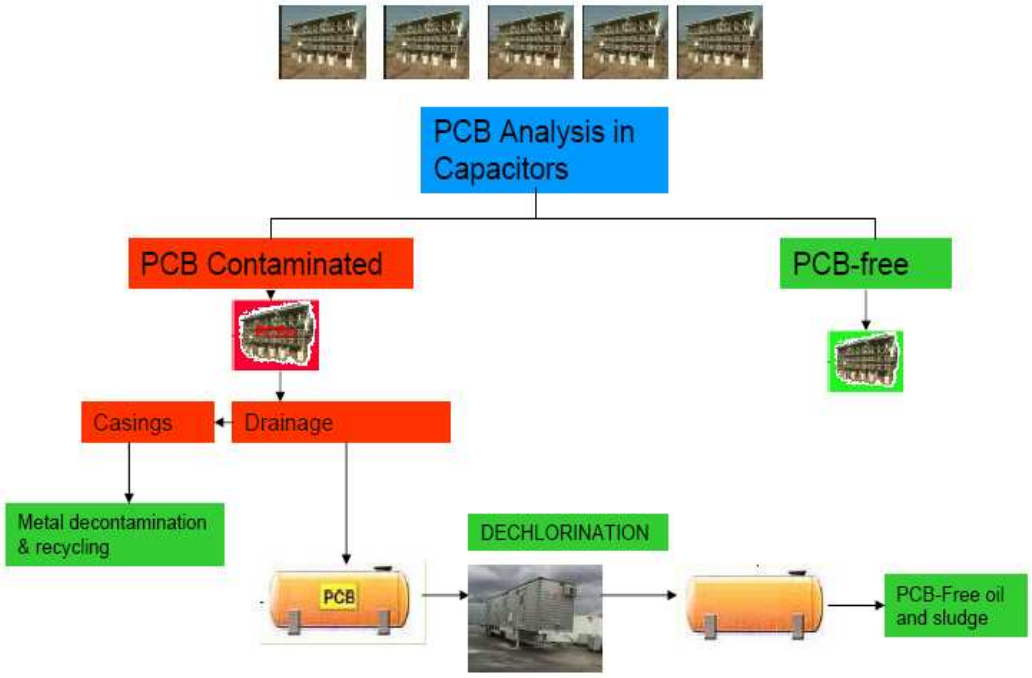


Fig. 2: Capacitor analysis and process

Strengthened Monitoring Capability

117. In India, there are few accredited laboratories for PCB testing. These laboratories are not sufficient to offer the required services to PCB owners in the country.

118. CPRI laboratories will be strengthened by the project. Currently, due to the lack of corresponding legislation and limited resources, the laboratory can not meet the demand that will be generated by the implementation of the Stockholm Convention in India. The project would therefore provide analytical tools to the CPRI laboratories to increase the services offered and meet the expected demand.

Table 5: Status of CPRI analytical capabilities

	Units of CPRI	Equipment presently available	Upgradation Needed Immediately	Future needs during the proposed project
1	CPRI Bangalore	GC with ECD	Nil	Additional equipment needed GC MS
2	CPRI STDS Bhopal	GC	ECD	Additional equipment needed GC MS
3	CPRI RTL Ghaziabad (to be shifted to NOIDA)	GC with ECD	Nil	Additional equipment needed GC MS
4	CPRI RTL Kolkata	GC	ECD	Additional equipment needed GC MS
5	CPRI RTL Guwahati	GC	ECD	Nil

There are over 40 accredited analytical laboratories, the list of which is given in Annex 8.

119. The revised PCB-related legislation would require the PCB users to inspect the movement of all oil-containing electrical devices. To this end, the project will provide analytical tools to major utilities to screen and properly labeled their transformers.

120. Positive samples from the screening results will be sent to CPRI laboratories to confirm the contamination level of the transformers. Once the transformer is confirmed as PCB contaminated, the equipment's owner has to take the proper measures to ensure that the management of the PCB transformer follows.

Methodological Approach

121. The objective of the project to implement environmentally sustainable management of PCBs, PCB-containing equipment and waste will be achieved through a combination of strategies, including legislative and regulatory development, capacity building, public education, technology transfer, training and technical support. The project will also directly address PCBs contamination at targeted hot spots, removing and treating at least 7,700 tons of PCBs, PCB-containing equipment and wastes.

122. The project will develop and implement regulatory reforms, coupled with the innovative approaches described above, so as to create an enabling environment for PCBs wastes treatment facilities to operate on a sustainable basis.

123. The project will deliver extensive training programs enhancing technical competencies to achieve project objectives. Principal training activities include:

- Management training classes for project management staff;
- Training on new technological and economic policies, guidelines, standards, and specifications so as to implement ESM for project management staff and managerial and technical personnel of stakeholders;
- Training to technical personnel of stakeholders concerning handling, collection, packaging, interim storage and transportation of PCBs, PCB-containing equipment and wastes; and
- Staff training for safe disposal of PCBs, PCB-containing equipment and wastes to the managerial, technical and operational staff of the PCBs treatment and disposal facility.

124. The project will also undertake extensive stakeholder awareness raising and education activities, including:

- Development of TV and broadcasting program to disseminate knowledge of PCBs;
- Preparation of articles and reports for dissemination in national and local newspapers;
- Development and production of brochures for awareness raising regarding health and safety protection from PCBs wastes; and
- Establishment of hotline to allow reporting of PCBs related health and safety issues.

C.6 OUTCOMES, OUTPUTS AND ACTIVITIES

125. The table below lists project outcomes, outputs, and activities, along with responsibility for each activity, under each project outcome.

Outcome 1: Strengthened policy and regulatory framework to comply with the obligations under the Stockholm Convention

Output/Activity	Responsibility
Output 1.1 Legal and regulatory framework for the ESM of PCBs reviewed and assessed	
1.1.1 Evaluation of existing national legal and regulatory framework	MOEF, CPRI
1.1.2 Evaluation of gaps between Stockholm Convention requirements and existing legal/regulatory framework	MOEF, CPRI
1.1.3 Recommendations to legislative bodies for new and/or revised laws to implement Stockholm Convention requirements	MOEF, CPRI
1.1.4 Recommendations to regulatory bodies for new and/or revised regulations and guidelines to implement Stockholm Convention requirements	MOEF, CPRI
Output 1.2 Legal and regulatory framework at the national level established or upgraded	
1.2.1 Enactment of new and/or revised laws to implement Stockholm Convention requirements	MOEF, CPRI
1.2.2 Issuance of new and/or revised regulations to implement Stockholm Convention requirements	MOEF, CPRI
Output 1.3 National legal and regulatory framework implemented in targeted pilot states	
1.3.1 Evaluation of existing State enforcement of PCB management related laws and regulations	MOEF, CPRI
1.3.2 Identification of gaps between State implementation and National and Stockholm Convention requirements	MOEF, CPRI
1.3.3 Support for State adoption of revised and/or new measures to ensure environmentally safe management and disposal of PCB contaminants	MOEF, CPRI
Output 1.4 Pollution prevention and management of PCBs, PCB-containing equipment and waste in consonance with ESM guidelines	
1.4.1 Evaluate current practices for management of PCBs, PCB-containing equipment and wastes	MOEF, CPRI, UNIDO
1.4.2 Develop guidelines for management of PCBs, PCB-containing equipment and wastes in consonance with ESM guidelines	MOEF, CPRI, UNIDO
1.4.3 Stakeholder and PCB owners training in the management of PCBs, PCB-containing equipment and wastes in consonance with ESM guidelines	MOEF, CPRI, UNIDO

Outcome 2: Relevant institutions in India are enabled to manage PCBs in an environmentally sound manner as well as awareness raising on the adverse effects of PCBs

Output/Activity	*Responsibility*
Output 2.1 Institutional capacity for ESM of PCBs, PCB-containing equipment and wastes evaluated	
2.1.1 Identification of stakeholders to be targeted in institutional capacity building efforts	CPRI
2.1.2 Evaluation of current stakeholder institutional capacity for ESM of PCBs, PCB-containing equipment and wastes	CPRI, UNIDO
2.1.3 Identification of stakeholder capacity building needs	CPRI

Output 2.2 Training workshops for key stakeholder undertaken	
2.2.1 Training materials on the planning and organization of PCB phase-out and disposal methods developed.	CPRI, UNIDO
2.2.2 Workshop for planning and organization of PCB phase-out and treatment methods developed	CPRI, NPTI
2.2.3 Training workshops for PCB owners	CPRI, NPTI
2.2.4 Capacity building for workplace safety monitoring by safety inspection agencies	State Governments, MOP, CPRI, NPTI
2.2.5 Capacity building for environmental inspection agencies	CPCB, CPRI, NPTI, UNIDO
Output 2.3 A national tracking and record keeping system (PCB inventory database) established and maintained countrywide (28 states and 7 union territories)	
2.3.1 PCB owner workshop to introduce PCB reporting requirements	CPRI, PCB owners, UNIDO
2.3.2 PCB owner capacity building to identify and label PCB-containing equipment	CPRI, PCB owners
2.3.3 Provision of inventory monitoring kits and other monitoring supplies	CPRI, UNIDO
2.3.4 Inventory survey of PCB use in power sector	CPRI, PCB owners
2.3.5 Inventory survey of PCB use in ship breaking sector	CPRI, PCB owners
2.3.6 Inventory survey of PCB use in other non-power sectors	CPRI, PCB owners
2.3.7 Inspection and verification	CPCB, CPRI
2.3.8 Initial inventory completion	CPRI
2.3.9 Inventory updates	CPRI, PCB owners
Output 2.4 Sampling, analysis and monitoring capacity evaluated and strengthened in 13 states	
2.4.1 Upgrade laboratory facilities to monitor PCBs	CPRI, UNIDO
2.4.2 Technical training in PCB monitoring	CPRI, UNIDO
Output 2.5 Awareness raising carried out	
2.5.1 Information on PCB risks and risk minimization disseminated through print media	CPRI
2.5.2 Information on PCB risks and risk minimization disseminated through online sources	CPRI
2.5.3 Information on PCB risks and risk minimization disseminated through televised public service announcements	CPRI
2.5.4 Public awareness raising through targeted workshops	CPRI
2.5.5 Policy makers awareness building	MOEF, CPRI

Outcome 3: Targeted regional implementation for ESM of PCBs, PCB-containing equipment and waste

Output/Activity	***Responsibility***
Output 3.1: Dedicated environmentally sound maintenance capacity for PCBs, PCB-containing equipment and wastes established	
3.1.1 Identification of technical and technological needs to implement EMS for PCBs, PCB containing equipment and wastes	CPRI, UNIDO

3.1.2 Dedicated maintenance facility design, certification and procurement	CPRI, UNIDO
3.1.3 PCB owner maintenance facility ESM upgrades	CPRI, UNIDO
3.1.3 Technical training of stakeholders as well as interested candidates from other countries	CPRI, UNIDO

Outcome 4: Regional capability for final treatment and disposal of PCBs, PCB-containing equipment and wastes

Output/Activity	*Responsibility*
Output 4.1: Management system for identification, tracking, collection, packaging, transport, interim storage, record keeping, and disposal of PCBs, PCB-containing equipment and waste developed and operational in 13 states	
4.1.1 Develop guidelines for PCBs, PCB –containing equipment and waste identification, tracking, and record keeping	CPRI, UNIDO
4.1.2 Develop guidelines for PCBs, PCB –containing equipment and waste collection, packaging, and transportation	CPRI, UNIDO
4.1.3 Develop guidelines for PCBs, PCB –containing equipment and waste interim storage	CPRI, UNIDO
4.1.4 Develop guidelines for PCBs, PCB –containing equipment and waste disposal	CPRI, UNIDO
4.1.5 Develop information management software for PCB management system	CPRI
4.1.6 Train stakeholders in management system requirements and procedures	CPRI, Stakeholders
Output 4.2 ESM and transport to interim storage sites of PCB-containing materials carried out including specialized transport vehicles for highly concentrated PCBs with GPS and adequate preparedness measures in case of emergency on transport routes to the stationary disposal unit	
4.2.1 Identify locations for interim storage facilities	CPRI, State governments
4.2.2 Interim storage facility design, construction, provisioning, and commissioning	CPRI, State governments, UNIDO
4.2.3 Staffing and staff training for interim storage facilities	CPRI, UNIDO
Output 4.3 Final ESM treatment of at least 7,700 tons of PCBs, PCB-containing equipment and PCB-contaminated oil and wastes undertaken	
4.3.1 Technology requirements specification and procurement of decontamination equipment	CPRI, UNIDO
4.3.2 Decontamination of PCB-contaminated oil	Treatment facilities
4.3.3 Identify location for stationary treatment facilities	CPRI, State governments
4.3.4 Treatment facility design, technology requirements specification and procurement	CPRI, UNIDO
4.3.5 Treatment facility construction, equipping and commissioning	CPRI, State governments, UNIDO
4.3.6 Treatment facility staffing and staff training	CPRI, Treatment facilities, UNIDO
4.3.7 Disposal of PCBs, PCB-containing equipment, PCB contaminated oil and other PCB -containing wastes	Treatment facilities

Outcome 5: Project Management and monitoring and evaluation

Output/Activity	*Responsibility*
Output 5.1 Project management structure established	
5.1.1 Establish POPs Management Unit (PMU) and appoint project leadership staff	CPRI
5.1.2 Establish Project Steering Committee (PSC)	CPRI, MOEF
5.1.3 Recruit project advisor(s), policy experts, and technical experts in PCBs management, project evaluation, and program development	CPRI, UNIDO
5.1.4 Hold project management training for project management staff	CPRI
5.1.5 Establish PMUs within participating organizations and sign project participation contracts	CPRI, Stakeholders
5.1.6 Establish project management information system (MIS), including a project website to disseminate information to stakeholders	CPRI, Stakeholders
Output 5.2: An M&E mechanism designed and implemented according to GEF M&E procedures	
5.2.1 Prepare and hold Inception Workshop	CPRI, UNIDO
5.2.2 Measure impact indicators	CPRI
5.2.3 Carry out annual project financial audits	CPRI
5.2.4 Prepare Annual Project Reports and Project Implementation Reviews	CPRI, UNIDO
5.2.5 Hold annual Tripartite Review meetings	CPRI, UNIDO
5.2.6 Carry out mid-term external evaluation	UNIDO
5.2.7 Prepare and hold Project Completion workshop	CPRI, UNIDO
5.2.8 Carry out final external evaluation	UNIDO
5.2.9 Complete project Terminal Report	CPRI, UNIDO

C.7 ACTVITIES TIMELINE

Year	1				2				3				4				5			
Outcome/Output/Activity / Quarter	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Outcome 1: Strengthened policy and regulatory framework to comply with the obligations under the Stockholm Convention																				
Output 1.1 Legal and regulatory framework for the ESM of PCBs reviewed and assessed																				
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1.1.2 Evaluation of gaps between Stockholm Convention requirements and existing legal/regulatory framework																				
1.1.3 Recommendations to legislative bodies for new and/or revised laws to implement Stockholm Convention requirements																				
1.1.4 Recommendations to regulatory bodies for new and/or revised regulations and guidelines to implement Stockholm Convention requirements																				
Output 1.2 Legal and regulatory framework at the national level established or upgraded																				
1.2.1 Enactment of new and/or revised laws to implement Stockholm Convention requirements																				
1.2.2 Issuance of new and/or revised regulations to implement Stockholm Convention requirements																				
Output 1.3 National legal and regulatory framework implemented in targeted pilot states																				
1.3.1 Evaluation of existing State enforcement of PCB management related laws and regulations																				
1.3.2 Identification of gaps between State implementation and National and Stockholm Convention requirements																				
1.3.3 Support for State adoption of revised and/or new measures to ensure environmentally safe management and disposal of PCB contaminants																				

Year	1				2				3				4				5			
Outcome/Output/Activity / **Quarter**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**
Output 1.4 Pollution prevention and management of PCBs, PCB-containing equipment and waste in consonance with ESM guidelines																				
1.4.1 Evaluate current practices for management of PCBs, PCB-containing equipment and wastes																				
1.4.2 Develop guidelines for management of PCBs, PCB-containing equipment and wastes in consonance with ESM guidelines																				
1.4.3 Stakeholders and PCB owners training in the management of PCBs, PCB-containing equipment and wastes in consonance with ESM guidelines																				
Outcome 2: Relevant institutions in India are enabled to manage PCBs in an environmentally sound manner as well as awareness raising on the adverse effects of PCBs																				
Output 2.1 Institutional capacity for ESM of PCBs, PCB-containing equipment and wastes evaluated																				
2.1.1 Identification of stakeholders to be targeted in institutional capacity building efforts																				
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2.2.2 Workshop for planning and organization of PCB phase-out and treatment methods developed																				
2.2.3 Training workshops for PCB owners																				
2.2.4 Capacity building for workplace safety monitoring by safety inspection agencies																				

Year	1				2				3				4				5			
Outcome/Output/Activity **Quarter**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**
2.2.5 Capacity building for environmental inspection agencies																				
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Year	1				2				3				4				5			
Outcome/Output/Activity **Quarter**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**
2.5.4 Public awareness raising through targeted workshops																				
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Outcome 3: Targeted regional implementation for ESM of PCBs, PCB-containing equipment and wastes																				
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3.1.4 Technical training of stakeholders as well as interested candidates from other countries																				
Outcome 4: Regional capability for final treatment and disposal of PCBs, PCB-containing equipment and wastes																				
Output 4.1: Management system for identification, tracking, collection, packaging, transport, interim storage, record keeping, and disposal of PCBs, PCB-containing equipment and waste developed and operational in 13 states																				
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4.1.3 Develop guidelines for PCBs, PCB-containing equipment and waste interim storage																				

Year	1				2				3				4				5			
Outcome/Output/Activity / **Quarter**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**
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4.3.6 Treatment facility staffing and staff training																				
4.3.7 Disposal of PCBs, PCB-containing equipment, PCB contaminated oil and other PCB-containing wastes																				

Year	1				2				3				4				5			
Outcome/Output/Activity / **Quarter**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**
Outcome 5: Project Management and monitoring and evaluation																				
Output 5.1 Project management structure established																				
5.1.1 Establish Project Management Unit (PMU) and appoint project leadership staff																				
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Output 5.2: An M&E mechanism designed and implemented according to GEF M&E procedures																				
5.2.1 Prepare and hold Inception Workshop																				
5.2.2 Measure impact indicators																				
5.2.3 Carry out annual project financial audits																				
5.2.4 Prepare Annual Project Reports and Project Implementation Reports																				
5.2.5 Hold annual tripartite review meetings																				
5.2.6 Carry out mid-term external evaluation																				
5.2.7 Prepare and hold Project Completion workshop																				
5.2.8 Carry out final external evaluation																				
5.2.9 Complete Terminal Report																				

C.8 RISKS, SUSTAINABILITY AND REPLICABILITY

Possible Risks

Table 6: Identified risks with reference to project objectives

Outcomes	Risks	Level	Mitigation measures
Strengthened policy and regulatory framework to comply with the obligations under the Stockholm Convention	Law-making and regulatory bodies at state and union territories level will not timely be responsive to recommendations.	Low	Ensure recommended laws and regulations are practical and enforceable; stakeholders will be included in the development process; institutional capacity building and training will be provided
Relevant institutions in India are enabled to manage PCBs in an environmentally sound manner	Low level of participation and support of key stakeholders for the implementation of the project.	Low	Establishment of inter-sector National Steering Committee representing all relevant stakeholders
Targeted regional implementation for ESM of PCBs, PCB containing equipment and wastes	Potential transformer owners are not forthcoming to identify target transformers and to report PCBs, PCB-containing equipment and wastes.	Medium	Identification of conflicting stakeholder interests through involvement of stakeholders in the project design process.
Regional capability for final treatment and disposal of PCBs, PCB-containing equipment and wastes	Type of technologies selected does not meet the SC requirements on BAT and BEP. Serious threats to human health and the environment due to releases of PCBs during the removal, transport and treatment of PCBs, PCB-containing equipment and waste.	Medium	Establishing close links to the NIP project (updates of inventories). Technical workshops with technology providers and users as a preventive risk mitigation measures. Carrying out of environmental impact assessment studies for the removal, transport and treatment of PCBs, PCB-containing equipment and wastes. Development and implementation of environment management plans to mitigate possible risks.
Project management	Delay in project implementations as well as monitoring and evaluation may cause delays in holding regular project management and M&E meetings and issuing required reports	Low	Proper communication channels are established

Sustainability and Replicability

126. The sustainability of the project outputs will be ensured by the following:

- Strengthening implementation of policies, laws, and regulations related to PCBs, PCB-containing equipment and waste management and their enforcement will ensure the sustainability of the regulatory environment. Enforcement will also be improved if supported by adequate and targeted capacity building.
- Compliance with ongoing monitoring and reporting requirements under the Stockholm Convention will be improved by increasing the capacity and strengthening the infrastructure to collect and process data and to formulate reports to fit to the format and to meet the standards required by the Convention.
- Mobilization of stakeholders at national and state levels becomes self-sustaining given the critical mass of project activities both at avoiding cross-contamination of PCB-free equipment with PCBs from PCB-containing equipment and from other PCB-containing equipment specific treatment activities.
- The relevance of the project by mitigating environmental and public health issues resulting from unsafe storage of PCBs, PCB-containing equipment and wastes guarantees sustainability of project outputs.
- Experience gained through successful application of the BAT/BEP requirements for handling, collection, packaging, interim storage, transport and disposal of PCBs, PCB-containing equipment and wastes will provide a solid base for introducing sustainable life-cycle management for a wide range of hazardous wastes.

127. The financial sustainability of the project will be ensured by:

- Following decontamination process, recycle equipment carcasses and decontaminated oil that contain less than 50 ppm PCBs will generate revenues to assure the operation and maintenance of treatment facilities;
- The experience and lessons learned through the project will make possible to continue the disposal of the targeted amount of at least 7,700 tons of PCBs, PCB-containing equipment, PCB-contaminated oil and wastes by launching the elimination of all PCB-containing equipment, oil and wastes that contain higher than 50 ppm PCBs in the country by 2028 within the time-frame given by the Stockholm Convention; and
- The emergence of industrial and service sectors dedicated to technical and technological support of BAT/BEP in PCBs waste management, transport, interim storage, treatment and disposal will generate economic activity and employment.

128. The project also offers potential replicability of its results in long-term that will be ensured by benefits, including but not limited to:

- BEP will be introduced in life-cycle management of other types of POPs wastes and hazardous wastes;
- BAT will be introduced in waste disposal of other types of POPs wastes;
- BAT will be introduced in waste disposal of dioxin-rich fly ash at nationwide;
- Successfully introduced and demonstrated alternative technologies will be applied for disposal of other types of POPs and chemical wastes;
- Experience and lessons learned through this project will be applied for other BAT/BEP projects in the power sector in the South East Asia region; and
- Whenever feasible and reasonable the lessons learned through this project will be applied globally in developing countries and countries with economies in transition.

129. The results of the project will also be replicable through presentations of global forums by the representatives of Indian government and UNIDO such as the PCB Elimination Club (PEC) established by the COP4 of the SC. The results of the project will be made available to the regional centers of the Stockholm Convention as well.

SECTION D: INPUTS

D.1 COUNTERPARTS INPUTS

130. The GEF, as the financial mechanism for the Stockholm Convention, will provide a proposed US$14.45 million (including US$ 350,000 for PPG) incremental cost funding for the project. The Government of India has committed to provide a total co-funding of US$ 28.85 million.

Baseline

131. As described in Section A.2 "Analysis of barriers" above, India needs to prepare and implement an environmentally sustainable PCB management program that allows the country to meet its obligations under the Stockholm Convention. The country currently does not have the proper legislative requirements to manage and control the use and disposal of PCB-containing materials. In addition there is lack of awareness by users, government and other stakeholders regarding the environmental and health and safety risks associated with the use of PCBs. These inadequacies permit the improper handling of PCB-containing materials resulting in people exposure to these toxic chemical and the uncontrolled release of PCBs into the environment.

132. India, despite of large inventory of PCB equipment and the even larger volume of untested PCB-containing electrical transformers, does not have proper disposal options for these wastes. The lack of within the country disposal options, users of PCBs in India must export their PCB-containing wastes to European incinerators. The high cost associated with this option and the lack of regulatory requirements to remove from in-service and properly disposed of the PCB-containing transformers and capacitors, are preventing PCB owners to take a more serious look at the PCBs problem. This inadequate response from PCB owners results in a further spread of the PCBs contamination within the electrical network and environmental releases of significant amounts of PCBs

133. Based on statistical analysis on the total number of transformers within the country's electrical system, it is estimated that India has about 350,000 transformers of different sizes contaminated with PCBs. The large number of transformers from the generating, transmission and distribution system result in an estimated volume of 35,000 metrics tones of PCB-containing mineral oil and about 52,000 metric tones of PCB contaminated transformer carcasses. In order to implement the provision in Article 6 of Stockholm Convention and Annex A, Part II, the deadline for eliminating usage and decontamination of PCB-containing equipment is planned as follows:

Year	Phase-out of existing PCB-containing equipment (%)
2013	20%
2016	40%
2019	60%
2022	80%
2025	100%

134. In the absence of this project, the PCB management in India is characterized as follows:

- A regulatory framework that is not in accordance to India's commitment to the international community under the Stockholm Convention;
- Under-developed institutional capacities, in terms of both, hardware (infrastructure) and software (skills and expertise) in electrical utilities, industrial and service industry to recognize and properly manage PCB contaminated equipment;
- Leaking PCB contaminated electrical equipment is not properly managed, causing an uncontrolled and continuous release of PCB into the environment.

- Under-developed institutional capacities, in terms of both hardware (infrastructure) and software (skills and expertise) for government officials to enforce the limited existing regulations (environmental, export and import regulations, etc.);
- Local PCBs disposal or PCBs waste export has not been reported;
- Lack of disposal technologies that comply with BAT/BEP and lack of technical capabilities in alternative technologies;
- Integration and coordination of PCBs waste management, treatment and disposal systems have not been explored to achieve optimal social, economic and environmental benefits; and
- Stakeholder awareness regarding pollution from PCBs waste management, storage and disposal is insufficient.

Alternative

135. Through this project, the government of India will establish the required regulatory framework to guide PCB owners, government officials, NGOs and public in general on the proper management and disposal of PCB wastes.

136. PCB-containing equipment, oil and wastes owners will adopt BEP for PCBs waste management.

137. The project will introduce new technology that meets BAT for cleaning PCB-contaminated oil and recycling equipment carcasses.

138. Decontaminated oil that has less than 50 ppm PCBs can be regarded as PCB-free and therefore could also be recycled.

139. The project will significantly contribute to the POPs focal area as follows:

- Introducing ESM and disposal of PCBs, PCB-containing equipment and wastes in India that also complies with BAT/BEP; and
- Avoiding releases of unintentionally produced POPs by applying BAT/BEP measures and adoption of alternative treatment processes and environmentally sound disposal.

Table 7: Summary Incremental Cost Matrix in US$

	Baseline	Increment	Alternative
Outcome 1: Strengthening of policy, legal, and regulatory framework	551,000	682,450	1,233,450
Outcome 2: Institutional capacity building and awareness raising	7,216,600	3,130,050	10,346,650
Outcome 3: Targeted regional implementation for ESM of PCBs, PCB-containing equipment and wastes	5,951,500	1,282,500	7,234,000
Outcome 4: Regional capability for final treatment and disposal of PCBs, PCB-containing equipment and wastes	15,003,400	8,693,000	23,696,400
Outcome 5: Project management	127,500	462,000	589,500
Total	**28,850,000**	**14,250,000**	**43,100,000**

D.2 UNIDO INPUTS

140. UNIDO will provide an in-kind contribution of US$150,000 for Outcomes 3, 4 and 5.

SECTION E: BUDGET

E.1 Project Budget in US$

Output	Buli	Description	Year 1		Year 2		Year 3		Year 4		Year 5		Total	
			US$	w/m	US$	w/m	US$	w/m	US$	w/m	US$	w/m	US$	w/m
Output 1.1: Legal and regulatory framework for ESM of PCBs reviewed and assessed	11-50	International consultants	15,000	1.0	15,000	1.0							**30,000**	**2.0**
	13-00	Personnel	13,000	12.0	13,000	12.0							**26,000**	**24.0**
	15-00	Project travel	10,000		10,000								**20,000**	
	17-50	National consultants	24,000	12.0	24,000	12.0							**48,000**	**24.0**
	35-00	Workshop / meetings	10,000		5,000								**15,000**	
	Sub-total		***72,000***	***25.0***	***67,000***	***25.0***							***139,000***	***50.0***
Output 1.2: Legal and regulatory framework at the national level established or upgraded	11-50	International consultants			15,000	1.0			7,500	0.5			**22,500**	**1.5**
	17-50	National consultants			13,000	6.5	13,000	6.5	13,000	6.5			**39,000**	**19.5**
	15-00	Project travel			2,000				1,000				**3,000**	
	Sub-total				***30,000***	***7.5***	***13,000***	***6.5***	***21,500***	***7.0***			***64,500***	**21.0**
Output 1.3: National legal and regulatory framework implemented in targeted states	11-50	International consultants					15,000	1.0	15,000	1.0			**30,000**	**2.0**
	13-00	Personnel			13,000	12.0	13,000	12.0	13,000	12.0			**39,000**	**36.0**
	15-00	Project travel			10,000		10,000		5,000				**25,000**	
	17-50	National consultants			48,000	24.0	48,000	24.0	48,000	24.0			**144,000**	**72.0**
	33-00	In-service Training					50,000		50,000				**100,000**	
	Sub-total				***71,000***	***36.0***	***136,000***	***37.0***	***131,000***	***37.0***			***338,000***	***110.0***
Output 1.4: Pollution prevention and management of PCBs, PCB-containing equipment and waste in	11-50	International consultants	15,000	1.0	15,000	1.0	15,000	1.0	15,000	1.0			**60,000**	**4.0**
	13-00	Personnel	2,150	2.0	2,150	2.0	2,150	2.0					**6,450**	**6.0**
	15-00	Project travel	10,000		10,000		5,000		2,500				**27,500**	

Output	Buli	Description	Year 1		Year 2		Year 3		Year 4		Year 5		Total	
			US$	w/m	US$	w/m	US$	w/m	US$	w/m	US$	w/m	US$	w/m
consonance with ESM guidelines	17-50	National consultants	4,000	2.0	4,000	2.0	4,000	2.0					**12,000**	**6.0**
	33-00	In-service Training	35,000										**35,000**	
	Sub-total		***66,150***	***5.0***	***31,150***	***5.0***	***26,150***	***5.0***	***17,500***	***1.0***			***140,950***	**16.0**
TOTAL OUTCOME 1			**138,150**	**30.0**	**199,150**	**73.5**	**175,150**	**48.5**	**170,000**	**45.0**			**682,450**	**197.0**
Output 2.1: Institutional capacity for ESM of PCBs, PCB containing equipment and wastes evaluated	11-50	International consultants	15,000	1.0			15,000	1.0			15,000	1.0	**45,000**	**3.0**
	13-00	Personnel	26,000	24.0			13,000	12.0			13,000	12.0	**52,000**	**48.0**
	15-00	Project travel	15,000				15,000				5,000		**35,000**	
	17-50	National consultants	24,000	12.0			12,000	6.0			12,000	6.0	**48,000**	**24.0**
	Sub-total		***80,000***	***37.0***			***55,000***	***19.0***			***45,000***	***19.0***	***180,000***	***75.0***
Output 2.2: Training workshops for key stakeholders	11-50	International consultants			7,500	0.5	22,500	1.5					**30,000**	**2.0**
	13-00	Personnel			13,000	12.0	13,000	12.0					**26,000**	**24.0**
	15-00	Project travel			20,000		30,000						**50,000**	
	17-50	National consultants			24,000	12.0	24,000	12.0					**48,000**	**24.0**
	21-00	Subcontract			100,000		100,000						**200,000**	
	34-00	Training			30,000		70,000						**100,000**	
	Sub-total				***199,500***	***24.5***	***254,500***	***25.5***					***454,000***	***50.0***
Output 2.3: National tracking and record keeping system (PCB inventory database) established and maintained countrywide	11-50	International consultants	15,000	1.0									**15,000**	**1.0**
	13-00	Personnel	13,000	12.0	13,000	12.0	13,000	12.0	13,000	12.0	13,000	12.0	**65,000**	**60.0**
	15-00	Project travel	30,000		30,000		10,000		10,000		10,000		**90,000**	
	17-50	National consultants	48,000	24.0	96,000	48.0							**144,000**	**72.0**
	33-00	In-service Training	15,000										**15,000**	

Outputs	Buli	Descrption	Year 1		Year 2		Year 3		Year 4		Year 5		Total	
			US$	w/m	US$	w/m	US$	w/m	US$	w/m	US$	w/m	US$	w/m
	21-00	Subcontract	200,000		400,000		400,000						1,000,000	
	Sub-total		***321,000***	***37.0***	***539,000***	***60.0***	***423,000***	***12.0***	***23,000***	***12.0***	***23,000***	***12.0***	***1,329,000***	***133.0***
Output 2.4: Sampling, analysis, and monitoring capacity evaluated and strengthened in 13 states	11-50	International consultants	30,000	2.0	30,000	2.0	15,000	1.0	15,000	1.0	30,000	2.0	**120,000**	**8.0**
	13-00	Personnel	6,500	6.0	6,500	6.0	6,500	6.0	6,500	6.0	6,500	6.0	**32,500**	**30.0**
	15-00	Project travel	20,000		10,000		10,000		5,000		5,000		**50,000**	
	17-50	National consultants	12,000	6.0	12,000	6.0	12,000	6.0	12,000	6.0	12,000	6.0	**60,000**	**30.0**
	34-00	Training	30,000										**30,000**	
	21-00	Subcontract	100,000		150,000		100,000						**350,000**	
	Sub-total		***198,500***	***14.0***	***208,500***	***14.0***	***143,500***	***13.0***	***38,500***	***13.0***	***53,500***	***14.0***	***642,500***	***68.0***
Output 2.5: Awareness raising	11-50	International consultants			7,500	0.5	7,500	0.5	7,500	0.5			**22,500**	**1.5**
	13-00	Personnel			13,000	12.0	6,500	6.0	6,500	6.0	6,500	6.0	**32,500**	**30.0**
	15-00	Project travel			30,000		30,000		30,000				**90,000**	
	17-50	National consultants			24,000	12.0	24,000	12.0	24,000	12.0	6,000	3.0	**78,000**	**39.0**
	21-00	Subcontract			70,000		100,000		50,000				**220,000**	
	35-00	Workshop / meetings			25,500		25,500		25,500				**76,500**	
	51-00	Communications / printing / translation/ etc.			1,000		1,500		1,500		1,050		**5,050**	
	Sub-total				***171,000***	***24.5***	***195,000***	***18.5***	***145,000***	***18.5***	***13,500***	***9.0***	***524,550***	***70.5***
TOTAL OUTCOME 2			**599,500**	**88.0**	**1,118,000**	**123.0**	**1,070,000**	**88.0**	**206,500**	**43.5**	**135,050**	**54.0**	**3,130,050**	**396.5**

Outputs	Buli	Description	Year 1		Year 2		Year 3		Year 4		Year 5		Total	
			US$	w/m	US$	w/m	US$	w/m	US$	w/m	US$	w/m	US$	w/m
Output 3.1: Dedicated environmentally sound maintenance capacity for PCBs, PCB containing equipment and wastes	11-50	International consultants	45,000	3.0	30,000	2.0	30,000	2.0	15,000	1.0	15,000	1.0	**135,000**	**9.0**
	13-00	Personnel	6,500	6.0	6,500	6.0	6,500	6.0	6,500	6.0	6,500	6.0	**32,500**	**30.0**
	15-00	Project travel	10,000		10,000		10,000		10,000		10,000		**50,000**	
	17-50	National consultants	12,000	6.0	12,000	6.0	12,000	6.0	12,000	6.0	12,000	6.0	**60,000**	**30.0**
	45-00	Equipment	800,000		200,000								**1,000,000**	
	Sub-total		***873,500***	***15.0***	***258,500***	***14.0***	***58,500***	***14.0***	***43,500***	***13.0***	***43,500***	***13.0***	***1,277,500***	***69.0***
TOTAL OUTCOME 3			***873,500***	***15.0***	***258,500***	***14.0***	***58,500***	***14.0***	***43,500***	***13.0***	***43,500***	***13.0***	***1,277,500***	***69.0***
Output 4.1: Management system for identification, tracking, collection, packaging, transport, interim storage, record keeping, and disposal of PCBs, PCB-containing equipment and waste developed and operational in 13 states	11-50	International consultants	15,000	1.0	30,000	2.0	30,000	2.0	18,000	1.2	18,000	1.2	**111,000**	**7.4**
	13-00	Personnel	6,500	6.0	6,500	6.0	6,500	6.0	6,500	6.0	6,500	6.0	**32,500**	**30.0**
	15-00	Project travel	10,000		10,000		10,000		5,000		5,000		**40,000**	
	17-50	National consultants	12,000	6.0	12,000	6.0	12,000	6.0	12,000	6.0	12,000	6.0	**60,000**	**30.0**
	35-00	Workshop / meetings					20,000						**20,000**	
	Sub-total		***43,500***	***13.0***	***58,500***	***14.0***	***78,500***	***14.0***	***41,500***	***13.2***	***41,500***	***13.2***	***263,500***	***67.4***
Output 4.2: ESM and transport to interim storage sites of PCB-containing materials incl. specialized transport vehicles for highly concentrated PCBs with GPS and adequate preparedness measures in case of emergency on transport routes to stationary disposal	11-50	International consultants			15,000	1.0	15,000	1.0	15,000	1.0	15,000	1.0	**60,000**	**4.0**
	13-00	Personnel			6,500	6.0	6,500	6.0	6,500	6.0	6,500	6.0	**26,000**	**24.0**
	15-00	Project travel			10,000		10,000		10,000		10,000		**40,000**	
	17-50	National consultants			12,000	6.0	12,000	6.0	12,000	6.0	12,000	6.0	**48,000**	**24.0**
	33-00	In-service Training			10,000				10,000				**20,000**	
	21-00	Subcontract			365,000								**365,000**	
	Sub-total				***418,500***	***13.0***	***43,500***	***13.0***	***53,500***	***13.0***	***43,500***	***13.0***	***559,000***	***52.0***

Outputs	Buli	Description	Year 1		Year 2		Year 3		Year 4		Year 5		Total	
			US$	w/m	US$	w/m	US$	w/m	US$	w/m	US$	w/m	US$	w/m
Output 4.3: Final ESM treatment of at least 7,700 tons of PCBs, PCB-containing equipment, and PCB-contaminated oil	11-50	International consultants	15,000	1.0	30,000	2.0	30,000	2.0	30,000	2.0	15,000	1.0	**120,000**	**8.0**
	13-00	Personnel	6,500	6.0	6,500	6.0	13,000	12.0	13,000	12.0	6,500	6.0	**45,500**	**42.0**
	15-00	Project travel	5,000		5,000		10,000		10,000		5,000		**35,000**	
	17-50	National consultants	12,000	6.0	12,000	6.0	12,000	6.0	12,000	6.0	12,000	6.0	**60,000**	**30.0**
	33-00	In-service Training					90,000		80,000				**170,000**	
	35-00	Workshop / meetings			20,000		20,000						**40,000**	
	21-00	Subcontract	3,000,000		4,320,000								**7,320,000**	
	Sub-total		***3,038,500***	***13.0***	***4,393,500***	***14.0***	***175,000***	***20.0***	***145,000***	***20.0***	***38,500***	***13.0***	***7,790,500***	***80.0***
TOTAL OUTCOME 4			**3,082,000**	**26.0**	**4,870,500**	**41.0**	**307,000**	**47.0**	**230,000**	**46.20**	**123,500**	**39.20**	**8,613,000**	**199.4**
Output 5.1: Establish project management structure	11-50	International consultants	15,000	1.0									**15,000**	**1.0**
	13-00	Personnel	13,000	12.0									**13,000**	**12.0**
	15-00	Project travel	3,000										**3,000**	
	17-50	National consultants	24,000	12.0									**24,000**	**12.0**
	45-00	Equipment	10,000										**10,000**	
	51-00	Communications, printing, translation, etc.	5,000										**5,000**	
	Sub-total		***70,000***	***25.0***									***70,000***	***25.0***

Outputs	Buli	Description	Year 1		Year 2		Year 3		Year 4		Year 5		Total	
			US$	w/m	US$	w/m	US$	w/m	US$	w/m	US$	w/m	US$	w/m
Output 5.2: Monitor and report on project results	11-50	International consultants	7,500	0.5	7.500	0.5	15,000	1.0	7,500	0.5	30,000	2.0	**67,500**	**4.5**
	13-00	Personnel	4,300	4.0	4,300	4.0	4,300	4.0	4,300	4.0	4,300	4.0	**21,500**	**20.0**
	15-00	Project travel	2,000		8,000		2,000		8,000		2,000		**22,000**	
	17-50	National consultants	8,000	4.0	8,000	4.0	8,000	4.0	8,000	4.0	8,000	4.0	**40,000**	**20.0**
	35-00	Workshops / meetings	37,500		37,500		25,000		25,000		40,000		**165,000**	
	51-00	Communications, printing, translation, other misc.			3,000		3,000		3,000		2,000		**11,000**	
	Sub-total		***59,300***	***8.5***	***68,300***	***8.5***	***57,300***	***9.0***	***55,800***	***8.5***	***86,300***	***10.0***	***327,000***	***44.5***
TOTAL OUTCOME 5			**129,300**	**33.5**	**68,300**	**8.5**	**57,300**	**9.0**	**55,800**	**8.5**	**86,300**	**10.0**	**397,000**	**69.5**
TOTAL PROJECT COSTS			**4,822,450**	**192.5**	**6,514,450**	**260.0**	**1,668,950**	**206.5**	**705,800**	**156.2**	**388,350**	**116.2**	**14,100,000**	**931.4**
PPG													350,000	
Support costs													1,445,000	
GRAND PROJECT TOTAL			**4,822,450**	**192.5**	**6,514,450**	**260.0**	**1,668,950**	**206.5**	**705,800**	**156.2**	**388,350**	**116.2**	**15,895,000**	**931.4**

E.2 Co-financing budget in US$

Outcome/Output/Activities	MOEF	Stakeholder participants	UNIDO (in-kind)	TOTAL
Outcome 1: Strengthened policy and regulatory framework to comply with the obligations under the Stockholm Convention				**551,000**
Output 1.1 Legal and regulatory framework for the ESM of PCBs reviewed and assessed				***32,500***
1.1.1 Evaluation of existing national legal and regulatory framework	10,000			10,000
1.1.2 Evaluation of gaps between Stockholm Convention requirements and existing legal/regulatory framework	2,500			2,500
1.1.3 Recommendations to legislative bodies for new and/or revised laws to implement Stockholm Convention requirements	10,000			10,000
1.1.4 Recommendations to regulatory bodies for new and/or revised regulations and guidelines to implement Stockholm Convention requirements	10,000			10,000
Output 1.2 Legal and regulatory framework at the national level established or upgraded				***6,000***
1.2.1 Enactment of new and/or revised laws to implement Stockholm Convention requirements	4,000			4,000
1.2.2 Issuance of new and/or revised regulations to implement Stockholm Convention requirements	2,000			2,000
Output 1.3 National legal and regulatory framework implemented in targeted pilot states				***503,500***
1.3.1 Evaluation of existing State enforcement of PCB management related laws and regulations	20,000			20,000
1.3.2 Identification of gaps between State implementation and National and Stockholm Convention requirements	3,500			3,500
1.3.3 Support for State adoption of revised and/or new measures to ensure environmentally safe management and disposal of PCB contaminants	138,000	342,000		480,000
Output 1.4 Pollution prevention and management of PCBs, PCB-containing equipment and waste in consonance with ESM guidelines				***9,000***
1.4.1 Evaluate current practices for management of PCBs, PCB-containing equipment and wastes	1,500			1,500
1.4.2 Develop guidelines for management of PCBs, PCB-containing equipment and wastes in consonance with ESM guidelines	2,500			2,500
1.4.3 Stakeholders and PCB owners training in the management of PCBs, PCB-containing equipment and wastes in consonance with ESM guidelines	5,000			5,000

Outcome/Output/Activities	MOEF	Stakeholder participants	UNIDO (in-kind)	TOTAL
Outcome 2: Relevant institutions in India are enabled to manage PCBs in an environmentally sound manner as well as awareness raising on the adverse effects of PCBs				**7,216,600**
Output 2.1 Institutional capacity for ESM of PCBs, PCB-containing equipment and wastes evaluated				***239,500***
2.1.1 Identification of stakeholders to be targeted in institutional capacity building efforts	74,000			74,000
2.1.2 Evaluation of current stakeholder institutional capacity for ESM of PCBs, PCB-containing equipment and wastes	158,000			158,000
2.1.3 Identification of stakeholder capacity building needs	7,500			7,500
Output 2.2 Training workshops for key stakeholder undertaken				***100,500***
2.2.1 Training materials on the planning and organization of PCB phase-out and disposal methods developed.	2,500			2,500
2.2.2 Workshop for planning and organization of PCB phase-out and treatment methods developed	5,000			5,000
2.2.3 Training workshops for PCB owners	90,000			90,000
2.2.4 Capacity building for workplace safety monitoring by safety inspection agencies	1,500			1,500
2.2.5 Capacity building for environmental inspection agencies	1,500			1,500
Output 2.3 A national tracking and record keeping system (PCB inventory database) established and updated with PCB inventories established during the NIP project				***6,604,100***
2.3.1 PCB owner workshop to introduce PCB reporting requirements	14,500			14,500
2.3.2 PCB owner capacity building to identify and label PCB-containing equipment	83,500	207,000		290,500
2.3.3 Provision of inventory monitoring kits and other monitoring supplies	2,000			2,000
2.3.4 Inventory survey of PCB use in power sector		5,600,000		5,600,000
2.3.5 Inventory survey of PCB use in ship breaking sector		117,000		117,000
2.3.6 Inventory survey of PCB use in other non-power sectors		58,500		58,500
2.3.7 Inspection and verification	70,000	175,000		245,000
2.3.8 Initial inventory completion	15,800			15,800
2.3.9 Inventory updates		260,800		260,800

Outcome/Output/Activities	MOEF	Stakeholder participants	UNIDO (in-kind)	TOTAL
Output 2.4 Sampling, analysis and monitoring capacity evaluated and strengthened				***125,000***
2.4.1 Upgrade laboratory facilities to monitor PCBs	33,500	83,500		117,000
2.4.2 Technical training in PCB monitoring	8,000			8,000
Output 2.5 Awareness raising carried out				***147,500***
2.5.1 Information on PCB risks and risk minimization disseminated through print media	32,500			32,500
2.5.2 Information on PCB risks and risk minimization disseminated through online sources	33,000			33,000
2.5.3 Information on PCB risks and risk minimization disseminated through televised public service announcements	40,000			40,000
2.5.4 Public awareness raising through targeted workshops	33,000			33,000
2.5.5 Policy makers awareness building	9,000			9,000
Outcome 3: Targeted regional implementation for ESM of PCBs, PCB-containing equipment and wastes				**5,956,500**
Output 3.1: Dedicated environmentally sound maintenance capacity for PCBs, PCB containing equipment and wastes established				***5,956,500***
3.1.1 Identification of technical and technological needs to implement EMS for PCBs, PCB containing equipment and wastes	47,500			47,500
3.1.2 Dedicated maintenance facility design, certification and procurement	445,000			445,000
3.1.3 PCB owners maintenance facility ESM upgrades		5,454,000	5,000	5,459,000
3.1.4 Technical training of stakeholders as well as interested candidates from other countries	5,000			5,000
Outcome 4: Regional capability for final treatment and disposal of PCBs, PCB-containing equipment and wastes				**15,083,400**
Output 4.1: Management system for identification, tracking, collection, packaging, transport, interim storage, record keeping, and disposal of PCBs, PCB-containing equipment and wastes developed and operational				***32,400***
4.1.1 Develop guidelines for PCBs, PCB-containing equipment and waste identification, tracking, and record keeping	3,500			3,500
4.1.2 Develop guidelines for PCBs, PCB-containing equipment and waste collection, packaging, and transportation	3,500			3,500
4.1.3 Develop guidelines for PCBs, PCB-containing equipment and waste interim storage	3,500			3,500
4.1.4 Develop guidelines for PCBs, PCB-containing equipment and waste disposal	3,500			3,500
4.1.5 Develop information management software for PCB management system	17,000			17,000

Outcome/Output/Activities	MOEF	Stakeholder participants	UNIDO (in-kind)	TOTAL
4.1.6 Train stakeholders and in management system requirement and procedures	700	700		1,400
Output 4.2: ESM and transport to interim storage sites of PCB-containing materials incl. specialized transport vehicles for highly concentrated PCBs with GPS and adequate preparedness measures in case of emergency on transport routes to stationary disposal unit carried out				***1,885,800***
4.2.1 Identify locations for interim storage facilities	800			800
4.2.2 Interim storage facility design, construction, provisioning, and commissioning	810,000	1,000,000	25,000	1,835,000
4.2.3 Staffing and staff training for interim storage facilities	50,000			50,000
Output 4.3 Final ESM treatment of at least 7,700 tons of PCBs, PCB-containing equipment and PCB-contaminated oil and wastes undertaken				***13,165,200***
4.3.1 Technology requirements specification and procurement of decontamination equipment	516,800		25,000	541,800
4.3.2 Decontamination of PCB-contaminated oil	1,636,300	2,316,000		3,952,300
4.3.3 Identify location for stationary treatment facilities	800			800
4.3.4 Treatment facility design, technology requirements specification and procurement	3,500		30,000	33,500
4.3.5 Treatment facility construction, equipping and commissioning	415,800			415,800
4.3.6 Treatment facility staffing and staff training	16,000			16,000
4.3.7 Disposal of PCBs, PCB-containing equipment, PCB-contaminated oil and other PCB-containing wastes	2,472,000	5,733,000		8,205,000
Outcome 5: Project Management and monitoring and evaluation				**192,500**
Output 5.1 Project management structure established				***55,500***
5.1.1 Establish Project Management Unit (PMU) and appoint project leadership staff	10,000			10,000
5.1.2 Establish Project Steering Committee	10,000			10,000
5.1.3 Recruit project advisor(s), policy experts, and technical experts in PCBs management, project evaluation, and program development	5,000		5000	10,000
5.1.4 Hold project management training for project management staff	5,000			5,000
5.1.5 Establish PMUs within participating organizations and sign MoAs as agreement on participation to the project	8,000	2,500		10,500
5.1.6 Establish project management information system (MIS), including a project website to disseminate information to stakeholders	10,000			10,000

Outcome/Output/Activities	MOEF	Stakeholder participants	UNIDO (in-kind)	TOTAL
Output 5.2: An M&E mechanism designed and implemented according to GEF M&E procedures				***137,000***
5.2.1 Prepare and hold Inception Workshop	8,000		10,000	18,000
5.2.2 Measure impact indicators	16,000			16,000
5.2.3 Carry out annual project financial audits	15,000			15,000
5.2.4 Prepare Annual Project Reports and Project Implementation Reviews	15,000		10,000	25,000
5.2.5 Hold annual tripartite review meetings	15,000		10,000	25,000
5.2.6 Carry out mid-term external evaluation	1,500		10,000	11,500
5.2.7 Prepare and hold Project Completion workshop	3,000		10,000	13,000
5.2.8 Carry out final external evaluation	1,500		5,000	6,500
5.2.9 Complete Terminal Report	2,000		5,000	7,000
TOTAL CO-FINANCING	**7,500,000**	**21,350,000**	**150,000**	**29,000,000**

SECTION F: MONITORING AND EVALUATION, REPORTING AND LESSONS LEARNED

Monitoring and Evaluation

141. Monitoring of project activities and evaluation of their results in the project will serve a dual function. First, it will facilitate tracking implementation progress toward the outcomes and objectives. Second, it will facilitate learning, feedback, and knowledge sharing on results and lessons among the primary stakeholders to improve knowledge and performance.

142. This section of the project document presents a concrete and fully budgeted monitoring and evaluation plan of the project (see Table 8 below).

Table 8: Monitoring and Evaluation plan

M&E activity	Responsible Parties	Budget US$	Time frame
Prepare and hold Inception Workshop	CPRI, UNIDO	40,500	At project start
Measure impact indicators	CPRI	30,000	Annually
Carry out annual project financial audits	CPRI	15,500	Annually
Prepare Annual Project Reports and Project Implementation Reviews	CPRI, UNIDO	20,000	Annually
Hold annual tripartite review meetings	CPRI, UNIDO	125,000	Annually
Carry out mid-term external evaluation	M&E Consultant, UNIDO	30,000	At mid-point of the project implementation
Prepare and hold Project Completion Workshop	CPRI, UNIDO	25,000	Within 12 months after the completion of the project implementation
Carry out final external evaluation	M&E Consultant, UNIDO	30,000	Within 12 months after the completion of the project implementation
Complete Project Terminal Report	CPRI, UNIDO	11,000	Within 6 months of completion of external evaluation
Total budget		**327,000**	

Project Inception Phase

143. A Project Inception Workshop (IW) will be conducted with the full project team, relevant government counterparts, co-financing partners, UNIDO and representative from the UNIDO Regional Office, as appropriate.

144. The fundamental objective of the Inception Workshop will be to assist the project team in understanding and assimilating the goals and objectives of the project, as well as to finalize the preparation of the project's first annual work plan on the basis of the project's logical framework matrix. This work will include reviewing the logical framework (indicators, means of verification,

assumptions), imparting additional detail as needed, and completing an Annual Work Plan (AWP) for the first year of project implementation, including measurable performance indicators.

145. Additionally, the IW will: (i) introduce project staff to the UNIDO team, which will support the project during its implementation; (ii) delineate the roles, support services, and complementary responsibilities of UNIDO staff vis-à-vis the project team; (iii) provide a detailed overview of UNIDO reporting and Monitoring & Evaluation (M&E) requirements, with particular emphasis on Annual Project Implementation Reviews (PIRs), the Annual Project Report (APR), Tripartite Review (TPR) meetings, as well as mid-term and final evaluations. Equally, the IW will provide an opportunity to inform the project team on UNIDO project related budgetary planning, budget reviews and mandatory budget rephrasing.

146. The IW will also provide an opportunity for all parties to understand their roles, functions, and responsibilities within the project's decision-making structures, including reporting and communication lines and conflict resolution mechanisms. The Terms of Reference (TOR) for project staff and decision-making structures will be discussed, as needed, in order to clarify each party's responsibilities during the project's implementation phase.

Monitoring responsibilities and events

147. A detailed schedule of project review meetings will be developed by the project management team in consultation with the project implementation partners and stakeholder representatives and incorporated in the Project Inception Report. The schedule will include: (i) tentative time frames for TPR and NSC meetings, and (ii) project related M&E activities.

148. Day to day monitoring of project implementation progress will be the responsibility of the NTA based on the project's Annual Work Plan (AWP) and its indicators. The PET will inform UNIDO of any delays or difficulties faced during implementation so that the appropriate support or corrective measures can be adopted in a timely and remedial fashion.

149. The Project Manager, the NTA and the CTA will fine-tune the progress and performance/impact indicators for the project in consultation with the full project team at the Inception Workshop. Specific targets for the first year implementation progress indicators together with their means of verification will be developed in this workshop. These will be used to assess whether implementation is proceeding at the intended pace and in the right direction and will form part of the AWP. Targets and indicators for subsequent years will be reviewed annually as part of the internal evaluation and planning processes undertaken by the Project Implementation Unit (PIU).

150. SMART (Specific; Measurable; Achievable and Attributable; Relevant and Realistic; Time-bound, Timely, Trackable and Targetable) indicators for impacts and results related to global environmental benefits are identified with baseline and target at Year 4 defined in the table below. All these impact indicators will be monitored annually at specific locations with effective means of verification. These will be undertaken through subcontracts or retainers with relevant institutions or through specific studies that are to form part of the projects activities. Indicators of project goal, progress and performance will be continuously monitored and evaluated throughout the whole project life.

Table 9: Key Impact Indicators

Key Impact Indicator	Baseline	Target (at Year 4)	Means of Verification	Sampling frequency	Location
Metric tons of PCBs, PCB-containing equipment, oil and wastes collected and transported in an environmentally sound manner	0	At least 7,700 tons	Check manifests for hazardous waste transportation	Annually	PCBs waste sites and storage facilities

Key Impact Indicator	Baseline	Target (at Year 4)	Means of Verification	Sampling frequency	Location
Metric tons of PCB-containing equipment dismantling and PCB-containing oil disposed of in an environmentally sound manner	0	At least 2,700 tons	On-site monitoring of facility operation	Annually	Stationary PCBs disposal centre
Metric tons of PCB-containing equipment and oil decontaminated in an environmentally sound manner	0	At least 5,000 tons	Surveys, monitoring	Annually	Mobile PCBs disposal units at PCB-containing equipment owners' sites
Increase or decrease of PCBs concentration in adjacent soil and water body, including surface water and underground water	To be determined in 1st year of implementation	Not higher than in 1st year of implementation	Monitoring by environmental authorities	Annually	Stationary disposal centre and sites of mobile disposal units

151. As the primary objective of this project is to carry out ESM disposal of PCBs and PCB-containing equipment, oil and wastes, the most direct indicators to characterize the impacts of this project should include

    - metric tons of pure, concentrated PCBs oil, PCB-containing equipment and PCB-containing mineral oil and wastes collected and disposed of in an environmentally sound manner; and
    - metric tons of decontaminated dielectric oils in PCB-containing equipment and PCB-containing mineral oil and wastes.

152. The ultimate result of the project should be the decrease or at least the stabilization of PCBs concentrations in adjacent soil and water body, including surface water and underground water, following the clearance of PCB-containing equipment and oil due to the removal of sources.

153. UNIDO through quarterly meetings with project counterparts or as frequent as deemed necessary will undertake periodic monitoring of the project implementation progress. This will allow parties to troubleshoot any problems pertaining to the project in a timely fashion to ensure the smooth implementation of project activities.

154. UNIDO and/or UNIDO Regional Office will conduct periodic visits based on agreed schedule to be detailed in the project's Inception Report / Annual Work Plan to assess project progress. Other members of the National Steering Committee may also accompany these visits. A Field Visit Report will be prepared by UNIDO and will be circulated to the project team and all Project Steering Committee members no less than one month after the visit.

155. Annual Monitoring will occur through Tripartite Review (TPR) meetings, which will take place at least once every year. The first such meeting will be held within twelve months of the start of the full project implementation. The PIU will prepare an Annual Project Report (APR) and submit it to UNIDO at least two weeks prior to the TPR for review and comments.

156. The TPR has the authority to suspend funds disbursement if project performance benchmarks are not met.

Terminal Tripartite Project Review

157. The terminal tripartite project review (TTPR) meeting will be held in the last month of project operation. The project proponent is responsible in the preparation of the Terminal Report and its submission to UNIDO. It will be prepared in draft at least two months in advance of the TTPR in

order to allow more time for its review. This will serve as the basis for discussions in the TTPR meeting. The TTPR considers the implementation of the project as a whole, paying particular attention to whether the project has achieved its stated objectives and contributed to the broader environmental objective. It decides whether any actions are still necessary, particularly in relation to sustainability of project results and acts as a means, which lessons learned can be captured for use in other projects under implementation or formulation.

Project Monitoring Reporting

158. The national project team in conjunction with the UNIDO will be responsible for the preparation and submission of the following reports that form part of the monitoring process. Items (a) through (f) are mandatory and are specifically related to monitoring, while items (g) through (h) have a broader function and the frequency and nature are to be defined throughout implementation.

(a) Inception Report

159. A Project Inception Report (IR) will be prepared immediately following the IW. It will include a detailed First Year Annual Work Plan divided into quarterly timeframes, which detail the activities and progress indicators that will guide the implementation during the first year phase of the project. The Work Plan will include the dates of specific field visits, support missions from UNIDO and/or UNIDO consultants, as well as timeframes for meetings of the project's decision-making structures. The report will also include the detailed project budget for the first full year of implementation, prepared on the basis of the Annual Work Plan, and including any monitoring and evaluation requirements to effectively measure project performance during the targeted 12 month timeframe.

160. When finalized, the report will be circulated to project counterparts, who will be given a period of one calendar month in which to respond with comments or queries. Prior to this circulation of the IR, UNIDO will review the document.

(b) Annual Project Report

161. The Annual Project Report (APR) is a UNIDO requirement and part of UNIDO central oversight, monitoring, and project management. It is a self-assessment report by project management to UNIDO, as well as a key input to the TPR. The APR will be prepared on an annual basis prior to the TPR to reflect the progress achieved in meeting the project's Annual Work Plan and assess performance of the project in contributing to the intended outcomes through outputs and partnership work.

162. The format of the APR is flexible but should include the following:

- Analysis of project performance over the reporting period, including outputs produced and information on the status of the outcome
- Constraints experienced in the progress towards results and the reasons for these
- Expenditure reports
- Lessons learned
- Recommendations to address key problems in lack of progress, if applicable.

(c) Project Implementation Review

163. The Project Implementation Review (PIR) is an annual monitoring process mandated by the GEF. It is an essential management and monitoring tool for project managers and offers the main vehicle for extracting lessons from ongoing projects. Once the project will be under implementation for a year, the project team shall complete the PIR. The PIR can be prepared any time during the year (July-June) and ideally immediately prior to the TPR. The PIR should then be discussed at the TPR so that the result would be a PIR that has been agreed upon by project staff, the national executing agency and UNIDO

(d) Quarterly Progress Reports

164. Short reports outlining the main updates in project progress should be provided quarterly to UNIDO by the project team.

(e) Periodic Thematic Reports

165. As and when called for by UNIDO, the project team will prepare Specific Thematic Reports, focusing on specific issues or areas of activity. The request for a Thematic Report will be provided to the project team in written form by UNIDO and will clearly state the issue or activities that need to be reported on. These reports will be used as a form of lessons learned exercise, specific oversight in key areas, or as troubleshooting exercises to evaluate and overcome obstacles and difficulties encountered. Regular site visits to the three (3) treatment facilities will be performed by PSC as well as UNIDO to report on monitoring that could be useful for better management of the facilities.

(f) Project Terminal Report

166. During the last three months of the project, the project team will prepare the Project Terminal Report (PTR). This comprehensive report will summarize all activities, achievements and outputs of the project, lessons learned, objectives met (or not met), and structures and systems implemented. The PTR will be the definitive statement of the Project's activities during its lifetime. It will also lay out recommendations for any further steps that may need to be taken to ensure sustainability and replicability of the project's activities.

(g) Technical Reports

167. Technical Reports are detailed documents covering specific areas of analysis within the overall project. As part of the Inception Report, the project team should prepare a draft Reports List, detailing the technical reports that are expected to be prepared on key areas of activity during the course of the Project, and tentative due dates. Where necessary, this Reports List will be revised and updated and included in subsequent APRs. Technical Reports may also be prepared by external consultants and should be comprehensive, specialized analyses of clearly defined areas of research within the framework of the project and its sites. These technical reports will represent, as appropriate, the project's substantive contribution to specific areas and will be used in efforts to disseminate relevant information and best practices at local, national and international levels.

(h) Project Publication

168. Project Publications will form a key method of crystallizing and disseminating the results and achievements of the Project. These publications may be scientific or informational texts on the activities and achievements of the Project in the form of journal articles, multimedia publications or other forms of distribution. Publications can be based on Technical Reports or may be summaries or compilations of a series of Technical Reports and other research. The project team will determine if Technical Reports merit formal publication and will also (in consultation with UNIDO, the government and other relevant stakeholder groups) plan and produce these publications in a consistent and recognizable format.

Independent Evaluations

169. The project will be subjected to at least two independent external evaluations as follows:

(a) Mid-term Evaluation. An independent Mid-Term Evaluation will be undertaken at the end of the second year of project implementation. The Mid-Term Evaluation will measure progress made towards the achievement of outcomes and will identify corrections if needed. The evaluation will focus on the effectiveness, efficiency, and timeliness of project implementation; highlight issues requiring decisions and actions; and present initial lessons learned on project design, implementation and management. Findings of this review will be incorporated as recommendations for enhanced implementation during the second half of the project's term. The organization, terms of reference and timing of the mid-term evaluation will be decided after consultation between the parties to the

project document. The Terms of Reference for this mid-term evaluation will be prepared by UNIDO in accordance with the generic TORs developed by the GEF Evaluation Office.

(b) Final Evaluation. An independent Final Evaluation will take place within 12 months after the completion of the project implementation, and will focus on the same issues as the mid-term evaluation. The final evaluation will also review impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental goals. The Final Evaluation should also provide recommendations for follow-up activities. The Terms of Reference for this evaluation will be prepared by the UNIDO in accordance with the generic TORs developed by the GEF Evaluation Office.

170. A Project Management Information System will be established to support the Project Manager and the project management team to ensure that all the project activities be completed on time, in quality and within budget. The MIS will keep baseline records of Annual Work Plans and contracts with consultants and subcontracts with performance indicators, result reports, responsibilities and budgets, and compare them with the progresses of the activities. A project website will be established to disseminate project information to the primary stakeholders and the general public.

Audit Clause

171. The Government will provide UNIDO with certified periodic financial statements and with an annual audit of financial statements relating to the status of the GEF funds according to the established procedures set out in the Programming and Finance manuals. The audit will be conducted by a legally recognized Government auditor, or by a commercial auditor engaged by the Government.

SECTION G: PRIOR OBLIGATIONS AND PREREQUISITES

172. The Project Document will be signed by UNIDO and the Government of the Republic of India. GEF assistance will be provided subject to UNIDO being satisfied that obligations and pre-requisites listed below have been fulfilled or are likely to be fulfilled. When fulfilment of one or more of these prerequisites fails to materialize, UNIDO may, at its discretion, either suspend or terminate its assistance.

G.1 Prior to Project Effectiveness

173. Legally binding co-financing agreements are signed for the private/public sector participation in the project.

G.2 During project implementation

174. Quarterly Progress reports, annual Project Reports and Project Implementation Review reports as well as measure impact indicators should be prepared. The project work plan and consequently the budget will be updated annually.

G.3 Within one year of start of project implementation

175. Annual audited financial reports should be prepared and submitted to GEF.

SECTION H: LEGAL CONTEXT

176. The project document shall be the instrument referred to the Standard Basic Agreement between the Government of the Republic of India and UNIDO. The project objectives shall be in line with the objectives of the Policies of the Government of the Republic of India.

177. The following types of revisions may be made to this Project Document with the signature of the Project Manager, provided he or she is assured that the other signatories of the Project Document have no objection to the changes as follows:

- Revision in, or addition of, any of the annexes of the Project Document; and
- Revisions that do not involve significant changes in the immediate subcomponents, objectives, outcomes or activities of the project, but are caused by rearrangement of the inputs already agreed to or by cost increases due to inflation.

ANNEXES:

Annex 1: Project Logical Framework

Annex 2: Environmentally Sound Technologies for PCBs disposal

Annex 3: Criteria for Selection of Host Operating Entity

Annex 4: Business Plan

Annex 5: Baseline analysis of PCB management

Annex 6: Identification and responsibilities of stakeholders

Annex 7: Terms of References for Consultants/Experts

Annex 8: Terms of References for Subcontracts

Annex 9: Environmental Laboratories in India

Annex 10: Assessment of Business Models

Annex 1: PROJECT LOGICAL FRAMEWORIK

Interventions	Objectively Verifiable Indicators	Sources of Verification	Assumptions and Risks
Project Goal	To reduce or eliminate the use and releases of polychlorinated biphenyls (PCBs) to the environment through promotion of environmentally sound management (ESM) of PCBs and disposal of at least 7,700 tons of PCB-contaminated equipment, oil, and other waste	Progress reports, activity implementation reports, lists of PCB containing oil and equipment maintained or disposed of in environmentally sound manner, copies of guidelines or regulations developed	Project inputs will be inadequate to accomplish stated objectives; project activities will be inadequate to allow identified barriers to be overcome.
Outcome 1: Strengthened policy and regulatory framework to comply with the obligations under the Stockholm Convention			
Output 1.1: Legal and regulatory framework for ESM of PCBs reviewed and assessed			
Activity 1.1.1: Evaluation of gaps between Stockholm Convention requirements and existing legal/regulatory framework ***Activity 1.1.2*:** Evaluation of existing national legal and regulatory framework ***Activity 1.1.3:*** Recommendations to legislative bodies for new and/or revised laws to implement Stockholm Convention requirements ***Activity 1.1.4:*** Recommendations to regulatory bodies for new and/or revised regulations and guidelines to implement Stockholm Convention requirements	➢ Existing national legal and regulatory framework evaluated. ➢ Gaps between Stockholm Convention requirements and existing legal/regulatory framework identified. ➢ Legislative bodies presented with recommendations for new and/or revised laws to implement Stockholm Convention requirements; number of proposed new/revised laws. ➢ Regulatory bodies presented with recommendations for new and/or revised regulations to implement Stockholm Convention requirements; number of proposed new/revised regulations.	➢ Evaluation report ➢ Gap analysis report ➢ Report on recommendations, copies of proposed new/revised legal texts ➢ Report on recommendations, copies of proposed new/revised regulations	➢ Delays in adoption of legal framework and specific policy and technical guidance may hamper implementation. ➢ Laws and regulations not fully and consistently enforced.
Output 1.2: Legal and regulatory framework at the national level established or upgraded			
Activity 1.2.1: Enactment of new and/or revised laws to implement Stockholm Convention requirements. ***Activity 1.2.2***: Issuance of new and/or revised regulations to implement Stockholm Convention requirements.	➢ Number of new/revised laws adopted relative to recommendations ➢ Number of new/revised regulations adopted relative to recommendations	➢ Activity report, copies/summaries of new/revised legal texts ➢ Activity report, copies/summaries of new/revised regulations	➢ Law making bodies at state and union territories will not timely be responsive to recommendations ➢ Regulatory bodies will not timely be responsive to recommendations

Interventions	Objectively Verifiable Indicators	Sources of Verification	Assumptions and Risks
Output 1.3: National legal and regulatory framework implemented in targeted states			
Activity 1.3.1: Evaluation of existing State enforcement of PCB management related laws and regulations ***Activity 1.3.2:*** Identification of gaps between State implementation and National and Stockholm Convention requirements ***Activity 1.3.3:*** Support for State adoption of revised and/or new measures to ensure environmentally safe management and disposal of PCB contaminants	➢ State enforcement of PCB management related laws and regulations evaluated; number of states and union territories reviewed. ➢ Number of states and union territories analyzed, number of gaps identified. ➢ Number of states assisted, person-weeks support provided, number of new measures adopted, amount of PCBs managed and disposed of in environmentally safe manner	➢ Gap analysis report ➢ Activity reports, copies/ summaries of new/revised measures adopted at State and union territories levels	➢ States and union territories may face difficulties in timely implementation of PCB management requirements
Output 1.4: Pollution prevention and management of PCBs, PCB-containing equipment and waste in consonance with ESM guidelines			
Activity 1.4.1: Evaluate current practices for management of PCBs, PCB containing equipment and wastes ***Activity 1.4.2:*** Develop guidelines for management of PCBs, PCB containing equipment and wastes in consonance with ESM guidelines ***Activity 1.4.3***: Stakeholder and owner training in management of PCBs, PCB containing equipment and wastes in consonance with ESM guidelines	➢ Current PCB management practices evaluated ➢ PCB management guidelines developed ➢ Number of stakeholders and individuals trained	➢ Copy of evaluation report ➢ Copy of guidelines ➢ Training activity report	➢ Stakeholders unwilling to share information and implement measures
Outcome 2: Relevant institutions in India are enabled to manage PCBs in an environmentally sound manner as well as awareness raising on the adverse effect of PCBs			
Output 2.1: Institutional capacity for ESM of PCBs, PCB-containing equipment and wastes evaluated			
Activity 2.1.1: Identification of stakeholders to be targeted in institutional capacity building efforts ***Activity 2.1.2:*** Evaluation of current stakeholder institutional capacity for ESM of PCB containing equipment and wastes ***Activity 2.1.3***: Identification of stakeholder capacity building needs	➢ Number of train-the-trainers program carried out ➢ Number of stakeholders identified ➢ Current stakeholder capacity evaluated ➢ Stakeholder capacity building needs identified	➢ Curricula and/or training materials for train-the-trainers program ➢ Activity reports ➢ Evaluation report	➢ Low level of participation and support of key stakeholders for the implementation of the project

Interventions	Objectively Verifiable Indicators	Sources of Verification	Assumptions and Risks
Output 2.2: Training workshops for key stakeholders undertaken			
Activity 2.2.1: Training materials on the planning and organization of PCB phase-out and disposal methods ***Activity 2.2.2:*** Workshop for planning and organization of PCB phase-out and treatment methods developed ***Activity 2.2.3***: Training workshops for PCB owners ***Activity 2.2.4***: Capacity building for workplace safety monitoring by safety inspection agencies ***Activity 2.2.5:*** Capacity building for environmental inspection agencies	➢ Workshop held on PCB phase-out and treatment methods; number of workshops and participants. ➢ Number of individual trained ➢ Number of specific occupational and environmental safety workshops for occupational and environmental safety inspectors ➢ Number of specific occupational and environmental safety workshops for stakeholder staff	➢ Training activity reports ➢ Copy of training materials, training reports ➢ Occupational and environmental safety guidelines for handling PCBs, PCB-containing equipment and wastes	➢ Due to delays in project implementation, lack of adequate number of trainers to carry out workshops ➢ Training materials and guidelines are not timely available
Output 2.3: A national tracking and record keeping system (PCB inventory database) established maintained countrywide (28 states and 7 union territories)			
Activity 2.3.1: PCB owner workshop to introduce PCB reporting requirements ***Activity 2.3.2:*** PCB owner capacity building to identify and label PCB-containing equipment ***Activity 2.3.3:*** Provision of inventory monitoring kits and other monitoring supplies ***Activity 2.3.4:*** Inventory survey of PCB use in power sector ***Activity 2.3.5:*** Inventory survey of PCB use in shipbreaking sector ***Activity 2.3.6***: Inventory survey of PCB use in other non-power sectors ***Activity 2.3.7***: Inspection and verification ***Activity 2.3.8***: Initial inventory completion ***Activity 2.3.9***: Inventory updates	➢ Information materials developed and provided to stakeholders. ➢ Number of stakeholders contacted and provided with information and technical support ➢ Amount of monitoring kits and other monitoring equipment/supplies provided ➢ Completed power sector inventory list, number of items listed ➢ Completed shipbreaking sector inventory list, number of items listed ➢ Completed non-power sector inventory list, number of items listed.	➢ Activity implementation report ➢ List of monitoring equipment / supplies provided ➢ Inventory reports	➢ Stakeholders unwilling to participate in training activities ➢ Stakeholders in other non-power sector will be unwilling to participate in the completion of inventory

Interventions	Objectively Verifiable Indicators	Sources of Verification	Assumptions and Risks
Output 2.4: Sampling, analysis and monitoring capacity evaluated and strengthened in 13 states			
Activity 2.4.1: Upgrade laboratory facilities to monitor PCBs ***Activity 2.4.2:*** Technical training in PCB monitoring	➢ Number of laboratories upgraded ➢ Number of new accreditations issued ➢ Guidelines of good laboratory practices issued ➢ Number of equipment purchased nad installed ➢ Standard sampling and analytical methodology adopted	➢ Guidelines of good laboratory practices ➢ New accreditations ➢ List of equipment purchased and installed ➢ Copy of methodology	Lack of trainers in PCBs monitoring
Output 2.5: Awareness raising carried out			
Activity 2.5.1: Information on PCB risks and risk minimization disseminated through print media ***Activity 2.5.2***: Information on PCB risks and risk minimization disseminated through online sources ***Activity 2.5.3***: Information on PCB risks and risk minimization disseminated through televised public service announcements ***Activity 2.5.4:*** Public awareness raising through targeted workshops ***Activity 2.5.5***: Policy maker awareness building	➢ Number of activists carrying out awareness raising ➢ Number of articles published and estimated readership ➢ Number of website hits and registered users ➢ Number of public service announcements (PSAs) developed and broadcast, estimated viewership ➢ Number of workshops and workshop participants ➢ Number of communications and consultations with policy makers	➢ Awareness raising materials ➢ Activity reports ➢ Public service announcement ➢ Copies/summaries of information provided to policy makers	➢ Public, particularly its most vulnerable segments have not been sensitized ➢ Public participation is low ➢ Lack of adequate number of activists to carry out awareness raising
Outcome 3: Targeted regional implementation for ESM of PCBs, PCB-containing equipment and wastes			
Output 3.1: Dedicated environmentally sound maintenance capacity for PCBs, PCB-containing equipment and wastes established			
Activity 3.1.1: Identification of technical and technological needs to implement EMS for PCB containing equipment ***Activity 3.1.2:*** Dedicated maintenance facility designation, certification, and procurement ***Activity 3.1.3***: PCB owner maintenance facility ESM upgrades	➢ Technical and technological needs to implement EMS for PCB containing equipment identified ➢ Number of PCB management facilities certified ➢ Maintenance facilities supplied with necessary equipment	➢ Activity reports ➢ Evaluation reports ➢ Copies of certification certificates ➢ List of equipment provided ➢ Training activity reports	➢ Potential transformer owners not willing to identify target transformers and to report PCBs, PCB-containing equipment and waste in order to efficiently participate in the maintenance program

Interventions	Objectively Verifiable Indicators	Sources of Verification	Assumptions and Risks
Activity 3.1.4: Technical training	➢ Facility staff trained		➢ Project resources inadequate ➢ Lack of private sector interest
Outcome 4: Regional capability for final treatment and disposal of PCB wastes			
Output 4.1: Management system for identification, tracking, collection, packaging, transport, interim storage, record keeping, and disposal of PCB waste developed and operational			
Activity 4.1.1: Develop guidelines for PCBs, PCB-containing equipment and waste identification, tracking and record keeping ***Activity 4.1.2:*** Develop guidelines for PCBs, PCB-containing equipment and waste collection, packaging and transportation ***Activity 4.1.3:*** Develop guidelines for PCBs, PCB-containing equipment and waste interim storage ***Activity 4.1.4:*** Develop guidelines for PCBs, PCB-containing equipment and waste disposal ***Activity 4.1.5***: Develop information management software for PCB management system ***Activity 4.1.6:*** Train stakeholders in management system requirements and procedures	➢ Guidelines developed for PCBs, PCB-containing equipment and waste identification, tracking and record keeping ➢ Guidelines developed for PCBs, PCB-containing equipment and waste collection, packaging and transportation ➢ Guidelines developed for PCBs, PCB-containing equipment and waste interim storage ➢ Guidelines developed for PCBs, PCB-containing equipment and waste disposal ➢ information management software developed for PCB management system ➢ Number of stakeholders and individuals trained in guidelines and management system	➢ Copy/summary of guidelines ➢ Copy/summary of software specifications ➢ Training activity report	➢ Serious threats to human health and the environment due to releases of PCBs during the removal, transport and treatment of PCB waste.
Output 4.2: ESM and transport to interim storage sites of PCB-containing materials carried out including specialized transport vehicles for highly concentrated PCBs with GPS and adequate preparedness measures in case of emergency on transport routes to the stationary disposal unit			
Activity 4.2.1: Identify locations for interim storage facilities ***Activity 4.2.2***: Interim storage facility design, construction, provisioning, and commissioning ***Activity 4.2.3***: Staffing and staff training for interim storage facilities	➢ Number of ESM storage facilities established ➢ Locations identified for ESM interim storage facilities ➢ Number of ESM interim storage facilities established ➢ Number of staff hired and trained	➢ Site evaluation report ➢ Activity report ➢ List and description of sites established ➢ Training report	➢ Accidents and environmental releases during transport of PCB waste to interim storage sites

t	➢ d	➢	➢ Not enough PCB waste to ensure commercial viability of identified technology options

Interventions	Objectively Verifiable Indicators	Sources of Verification	Assumptions and Risks
Output 4.3: Final ESM treatment of at least 7,700 tons of PCBs, PCB-containing equipment, and PCB-contaminated oil undertaken			
Activity 4.3.1: Technology requirements specification and procurement of three (3) treatment facilities ***Activity 4.3.2:*** Decontamination of PCB contaminated oil below 50 ppm of PCBs level ***Activity 4.3.3:*** Identify location for stationary treatment facility ***Activity 4.3.4***: Stationary treatment facility design, technology requirements specification, and procurement ***Activity 4.3.5***: Stationary treatment facility construction, equipping, and commissioning ***Activity 4.3.6***: Treatment facility staffing and staff training ***Activity 4.3.7:*** Disposal of PCBs, PCB-contaminated oil and PCB-containing equipment and wastes	➢ Three (3) treatment facilities established ➢ One (1) stationary and two (2) mobile technologies identified and selected, equipment procured ➢ Three (3) treatment facilities locations identified ➢ Three (3) treatment facilities designed ➢ Three (3) treatment facilities commissioned ➢ Number of staff trained ➢ 7,700 tons of PCB contaminated material treated or disposed of	➢ Terms of reference of subcontract with vendors ➢ List and specifications of equipment procured ➢ Criteria of treatment facility locations ➢ Copy/summary of design specifications ➢ Vendor's report on commissioning ➢ Training report ➢ Copy/summary of facility PCB treatment logs	➢ Type of technologies selected meet SC BAT/BEP requirements ➢ Delays in procurement of equipment will delay decontamination ➢ Trained technical staff will stay with the project and their turnover will be low
Outcome 5: Project Management and monitoring and evaluation			
Output 5.1: Project management structure established			
Activity 5.1.1: Establish Project Management Unit (PMU) and appoint project leadership staff ***Activity 5.1.2:*** Establish Project Steering Committee (PSC) ***Activity 5.1.3:*** Recruit project advisor(s), policy experts and technical experts in PCBs management, project evaluation and program development	➢ PMU established and staffed ➢ PSC established and staffed ➢ Project experts recruited ➢ Project Management training held ➢ Stakeholder PMUs established and staffed ➢ MIS established	➢ List of PMU staff ➢ List of PSC members ➢ Terms of references for experts, copy of appointment notice ➢ Copy of training materials, training reports ➢ Contact list for stakeholder PMUs	➢ Changes in project input prices and exchange rates may increase project costs

Interventions	Objectively Verifiable Indicators	Sources of Verification	Assumptions and Risks
Activity 5.1.4: Hold project management training for project management staff ***Activity 5.1.5***: Establish PMUs within participating organizations and sign MoAs as agreement on participation to the project ***Activity 5.1.6***: Establish project management information system (MIS), including a project website to disseminate information to stakeholders		➢ MIS specifications and user instruction	
Output 5.2: An M&E mechanism designed and implemented according			
Activity 5.2.1: Prepare and hold Inception Workshop ***Activity 5.2.2****:* Measure impact indicators ***Activity 5.2.3***: Carry out annual project financial audits ***Activity 5.2.4:*** Prepare Annual Project Reports and Project Implementation Reviews ***Activity 5.2.5:*** Hold annual Tripartite Review meetings ***Activity 5.2.6*** Carry out mid-term external evaluation ***Activity 5.2.7***: Prepare and hold Project completion workshop ***Activity 5.2.8:*** Carry out final external evaluation ***Activity 5.2.9***: Complete project Terminal Report	➢ Inception Workshop held ➢ Detailed workplan prepared ➢ Updated impact indicators ➢ Financial audit completed ➢ Annual reports and PIRs completed ➢ Annual TPR meetings held ➢ Mid-term evaluation completed ➢ Final external evaluation held ➢ Project Terminal Report completed	➢ Monitoring reports ➢ Inception report ➢ Progress Reports ➢ Copy of audit reports ➢ Copies of annual reports and PIRs ➢ TPR meeting proceedings ➢ Copy of mid-term evaluation report ➢ Copy of final external evaluation report ➢ Copy of project terminal report	➢ Delays in project implementations as well as monitoring and evaluation may cause delays in holding regular project management and M&E meetings and issuing required reports

ANNEX 2: ENVIRONMENTAL SOUND TECHNOLOGIES FOR PCBS DISPOSAL

NON-COMBUSTION TECHNOLOGIES FOR THE DESTRUCTION OF PCBs AND/OR DECONTAMINATION OF PCBs CONTAMINATED MATERIALS

1. INTRODUCTION

This project document "Environmentally Sound Management and Final Disposal of PCBs in India" outlines UNIDO's proposal for the provision of technical assistance to public and private sector actors to increase the in-country capacity for overcoming identified barriers for safe and sustainable management of PCB-containing transformers at all stages of their life cycle.

It is estimated that up to 10% or about 3,500,000 electrical transformers in use maybe contaminated with PCBs above the threshold level of 50 mg/kg or ppm. Based on the inventory of transformers in the generating, transmission and distribution electrical systems, including the industrial sector, it is estimated that 10% of contamination level represents nearly 35,000 metric tons of PCB contaminated mineral oil. The estimated PCB-contaminated transformer carcasses are 52,000 metric tones and the total weight of the PCB-containing transformers is 87,000 metric tones.

The existence of PCB-containing mineral oil transformers in any given jurisdiction is a complex problem due the number of transformers involved and the locations where they are installed. Larger power transformers can be found in electrical generating stations and transmission stations, medium size transformers are usually found in distribution stations and industrial sites, heavy users of electricity such mining, steel and manufacturing facilities, while small distributions transformers are installed in the electrical distributions network covering the whole country.

Because of the logistic and tremendous efforts required to analyze all electrical transformers, in most countries, owners of transformers and government officials have established programs where medium and large size transformers are analyzed. Depending on the PCBs level found, measure to properly manage the units are implemented. Small sizes transformers, on the other hand, are left in-service until their useful life expired. Once these transformers are to be replaced, the oil in the transformers are tested for PCB content and managed appropriately.

An environmentally friendly manner to manage and re-classify large and medium size PCB-containing mineral oil transformers is using a retrofilling method. This method of managing low level PCB-containing mineral oil from in-service electrical systems is widely used by the industry to convert PCB-containing equipment into non-PCB units. The retro-filling solution for high level PCB transformer was commercially available in North America in the early 1990's, but it has been discontinued.

Retrofilling is an economical and simple solution for the removal of PCB-containing mineral oil from in-service equipment. Depending on the original PCB level in the mineral oil of the contaminated transformer, retro-filling may have to be repeated to achieve the usually less than 50 ppm target level. Based on industry experience, transformers with PCB in the liquid that contain between 50 and 700 ppm will require just one retro-filling process to achieve a final PCB concentration of less than 50 ppm. Transformers that contain between 700 and 2,000 ppm will require two retro-fillings to achieve less than 50 ppm target. However, transformers than contain between 2,000 and 10,000 pm will require retrofilling to be applied 3 times to achieve less than 50 ppm.

Because most of the mineral oil electrical transformers contaminated with PCBs contain less than 700 ppm, then it is expected that one retrofilling application will be required to convert most of the PCB-containing transformers into PCB-free units. Retrofilling, when applied to PCB-containing mineral oil transformers is a sound and economical solution for the elimination of PCBs from electrical systems.

In order to economically apply the retrofilling solution to mineral oil PCB-containing transformer, it is necessary to have access to a dechlorination unit that can treat the mineral oil and selectively destroy the PCBs. The dechlorination system however has to be able to yield a mineral oil that can be suitable for re-use in the electrical transformer.

Distribution of the PCB in transformers shows that most of the PCBs are in the dielectric fluid and in the absorbed porous components namely insulating paper and wood spacers. A very small fraction of PCBs in a transformer is contained in the metallic components. Specifically, PCBs or oil-containing PCBs are held on the surface of the inert metallic (steel) and imbedded in the varnish that may be coating the conductor (copper wiring). Degreasing solvents have been used to dissolve the PCBs from the metallic surfaces, rendering a PCB-containing solvent and a PCB-free metal.

Aggressive solvents such as Perchloroethylene and other chlorinated materials are being used to decontaminate porous materials and metals from PCB-containing transformers. Technologies based on solvent extraction require a method to reclaim the solvent. Because of the significant difference of the boiling point between the chosen solvent and the PCBs, distillation has been commonly used for this purpose.

In the context of the proposed PCB project in India, however, where a smaller number of PCB-containing transformers will require metal cleaning, it is conceived that rather than using the normal degreasing solvent such as Perchloroethylene, hot mineral oil can be used as PCB dissolvent agent. The hot oil will be able to dissolve the PCBs from the metallic surfaces and lowering the contamination level to lower than 50 mg/kg or other acceptable standard. The PCB-containing oil recovered from the metal cleaning activity will then be treated in the dechlorination unit, destroying selectively the PCBs and rendering a dielectric fluid suitable for re-use in transformers or for cleaning additional metallic components.

The vast extent of the PCB contamination problem in India represents a significant economical and environmental challenge for the Indian government and PCB users to meet the commitments made under the Stockholm Convention.

In order to assist countries like India to deal with the disposal of obsolete POPs, including PCBs, the GEF, concurrent with its mandate to support innovative and environmentally sound approaches and technologies, will support the demonstration and replication of innovative and cost-effective practices and technologies, in particular non-combustion technologies. Based on waste streams, some of these non-combustion technologies have proven to be superior to incineration, not only economically, but also from the environmental and social points of view.

The proposed project aims at establishing decontamination/treatment facilities for the environmentally sound dechlorination and reclamation of PCB-containing mineral oil as well as at the decontamination, reclamation and recycling of copper and steel recovered from PCB-containing mineral oil transformers, specifically through:

- Establishment of facilities to drain, dismantle and decontaminate metal components from PCB-containing transformers.
- Establishment of dechlorination plants to reclaim PCB-containing mineral oil. These plants could be made fixed or mobile and would be used to clean PCB-containing mineral oil from in-service transformers, as well as to clean the mineral oil used to clean the metallic components of surplus PCB-containing transformers.

It is foreseen that the establishment of these facilities will provide India with:

- Within the country, long-term, best economical solution for dealing with PCB disposal problem. Decontamination of PCB mineral oil using dechlorination methods is less expensive than shipping and incinerating the waste in European incinerators. In addition, the mineral oil in dechlorination systems is reclaimed and reused in transformers, unlike incineration where it is totally destroyed and has to be replaced by new oil to fill the empty transformers.
- Best environmental solution, as only the small fraction of PCB within the waste matrix, is selectively destroyed without the need to destroy the whole matrix as incineration would do. This approach not only reduces the potential generation of carbon dioxide, but allows the recovery and recycling of valuable commodities such as transformer mineral oil, copper and steel.
- Best social solution, as sustainable jobs are created within India to maintain the facilities and the PCB services being offered.

There are numbers of non-combustion technologies that have developed and used for the treatment and destruction of PCB-containing materials. In order to have a complete view of these technologies and their application for the destruction and/or decontamination POP contaminated materials the Scientific and Technical Advisory Panel (STAP) held a workshop in Washington D.C from 1-3 October, 2003.

The STAP workshop was attended by experts from developed and developing countries, academia, research, international and government agencies, as well as representatives of the GEF Secretariat and the Implementing Agencies. The workshop was also attended by representatives from the Stockholm and Basel Convention Secretariats, UNIDO and FAO.

In addition to the STAP workshop, a document prepared for the first meeting of the Technical Advisory Group (TAG) of the UNDP/UNIDO/GEF Project "*Demonstration of Viability and Removal of Barriers that Impede Adoption and Effective Implementation of Available, Non-combustion Technologies for Destroying Persistent Organic Pollutant"* also contains relevant information on non-combustion technologies.

Rather than repeating ourselves and provide information already available in the public domain, this reports summarizes those technologies that are suitable for use in the proposed PCB project in India. When available, additional information is presented for those technologies already identified.

The following proposed criteria were applied to the PCB destruction/dechlorination technologies considered for this project:

A. Complete destruction of the PCB contaminant without destruction of the mineral oil.
B. Commercially available and proven track record
C. Prevent the formation of dioxins, furans and other by-product POPs.
D. Not generate any wastes with POPs characteristics.

Based on the above-mentioned criteria, the following technologies are considered suitable for use in the proposed project for India:

- Based Catalysed Dechlorination (BCD)
- Sodium Reduction Processes
- CDP Process
- Gas Phase Chemical Reduction Process
- Supercritical Water Oxidation
- Solvated Electron Process

2. NON COMBUSTION TECHNOLOGIES

2.1 Based Catalyzed Dechlorination (BCD) Process

The BCD process was developed on the basis of earlier APEG dechlorination methodologies by EPA's Risk Reduction Engineering Laboratory from 1988 to 1993, in cooperation with the National Facilities Engineering Services Center (NFESC) of US Navy to remediate liquids, soils, sludge and sediments contaminated with chlorinated organic compounds, especially PCBs, PCDD/PCDF.

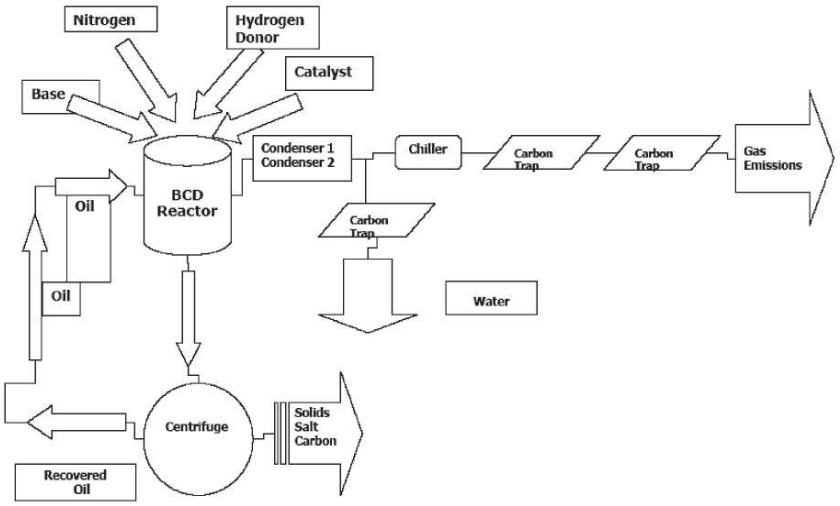
A broad range of POPs, from PCB liquids to organo-chlorinated pesticides can be treated by BCD technology. The treatment can be direct or by 2 separate steps, depending on the type of the feed. The first step is the indirect thermal desorption (in case of solids and contaminated matrices), which is a continuous flow process, and the second step is the intrinsic BCD reaction of POPs (condensates from the first step or liquid POPs which can be fed directly), which is a batch process.

In the typical direct BCD application for treating pure or high level liquid PCB, the PCB material is pumped into the reactor heated to 350℃, called als o Stirred Tank Reactor (STR), containing high boiling point hydrocarbon oil, a base, and a proprietary BCD catalyst.

The hydrocarbon oil acts as solvent and hydrogen donor at the same time. Other donors of hydrogen, such as aliphatic alcohols, amines, or other compounds can also be used, in addition to the oil, as well

as other reactants (no mention which kind, probably proprietary). Bulk organic solids can be fed as slurries in water as well as organic liquids can also be fed as water emulsions. During the BCD treatment the halogen atoms are removed from the target compound producing NaCl, and the rest of organic molecule is converted into a carbon-like material ranging from carbon black to asphalt. The other products of reaction include water and small quantities of cracked hydrocarbons. The reaction times are normally short (several hours) and must be longer for higher chlorine content in the feed. As the reaction is exothermic the high chlorine content POPs (over 50%) should be fed over periods of time.

Inert solids containing low concentration of POPs or the types of waste not suitable for loading in the STR directly (contaminated soils, sludges, debris, transformers, etc.), after the pre-treatment, if any applied, are fed into a heated Indirect Thermal Desorption (ITD) unit having either batch or continuous flow design and allowing treatment of a range of throughputs. The ITD unit represents a rotary reactor, called also Rotary Kiln Reactor (RKR), where the mixture is heated at 200-400 ℃. In the ITD unit the halogenated compounds volatilize and undergo partial or complete decomposition



Emissions

BCD plants are equipped with charcoal filters which capture organic emissions. The resultant salt/water can be carbon filtered and recycled or disposed. The oil and catalyst can also be recovered for reuse or be disposed of, e.g. in a cement kiln. A new option allows recovery of up to 95% of oil by refining it. Heavy oils cannot be recycled and are disposed of in the incinerator. Solid residues may be captured for assay and reprocessing if needed.

Energy requirements and Material requirements

The Energy requirements to operate the system will depend on the batch size and is mainly required to heat up the waste to the desired temperature and are expected to be comparable to other chemical processes.

Capacity

Organic liquids, e.g. PCB up to 100% can be fed directly, whilst solids can be fed in the reactor only as slurries in the carrier oil. Therefore according to some evaluations, BCD reactors are limited to the treatment of 30-55% strength POPs. According to the vendor, the PCB waste of over 1% can be processed in batch solid processors that can handle from 1 to 5 tons of material per batch; pure HCB can be loaded 1 t per batch and would be reacted in 2 hrs. Thus, it can be expected that no more than 3 batches of concentrated POPs can be processed per day. Two batches of 3 tons pure POPs per day make nearly 100 t/ month of POP.

Efficiency

High destruction efficiencies (99.99 – 99.9999%) have been demonstrated for DDT, PCBs, HCB, and PCDD/PCDFs (UNEP, Report on destruction capacity, 2004). It has also been reported that reduction of chlorinated organics to less than 2 mg/kg is achievable

Portability

Modular, transportable or fixed plants have been built

State of commercialization

Commercially licensed in USA, Australia, Mexico, Japan and Spain

Vendor

Patent holder: BCD Group Inc., Cincinnati, OH 45208, USA (www.bcdinternational.com). BCD Group, Inc. sells licences to operate the technology. Currently, licences are held by companies based in Australia, Japan, Mexico and the United States.

2.2 Sodium Reduction Method

The sodium-based reaction for the destruction of polychlorinated biphenyls (PCBs) and other toxic chlorinated materials has been used for a number of companies to develop efficient and economical means to manage PCB wastes. Most of the applications have been for the selectively destruction of PCBs from mineral oil, rendering a PCB-free dielectric fluid suitable for re-use in electrical transformers. Some uses however, have also been applied for the destruction of pure PCBs. Most noticeable of all, is the Toyota City PCB destruction plant commissioned and operated by the government of Japan for the destruction of pure PCBs.

The sodium based reaction for the dechlorination of electrical insulating oils contaminated with low levels of PCBs is dependent on the reaction of active sodium with the chlorine in the PCB molecules, under carefully controlled conditions, to form sodium chlorine and hydrocarbon residues.

The principle reaction in the process is the direct removal of the chlorine atoms from the PCB molecule by sodium:

i.e.: $RCl_x + Na^+ \text{-------} > NaCl + R^+_{x-1}$

Where RCl is a PCB molecule containing x number of chlorine atoms (x =1 to 10), Na^+ is a reactive sodium atom, and R^+_{x-1} is a PCB molecule with 1 chlorine atom removed.

R^+_{x-1} is reactive free-radical from the biphenyl structure and combines with H^+ ,formed by the reaction of sodium with water or donated by the mineral oil, to form a neutral RH molecule. If RH contains additional chlorine, it is again attacked by sodium and the process is repeated until all chlorine atoms have been replaced by hydrogen atoms. At this point, the PCB molecule has been converted to a biphenyl molecule and all chlorine atoms have combined with sodium to form sodium chloride or table salt.

Important side reactions which can occur during the dechlorination process include the reaction of sodium with trace water or with acidic organic oxidation products formed while the oils were in service. These side reactions render undesirable acidic oil components insoluble and therefore assist in their removal in subsequent centrifuging and filtering stages.

While the principal organic product formed in the dechlorination reaction is biphenyl, a small amount of an insoluble residue known as Polyphenyls is also produced as a result of biphenyl polymerization. The yield of Polyphenyls increases relative to that of biphenyl as the PCB concentration of the input oil increases. As with neutralized oil acids, this material is removed from the oil in subsequent treatment stages.

Complete dechlorination reaction occurs in both highly concentrated PCB liquid waste (i.e. pure) or low concentration PCB contaminated mineral oil.

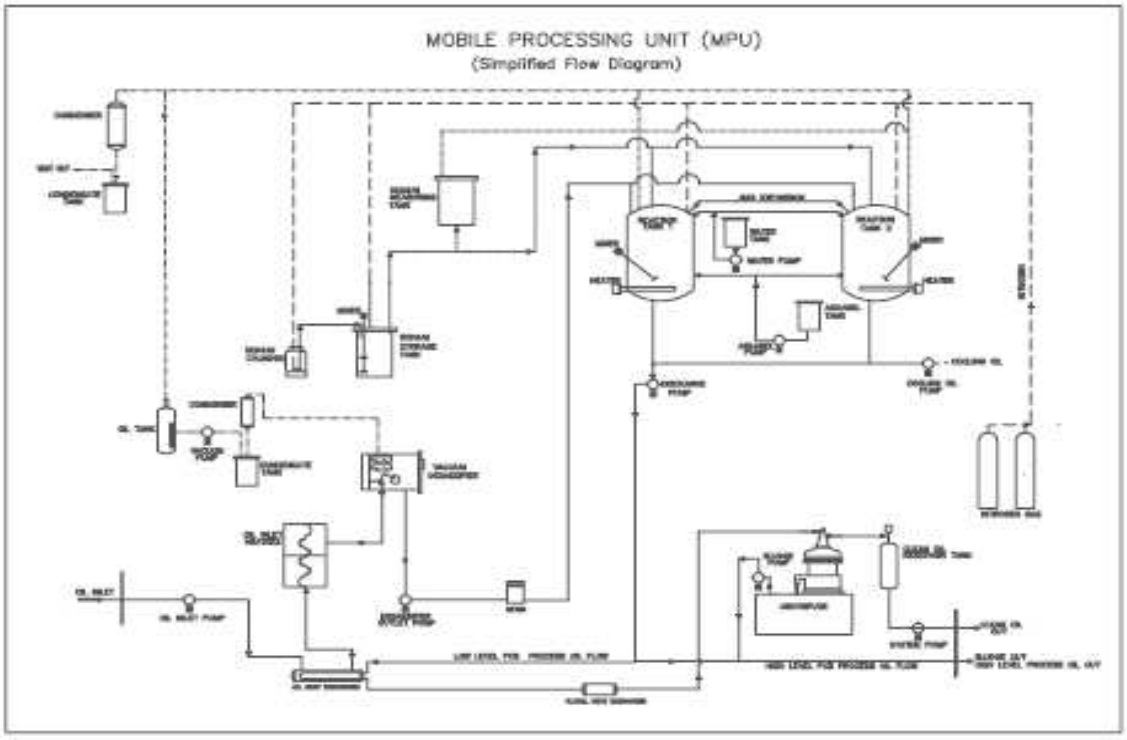
The sodium based reaction for the dechlorination of PCB contaminated mineral oil can be designed as a batch or or a continuous process. Although as a batch process this mode of operation may reduce the throughput capacity of a similar size system when operated on a continuous mode, there are several practical advantages of the batch process, namely:

- Better emission control. In a batch process the reaction vessel remain close until batch analytical data confirms all PCBs in the reactor has been destroyed. Once the PCB destruction has been confirmed, the reaction vessel is purged with nitrogen during the neutralization of the excess sodium used in the reaction. Obviously, the same level of control cannot achieve on a continuous process.

- The batch operation mode avoid cross contamination of already cleaned oil. As every batch of oil is analyzed prior to evacuation of the reaction vessel, in the batch process everything in the reaction vessel is analyzed. In a continuous processing mode, samples are taken at the different times and if there is fault in the operating conditions, this fault, translated in poor destruction reaction, could be detected only after it has already cross contaminated the already cleaned oil.

- The sodium-based reaction as most PCB destruction reaction, it is an exothermic process. The heat of reaction is quite significant and depending on PCB concentration, could generate enough heat to increase the temperature of the reaction mixture well over the mineral oil flash point. This is even more important when destroying high level PCB liquid waste.

A typical diagram describing a sodium-based PCB destruction unit is given in Figure 2.2.1



As shown in Figure 2.2.1 above, a typical sodium-based PCB destruction system would have two reaction vessels. At the start of a daily operation, both reaction vessels will be empty. One reaction vessel will be first filled with PCB contaminated mineral oil, while the second one remains empty. At the completion of the first batch, the reaction vessel is emptied. As the first reaction vessel is emptied, the second vessel is simultaneously loaded with PCB contaminated oil. Heat from the completed reaction (warm oil) is used to warm up the second batch being loaded. The batch process continues until the work load for the day is completed.

To start the process operation for decontaminating PCB-containing mineral oil, the PCB level in the oil to be treated is first determined. The presence of other chlorinated contaminants such as tri and tetra-chlorobenzenes, dioxins and furans, water or acids is further investigated or determined.

Once the PCB level in the oil to be treated is known (in addition to other chlorinated material), waste oil is fed into the processing unit. After passing through a heat exchanger and a heater, the oil goes into a degassifier where water and other volatile components are removed. The contaminated oil is further heated to about 80-85 ^{o}C before reaching the selected reaction vessel.

Once the reaction vessel is loaded with the pre-determined PCB contaminated oil volume and the oil temperature is at the desired level, the sodium dispersion reagent is added. After adding the sodium reagent, the PCB destruction reaction is allowed to complete for 15 to 30 minutes. The occurrence of the reaction is evidenced by a slightly increase in the mixture's temperature. The amount of heat evolved and therefore the oil's temperature increase will depend on the PCB and other chlorinated material concentration.

As the PCB destruction reaction is a free-radical type of reactions, it usually goes to completion very quickly. After the reaction period has elapsed, a sample of the reacting mixture is taken and promptly analyzed. If the analytical results confirmed that the reaction has been completed, then the gas in the reaction vessel is purged with nitrogen and the excess of sodium reagent in the vessel is neutralized with water.

The amount and composition of the sludge by-product will depend on the initial PCB concentration in the treated batch and the amount of sodium reagent added. The higher the PCB level in the original oil, the sludge would have relatively higher concentration of Polyphenyls and Sodium Chloride and lower concentration of Sodium Hydroxide. As the PCB in the original waste oil increases, the sodium-chlorine ratio required to effectively complete the PCB destruction reaction is reduced, thereby relatively reducing the amount of excess sodium left in reaction vessel that needs neutralization.

For batches of contaminated oil with low PCB concentrations (i.e. less than 2,000 ppm), the sludge by-product can be separated from the oil in the system's centrifuge. However, the sludge quickly settles and separates from the oil in high PCB level waste oil.

Once the sludge is separated from the cleaned oil, the sludge can be further treated with an acidic water solution to convert of Sodium Hydroxide into water and the corresponding salt and to separate the petroleum-based Polyphenyls fraction. This clean Polyphenyls fraction composed of Carbon and Hydrogen can be used as fuel in industrial furnaces.

Emissions

Air emissions include nitrogen and hydrogen gas. Air emission of organic byproduct is low due that these facilities have air pollution control system that include activated charcoal filter.

Solid and liquid by-products include polyphenyls, sodium chloride, sodium hydroxide and excess water injected into the system to neutralize excess of metallic sodium used in the reaction.

Energy and Material requirements

Energy requirements are expected to be relatively low due to low operating temperatures associated with the sodium reduction process and significant amounts of sodium are required to operate this process

Capacity

The sodium reduction method has been applied for the decontamination of mineral oil containing PCBs above 50 ppm to the destruction of pure PCBs (100%).

The throughput capacity of the plants depends on the concentration of PCBs in the waste stream and the reaction vessel built in the facilities. Fixed facilities with batch capacity of 2500 litres of PCB contaminated mineral oil and 100 kg of pure PCBs and mobile facilities with batch capacity of 1500 litres of PCB contaminated mineral oil and 50 kg of pure PCBs have been built and are operating.

Efficiency

Total Destruction Efficiencies of greater than 99.9999% for pure PCBs have been reported.

The process has also been demonstrated to meet regulatory criteria in EU, USA, Canada, South Africa, Australia and Japan for PCB treatment (eg. in Canada to [PCB] < 2 ppm for treated oil; and [PCB] < 0.5 ppm; [dioxins] < 1 ppb for solid residues).

Case studies

The sodium reduction method has been applied for many years as mobile facilities in North America, Europe and Japan.

The Toyota City PCB destruction plant owned and operated by the Government of Japan uses the sodium reduction method, based on Kinectrics Inc. technology to destroy pure PCBs since 2005.

Portability

This process is available as a fixed and as a mobile system and can be designed to meet different throughput capacity.

Vendor

List of some of the processes commercially available in the world:

JESCO (Japan – Toyota City Plant)
PCB Containment Technologies (Canada)
Kinectrics Inc. (Canada) – www.kinectrics.com
SD Myers (USA)
Sanexen Environmental (Canada)
Fluidex (South Africa)
Nippon Soda (Japan)
EarthFax Engineering Inc. - www.earthfax.com
Powertech Labs Inc.- www.powertechlabs.com

2.3 CDP Process

CDP Process was developed and patented by Sea Marconi Technologies since 1982 and is one of the processes used to treat in-line PCB contaminated transformers. The process is connected to the transformer and in continuous mode and closed circuit, with circulation of warm oil, without requiring the draining, even partial of the transformers, re-establishing the chemical-physical features of the oil to the same conditions of new oil and reclassifying it “PCBs free” in accordance with European Directive 59/96. A schematic of the system’s connection to a PCB contaminated transformer is shown in Figure **2.3.1**.

The process uses a granulate solid reagent not mixable with the oil, formed by mixtures of polyethylene glycols and solid polypropylene glycols with high molecular weight, a mixture of bases and a radical initiator or other catalysers.

During the continuous circulation, the insulating liquid is heated at a temperature between 80 and 100 ℃ and undergoes:

- Chemical dehalogenation by percolation under pressure on the solid reagent, pre-prepared in filtering cartridges contained in appropriate containers (columns);
- Depolarisation by percolation under pressure on adsorbent particle supports with a high surface;
- Degassing, dehumidification under vacuum and micro filtration

This type of multifunctional process is performed in a continuous manner by the closet-loop circulation of the oil, without draining the contaminated equipment; the latter is simply connected to a decontamination mobile unit, with a variable flow from 700 through 2,000 l/h. These mobile units called Decontamination Mobile Units (DMU) are modular systems with compact dimensions equipped with automatic safety and process control systems capable of operating under all operational conditions especially on energized and under load transformers. The abbreviation DMU indicates that they are able to effectively Diagnose, Decontaminate, Depolarise, Dehalogenate and Detoxify Insulating Fluids.

The stability through time of the values obtained, in case of reuse of the decontaminated oils and equipment is ensured by the circulation of the oil itself that acts as a solvent for the progressive extraction of the PCBs from the porous materials inside the equipment.

The mobile units can be equipped with spill protection systems (Spill Guard), self-cleaning systems also capable of eliminating emissions into the atmosphere (Emx-Clean) and automatic supervision and control systems for all the safety parameters of the process to prevent the origin of possible accidents

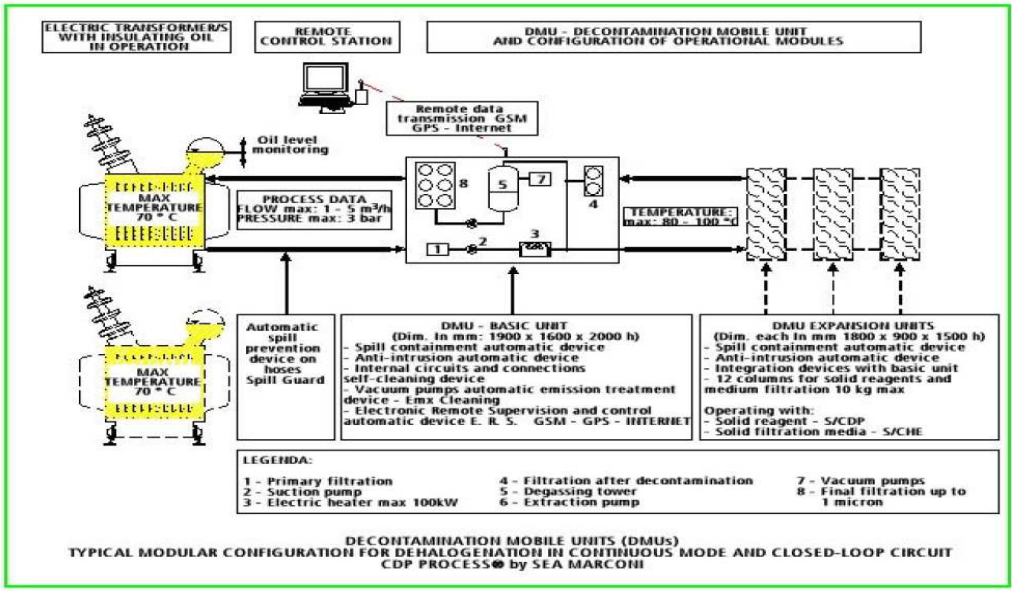


Figure 2.3.1. CDP Process connected to a PCB contaminated transformer

Emissions

The amount of spent reagent as by-product depends on the concentration of PCBs in the waste feedstock. For low level PCB mineral oil (around 100 ppm), the solid byproduct produced is about 0.5 kg/ton oil.

Energy requirements and Material requirements

Energy requirements are expected to be similar to other chemical based technologies.

Capacity

The supplier of this technology claims that a broad range of concentration can be treated by the process (25-50000 ppm), however the company's webpage www.seamarconi.com shows that a mineral oil initially containing 107 mg/kg of PCBs was decontaminated to a less than 10 mg/kg. No data on time or reagent required to treat the claimed mineral oil containing 50000 ppm is provided.

Throughput capacity of 500-1500 L/h or 1,500,000 kg oils per year is reported.

Efficiency

Discrete destruction efficiencies (99.9%) have been demonstrated for PCBs, (UNEP, Report on destruction capacity, 2004). The operational experience demonstrates that, in general, a single intervention is sufficient to ensure the reaching of the required threshold limit also starting from initial concentrations of 500-1000 mg/kg of PCBs. With higher concentrations, up to 50,000 mg/kg of PCBs, it has been demonstrated that several interventions through time are necessary

Case studies

The technology has been used in many countries, including France, Spain and South Africa.

Known case histories demonstrate that the concentration of PCBs measured on a large population of power transformers in operation after 12 months from the performance of the decontamination remain stable at values at 3.5 % of the initial concentration, even in cases of starting values exceeding 500 – 1000 mg/kg.

Portability
Modular, transportable or fixed plants have been built

State of commercialization

The technology is well established and the company has different offices and factories in Europe and South America.

Vendor: Sea Marconi Technologies, Collegno, Italy. www.seamarconi.com

2.4 Gas Phase Chemical Reduction (GPCR) Process

The technology was developed and commercialized by ELI Eco Logic International Inc. in Canada. It is claimed that process can treat all types of chlorinated waste in different forms, such as bulk organic solids and liquids, high-strength PCB oils and mixed solid materials, aqueous waste, contaminated soils and sediments.

The Eco Logic's GPCR technology is based on the gas-phase thermo-chemical reduction of organic compounds by hydrogen at temperatures of 875℃ and low (atmospheric) pressures. The reaction between waste and hydrogen occurs only in the gaseous phase, therefore solid and liquid materials need to be pre-treated.

Depending on the waste type, three pre-treatment units can be used to volatilize wastes prior to treatment in the GPCR reactor:

- The liquid waste pre-heater system (LWPS) is used for homogeneous liquids with low suspended solids content (up to 0,5 %), like PCB oil, oily waste, and watery waste. The vaporized liquids are then injected directly in the reactor.
- The TORBED reactor, developed by Torftech Limited (UK), Torftech (Canada) Inc., is designed for contaminated soils and sediments, but can also be adapted for liquids and sludges.
- Thermal reduction batch processor (TRBP) is used for bulk solids, including those in drums, such as electrical equipment, drummed waste, wood pallets, concrete, rubble, miscellaneous solids. The treatment involves the high temperature desorption of the organic waste content from solid in an oxygen free atmosphere (heated in presence of hydrogen to approximately 600℃). The volatized organic compounds are mixed with hydrogen and water and swept into the reactor.

In addition, other pre-processing is required for large capacitors and building rubble. Large capacitors are punctured and drained, while rubble and concrete must be reduced in size to less than one square metre.

Pure organic liquid waste streams, as well as organic gases (if oxygen free) can be fed directly to the reactor through atomizing nozzles, where the recirculation product gas is used to atomize the liquid waste. The process requires electricity, hydrogen, water (which enhance the reduction acting as hydrogen donor), and caustic for scrubbing. The process provides in excess the 2 seconds residence time for gases in the reactor at 875℃ needed for e fficient destruction of organic wastes.

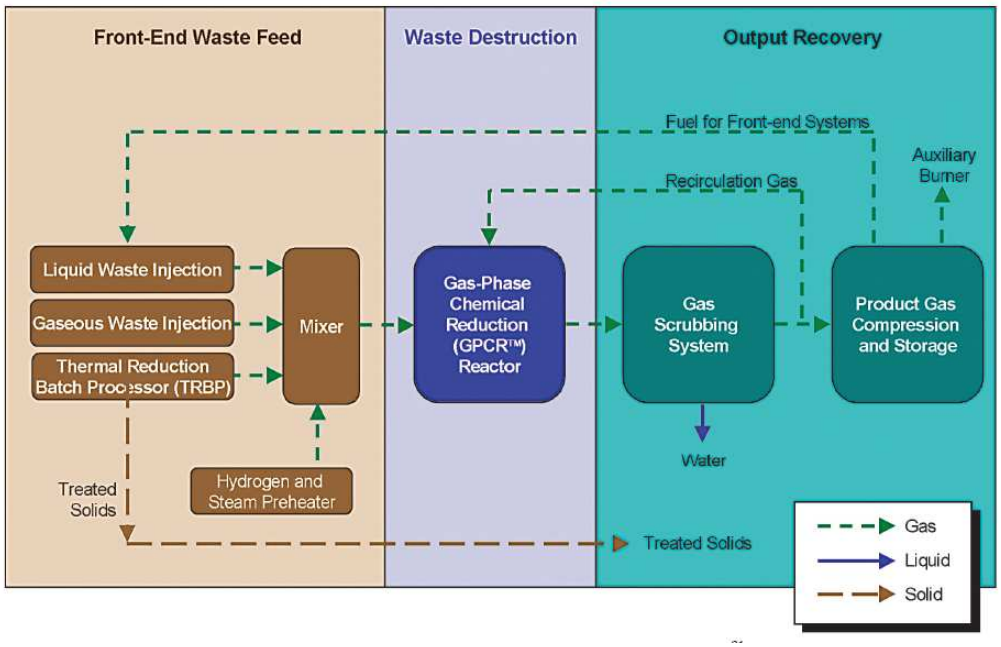
The general chemistry of conversion of a hydrocarbon structure containing chlorine and possibly oxygen can be expressed in the following way:

$$C_xH_yCl_xO_z + H_2 \rightarrow CH_4 + H_2O + HCl \text{ (thermal)}$$

Methane is converted into hydrogen via the steam reforming and gas-water shift reactions, which are expressed as follows:

$$CH_4 + H_2O \rightarrow H_2 + CO \text{ (steam reforming, catalytic)}$$

$$CO + H_2O \rightarrow CO_2 + H_2 \text{ (water-gas shift, catalytic)}$$



Emissions

Potential emissions include hydrogen chloride, methane and low molecular weight hydrocarbons. Residues from the GPCR process include used liquor and water. Solid residues will also be generated from solid waste inputs. The gases exiting the reactor are going through the caustic scrubber where hydrogen chloride is removed (see post-treatment). To assure the complete dechlorination an on-line mass spectrometer is provided which can divert all gases into the recirculation mode. Following the scrubbing step the resulting mixture of gases, which is rich of methane, propane and hydrogen can be re-circulated entirely or partially, where the other part can be used as fuel in the boiler. Scrubber residue and particulate require disposal off-site.

Since the GPCR process takes place in a reducing atmosphere the possibility of PCDD and PCDF formation is said to be limited

Energy and Material requirements

Methane produced during the process can be used to form enough hydrogen to operate the process. Anyway, there is a possible need for hydrogen supplies, at least during start-up. It has been reported that electricity requirements range from 96 kWh per tonne of soil treated to around 900 kWh per tonne of pure organics treated

Capacity

GPCR is capable of treating high-strength POP wastes. Bulk solids POPs, such as concentrated pesticides can be processed using the TRBP unit, which is integrated in the process. Similarly, high strength liquid PCBs can be processed in the LWPC unit. The maximum throughput of 75 t/month is claimed by the vendor, which corresponds to the maximum capacity of the TRBP pre-treatment unit which processes pure organic solids, liquids, or liquids with suspended solids.

Efficiency

Destruction Efficiencies (Des) of 99.9999% have been reported for DDT, HCB, PCBs, PCDDs and PCDFs

Case studies

Since the eighties ELI Eco Logic has been conducting research starting from the laboratory and bench scale tests. The full scale plant operated for more than 5 years in Kiwana, Australia (now shut down). Other full and pilot scale plants and demonstration projects ran in Canada, USA, and Japan.

Portability

GPCR is available in fixed and transportable configurations

State of commercialization

Although the technology has been licensed in USA, Australia, Mexico, Japan and Spain, there is not any commercial unit currently operating.

Vendor

Patent holder: ELI Eco Logic International Inc. in Canada. The GPCR technology is now provided by Hallett Environmental & Technology Group Inc. of Ontario, Canada.

2.5 Supercritical Water Oxidation (SCWO)

SCWO treats wastes in an enclosed system, using an oxidant (e.g. oxygen, hydrogen peroxide, nitrite, nitrate, etc.) in water at temperatures and pressures above the critical point of water (374℃ and 218 atmospheres). Under these conditions, organic materials become highly soluble in water and are oxidized to produce carbon dioxide, water and inorganic acids or salts.

The SCWO technology has been in development by many companies for more than two decades.

In a typical SCWO system, the waste is injected, together with water and air or oxygen, in a column where the mixture is heated and compressed so that the water becomes supercritical. Most organic matter is highly soluble in SCW (solubility is near to that in alcohols or acetone). Moreover the viscosity and diffusivity of SCW are comparable with more like that of gas, while the density is comparable with liquid. Due to these physical properties, the SCW has high molecular kinematic energy and is considered as highly activated reaction phase. Therefore, in the presence of oxygen, the organic compounds are oxidized and completely destroyed to carbon dioxide, nitrogen and water. Chlorinated organics produce hydrochloric acid.

Emissions

It has been reported that emissions contain no oxides of nitrogen or acid gases such as hydrogen chloride or sulphur oxide and that process residues consist of water and solids if the waste contains inorganic salts or organics with halogens, sulphur or phosphorus. Limited information has been reported regarding potential concentrations of undestroyed chemicals. The process is designed such that emissions and residues can be captured for reprocessing if needed.

During laboratory-scale PCB destruction, it was shown that the SCWO technology has the potential to form high concentrations of PCDFs during PCB degradation even at temperatures of practical operation.

Energy and Material requirements

Electricity is required to compress and circulate ammonia in the process and due the combinations of high temperatures and pressures. However, it has been claimed that as long as relatively high hydrocarbon content is present in the feed, no energy input is required to heat up the feed to supercritical temperatures. Heating requirements should be insignificant. No gas is required by technology. Water constitutes the reaction medium and is continuously consumed.

Since the temperature and pressures can be very high and halogen ions can cause corrosion, the SCWO reaction vessel must be constructed of materials with high resistance.

Capacity

It is claimed that pilot SCWO plants can process up to 360 t/month, according to different sources, maximum 20% organic materials can be present in the load, which means 58 to 72 t/month of pure POPs can be processed.

Efficiency

Total destruction efficiencies of greater than 99.999 % and DREs of greater than 99.9999 % have been claimed for aldrin, chlordane and PCBs for SCWO (Ministry of the Environment of Japan, 2004). DREs as high as 99.9999 per cent have also been demonstrated for PCDDs in bench-scale tests with PCDDs and pesticides.

Case studies

There have been a number of projects, from pilot to neo-commercial, on the use of the SCWO for treatment of chemical weapons and other organic wastes, including POPs.

The Japanese AHO plant for PCB and other chlorinated waste destruction operates from 2002. This technology developed by SRI International, USA was licensed to Mitsubishi Heavy Industries which received exclusive field-of-use license in Japan. It may be also useful for POP waste reaction (e.g. the ORGANO's SCWO technology was successfully tested for PCB treatment on the bench scale), it seems that only the SRI/Mitsubishi plant has had relevant commercial experience.

Portability

Currently utilized in a fixed configuration, but SCWO units are thought to be transportable

Vendor

The companies that commercialized and operated SCWO are reported hereafter:

Company	Year of establishment or first involvement	Licensees or partners
MODAR, Inc.	1980	Organo
MODEC (Model Environmental Corp.)	1986	Organo, Hitachi, NGK, NORAM
Oxidyne Corp.	1986	
EcoWaste Technologies, Inc.	1990	Chematur, Shinko Pantec
Abitibi-Price, Inc.	1991	
General Atomics	1991	Komatsu, Kurita
Foaster Wheeler Development Corp.	1993	
SRI International	1993	Mitsubishi
KemShredder, Ltd.	1993	
Chematur Engineering AB	1995	Johnson Matthey, WS Atkins, Stora-Enso, Feralco
HydroProcessing L.L.C.	1996	
Prochem Tech, Inc.	1987	

2.6 Solvated Electron Technologies

Commodore Solution Technologies, Inc. has developed an innovative total systems approach to environmental remediation, which utilizes a patented (Abel, 1992) chemistry called Solvated Electron Technology (SET ^{TM}). Solvated electron solutions are some of the most powerful reducing agents known. Formed by dissolving alkali and alkaline-earth metals in anhydrous liquid ammonia to produce a solution of metal cations and free electrons, solvated electron solutions are capable of providing unique reductants of great activity. They provide a highly useful mechanism for the reductive destruction of many organic molecules and are extremely effective in the dehalogenation of halogenated organic compounds.

Commodore has received a nationwide EPA operating permit for the non-thermal destruction of PCBs in soils, oils, surfaces and solid materials using this process. The permit further allows for the recycle of treated PCB containing oils.

The SoLV^{TM} process is a total solution that incorporates pre- and post- treatments, where necessary for environmental clean up. It is applicable to a broad range of substrates including liquids, solids, soils,

personnel protective equipment and job materials. Commodore has successfully commercialized this technology. Equipment capable of treating 10 tons a day is currently in the field. This paper provides an overview of the technology and process. Individual case studies are available for specific examples where the process has been utilized.

Functional organic compounds have proven to be some of the most difficult and expensive remediation challenges to face the environmental clean up industry. As a class, they represent some of the most toxic, environmentally persistent, and difficult-to-destroy compounds known. In the environment, materials such as pesticides, PCBs, dioxins, furans, PAHs, BTXs, explosives, chemical warfare agents, chlorofluorocarbons, and chlorinated solvents are deemed to pose a hazard to health and the environment, even when present in relatively small quantities. To meet today's stringent cleanup standards, vast quantities of materials such as soil, job equipment, adsorbents, process liquids, and building materials must be treated to remove contaminants that may be present in quantities measurable only in parts-per-million.

Other than landfill, commercially available remediation technology options are limited principally to thermal processes such as incineration; plasma arc, catalytic extraction, gas phase chemical reduction, and thermal desorption. These are undesirable due to generation of off gases such as dioxins. There is a need for a total system and cost effective remediation approach that can destroy contaminants while rendering the soil or other matrix materials non-hazardous.

The SoLV^{TM} process utilizes solvated electron solutions to destroy hazardous contaminants. In the process, contaminants are destroyed by a chemical reduction mechanism, whereby the functional organic compounds are converted to petroleum hydrocarbons and metal salts. In the case of a PCB molecule, the halogen atoms are stripped from the halogenated organic compound and converted to sodium chloride and the carbon skeleton is converted to high molecular weight hydrocarbons. The resultant remediated soil can be returned to its original location.

The application of this versatile chemistry to environmental matrices has been proven by Commodore to be a cost-effective approach for addressing environmental remediation issues. Further, the chemistry has been validated by an independent research group.

Although the discovery was made in 1865 that sodium metal dissolves in liquid anhydrous ammonia to form a dark blue solution with some rather unusual properties, solvated electron solutions still remain an under utilized phenomenon to most chemists. Yet, solvated electron solutions are one of the more powerful reducing agents known. Solvated electron solutions, also referred to as dissolving metal solutions, are formed by dissolving alkali or alkaline-earth metals, including sodium, calcium, lithium, and potassium, in anhydrous liquid ammonia.

Formation of the solvated electron is believed to occur as illustrated in the following

Equation:

$$Na^{O} \xrightarrow{NH3} Na^{+} + e^{-}$$

The solutions, which form rapidly when the metal enters the ammonia, are characterized by a deep blue coloration and an electrical conductivity approaching that of liquid metals. For convenience, the solvated electron systems are frequently regarded as solutions of the metallic cation and electrons, a concept supported by the results of a number of physical measurements.

Halogens can be split from organic halides by solvated electron solutions, yielding quantitative amounts of the halogen anion. In fact, this procedure was employed as early as 1914 for the analytical determination of organic halogens. By properly controlling reaction parameters, it is possible, in the case of the alkyl and aryl halides, to direct the reaction pathway so that the fully substituted parent hydrocarbon and the metal-halide are the sole reaction products. For the case of aromatic material, the parent hydrocarbon can react further to produce high molecular weight oligomers.

In addition to halogens, many other organic molecules are reactive towards solvated electrons.

Several review articles have appeared that addresses the broad application of the chemistry. Organic phosphorous and sulfur compounds such as pesticides and chemical warfare agents are known to be reactive to solvated electrons. It is also well understood that aromatic materials such as benzene and poly aromatic hydrocarbons are chemically reduced by the Birch reaction using solvated electrons.

The SoLV^{TM} process is modular in nature. Commodore has developed several process variations depending on the nature of the material being remediated. The various modules are designed to be tailored to each particular remediation site in a manner such that the most cost-effective sequence is utilized. The SET^{TM} treatment module is the centerpiece of the process and is a critical component of each process. All equipment is mobile and able to be placed at the site, which eliminates the expense of transporting hazardous materials. Space does not allow the description of all the possible combinations of these modules. However, they generally include front-end modules that can remove water or extract the contaminants of interest. Next, the SET^{TM} treatment module is required to destroy the contaminants. Back end modules are available to recycle ammonia, pH adjust, concentrate or fix the reaction products depending on the specific needs of the client.

Commodore's commercial L1200 liquid unit is shown in Figure I.

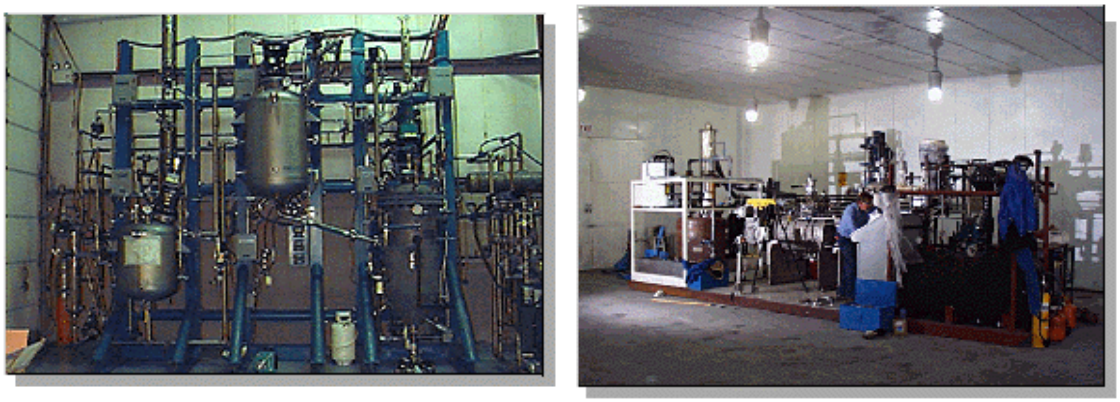


Exhibit IV
Commodore's Mobile SL/2

These systems consist of a sodium transfer station, which warms sodium cast in shipping drums to a liquid state, and then pumps the liquid to the solvator tank. This tank is filled with anhydrous ammonia from an ammonia storage tank. The sodium dissolves in the ammonia creating a solvated solution. This solution is discharged to a reactor vessel, where a volume of approximately 65 gallons of the solvated solution is maintained.

Contaminated liquid is pumped to the reactor vessel where organics are instantly destroyed. The conductivity of the solution in the reactor vessel is continuously monitored, and when it drops to 200 Mhos feed is stopped. The destruction reaction is very fast and is essentially diffusion controlled. Removing ammonia vapor controls the temperature and pressure of the vessel. This results in lowering the temperature of the vessel. The feed rate for this system is approximately 1,600 pounds of material per day.

Oils such as contaminated transformer and cutting fluids can be readily detoxified using SET^{TM} in Commodore's L-1200 system. This is a liquid unit, which requires the ability to pump the material to be treated. Oils containing over 20,000 ppm of PCB have been detoxified to below 0.5 ppm PCB. Table I lists data for destruction of PCBs in oils.

Table 2. Destruction of PCBs in Oils

Material	Pre-Treatment (ppm)	Post-treatment (ppm)
Used Motor oil	23,339	<1.0
Transformer oil	509,000	20*
Mineral Oil	5000	<0.5
Hexane	100,000	0.5
*Sodium feed was deficient. Can be improved by using additional sodium.		

Based on the Vendor's claim, the above data demonstrates the effectiveness of the SoLV™ process in destroying hazardous organic materials. The SoLV™ process is very versatile and adaptable to a broad range of remediation situations.

One distinguishing feature of the SoLV™ process is that no portion of the original molecule is discharged to the atmosphere or to water. The process is reductive in nature and therefore not capable of forming dioxins or furans and similar wastes, which can be found in oxidizing technologies. This is especially beneficial, because communities are becoming increasingly watchful of waste facilities as concerns mount over particulate material that is released to the atmosphere and surrounding water.

The end products from the SoLV™ process are principally metal salts such as sodium chloride and hydrocarbons. The product streams are not classified as RCRA hazardous and they pass all of the hazard criteria identified in USA 40 CFR 261.21 through 40 CFR 261.24.

The only raw materials needed for the process are ammonia, sodium, and a neutralizing acid such as sulfuric acid. All of these reactants are commodity chemicals.

When considered in light of other process available, the hardware required implementing the SoLV™ process is simple and compact. All process equipment is off the shelf and engineered to be mobile. Destruction can take place at the site without the cost associated with transporting hazardous cargo.

Capacity

The current commercial systems can treat up to 10 t/day or 300 t/month [UNEP, 2004]. Considering the maximum POP content of 25% the POP throughput is 75 t/month. POP strengths of up to 250,000 ppm (PCBs) have been tested, as reported by vendor. It is claimed that the process is also applicable to the full strength solid wastes, such as bulk pesticides, but there are no documented data. 500,000 ppm PCBs have been also treated, however the result was not satisfactory (20 ppm remaining) because of insufficient sodium feed, so the maximum strength of 25% is assumed.

Emissions

At the end of the reaction, ammonia is recovered for reuse by heating, and the remaining treatment residues are removed from the cell and disposed in approved facilities.

Products emissions are minimal and mainly consist of ammonia which is scrubbed. Solid residues, such as salts and organic oils should be disposed, e.g. in a landfill or be returned to the environment, depending on the waste type treated. The treated soils can be disposed in a non-hazardous landfill.

Case studies

The SET technology was in development since the late eighties. For many years the technology operated on the pilot scale in USA for soil treatment. In 1995-1995 SET was demonstrated to the EPA and received a national permit for on-site treatment of PCB contaminated soil, which was extended to the treatment of oils in 1998. Commodore's medium scale S-4 units are available since 1997-1998. Later on bigger scale commercial S-10 units appeared, which were demonstrated for PCB treatment in soil in 2000 at a Pennsylvania Air National Guard facility.

State of commercialization

The whole process has been developed as a modular transportable system, based around the central treatment module. Other units would include front-end modules for water removal or contaminant extraction/pre-concentration, and back-end units for ammonia recycling (refrigeration), pH adjustment, and post-treatment of the residues.

Vendor
The Solvated Electron Technology can be licensed from Commodore Applied Technologies Inc. from the USA.
Vendor website: www.commodore.com

Annex 3: CRITERIA FOR SELECTION OF HOST OPERATING ENTITY

a. License and Permit of the host

The Ministry of Environment and Forests (MoEF) and Ministry of Power (MOP) have authorized CPRI as a nodal agency to undertake the activities of NIP and post-NIP projects. One of the objectives of the NIP is the development of inventory of PCBs, PCB contamination and wastes from utilities and industries. The objective of post NIP is the safe transport and environmentally sound management and safe disposal of the PCBs.

b. Staff qualifications

CPRI has experienced staff to operate the disposal units. The minimum qualification of the concerned staff is as follows:

Officers: M.Sc. in Chemistry /B.E Chemical Engineering
Equipment Operators: Diploma in Mechanical Engineering

c. Location in a dedicated area where government allows other wastes treatment facilities.

1. Stationary unit at → VAPI, Gujarat
2. Mobile Units at → CPRI, Bangalore
   → RTL, CPRI, Noida.

For waste treatment, the concerned government will be approached for permission.

d. Any existing environmental impact assessment (EIA) and what kind of modification in laws and regulations required to minimize

EIA is not applicable in this case.

e. Whether license grant of Government

The CPRI, the operating entity, would approach the Government for the license whenever required.

f. Permission granted by local authority for construction of similar facility

The CPRI, the operating entity, would apply for permission once the project is approved.

g. Public attention

Public attention is undertaken through organizing awareness raising programmes, seminars/ workshops and through media by advertisement on PCBs in the papers.

ANNEX 4: BUSINESS PLAN

Objectives

The overall objective of the project is to reduce / eliminate in India the use and releases of PCBs to the environment through promoting measures to minimize exposures and risks by introducing environmentally sound management and disposal of PCBs, PCB-containing equipment and PCB-containing mineral oils aiming at the final and virtual disposal of all PCBs inventory in India by 2025 and 2028, respectively. The immediate objective of the project is to remove 7,700 tones of PCBs wastes from targeted sites and transport and dispose these in an environmentally sound manner.

The proposed project aims at establishing decontamination/treatment facilities for the environmentally sound dechlorination and reclamation of PCB-containing mineral oil as well as at the decontamination, reclamation and recycling of copper and steel recovered from PCB-containing mineral oil transformers, specifically through:

- Establishment of facilities to drain, dismantle and decontaminate metal components from PCB-containing transformers.
- Establishment of dechlorination plants to reclaim PCB-containing mineral oil. These plants could be fixed or mobile and would be used to clean PCB-containing mineral oil from in-service transformers, as well as to clean the mineral oil used to clean the metallic components of surplus PCB-containing transformers.

The Central Power Research Institute (CPRI), the executing agency and who will function as the operating entity, has made a market analysis of the available disposal technologies and after a thorough review it has been proposed to introduce dechlorination technology for decontamination of PCB contaminated mineral oil and pure PCB liquids. One option will be an innovative mobile processing system for the dechlorination and reclamation of the contaminated dielectric fluids of less than 5,000 ppm PCB level. Such dechlorination of PCB-containing mineral oil is a standard practice that is used in the USA, Canada, Europe and other countries.

Prerequisites

It is assumed that the necessary equipment will be made available to destroy both liquid and solid POPs and contaminated equipment in the country.

For the basis of project design, technologies that have been proven for their safety and cost-effectiveness in international market were considered. The operating entity will prepare its own business plan and undertake financial analysis of the proposed technology through international bidding for final selection.

Business model

Operating entity

CPRI as the operating entity will take the overall responsibility for disposal of PCBs in accordance with the National Implementation Plan (NIP) of India.

CPRI shall identify the site for the destruction facility. The operating entity will directly negotiate with the owners or users of PCBs in order to dispose of the PCB-containing equipment in an environmentally sound manner at an agreed fee range. The stated price estimates will be applied to owners or users using the destruction facilities.

The operating entity will identify service providers. Meetings would be held with each of the identified service providers to explain the details of the Project and the services required from them. The service providers would then be invited to submit proposals giving details of the services they would provide under the project. After evaluating the submitted proposals, the operating entity will enter into contractual agreements with the selected service providers and the fees for their services will also be determined.

The operating entity will set up three (3) disposal facilities; one stationary unit at Gujarat and one mobile unit each in Delhi and Bangalore covering approximately 80% or more of the PCB-containing equipment, PCBs oil and PCB-containing waste found in India.

The operating entity will construct storage facilities for 250 tons of PCBs and PCB-contaminated materials at the stationary dechlorination facility site. If feasible, it may expand its storage to 500 tons.

The disposal of PCBs in the country under the project activities timeline is as follows:

The operating entity will prepare the site for and operate both the stationary and the mobile dechlorination facilities. Based on the Project design, it is assumed that the appropriate equipment will timely be provided to the operating entity to enable the final disposal of PCBs. An appropriate storage facility for PCBs will also be provided at the stationary facility site.

The CPRI will oversee accredited service providers that have all the necessary permits to undertake their respective activities through subcontract arrangements including the following:

- Removal of PCB oil from transformers and capacitors
- Packaging of wastes into containers, ready for shipment in an environmentally sound manner
- Dismantling of transformers and associated parts for easy transfer followed with proper labeling
- Transportation of the properly packaged PCB oil and wastes to the storage facility of the stationary disposal facility site

CPRI shall assure that all technical personnel of service providers have adequate knowledge and experience in handling PCB equipment and oil and in the retro-filling transformers.

Service providers

The service providers are public and private companies that are specialized in maintaining and retro-filling of transformers. They should also be specialized in dismantling and transporting PCB-containing equipment, oil and wastes from the PCB owners and users to the storage facility of the stationary facility site in an environmentally sound manner.

The technical staffs of the service providers are properly trained to have adequate knowledge and experience in handling PCB containing equipment and oil and in retro-filling transformers. If this prerequisite is not assured, the CPRI shall provide proper technical training courses at workshop level to the service provider's technical personnel.

The specially designed training courses shall cover at least the following elements of handling PCB-containing equipment, PCBs oil and PCB-containing waste:

- On site drainage of transformers and capacitors
- Collecting drained oil in appropriate secure containers
- Dismantling, packaging and sealing of transformer carcasses
- Specialized secured transport vehicle for PCB-containing equipment, PCBs oil and PCB-containing waste

PCB owners and users

PCB owners and users are those public or private entities that are owners of on-line PCB-containing electric equipment and/or owner or store off-line PCB-containing equipment, PCB oils or PCB-containing waste.

The owners of on-line PCB-containing electric equipment shall enter into contractual arrangement with CPRI in maintaining and retro-filling, if feasible, their equipment.

The owners and users of off-line PCB-containing equipment, PCB oils or PCB-containing wastes shall also enter into contractual arrangements with CPRI in order to dispose of their PCB waste in an environmentally sound manner.

Financial Analysis

Project Feasibility without GEF Funding

The GEF funding will have a catalytic role that will speed up meeting the PCB-related Stockholm Convention requirements. More specifically it will speed up commissioning and operation of PCB destruction facilities in India. The operating entity need not attempt to do a financial analysis of this scenario, as it is not likely to enter into this business and that there would be ample time to meet the 2025 and 2028 timeframes given by the Convention.

Project Feasibility in a Greenfield Site

The stationary dechlorination unit will be commissioned in one of the regional centers of CPRI in Gujarat. Therefore, there would be substantial reduction in investment due to the fact that it would be located in CPRI's facility, where there are already available necessary infrastructure facilities. That being the case, utilities can be easily provided and the Project can take advantage of the economies of centralized operations of these utilities.

Financial Analysis of the Project's Investment Component

Considering the nature of the business operations as described above, the operating entity would develop a financial model to evaluate the feasibility of its investment in the Project. This is necessary to justify its request for funds from its pool resources. The resulting destruction fee to be charged by the operating entity to clients will be built up with the total fee paid by the service providers. The bottom line fee should not exceed the cost of exporting the PCBs, which is the most recent prevailing rates (based on actual offers) in the international market for export of PCBs in Asia in the range of US$ 9-10/kg.

The following assumptions were used in the financial analysis of the operating entity investment:

Technology

Although the specific dechlorination technology is yet to be selected for the Project in India, the operating entity developed its financial model using the cost structure of a PCB destruction facility utilizing established technologies to estimate the operating costs. The financial model would be modified as soon as the technology is selected and actual costs are made available from the technology licensor.

GEF Funding

The Global Environmental Fund will provide a grant of US$ 14.45 million to the project, US$ 7.32 million of which would be for capital equipment purchase for the disposal of targeted stocks.

Source of the co-financing

The operating entity and the Government of India (GOI) have put up a co-financing of US$ 28.85 million to undertake the project activities. The operating entity's co-financing for the project will be sourced entirely from its own budgetary allocations, which clearly confirms the commitment of the GOI and, through the Government, the CPRI to the implementation of the project.

Installed Capacity and Utilization Rate

A stationary dechlorination unit capacity of 500 tons/year will treat the high concentration of PCB oils and capacity utilization of 85% is assumed. It will treat the high concentrated PCBs oil and its wastes that are more difficult to dechlorinate. The two (2) mobile units will have a capacity of 1,000 tons/year each but will mainly dechlorinate PCB-containing mineral oil in the range of 1,000-5,000 ppm PCBs content from the distribution transformers. Their capacity utilization will be around 85% as well. It is feasible to retro-fill transformers which are having less than 1,000 ppm PCBs content with mineral oil. The total installed capacity is about 9,000 tons at the 3 facilities in their 4 years of operation. Therefore, it needs all PCB disposal requirements of the project.

Amount of PCB to be processed

The Project will remove and dispose of approximately 7,700 tons of pure, concentrated PCBs, PCB-contaminated decommissioned equipment and PCB-containing oil. For the purposes of financial analysis, the operating entity assumed that about 33% of this is PCBs oil that will be destroyed at the stationary dechlorination facility, enabling the facility to operate continuously during the entire duration of the project. The rest 67% would be treated by the two (2) mobile units where mineral oil could be recycled after the treatment.

Start-up of Operation

It is assumed that the facilities (both stationary and mobile) will start operation in the second year of the Project implementation.

Operating Life of the Facility

The facilities (both stationary and mobile) will operate beyond the timeframes of the Project as it is foreseen that the total inventory of PCBs in India is more than the targeted 7,700 tons of pure, concentrated PCBs, PCB-contaminated decommissioned equipment and PCB-containing oil.

Microeconomics

The model is structured to factor in reasonable increases in the cost of inputs (using an inflation rate projection) and currency depreciation. Prevailing exchange rate of the Government of India were used for the INR/USD exchange rate, as well as for inflation and interest rate. An annual increase in the service fees was assumed likewise, using the same inflation rate projection.

Hurdle Rate

Minimum return on investment necessary to cover all costs associated with a project. Taking into account the average lending rates in India, a hurdle rate of 18% was used for IRR and NPV analysis.

Electricity

Cost of electricity will be determined by the State Electricity Board.

Salvage Value

The salvage value is the estimated value of an asset at the end of its useful life. As the facilities (both stationary and mobile) will be in operation till the end of their utilities, therefore, taking into consideration a 10% depreciation rate then it would be around 10 years, hence no salvage value is assumed for the plant.

Fixed investment costs and operating costs

The total fixed investment and operating costs have been estimated at US$ 20.49 million, out of which US$ 7.32 million would be GEF grant and U$ 13.17 million would be co-financing. Taking into account

the destruction of the total 7,700 tones of PCB-containing equipment, oil and wastes, the unit cost of destruction is about US$ 2.7/kg. The basic reference cost of the disposal has been obtained from the experience of CPRI, who is the leading institution in India handling PCBs, nevertheless, the project will provide a benchmark figure. It should also be noted that the current disposal fee for medical waste incineration by a private service provider in Karnataka is Rupee 375 per 2.5 kg that is equivalent to about US$ 3,000/ton[3]. It is expected that through local dismantling of transformers and reducing the volumes (by approx. 55-60%) for export to a qualified incinerator, it will be possible to keep the disposal costs within US$ 3.0 – 3.5/kg of the pre-separated PCB wastes.

Results of Financial Analysis

Total Cost to PCB owners and users

The operating entity and the PCB owners and users will agree on the service fee for each transaction. Then the operating entity will set the same with the service provider that would take care of packaging, transporting, temporary storage and dechlorination of the PCBs. VAT and other taxes of the Government would be added to the fee.

Cost to Export of PCBs

It has been consistently mentioned that the cost of exporting PCBs and PCB equipment ranges from US $ 5-10 /kg. It should however be noted that the most recent prevailing rates (based on actual offers) in the international market for export of PCBs in Asia is in the range of US$ 9-10/kg.

Affordability Analysis

As shown in the above costs analysis, the total cost to destroy the PCB-containing equipment, oil and PCB equipment does not go beyond the lower range of the export cost.

Break even point

The break even point is defined as the equilibrium point at which the variable margin equals the fixed costs. In other words the break-even point is the point at which income matches expenditures. In the financial analysis it is in the first year of the operation of the destruction facility that this would be reached.

Internal rate of return

The internal rate of return is the discount rate at which the present value of cash inflows equals the present value of cash outflows. In the financial analysis the internal rate of return is estimated to be around 25%.

Overall financial assessment

As the break-even point in the first year of the operation and the internal rate of return is 25%, it confirms that the socio-economic benefits gained through this project are high.

[3] Exchange rate is US$ 1 = Rupee 50 (April 2009)

ANNEX 5: Baseline analysis of PCB management

The baseline analysis of the “Environmentally sound management and final disposal of PCBs in India” covers the analysis of the legislation on hazardous wastes in general and on PCBs in particular. It also covers the initial PCBs inventory and the development of a countrywide PCBs inventory. Finally it describes the current PCBs management and disposal practices in the country.

PCBs legislation

Hazardous wastes are the special class of highly toxic industrial waste requiring separate ‘Treatment, Storage and Disposal Facility’ (TSDF). The Basel Convention signed on 15 March 1990 makes it mandatory for the country to minimize generation of hazardous waste and their degree of hazardousness and to dispose of them close to the source, reducing their trans-boundary movement. Though 89 sites in different parts of the country were identified for TSDF and out of which 30 notified, only 11 had been put into operation by September 2003, leaving the bulk of hazardous wastes being dumped in improper landfills. The Supreme Court Monitoring Committee on Hazardous Wastes (SCMC) set up the Supreme Court of India had estimated that every day close to 12,000 tones of hazardous wastes were being generated in the country.

In May 1997, the Supreme Court had questioned state governments about the reasons why units authorized to handle hazardous waste operated without environmentally sound and safe disposal sites and why units operating without any authorization should not be closed down. In October 2003, the Court had set a time limit of three weeks for closure of all unauthorized units, and had given one year for the SPCBs to set up proper landfill sites in each state. India's SCMC, set up in November 2003 by the Supreme Court, the nation’s apex court to monitor the progress in implementation of the HW Rules as well as a series of orders passed by the court since 1995. Since then it had been "pursuing certain serious and chronic situations" relating to the management of hazardous wastes. Implementation of the Court's orders on treating hazardous wastes are "still far from satisfactory in most states," said the panel, referring to a judgment of the Supreme Court dated 14 October 2003. The Committee detailed a long list of concerns, and said it had forced industrial units to shut down because they had committed violations of hazardous waste laws. From the Committee’s report it becomes clear that the situation is grave. Non-complying factories had to be closed, in western India some 75 units were found to be discharging highly acidic untreated effluent, and groundwater was found to be polluted by toxic effluents. The Committee also pointed out that hazardous wastes have been imported into India in violation of the Supreme Court's orders and, in some cases, are being held in the custody of ports and container depots. For the first time since the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal was ratified by India in 1992, the Monitoring Committee said it has initiated return of hazardous wastes that have been wrongly imported into India. For example it directed the return of PCB-contaminated old transformer components to Germany. Initially, the Committee said it had called on India's state level pollution control boards, and asked them to make detailed presentations on their efforts to comply with the Supreme Court ruling on hazardous wastes. In January 2004 at its meeting held in Mumbai, the chairpersons and member secretaries of the pollution control boards of five states reported to the Committee that together they generate more than 80 percent of the country's hazardous wastes. These states are Andhra Pradesh, Gujarat, Karnataka, Maharashtra and Tamil Nadu.

The Committee has also begun to set up Local Area Environment Committees comprising Pollution Control Board officials, industry representatives and nongovernmental organizations. Such small committees would continue to monitor to determine whether the court orders were implemented and "restore some faith of civil society in the implementation of the Supreme Court Order." The Committee reminded all factory operators that, "All industrial units involved in the handling of hazardous chemicals and hazardous wastes are now required, without exception, to put up a board both in English and the local language outside their factory gates, easily accessible to the public, disclosing the quantities of air emissions, water effluents and hazardous wastes generated by them and which are authorized by the pollution control board under the various environment laws."

In exercise of the powers conferred by sections 6, 8 and 25 of the Environment (Protection) Act, 1986 (29 of 1986), the Central Government made the following rules further to amend the Hazardous

Wastes (Management and Handling) Rules, 1989. The amended rules have been called the Hazardous Wastes (Management and Handling) Amendment Rules, 2003; and they came into force on the date of the publication in the Official Gazette - The Gazette of India, Extraordinary, Part-II-Section-3-Sub-section (ii), Published by Authority, No. 471, New Delhi, Friday, May 23, 2003, MINISTRY OF ENVIRONMENT AND FORESTS NOTIFICATION NEW DELHI, 20 May 2003, S.O. 593(E). In the Hazardous Wastes (Management and Handling) Rules, 1989, among others several new clauses that have great relevance to the PCBs management and disposal have been inserted.

The terminology of the hazardous wastes has been redefined and expanded. In the Amendment Rules, 2003, "hazardous waste" means any waste which by reason of any of its physical, chemical, reactive, toxic, flammable, explosive or corrosive characteristics causes danger or is likely to cause danger to health or environment, whether alone or when in contact with other wastes or substances, and shall include:

(a) wastes listed in column (3) of Schedule-1;

(b) wastes having constituents listed in Schedule -2 if their concentration is equal to or more than the limit indicated in the said Schedule; and

(c) wastes listed in Lists 'A' and 'B' of Schedule -3 (Part-A) applicable only in case(s) of import or export of hazardous wastes in accordance with rules 12, 13 and 14 if they possess any of the hazardous characteristics listed in Part-B of Schedule 3.

For the purposes of this clause, (i) all wastes mentioned in column (3) of Schedule -1 are hazardous wastes irrespective of concentration limits given in Schedule-2 except as otherwise indicated and Schedule -2 shall be applicable only for wastes or waste constituents not covered under column (3) of Schedule -1; and (ii) Schedule-3 shall be applicable only in case(s) of import or export.

The polluter pays principle has also been spelled out very clearly in the Amendment Rules, 2003. It describes that the occupier and operator of a facility shall also be liable to reinstate or restore damaged or destroyed elements of the environment at his cost, failing which the occupier or the operator of a facility, as the case may be, shall be liable to pay the entire cost of remediation or restoration and pay in advance an amount equal to the cost estimated by the State Pollution Control Board or Committee. Then, the Board or Committee shall plan and cause to be executed the program for remediation or restoration. The advance paid to State Pollution Control Board or Committee towards the cost of remediation or restoration shall be adjusted once the actual cost of remediation or restoration is finally determined and the remaining amount, if any, shall be recovered from the occupier or the operator of the facility.

The environmentally sound technologies have also been defined in the Amendment Rules, 2003. It states that the re-refiners and recyclers shall use only environmentally sound technologies while recycling and re-refining non-ferrous metal wastes or used oil or waste oil. In case of used oil, re-refiners using acid clay process or modified acid clay process shall switch over within six months from the date of commencement of the Hazardous Wastes (Management and Handling) Amendment Rules, 2003 to other environmentally sound technologies such as:

(a) Vacuum distillation with clay treatment;

(b) Vacuum distillation with hydrotreating;

(c) Thin film evaporation process; or

(d) Any other technology approved by the Ministry of Environment and Forests.

The re-refiners and recyclers shall be registered with the Ministry of Environment and Forests or the Central Pollution Control Board in accordance with the procedure laid down in rule 19 shall file a compliance report of having adopted one of the technologies mentioned in sub-rule (1) within six months from the date of commencement of the Hazardous Wastes (Management and Handling) Amendment Rules, 2003. However, such registration with the Ministry of Environment and Forests shall cease to be valid if the re-refiners and recyclers fail to apply those technologies approved by the MOEF. The State Pollution Control Board or Committee shall inspect the re-refining and recycling units within three months of the expiry of the six months period referred to in above and submit a compliance report to the Central Pollution Control Board which shall compile such information and furnish the same to the Ministry of Environment and Forests on a regular basis. The Ministry of Environment and Forests shall notify from time-to-time specifications and standards to be followed by recyclers and re-refiners.

The schedules that may be relevant to PCBs management are as follows:

Schedule - 1
List of Hazardous Wastes

Petroleum refining/re-refining of used oil/recycling of waste oil process
Hazardous wastes: Oily sludge/emulsion; Spent catalyst; Slop oil; Organic residues from process; Chemical sludge from waste water treatment; and Spent clay containing oil

Industrial operations using mineral/synthetic oil as lubricant in hydraulic systems or other applications
Hazardous wastes: Used/spent oil; and Wastes/residues containing oil

Production and/or industrial use of solvents

Hazardous wastes: Contaminated aromatic, aliphatic or naphthenic solvents not fit for originally intended use; Spent solvents; and Distillation residues

Disposal of barrels / containers used for handling of hazardous wastes / chemicals

Hazardous wastes: Chemical-containing residue from decontamination and disposal; Sludge from treatment of waste water arising out of cleaning / disposal of barrels / containers; and

Discarded containers / barrels / liners used for hazardous wastes/chemicals

Purification process for organic compounds/solvents

Hazardous wastes: Filters and filter material, which have organic liquids in them, e.g. mineral oil, synthetic oil and organic chlorine compounds; Spent catalyst; and Spent carbon

Waste treatment processes, e.g. incineration, distillation, separation and concentration techniques

Hazardous wastes: Sludge from wet scrubbers; Ash from incineration of hazardous waste, flue gas cleaning residues; Spent acid from batteries; and Distillation residues from contaminated organic solvents

Schedule - 2
List of Wastes Constituents with Concentration Limits*
Class A
Concentration limit: 50 mg/kg that is higher or equal to 50 ppm
A16 - Halogenated compounds of aromatic rings, e.g. polychlorinated biphenyls (PCBs), polychloroterphenyls (PCTs) and their derivatives

Schedule - 3
Part A: Lists of Wastes Applicable for Import and Export List

A1180 - Waste Electrical and electronic assembles or scrap containing, compounds such as accumulators and other batteries included on list A, mercury-switches, glass from cathode -ray tubes and other activated glass and PCB capacitors, or contaminated with Schedule 2 constituents (e.g. cadmium, mercury, lead, polychlorinated biphenyls) to an extent that they exhibit hazard characteristics indicated in part B of this Schedule (see B1110)

B1040 - Scrap assemblies from electrical power generation not contaminated with lubricating oil, PCBs or PCTs to an extent to render them hazardous

B1110 - Electrical and electronic assemblies: Waste electrical and electronic assemblies scrap (including printed circuit boards) not containing components such as accumulators and other batteries included on list A, mercury-switches, glass from cathode-ray tubes and other activated glass and PCB-capacitors, or not contaminated with constituents such as cadmium, mercury, lead, polychlorinated biphenyl) or from which these have been removed, to an extent that they do not possess any of the constituents mentioned in Schedule 2 to the extent of concentration limits specified therein

Schedule - 5
Specifications for Used oil Suitable for Re-refining
Maximum Permissible Limit
Polychlorinated biphenyls (PCBs) - Below detection limit

Schedule – 6

Specifications for Waste Oil Suitable for Recycling
Maximum Permissible Limit
Polychlorinated biphenyls (PCBs) - Below Detection Limit

Schedule - 8
Hazardous Wastes Prohibited for Import and Export
Basel Number A 3180
OECD Number AC 120
Waste, substances and articles containing, consisting of or contaminated with polychlorinated biphenyles (PCB) and/or polychlorinated terphenyls. (PCT) and/or polychlorinated naphthalenes (PCN) and/or polybrominated biphyenyles (PBB) or any other polybrominated analogues of these compounds

India is becoming the waste destination of the entire world stated by the Ministry of Finance, Department of Revenue, Central Board of Excise and Customs Office on the issue of hazardous waste imports into India, recently. The comment highlighted the helplessness of those who are meant to protect India from waste imports, through its impossibly porous 7,500 km long coastline. Meanwhile, as officials of the Indian Ministry of Environment and Forests hesitant about their commitments to the international environmental conventions such as the Basel Convention, and environmentalists celebrate victory in obtaining a blanket hazardous wastes import ban from the Supreme Court of India, for the unperturbed waste importers it seems to be `business as usual'. To illustrate the situation that prevails it is enough to refer to the 315-metre long and 46,000-tonne, 11-storey Blue Lady (formerly S S Norway), which left the port of Malaysia for Dubai for 'repairs' in May 2006 and later sailed towards Alang, Gujarat, for ship-breaking. According to the then ship's owner (and breaker) Haryana Ship Demolitions Pvt. Ltd., the ship contained 1,240 tons of asbestos containing materials (ACM), and also a considerable amount of polychlorinated biphenyls (PCBs).

Lead Ash, Battery Scrap, Zinc Ash, Waste Oil and even old ships laden with PCBs and asbestos meant to be broken, are increasingly being labelled `Destination India'. In the case of zinc and lead wastes alone, India imports over 70,000 Mt. and 50,000 Mt. (1995) respectively through its 7 major and over 100 minor ports. Import data from other ports is almost impossible to obtain, since almost none of them are computerised. Moreover custom clearances can take place from over 1000 customs depots scattered throughout the country, each manned by a few clearing officials having to deal with over 100 assorted consignments each day. Hence despite the Indian Government's claims, in the Courts, the Parliament and the media, that the situation is under control, the ground reality is actually quite different. Regulating hazardous waste is never easy, and if the commitment to do so is lacking, then the task is an impossible one.

PCBs inventory

PCBs were never produced in India. The import of PCBs was banned in 1998. The import ban was further reconfirmed by Schedule – 8: Hazardous Wastes Prohibited for Import and Export of the Hazardous Wastes (Management and Handling) Amendment Rules, 2003. A survey carried out by CPRI from 2004 to 2008 partially assessed the PCBs situation in India, which included the establishment of a preliminary inventory on PCB-containing electrical equipment and the evaluation of India’s capacity for the ESM and disposal of PCBs. In all 28 states and 7 union territories of India, an estimated total number of about 45,000 power and about 3,500,000 distribution transformers exist. 7,700 tons will be disposed of in the proposed project. This initial inventory will be expanded and improved through the implementation of the NIP project that is also a full-sized project in India, which preliminary inventory will be used as baseline for planning purposes implementing the provisions of the Stockholm Convention.

According to the statistics of the number of electrical transformers (the principal location for PCB-contaminated oils), total contaminated equipment and oil and in India far exceeds this amount (please see table below). In Europe and North America about 15 % of transformers contain more than 50 ppm PCBs. In developing countries this ratio might be higher. In Morocco it has been found that about 20-30% of transformers contained higher than 50 ppm PCBs.

Estimated Number of PCB-containing Electrical Transformers

Size of transformers	#	Oil weight (liter/unit)	Contaminated oil (tons)	Contaminated equipment (tons)	Total contaminated material (tons)[4]
Power transformers	45,000				
Small	31,500	2,000	5,418	8,127	13,545
Medium	11,250	5.000	4,838	7,256	12,094
Large	2,250	30,000	5,805	8,708	14,513
Distribution transformers	3,500,000				
Small	1,155,000	50	4,967	7,450	12,416
Medium	1,155,000	100	9,933	14,900	24,833
Large	1,155,000	200	19,866	29,799	49,665
Total transformers	3,545,000		34,766	52,148	86,914

It is also reasonable to consider that all users where the fire hazard is high and could create very great damages both in human life and material goods pure PCBs transformers are used. These transformers are filled with Askarel, a brand name PCBs product, a synthetic electrically insulating liquid, which is non-flammable; when decomposed by an electric arc, the gaseous products also are non-flammable. These transformers are applied in mines, schools, hospitals, hotels, etc.

Main owners of PCB-containing equipment and PCB oils in the public sector are the power generation and transmission companies (state electricity boards) and in the private sector the mining, lubricant and ship-breaking industries, etc.

In ship-breaking industry it is estimated that each ship may contain PCB-containing wastes in the rage of 200-800 kg. The ship-breaking industry in India is likely to witness increasing activity in the next 10 years with the European Union's proposed accelerated phase-out of single-hull tankers (20,000 to 30,000 DWT — dead weight tonnage). On an average, oil tankers accounted for 40 per cent of the volumes scrapped during 1993-2004, the report said. According to a recent study, there are more than 2,250 single-hull tankers of 5,000 DWT, or a total of 129.5 million DWT (till January 2004), that will have to be scrapped. This is 25-30 per cent higher than the estimate of peak volume of 2015. For instance, 4,658 ships were scrapped between 1994 and 2003. Of this 2,638 were scrapped in India, followed by Bangladesh (603), China (523) and Turkey (125). In other words, India accounted for around 60 per cent of the global ship-breaking, and whole of Asia 75 per cent.

Some 250 Indian companies are involved in ship-breaking, mostly along the Gujarat coast. The main reason behind India's success in this secondary industry is the cheap labor. In 2002, the per capita Gross National Income (GNI) — a proxy for labour costs — in France was more than 40 times that in India. The Alang and Sosia Ship Breaking Yard (ASSBY) is located on the coast of Bhavnagar district and in the Gulf of Cambay, a distance of 56 km south from Bhavnagar city. This place has the best continental shelf available for ship breaking in the whole of Asia. At the same time, it is known for the highest tidal level (10 meters) in the country. The vast expanse of intertidal zone gets exposed during ebb tide which makes it convenient for ship breaking activity, whereas the high tide makes it possible to accommodate big ships. The first ship breaking activity started in 1983 at Alang. Today ASSBY boasts the biggest ship-breaking yard in whole of Asia with 182 plots carrying on this activity year round. In 1997, ships worth 3.2 million tons were broken in this yard.

There are around 24,000 direct workers and some 11,000 to 12,000 workers in allied activities in the ASSBY area. Out of around 35,000 workers, according to one survey, only 0.55% belongs to Gujarat. It means that more than 99 percent of the workers are from other states. They are mainly from three states, Orissa, U.P. and Bihar. They are mainly from backward and drought prone regions of those states. This means that this is a migrant labour force. The Interstate Migrant Workman Act will have to

[4] PCB-contaminated oil and equipment weight is estimated based on 10% contamination rate, conservative by international developing and developed world standards.

be applied here. If this Act is applied, most of the problems of working and living conditions can be solved, because the ISMW Act mentions accommodation, medical facilities and even traveling allowances. Wages are not a problem for these workers, but the working living conditions are hazardous and inhuman.

So far as safety aspects are concerned, no standards are observed either by workers or by plot management. Out of 361 workers, according to the survey, 14 (3.88%) workers reported accidents, 11 workers (3.05%) sustained burns and 14 workers (3.88%) reported injuries. Ten workers (2.77%) wear helmets, only one worker reported having gloves, two workers reported having shoes and three workers reported having welding glasses.

Ship breaking labour is a semi-technical task. The survey mentions that 32 workers (8.62%) reported that they received some informal training, while the rest of them are untrained. Working hours are not decided. More than 50 percent of the workers reported that they work for between 8 and 12 hours. The state of industrial safety is found to be very poor as only a few plot owners provide safety equipment such as shoes, glasses, gloves etc. The nozzles of gas cylinders create accidents due to heat and explosion. The oil remaining in fuel tankers also is a major cause of accidents. Fire accidents take place many times. As of today, the ship breaking industry falls under the Factory Act and they have to follow Factory Act rules. There are various rules covering safety provisions mentioned in Factory Act and they should be followed religiously. However, what is more important is the development of a safety conscious mind set or culture for the ship breaking activity. All concerned stakeholders will have to come together to evolve such a safety conscious mind set.

Another application for PCBs is the light fixtures. In India Fluorescent light ballasts also contain PCBs, about 8 g each. A further application would be as plasticizer in a wide range of products manufactured by the chemical industry but allegedly in India PCBs have never been used for such a purpose.

Considering the fact that according to international statistics approximately 30 % of the total PCBs inventory is in non-electric equipment, the total inventory in India may be well over 100,000 tons of PCB-containing materials and wastes.

PCBs management and disposal

The major users of PCBs were power generation units and state electricity boards. There are at least 95 state electricity boards, transmission and distribution companies as well as at least 123 private sector utilities, power generating companies and independent power producers. These users do not store transformer oil. They have contracted service and maintenance of transformers and capacitors to local parties. Hence, they do not have PCBs storage facilities. Users of capacitors are large units not into manufacturing of capacitors. Therefore, such units do not have stock of PCBs in their premises. Further, PCB-containing oils that need to be replaced from time to time are collected by local agents. These local agents in turn sell them to oil reprocessing units wherein the moisture content is removed. It is then repacked and sold in the market. The electricity companies auction the old and defunct transformers. Agents then buy these transformers and use them for reprocessing activities.

Currently there are no standard and established disposal practices for the out-of-operation PCB-containing equipment and wastes. According to a survey carried out by CPRI, about 60% of PCB-containing equipment, oil and wastes are stored at the PCBs owners' yards and about 40% disposed of in an environmentally unsound manner. PCB-containing oil is mostly dumped by draining into the soil and such a way it ends up in the waterways. The equipment carcasses may also be dumped or sold as scrap. The state-of-the-art processing of PCB-containing mineral oil transformers containing less than 1,000 ppm PCBs, that represent about 90-95 % of all transformers, would be as follows: draining, dechlorination, dewatering (polishing), adding 0.1 % antioxidant and retrofilling. The solvent of choice for decontaminating the carcasses is perchloroethylene, a non-flammable liquid with a boiling point that is very different from that of PCBs, hence the separation process is easy. Retrofilling Askarel transformers are not an economic option as the extraction process should be repeated too many times (20-30 times).

Statistical data on quantities of out of service PCB-containing electrical equipment are not available. Most of the broken down transformers are recycled and reused. The out of service capacitors are stored at the facilities of their owners. However, the PCB-containing equipment and oil is not managed as hazardous waste in an environmentally sound manner. The lack of proper management may result in social costs for the health of population, deterioration of the environment and excessive expenditures for late mitigation measures. The assessment of such costs is crucial for government decision-making. Capacity for economic and social costs/benefits assessments concerning POPs-related measures is currently not available and needs to be created.

Incineration plants for disposal of hazardous wastes including PCBs do not exist in the country. Some cement industries have recently shown interest to get involved in PCBs disposal however, they are not equipped in co-incinerating hazardous wastes. Therefore they would require a substantial amount of investment in terms of both human and financial resources before entering such a venture.

It is expected that through local dismantling of transformers and reducing the volumes (by approx.55-60%) for export to a qualified incinerator, it will be possible to keep disposal costs within US$ 3.0-3.5/kg of the pre-separated PCB wastes. The only current reference cost that has been available is the disposal fee for medical waste incineration by a private service provider. The disposal fee of this particular type of hazardous waste is Rupee 375 per 2.5 kg that is equivalent about US$ 3,000/ton (exchange rate is US$ 1 = Rupee 50).

ANNEX 6: IDENTIFICATION AND RESPONSIBILITIES OF STAKEHOLDERS

Central Sector Organizations that have relevance to the project

Central Electricity Authority (CEA)

The Central Electricity Authority (CEA) is a statutory organization constituted under Section 3 of the repealed Electricity (Supply) Act, 1948. It was established as a part-time body in the year 1951 and made a full-time body in the year 1975. With the objective of reforming the Power Sector, the Electricity Act, 2003 (No. 36 of 2003) has been enacted and the provisions of this Act have been brought into force with effect from 10 June, 2003. With the coming into force of the Electricity Act, 2003, the Indian Electricity Act, 1910, Electricity (Supply) Act, 1948 and Electricity Regulatory commissions Act, 1998 stand repealed. CEA is under the Ministry of Power, Government of India.

As per section 73 of the Electricity Act, 2003, the Central Electricity Authority shall perform such functions and duties as the Central Government may prescribe or direct, and in particular to:

a) advise the Central Government on the matters relating to the national electricity policy, formulate short-term and perspective plans for development of the electricity system and coordinate the activities of the planning agencies for the optimal utilization of resources to sub serve the interests of the national economy and to provide reliable and affordable electricity to all consumers;

b) specify the technical standards for construction of electrical plants, electric lines and connectivity to the grid;

c) specify the safety requirements for construction, operation and maintenance of electrical plants and electric lines;

d) specify the Grid Standards for operation and maintenance of transmission lines;

e) specify the conditions for installation of meters for transmission and supply of electricity;

f) promote and assist in the timely completion of schemes and projects for improving and augmenting the electricity system;

g) promote measures for advancing the skills of persons engaged in electricity industry;

h) advise Central Government on any matter on which its advice is sought or make recommendation to that Government on any matter if, in the opinion of the Authority, the recommendation would help in improving the generation, transmission, trading, distribution and utilization of electricity;

i) collect and record the data concerning the generation, transmission, trading, distribution and utilization of electricity and carry out studies relating to cost, efficiency, competitiveness and such like matters;

j) make public from time to time the information secured under this Act, and provide for the publication of reports and investigations;

k) promote research in matters affecting the generation, transmission, distribution and trading of electricity;

l) carry out, or cause to be carried out, any investigation for the purpose of generating or transmitting or distributing electricity;

m) advise any State Government, licensees or the generating companies on such matters which shall enable them to operate and maintain the electricity system under their ownership or control in an improved manner and where necessary, in coordination with any other Government, licensee or the generating company owning or having the control of another electricity system;

n) advise the Appropriate Government and the Appropriate Commission on all technical matters relating to generation, transmission and distribution of electricity; and

o) discharge such other functions as may be provided under this Act.

In addition to above functions and duties, CEA has to perform the following functions in terms of the under mentioned sections of the Electricity Act, 2003:

Section 3: - NATIONAL ELECTRICITY POLICY AND PLAN

(1) The Central Government shall, from time to time, prepare the National Electricity Policy and tariff policy, in consultation with the State Governments and the Authority for development of the power system based on optimal utilization of resources such as coal, natural gas, nuclear substances or materials, hydro and renewable sources of energy,

(2) The Central Government shall publish the National Electricity Policy and tariff policy from time to time.

(3) The Central Government may, from, time to time, in consultation with the State Governments and the Authority, review or revise the National Electricity Policy referred to in sub-section (1).

(4) The Authority shall prepare a National Electricity Plan in accordance with the National Electricity Policy and notify such plan once in five years.

PROVIDED that the Authority while preparing the National Electricity Plan shall publish the draft National Electricity Plan and invite suggestions and objections thereon from licensees, generating companies and the public within such time as may be prescribed;

PROVIDED FURTHER that the Authority shall -

(a) notify the plan after obtaining the approval of the Central Government;

(b) revise the plan incorporating therein directions, if any, given by the Central Government while granting approval under clause (a).

(5) The Authority may review or revise the National Electricity Plan in accordance with the National Electricity Policy.

Section 53 - PROVISION RELATING TO SAFETY AND ELECTRICITY SUPPLY

The Authority may in consultation with the State Governments, specify suitable measures for:

a) protecting the public (including the person engaged in the generation, transmission or distribution or trading) from dangers arising from the generation, transmission or distribution or trading of electricity, or use of electricity supplied or installation, maintenance or use of any electric line of electrical plant;

b) eliminating or reducing the risks of personal injury to any person, or damage to property of any person or interference with use of such property;

c) prohibiting the supply or transmission of electricity except by means of a system which conforms to the specification as may be specified;

d) giving a notice in the specified form to the Appropriate Commission and the Electrical Inspector, of accidents and failures of supplies or transmission of electricity;

e) keeping by a generating company or licensee the maps, plant and sections relating to supply or transmission of electricity;

f) inspection of maps, plans and sections by any person authorized by it or by Electrical Inspector or by any person on payment of specified fee;

g) specifying action to be taken in relation to any electric line or electrical plant, or any electrical appliance under the control of a consumer for the purpose of eliminating or reducing the risk of personal injury or damage to property or interference with its use;

NORTH EASTERN ELECTRIC POWER CORPORATION LIMITED (NEEPCO)

North Eastern Electric Power Corporation Limited (NEEPCO) under the Ministry of Power, Government of India with an authorized share capital of Rs.3500 crore has been upgraded to **Schedule 'A' status on 15th July 2008**.The Corporation was established on the 2nd of April, 1976 as a wholly owned Government of India Enterprise to plan, promote, investigate, survey, design, construct, generate, operate and maintain hydro and thermal / gas stations. NEEPCO has an installed capacity of 1130 MW which is 45% of the total installed capacity of the Region. Total number of units in operation under NEEPCO is 26. The Corporation has a total of 660 MW under construction with 4954 MW to be added during XI Plan and XII Plan till 2017. With its headquarters in the charming town of Shillong, the capital of Meghalaya, NEEPCO is a vivacious enterprise with projects located in the various states of the North East.

Power Grid Corporation of India Ltd (PGCIL)

PGCIL, a Navratna Public Sector Enterprise, is one of the largest transmission utilities in the world. PGCIL wheels about 45% of the total power generated in the country on its transmission network. PGCIL has a pan-India presence with around 68,000 Circuit Kms of Transmission network and 115 nos. of EHVAC & HVDC sub-stations with a total transformation capacity of 75,000 MVA. PGCIL has also diversified into Telecom business and established a telecom network of more than 19,000 Kms across the country. PGCIL has consistently maintained the transmission system availability at 99.65%, which is at par with the International Utilities.

Rural Electrification Corporation Ltd (REC)

Rural Electrification Corporation Limited (REC) was incorporated on 25 July 1969 under the Companies Act 1956. REC is a whole owned Government of India Public Sector Enterprise with a net worth of Rs. 5,368 Crore. Its main objective is to finance and promote rural electrification projects all over the country.

Central Pollution Control Board (CPCB)

The Central Pollution Control Board (CPCB), is statutory organization, was constituted in September, 1974 under the Water (Prevention and Control of Pollution) Act, 1974. Further, CPCB was entrusted with the powers and functions under the Air (Prevention and Control of Pollution) Act, 1981. It serves as a field formation and also provides technical services to the Ministry of Environment and Forests of the provisions of the Environment (Protection) Act, 1986.

Principal functions of the CPCB, as spelt out in the Water (Prevention and Control of Pollution) Act, 1974, and the Air (Prevention and Control of Pollution) Act, 1981, (i) to promote cleanliness of streams and wells in different areas of the States by prevention, control and abatement of water pollution, and (ii) to improve the quality of air and to prevent, control or abate air pollution in the country. Air Quality Monitoring is an important part of the air quality management. The National Ambient Air Quality Monitoring (NAAQM) Programme has been established with objectives to determine the present air quality status and trends and to control and regulate pollution from industries and other source to meet the air quality standards. It also provides background air quality data needed for industrial sitting and towns planning. Besides this, CPCB has an automobile monitoring station at ITO Intersection in New Delhi. At this station Resirable Suspended Particulate Matter (RSPM), Carbon Monoxide (CO), Ozone (O3), Sulphur Dioxide (SO2), Nitrogen Dioxide (NO2) and Suspended Particulate Matter (SPM) are being monitored regularly. This information on Air Quality at ITO is updated every week. Fresh water is a finite resource essential for use in agriculture, industry, propagation of wildlife & fisheries

and for human existence. India is a riverine country. It has 14 major rivers, 44 medium rivers and 55 minor rivers besides numerous lakes, ponds and wells which are used as primary source of drinking water even without treatment. Most of the rivers being fed by monsoon rains, which are limited to only three months of the year, run dry throughout the rest of the year often carrying wastewater discharges from industries or cities/towns endangering the quality of our scarce water resources. The parliament of India in its wisdom enacted the Water (Prevention and Control of Pollution) Act, 1974 with a view to maintaining and restoring wholesomeness of our water bodies. One of the mandates of CPCB is to collect, collate and disseminate technical and statistical data relating to water pollution. Hence, Water Quality Monitoring (WQM) and Surveillance are of utmost importance.

The scheme of labeling of Environment Friendly Products is on anvil for household and other Consumer Products to meet certain environment criteria along with the quality requirements of Indian Standards. The scheme is known as Ecomark Scheme of India.

The information on Pollution Control in 17 highly polluting categories (medium and large) of industries is available. It also includes status of compliance with stipulated environmental standards for these industries.

Functions of the Central Board at the National Level

- advise the Central Government on any matter concerning prevention and control of water and air pollution and improvement of the quality of air.
- plan and cause to be executed a nation-wide programme for the prevention, control or abatement of water and air pollution;
- co-ordinate the activities of the State Board and resolve disputes among them;
- provide technical assistance and guidance to the State Boards, carry out and sponsor investigation and research relating to problems of water and air pollution, and for their prevention, control or abatement;
- plan and organize training of persons engaged in programme on the prevention, control or abatement of water and air pollution;
- organize through mass media, a comprehensive mass awareness programme on the prevention, control or abatement of water and air pollution;
- collect, compile and publish technical and statistical data relating to water and air pollution and the measures devised for their effective prevention, control or abatement;
- prepare manuals, codes and guidelines relating to treatment and disposal of sewage and trade effluents as well as for stack gas cleaning devices, stacks and ducts;
- disseminate information in respect of matters relating to water and air pollution and their prevention and control;
- lay down, modify or annul, in consultation with the State Governments concerned, the standards for stream or well, and lay down standards for the quality of air; and
- perform such other function as may be prescribed by the Government of India.

Functions of the Central Board as State Boards for the Union Territories

- advise the Governments of Union Territories with respect to the suitability of any premises or location for carrying on any industry which is likely to pollute a stream or well or cause air pollutions;
- lay down standards for treatment of sewage and trade effluents and for emissions from automobiles, industrial plants, and any other polluting source;
- evolve efficient methods for disposal of sewage and trade effluents on land;
- develop reliable and economically viable methods of treatment of sewage, trade effluent and air pollution control equipment;

- identify any area or areas within Union Territories as air pollution control area or areas to be notified under the Air(Prevention and Control of Pollution) Act, 1981;
- assess the quality of ambient water and air, and inspect wastewater treatment installations, air pollution control equipment, industrial plants or manufacturing process to evaluate their performance and to take steps for the prevention, control and abatement of air and water pollution.

As per the policy decision of the Government of India, the CPCB has delegated its powers and functions under the Water (Prevention and Control of Pollution) Act, 1974, the Water (Prevention and Control of Pollution) Cess Act, 1977 and the Air (Prevention and Control of Pollution) Act, 1981 with respect to Union Territories to respective local administrations. CPCB along with its counterparts State Pollution Control Boards (SPCBs) are responsible for implementation of legislations relating to prevention and control of environmental pollution.

Electrical Research and Development Association

A wide variety of Electrical materials, Equipment and Component are used in Power generation, Transmission and Distribution networks and the country has attained self sufficiency in manufacturing all these materials, equipment and components. To ensure high quality of these equipment, testing has to be carried out as per national, international or user specified specifications to qualify them for their intended applications. Thus availability and access to highly sophisticated testing facilities is a prerequisite for ensuring high quality of materials / products.

Electrical Research and Development Association (ERDA), the R&D Institution of the Indian Electrical Industry was established to provide a wide range of sophisticated testing facilities, many of which are too expensive for individual manufacturer to establish and operate. Amongst the test facilities established at ERDA “On line Short Circuit Testing” and “High voltage Impulse tests”, facilities together meet majority of testing needs of the industry under one roof. This brochure highlights these two facilities.

Central Power Research Institute

Central Power Research Institute (CPRI) is an autonomous society under Ministry of Power, Government of India. It is the power house of the Indian electrical industry. Set up in 1960 by the Government of India, it was reorganized into and autonomous society in 1978. It functions as a centre for applied research in electrical power engineering assisting the electrical industry in product development and quality assurance. CPRI also serves as an independent authority for testing, evaluation and certification of power equipment and components to ensure reliability and improve, innovate and develop new products. CPRI is managed by its Governing Council comprising members representing the Government, the electrical utilities, the industry, academic institutions, etc. The Secretary of the Ministry of Power is the President of the Governing Council and Eminent professionals from industries, utilities, prestigious academic and research institutions and the government is the members. The Chief Executive of CPRI, the Director General is a member and secretary of the Governing Council. CPRI employs over 300 highly qualified and experienced engineers and scientists besides other supporting staff.

The vision, mission statement, the value and attitude of CPRI are as follows:

- **Vision:** To be the global leader in R &D, Testing and Consultancy in Electric Power through frontier research and on the cutting edge technologies.
- **Mission:** To carry out applied research and provide quality services for achieving reliability and economy in Power Systems through excellent facilities, commitment and best practices, ensuring self-sustenance.
- **Value:** We value customer satisfaction by sharing our knowledge and caring for their needs, maintaining total transparency in our operations.

- **Attitude:** Together we strive to learn more and serve the Society better with an open mind and futuristic outlook, always willing to accept new challenges.

Objectives of CPRI

The objectives of CPRI are according to its Annual Report 2005-2006 are as follows:

- Function as a National Power Research Organization for undertaking and/or sponsoring R&D projects in the field of generation, transmission, distribution and operation of electricity supply system.
- Provide necessary central research and testing facilities for evaluation of materials and performance of power equipment.
- Serve as a National Testing and Certification Authority for the purpose of certification of rating and performance to ensure availability of quality equipment for use under conditions prevalent in Indian Power Systems.
- Coordinate R&D activities in the various Sate Electricity Boards and maintain liaison with other institutions engaged in research connected with power systems and/or power equipment. Act as an apex body for initiating and coordinating the R&D in the field of electric power.
- Evolve criteria for standards of various equipment for operation under the Indian conditions and effectively participate in formulation of national standards.
- Identify problems in the areas of basic and applied research and arrange such studies in-house and in academic institutions.
- Collect information and maintain documentation in the field of power engineering and publish paper, periodical or report kin furtherance of the objectives of the Institute.
- Establish, maintain and manage laboratories, workshops and other facilities for furthering scientific and technological research and conduct experiments for exploiting the inventions and discoveries to the cause to the power development in the country.
- Enter into agreement with any enterprise or institution or person or persons and provide funds to them to carry our research and development programme of the Institute.
- Involve in Diagnostic, Renovation and Modernization, Life Evaluation and Life Extension studies of thermal and hydroelectric power plants.
- Become an international recognized and accredited laboratory to cater electrical equipment manufacturers of Asia, Europe, Middle East, etc.

Quality Policy

Central Power Research Institute (CPRI) is the National Institute for Research and Development in Electrical Power Engineering. CPRI is also an independent Third Party Testing & Certification Organization, and undertakes R&D, Consultancy projects for Power Sector. CPRI is always committed to maintaining consistent quality in third party testing, certification and calibration activities for meeting the requirements of National and International Standards. It is committed to timely and successful completion of R&D and consultancy projects to the entire satisfaction of its sponsors and customers. The Quest of quality and continual improvement is an on-going process at CPRI. Best professional practices of CPRI and confidence of customers in the quality of its services is a reliable base for its present and future business. The Quality Policy & Management System is integrated and implemented through the active involvement of the entire organization for compliance to ISO/IEC 17025-2005 Standard requirements in respect of its testing & certification, calibration services to ISO 9001-2000 Standard in respect of its R&D and Consultancy services. All facilities required for implementation of this policy will be provided.

Research and Development

With the total installed capacity of over 135,000 MW and with a vision for providing affordable quality power to each strata of the Society by 2012, it is not only necessary to ensure that, state-of-the-art technology is utilized but also that appropriate technology is developed keeping in view the social operating conditions in the country and the need to observe economy in a capital intensive sector. Broadly, R&D has two dimensions, namely a) R&D for Industry manufacturing electrical equipment for generation/transmission & distribution of power and b) the applied research involving improvement of efficiency and effectiveness of various techniques, procedures, processes, maintenance and upkeep of equipment from technical, techno-economic and technological point of view. The cost of research being prohibitively high it is necessary that state-of-the art technology evolved world-wide is harnessed to achieve CPRI's goals in the most efficient cost effective manner. In order to do this, CPRI must be in a position to assess and assimilate the latest technologies, adapt available technologies to suit the country applied needs and where required develop domestic production to meet our own specific requirements.

With its state-of-the art infrastructure and expertise, CPRI has made significant contributions to the power sector in the country for improved planning, operation and control of power systems. Besides in-house R&D, CPRI also undertakes sponsored research projects from manufacturers and other agencies in different areas of specialization. A number of products developed by CPRI have been licensed for commercial production. The Digital energy meters, Automatic power factor controller, Digital field strength meter, Solar selective coatings, Epoxy novolac resin, Capacitor fluid from rapeseed oil, Value added products from fly ash, Online & offline reclamation of used transformer oil, Electroless nickel coatings on Mild Steel, Electrostatic voltage divider & Software packages for power systems application are a few to quote from a long list.

Evaluation and Testing

With its quality of output on par with International standards CPRI offers specialized services on the performance, evaluation and certification of different kinds of power equipment like Switchgear, Fuse Gears, Transformers, Cables, Capacitors, Insulating Materials and Systems, Transmission Line Towers, Liquid Dielectrics and Non Conventional Energy Devices in its seven laboratories spread all over India.

Consultancy Services

CPRI offers expert consultancy services in the areas of Transmission and Distribution Systems, Power Quality, Energy Auditing, Power System Analysis, Tower Design, Conductor Vibration, Power System Instrumentation. Transformer Oil Reclamation, New materials for Power System application, High Power, Extra High Voltage and related fields. It also offers product design and development, Remaining Life Assessment and life extension studies and renovation and modernization studies of both thermal and hydro power plants.

Quality Certification

CPRI's laboratories are accredited under National Accreditation Board for Testing and Calibration Laboratories (NABL) as per ISO/IEC/7025 standards. CPRI has been accredited by ASTA BEAB of U.K. and IEC CB. CPRI is a full member in the group of STL (Short Circuit Testing Liaison) of Europe. In addition, it has long term collaboration with reputed International Laboratories like CESI of Italy, EDF of France, and EPRI of USA.

CPRI Network

With its head office located at Bangalore, the Institute has seven state-of-the-art infra-structural facilities in different parts of India to cater to the needs of power equipment manufacturers and user industries. These are as follows:

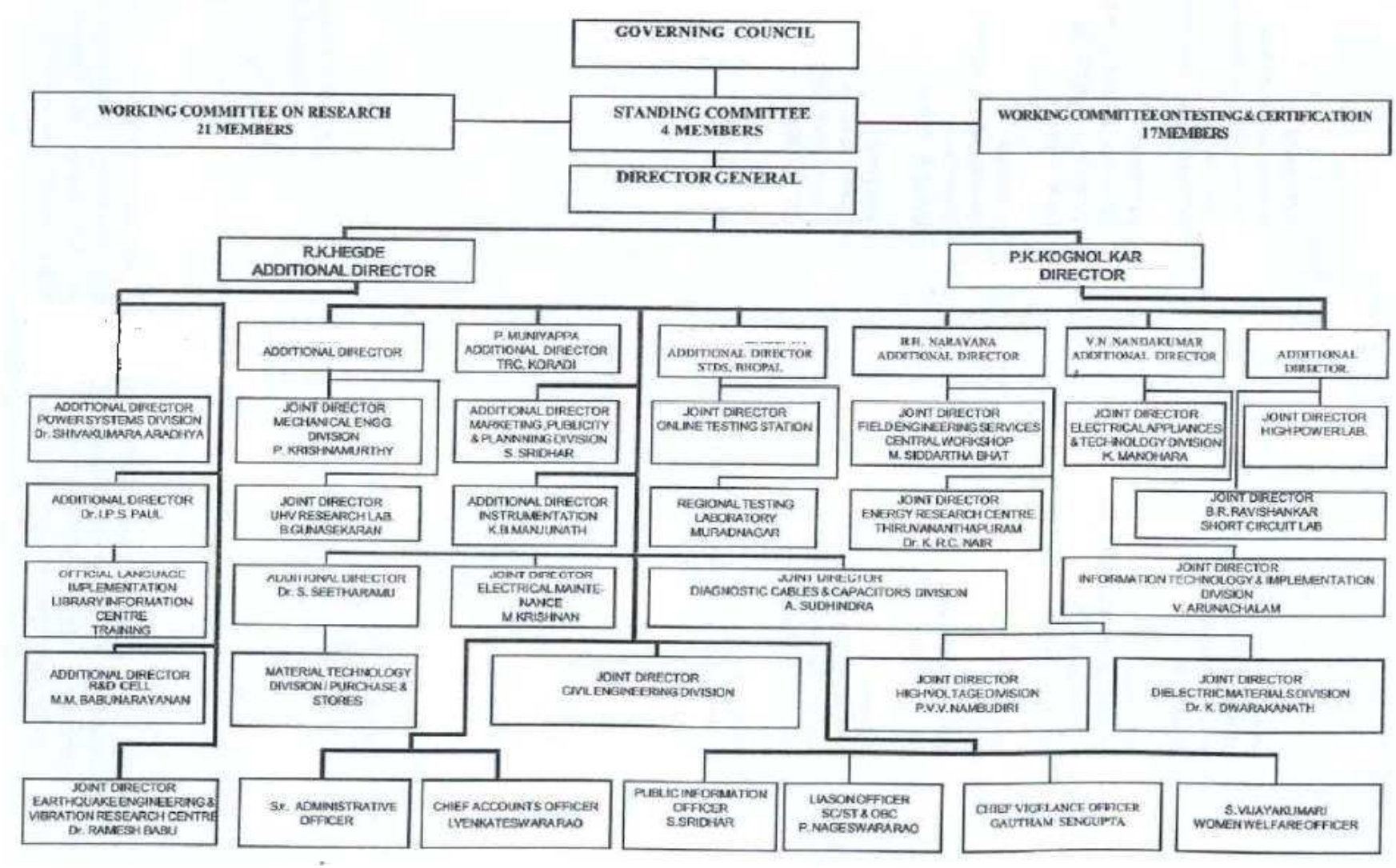
- Central Power Research Institute, Bangalore
- Switchgear testing and development station, Bhopal
- Ultra High Voltage Research Laboratory, Hyderabad
- Thermal Research Centre, Nagpur
- Regional Testing Laboratory, Muradnagar
- Regional Testing Laboratory, Kolkata
- Regional Testing Laboratory, Guhawati

Organization Structure

CPRI's Governing Council comprises of the president (the Secretary of the Ministry of Power), the vice president (the Chairperson of the Central Electricity Authority) and 19 members including eminent professionals from industries, utilities, prestigious academic and research institutions and the government. One of the members of the Governing Council is the Director General of CPRI.

Standing Committee is the supervisory body of CPRI that have advice and guidance from several committees such as the Committee on Research, Committee on Testing and Certification and Research Scheme on Power (RSOP) Expert Committee.

The organization structure of CPRI is given below.


GOVERNING COUNCIL
WORKING COMMITTEE ON RESEARCH 21 MEMBERS
STANDING COMMITTEE 4 MEMBERS
WORKING COMMITTEE ON TESTING & CERTIFICATION 17 MEMBERS
DIRECTOR GENERAL
R.K.HEGDE ADDITIONAL DIRECTOR
P.K.KOGNOLKAR DIRECTOR
ADDITIONAL DIRECTOR POWER SYSTEMS DIVISION Dr. SHIVAKUMARA ARADHYA
ADDITIONAL DIRECTOR Dr. I.P.S. PAUL
OFFICIAL LANGUAGE IMPLEMENTATION LIBRARY INFORMATION CENTRE TRAINING
ADDITIONAL DIRECTOR R&D CELL M.M. BABUNARAYANAN
JOINT DIRECTOR EARTHQUAKE ENGINEERING & VIBRATION RESEARCH CENTRE Dr. RAMESH BABU
ADDITIONAL DIRECTOR
JOINT DIRECTOR MECHANICAL ENGG. DIVISION P. KRISHNAMURTHY
JOINT DIRECTOR UHV RESEARCH LAB. B.GUNASEKARAN
ADDITIONAL DIRECTOR Dr. S. SEETHARAMU
MATERIAL TECHNOLOGY DIVISION / PURCHASE & STORES
P. MUNIYAPPA ADDITIONAL DIRECTOR TRC, KORADI
ADDITIONAL DIRECTOR MARKETING, PUBLICITY & PLANNING DIVISION S. SRIDHAR
ADDITIONAL DIRECTOR INSTRUMENTATION K.B.MANJUNATH
JOINT DIRECTOR ELECTRICAL MAINTE-NANCE M.KRISHNAN
ADDITIONAL DIRECTOR STDS, BHOPAL
JOINT DIRECTOR ONLINE TESTING STATION
REGIONAL TESTING LABORATORY MURADNAGAR
JOINT DIRECTOR DIAGNOSTIC CABLES & CAPACITORS DIVISION A. SUDHINDRA
JOINT DIRECTOR CIVIL ENGINEERING DIVISION
R.H. NARAYANA ADDITIONAL DIRECTOR
JOINT DIRECTOR FIELD ENGINEERING SERVICES CENTRAL WORKSHOP M. SIDDARTHA BHAT
JOINT DIRECTOR ENERGY RESEARCH CENTRE, THIRUVANANTHAPURAM Dr. K.R.C. NAIR
JOINT DIRECTOR HIGH VOLTAGE DIVISION P.V.V. NAMBUDIRI
V.N. NANDAKUMAR ADDITIONAL DIRECTOR
JOINT DIRECTOR ELECTRICAL APPLIANCES & TECHNOLOGY DIVISION K. MANOHARA
JOINT DIRECTOR B.R. RAVISHANKAR SHORT CIRCUIT LAB
JOINT DIRECTOR INFORMATION TECHNOLOGY & IMPLEMENTATION DIVISION V. ARUNACHALAM
ADDITIONAL DIRECTOR
JOINT DIRECTOR HIGH POWER LAB.
JOINT DIRECTOR DIELECTRIC MATERIALS DIVISION Dr. K. DWARAKANATH
Sr. ADMINISTRATIVE OFFICER
CHIEF ACCOUNTS OFFICER LYENKATESWARA RAO
PUBLIC INFORMATION OFFICER S.SRIDHAR
LIASON OFFICER SC/ST & OBC P. NAGESWARA RAO
CHIEF VIGILANCE OFFICER GAUTHAM SENGUPTA
S. VIJAYAKUMARI WOMEN WELFARE OFFICER

Services offered by CPRI

CPRI offers a wide range of services if enquiries sent to the Institute that are including but not limited to:

- Rich experience over 48 years in testing, research and consultancy
- Unique facilities for testing of electrical equipment to meet both the National and International Standards, including UL/CSA norms
- Laboratories have been accredited as per ISO/IEC 17025 norms
- Laboratories have been approved under IECEE-CB scheme
- Laboratories have been assessed by INTERTEK-ASTA BEAB UK for testing of LV and MV Equipment as per ISO/IEC 17025 norms
- Research and Consultancy activities of the Institute have been accessed and accredited for ISO 9001:2000 by NVT-KEMA
- CPRI has been accorded by the Membership in the Short Circuit Testing Liaison (STL) of Europe
- Executed Testing assignments for countries in the Middle East, South East Asia and Africa
- Third Party Inspection to power utilities
- Condition assessment of plant equipment
- Energy audits
- Customized training

Testing Facilities

The testing facilities provide a wide range of services as follows:

- High power with synthetic test facility for short circuit testing
- High voltage including ultra high voltage
- Transmission tower and line accessories testing
- Instrumentation
- Materials testing
- Seismic qualification of power equipment
- Insulation
- Power system studies, studies on distribution system and real time digital simulation
- Ingress protection, explosion flame proof and domestic electrical appliances
- Protocol testing and for energy meters and relays
- Expertise for third party inspection for equipment procured by utilities

Equipment Tested

- Switchgear
- Fuse gear
- Transformers
- Cables
- Insulators
- Bushings
- Lightning arresters
- Low tension and high tension capacitors
- Insulating materials
- Transmission towers
- Domestic electrical appliances

Collaborative Research and New Facilities

In 2006 CPRI set up in Bangalore an exclusive Centre for Collaborative and Advanced Research (CCAR) with academic institutions, power utilities and industry. CPRI has a state of the art Training and Accommodation facility for organizing training workshops, seminars, etc. CPRI set up in 2006 two

other laboratories in Bangalore, namely the Centre for Industrial Solid Waste Utilization (CISWU) and the Power Capacitors Laboratory.

Services offered by various Units/Laboratories

The services offered by the various units and laboratories of CPRI are as follows:

SWITCHGEAR TESTING & DEVELOPMENT STATION (STDS), GOVINDAPURA, BHOPAL

This unit situated adjacent to the Bharat Heavy Electrical Limited (BHEL) premises at Bhopal, the capital city of Madhya Pradesh, has two main testing stations for conducting short circuit tests they are:

Station I
Direct short circuit test station of 1500 MVA (Mega Volt Ampere) capacity utilizing a specially designed short circuit alternator. This station mainly caters to short circuit tests on high and medium voltages switchgears, transformers and other allied equipments.

Station II
On line testing station drawing test power upto 100 MVA from the MPEB grid. This station mainly caters to short circuit tests on low voltage switchgears, transformers and other allied equipments. The Unit has also established an Energy Meter Testing Laboratory with modern facilities for conducting all Type Tests on Energy Meters as per National and International Standards under one roof.

UHV RESEARCH LABORATORY, HYDERABAD

UHV Research laboratory has the necessary infrastructure to simulate actual operating conditions on an experimental line in the range of 220 kV to 1200 kV to evaluate its suitability and adaptability to Indian Power Systems taking into account the climatic, environmental, ecological and biological conditions pertaining to our country. This is a unique facility in this part of the world. Besides, the laboratory is capable of catering to electrical manufacturers for their investigatory and commercial tests for equipment up to 1200 kV class.

THERMAL RESEARCH CENTRE, KORADI, NAGPUR

TRC has been established at the Koradi Thermal Power Station, MSEB, about 15 kms from Nagpur. The facility has necessary infrastructure and expertise to take up operation and maintenance problems of thermal power generation in the country. The objectives include the following:

- Investigations of flue treatment, ignition studies, coal characteristics, pilot scale studies for coal gasification, slurry fuels, benefication, efficient combustor designs, pressurized FBC, etc.
- Energy conservation in power plant and improvements in efficiencies of combustion auxiliaries & interconnected systems.
- Performance evaluation of high temperature materials used for stress corrosion, fatigue & creep and materials conservation.
- Dynamic corrosion studies, development of protection schemes & high temperature wear resistant materials, improved water chemistry studies.
- Condition assessment, life estimation and extension studies, failure / risk analysis for renovation of vital power plant components.
- Evaluation of design & performance of flue gas, air and water pollution control devices & techniques.
- Environmental pollution impact assessment on the basis of solid data, modelling and combustion studies to control NC emission.
- Power plant waste utilisation & development of technologies for value added products from waste.
- Online instrumentation for analysis of water, coal, drum level, furnace
- control, failures and various processes.

REGIONAL TESTING LABORATORY, MURADNAGAR /GHAZIABAD

The Regional Testing Laboratory (RTL) is located in the NTPC's Central Satellite Earth Station campus, 15 km away from Ghaziabad. The laboratory is set up with a view to cater to the testing, certification and evaluation needs of electrical power equipment manufacturing industry. Act as a liaison unit of CPRI with various customers in the region and coordinate their test requirements which are beyond the scope of the Regional Laboratory but within
the capabilities of Bangalore and other units.

The laboratories established at RTL are:

- High voltage laboratory
- Liquid Dielectric and Coal Laboratory
- Cable and Capacitors Laboratory
- Insulation Laboratory

REGIONAL TESTING LABORATORIES, KOLKATA AND GUWAHATI

The facilities have been set up to cater to the needs of the Eastern and North Eastern Regions of the country. Both the facilities have state of art testing facilities for testing Transformer Oil. The Units are also housed with a mobile van for testing at Site. They also serve as liaison centres for consolidating the Testing and Consultancy requirements of the region.

Performance of CPRI in 2006-2007

Sl. No	Performance Parameters	Performance 2005-06	Performance 2006-07	Remarks
1	Revenue Earnings [Rs. In Crores]	41.47	42.35	Despite non-availability of 2 major facilities together affecting a revenue of Rs 6.00Cr
2	Research Papers International	36	29	Screening within CPRI is made more stringent
	National	84	58	
3	Research projects [Completed]	9	8	
4	Continuing Education programmes	19	36	
5	Filings of Patents / Technology Transfers / Commercialization of Technologies	3	7	
6	Utilization of Capital Budget %	89.48	70.42	

The overall performance of CPRI in 2006-2007 on a 100 point weightage basis is very good. The revenues in 2007-2008 were about Rs 60 Crores. The government budget for the current 5-year plan is about Rs 750 Crores (equivalent to about Rs 150 Crores annually).

NATIONAL POWER TRAINING INSTITUTE

National Power Training Institute (NPTI), an ISO 9001 & ISO 14001 organization, is a national apex body for training and human resources development in power sector with its Corporate Office at Faridabad. NPTI operates on an all India basis through its Units in different power zones of the country located at Faridabad, Neyveli (1965), Durgapur (1968), Badarpur, New Delhi (1974), Nagpur (1975), Centre for Advanced Management and Power Studies (CAMPS), Faridabad (2000), North-Eastern Regional Institute, Guwahati (2003), Hydro Power Training Institute (HPTI) to be established at Nangal, Power Systems Training Institute (PSTI), Bangalore (1972), and Hot Line Training Centre (HLTC) also at Bangalore (1974).

NPTI is totally committed and consciously aware of manpower development and training requirements and has several short-term and long-term training programs to meet the urgent, and long term needs and objectives of the power sector and allied Industries. It has a track record of having trained more than 100,000 power professional in regular programs for over 4 decades. The financial year 2004-05 has been a milestone year of continued quantum jumps in the annals of NPTI. The year has passed with a note of true quest for innovation, multifarious attempts to reach many more clients in distinct segments of education and training through passionate and innovative marketing of our core competencies and specialist services with a firm commitment to quality and our resolve to reach new heights of excellence, achieving Excellent rating for the fourth consecutive year in the MoU signed with the Ministry of Power.

NPTI has professional expertise in the field of training and HRD in power sector with industry specific technical interface and is the only Institution of its kind in India catering to the core power sector and allied energy sector. NPTI serves as a National Certification Authority for the purpose of certification of competence to ensure availability of properly trained personnel to man the Indian Electricity Industry under Rule 3, Sub Rule 2A of Indian Electricity Rules, 1956 amended in 1981.

NPTI identified as a Premier Nodal Institute for Advanced Learning and Management studies for higher echelons of Power Sector in the advanced and frontier technologies has also established a Centre for Advanced Management and Power Studies (CAMPS) and has been developing comprehensive capsule courses covering areas of hydro, thermal, power systems, total quality management, executive development training, etc. covering technology-management interface, power-environmental interface, power financing, privatization and regulatory issues through workshops, seminars, conferences for dissemination of latest information to blend technology with management in order to create systems of excellence in the power sector.

NPTI has the capability of conducting on-plant/on-site customised training programs and has conducted many on-site and on-the-job training programs to meet the urgent needs of various electricity boards, corporations and private utilities across the country. To illustrate the training capacity of NPTI during the year 2004-05 an awareness program on Water for Sustainable Power was organized covering as many as many as 25,956 people.

Commitment to quality is an on-going process in NPTI, with a focus on being client friendly. The surveillance audits reveal that NPTI outshined ISO certified institutions in terms of a very strong orientation and commitment to ever extending targets of performance maintaining high quality.

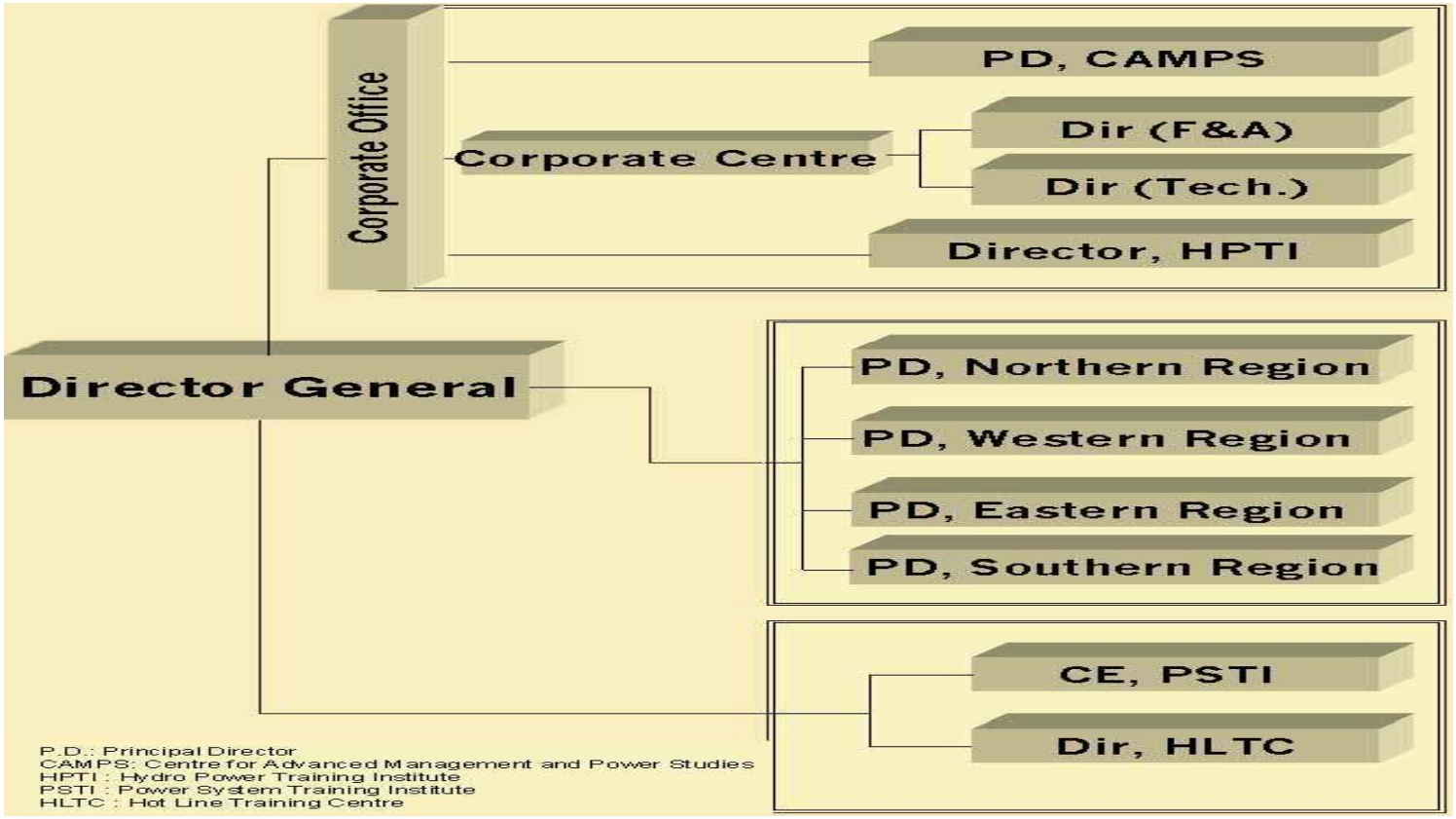
State Electricity Boards/State Secretaries, Departments/ Generation, Transmission and Distribution Companies

There are at least 95 entities in the 28 states and 7 union territories.

Private Sector

There are at least 123 private sector utilities, power generating companies and independent power producers.

Organizational Structure



ANNEX 7: TERMS OF REFERENCE FOR CONSULTANTS/EXPERTS

Post: Chief Technical Advisor (CTA)

Duration: 18 work-months over a period of 5 years

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Duty station: India and home-based

The CTA will assist the National Executing Agency (national counterpart) and UNIDO in smooth implementation of the project activities.

Purpose:

i. Transfer international experience in institutional and regulatory framework strengthening and enforcement associated with POPs PCB management. Provide technical advice for the program implementation, including preparation of training manual, training program, technology transfer, research, awareness raising, monitoring and evaluation;

ii. Review terms of references (ToRs) for individual experts and implementation of project activities;

iii. Advise on project monitoring, evaluation, including providing comments and finalization of the progress reports on the ongoing activities, and annual action plan;

iv. Troubleshooting of technical and implementation issues that may emerge.

Scope of work

The CTA together with national experts will oversee execution of all technical components of the Project. The CTA will provide overall technical assistance in the following aspects:

- **Support to workshops and trainings** including participation in all important project workshops, introducing relevant international experience in the workshops, and reviewing and commenting all relevant deliverables of the workshops.

- **Support to project implementation including**:
  - development of work plan of the project activities
  - . providing assistance in developing, reviewing, and finalizing various programs such as technology research and transfer, enforcement and compliance, and awareness raising
  - participation in the training for researchers and trainers to transfer of the needed technologies to industries in the trainings
  - . guiding with the technology equipment vendors/suppliers, local experts of enterprise on technical issues concerning environmentally sound management of chemicals.

- **Monitoring and Evaluation** for the whole process of the project**.** The CTA will
  - review and finalize the TORs for selection of experts for smooth implementation of project activities
  - review and finalize all key project reports including annual reports, mid term report, evaluation report, etc.

- **Provide technical advice on establishment of MIS** including data of PCBs and PCBs containing equipment, wastes and its final disposal in ESM.

Qualifications and requirements:

- Extensive practical experience with POPs related issues;
- PhD in related field namely chemistry, chemicals technology, POPs related field or equivalent
- Experience with implementation of international projects;
- Good communication and writing skills in English; and
- Knowledge of the Stockholm Convention on POPs would be an asset.

Language: English

Post : International expert on ESM of PCBs

Duration: 6.0 w/months

Duties and Responsibilities:

The International expert on environmentally sound management of PCBs will assist the National Executing Agency (national counterpart) and UNIDO in the following duties:

(i) Provide overall technical assistance to all project stakeholders, relevant agencies, national and international experts so that they can undertake their duties in a responsible and informed manner.
(ii) Work together with the Executing Agency to carry out the following tasks:
   a. Training for the task team members for the development of the ESM system
   b. Training in practical implementation of the ESM for personnel involved in PCB handling.
   c. Identification of possible interim storage locations
(iii) Regularly liaise and coordinate the activities of the task teams, which develop the ESM system and implement the measures of the ESM system.
(iv) Provide on-site assistance during the implementation of the ESM measures in the demonstration areas.
(v) Provide assistance in upgrading the interim storage facilities and in implementing the ESM measures at those locations.
(vi) Undertake quarterly reporting to UNIDO on the completed and on-going services and tasks.
(vii) Liaise with institutions of the Executing Agency and UNIDO on the measures, which will be undertaken, upon changes in the work plan or budget.
(viii) Prepare reports on his/her missions

Qualifications and requirements:
- Extensive practical experience with POPs related issues;
- PhD in related field namely chemistry, chemicals technology, POPs related field or equivalent
- Experience with implementation of international projects;
- Good communication and writing skills in English; and
- Knowledge of the Stockholm Convention on POPs would be an asset.

Language: English

Post: International Expert on PCBs inventory and training
Duration: 36 weeks
Duty station: Bangalore and home-based

Duties:

The International expert on PCBs inventory and training will assist the National Executing Agency (national counterpart) and UNIDO in the following duties:

To assist the national counterpart to
1. Review national PCB's inventory of equipment being still in use. Make suggestions for the development of inventory in power sector, shipbreaking sector and other non-power sectors.
2. Prepare requirements, guidelines and provide training for inventory preparation. Review PCB-containing devices in use and obsolete ones.
3. Review inventory information and develop timetable for equipment replacement and for safe storage.
4. Prepare a management information system to hold inventory data and replacement timetables.
5. Inspect and verify data (PCB inventory reports) collected during NIP, validate these reports on collection and analysis methods
6. Analyse existing "end of life" methods, describe any chance of PCB release during use propose, if needed action to avoid releases
7. Facilitate national expert group meeting to reach consensus on key technical and logistical issues and to promote awareness of PCB issues in India.

8. Organize a pilot programme in selected state by conducting workshops to raise awareness of PCBs health and safety issues, inventory, management and destruction methods and techniques for key stakeholders.
9. Develop a proposal for a permanent, sustainable training programme to address all aspects of PCBs identification, inventories, analysis and disposal work.
10. Assess current PCB disposal management and monitoring and provide guidance on how to prepare a draft strategy. Review draft national strategy and make suggestions. Disseminate information to relevant stakeholders within the central and state governments, electrical utilities and industry.

Qualifications and requirements:
- Extensive practical experience with POPs related issues;
- PhD in related field namely chemistry, chemicals technology, POPs related field or equivalent
- Experience with implementation of international projects;
- Good communication and writing skills in English; and
- Knowledge of the Stockholm Convention on POPs would be an asset.

Language: English

Post: International Expert on PCB waste management and disposal
Duration: 16 weeks
Duty station: India in three States and home-based
Duties:

The International expert on PCB waste management and disposal will assist the National Executing Agency (national counterpart) and UNIDO to:

1. Develop guidelines for PCB waste identification and tracking
2. Develop guidelines for PCB waste collection, packaging, and transportation
3. Develop guidelines for PCB waste interim storage
4. Develop guidelines for PCB waste disposal
5. Develop information management software for PCB management system
6. Train stakeholders in management system requirements and procedures
7. Identify locations for interim storage facilities and provide guidance on interim storage facility design, construction, provisioning, and commissioning

Qualifications and requirements:
- Extensive practical experience with POPs related issues;
- PhD in related field namely chemistry, chemicals technology, POPs related field or equivalent
- Experience with implementation of international projects;
- Good communication and writing skills in English; and
- Knowledge of the Stockholm Convention on POPs would be an asset.

Language: English

Post: International Policy cum Legal Expert
Duration 16 weeks
Duty station: Bangalore and home-based
Duties: To assist the national counterpart, their subcontractors, experts and stakeholders and UNIDO:

1. Evaluation of existing national legal and regulatory framework
2. Evaluation of existing State enforcement of PCB management related laws and regulations
3. Identification of gaps between State implementation and National and Stockholm Convention requirements
4. Support for State adoption of revised and/or new measures to ensure environmentally safe management and disposal of PCB contaminants

Qualifications and requirements:
- Extensive practical experience with POPs related issues;
- PhD in related field namely chemistry, chemicals technology, POPs related field or equivalent
- Experience with implementation of international projects; and
- Good communication and writing skills in English;
- Knowledge of the Stockholm Convention on POPs would be an asset.

Language: English

Post : National expert on ESM of PCBs

Duration: 24.0 w/months

Duty station: Bangalore and other selected states

Duties and Responsibilities:

The expert on environmentally sound management of PCBs will work for the National Executing Agency (national counterpart) and would carry out the following duties:

- Provide technical assistance to all project stakeholders, relevant agencies, national and international experts so that they can undertake their duties in a responsible and informed manner.
- Organise the following activities:
  - Training for the task team members for the development of the ESM system
  - Training in practical implementation of the ESM for personnel involved in PCB handling.
  - Identification of possible interim storage locations
- Liaise and coordinate the activities of the task teams, which develop the ESM system and implement the measures of the ESM system.
- Provide on-site assistance during the implementation of the ESM measures in the demonstration areas.
- Provide technical inputs in upgrading the interim storage facilities and in implementing the ESM measures at those locations.
- Undertake quarterly reporting to the National executing Agency and the UNIDO on the completed and on-going services and tasks.
- Liaise with institutions of the Executing Agency and UNIDO on the measures, which will be undertaken, upon changes in the work plan or budget.
- Prepare reports on his/her missions

Qualifications and requirements:
- Extensive practical experience with POPs related issues;
- PhD in related field namely chemistry, chemicals technology, POPs related field or equivalent
- Experience with implementation of international projects;
- Good communication and writing skills in English; and
- Knowledge of the Stockholm Convention on POPs would be an asset.

Language: English

Post: National Expert on PCBs inventory and training
Duration: 48 w/months
Duty station: Bangalore and other selected states

Duties:

The national expert on PCBs inventory and training will work for the National Executing Agency (national counterpart) and would carry out the following duties:

- Review national PCB's inventory of equipment being still in use. Make suggestions for the development of inventory in power sector, shipbreaking sector and other non-power sectors.
- Prepare requirements, guidelines and provide training for inventory preparation. Review PCB-containing devices in use and obsolete ones.
- Review inventory information and develop timetable for equipment replacement and for safe storage.
- Prepare a management information system to hold inventory data and replacement timetables.
- Inspect and verify data (PCB inventory reports) collected during NIP, validate these reports on collection and analysis methods
- Analyse existing "end of life" methods, describe any chance of PCB release during use propose, if needed action to avoid releases
- Facilitate expert group meeting to reach consensus on key technical and logistical issues and to promote awareness of PCB issues in India.
- Organize pilot programme in selected state by conducting workshops to raise awareness of PCBs health and safety issues, inventory, management and destruction methods and techniques for key stakeholders.
- Develop a proposal for a permanent, sustainable training programme to address all aspects of PCBs identification, inventories, analysis and disposal work.
- Assess current PCB disposal management and monitoring and provide guidance on how to prepare a draft strategy. Review draft national strategy and make suggestions. Disseminate information to relevant stakeholders within the central and state governments, electrical utilities and industry.

Qualifications and requirements:

- Extensive practical experience with POPs related issues;
- PhD in related field namely chemistry, chemicals technology, POPs related field or equivalent
- Experience with implementation of international projects;
- Good communication and writing skills in English; and
- Knowledge of the Stockholm Convention on POPs would be an asset.

Language: English

Post: National Expert on PCB waste management and disposal
Duration: 48 w/months
Duty station: Bangalore and other selected states
Duties:

The National expert on PCB waste management and disposal will work with the National Executing Agency (national counterpart) to:

- Develop guidelines for PCB waste identification and tracking
- Develop guidelines for PCB waste collection, packaging, and transportation
- Develop guidelines for PCB waste interim storage
- Develop guidelines for PCB waste disposal
- Develop information management software for PCB management system
- Train stakeholders in management system requirements and procedures
- Identify locations for interim storage facilities and provide guidance on interim storage facility design, construction, provisioning, and commissioning

Qualifications and requirements:

- Extensive practical experience with POPs related issues;
- PhD in related field namely chemistry, chemicals technology, POPs related field or equivalent
- Experience with implementation of international projects;

- Good communication and writing skills in English; and
- Knowledge of the Stockholm Convention on POPs would be an asset.

Language: English

Post: Policy cum Legal Expert

Duration 24 w/months

Duty station: Bangalore and other selected states

Duties: To work for the National Executing Agency (national counterpart), their subcontractors, experts and stakeholders and would carry out the following duties:

- Evaluation of existing national legal and regulatory framework
- Evaluation of existing State enforcement of PCB management related laws and regulations
- Identification of gaps between State implementation and National and Stockholm Convention requirements
- Support for State adoption of revised and/or new measures to ensure environmentally safe management and disposal of PCB contaminants

Qualifications and requirements:

- Extensive practical experience with POPs related issues;
- PhD in related field namely chemistry, chemicals technology, POPs related field or equivalent
- Experience with implementation of international projects; and
- Good communication and writing skills in English;
- Knowledge of the Stockholm Convention on POPs would be an asset.

Language: English

ANNEX 8: TERMS OF REFERENCE FOR SUBCONTRACTS

Subcontract 1: Strengthening the capacity of institutions and stakeholders in the handling of PCBs, equipment and wastes through important training to the stakeholders

Scope of contracting services

The objective of this subcontract is to strengthen the capacity of institutions and stakeholders in handling PCBs, equipment and wastes.

Activities

The contractor of the subcontract shall undertake the following activities:

- Develop training materials on PCB phase-out strategy and disposal methods
- Organize training workshop for PCB owners
- Capacity augmentation for workplan safety monitoring
- Capacity building for Safety and Environmental Inspection Agencies

Output:

- Training materials prepared
- Training workshops organized for PCB owners
- PCB phase-out strategy and treatment method established
- Capacity enhanced for Safety Inspection and Environmental Inspection Agencies.

Qualification:

The contractor of this subcontract:

- Must have experience in developing training materials on the subject; and
- Must have experience in organizing training workshops

Subcontract 2: Strengthening of national tracking and record keeping system for updating PCBs inventory

Scope of contracting services

The objective of this subcontract is to establish the national tracking and record keeping system of the PCBs inventory database with an aim to update the … PCB inventory established during the NIP.

Activities

The contractor of the subcontract shall undertake the following activities:

- Organize a workshop for PCB owners to introduce PCB reporting requirements
- Identify and label PCB containing equipment in the country
- Undertake inventory survey of PCB in power sector, ship breaking sector and other non-power sectors
- Validate and verify the inventory
- Update the inventory

Output:

- PCB owner trained on PCB reporting requirements
- PCB containing equipment identified and labelled
- Inventory completed
- Inventory updated

Qualification:

The contractor of this subcontract should have sufficient experience or knowledge in:

- Reporting requirements of PCBs under the Stockholm Convention; and
- Inventorisation of equipment in power and non-power sectors.

Subcontract 3: Strengthen sampling, analysis and monitoring capability for PCB analysis and evaluation

Scope of contracting services

The objective of this subcontract is to strengthen the laboratory capabilities to adopt internationally accepted procedures and specified equipment for the evaluation of PCB content in the targeted equipment and PCB contamination in relevant wastes.

Activities

The contractor of the subcontract shall undertake the following activities:

- Introduce to the technical staff international analytical methodologies for PCB identification and quantification
- Evaluate standard analytical equipment to purchase and equip the targeted laboratories.
- Set up training courses on PCB monitoring for the technical staff

Outputs

- New equipment items identified, purchased and installed
- Standard methodology adopted
- Technical staff properly trained

Qualifications:

The contractor of the subcontract must have experience or knowledge in:

- Internationally accredited methodologies for PCB analysis
- Setting up training course for POP analysis
- Laboratory equipment and installation
- Evaluation of PCB contamination and emissions

Subcontract 4: Undertake awareness raising on the adverse effect of PCBs

Scope of contracting services

The objective of this subcontract is to raise awareness on PCBs amongst public, media, government, NGOs and policy makers

Activities

The contractor of the subcontract shall undertake the following activities:

- Develop and dissimenate information on PCBs risks and risk mitigations
- Organize training programme/workshops for wide publicity of the information on adverse effect of PCBs

Output:

- Information material prepared
- Awareness raising workshops/training programme organized
- Public, media, government, NGOs and policy makers made aware about PCBs effects.

Qualification:

The contractor of this subcontract should have sufficient experience in:

- Developing awareness raising materials on POPs especially PCBs; and
- Organizing/conducting workshops/training programme for a large group of audience.

Subcontract 5: Demonstrate the sustainability of regional solution for the final treatment and disposal of PCB containing equipment, PCB contaminated oil and PCB contaminated waste coming from the maintenance, dismantling and de-chlorination activities of the targeted equipment

Scope of contracting services

The objective of this subcontract is to demonstrate the application of suitable methodologies for the final treatment and disposal of PCB contaminated waste produced in the disposal and maintenance activities of targeted equipment.

Activities

The contractor of the subcontract shall undertake the following activities:

- Develop guidelines/specifications on ESM of PCB contaminated waste arising from maintenance procedures
- Strengthen capacity to collect, package, transport, and/or store PCB contaminated wastes
- Evaluate soil contamination risks and recommend leakage treatment approaches for local solution
- Monitor, record and evaluate the implementation process and result

Outputs

- Specifications for environmentally sound collection, packaging, transportation and final disposal of targeted wastes.
- Improved personnel capacity for waste management and improved awareness
- Local solution identified and operating

Qualifications

The contractor of the subcontract

- Must have experience in drafting guidelines and/or rules,
- Must have experience with hazardous waste management,
- Experience of working with stakeholders in the sector of waste management would be preferred,
- Must have experience in the evaluation of contamination arising from storage facilities.

Subcontract 6: Demonstrate the application of environmentally sound methodologies for PCB containing equipment and wastes

Scope of contracting services

The objective of this subcontract is to demonstrate the application of suitable methodologies for the disposal of PCB oils.

Activities

The contractor of the subcontract shall undertake the following activities:

- Develop and introduce guidelines for environmentally sound disposal of PCB-containing equipment and wastes
- Procure, install and operate the ESM facility
- Train the relevant managerial and operation staff

Outputs

- Guidelines for environmentally sound disposal of PCB equipment and wastes
- PCB-containing oils treated and/or recycled,
- List of PCB containing materials disposed of
- Operation and pollutant release indicators of the demonstrated facilities meeting BAT achievable limits
- Treated waste meeting standards for safe disposal

Qualifications:

The contractor of the subcontract must have experience or knowledge in:

- engineering monitoring and supervision
- engineering cost auditing
- treatment and recycling of PCB contaminated oil, preferably gained in international projects
- standards and norms development relevant to engineering projects
- BAT/BEP related guidelines and guidance and the SC related information

ANNEX 9: ENVIRONMENTAL LABORATORIES IN INDIA

Environmental laboratories (Govt./Semi-Govt./Public Sector/Undertakings/Educational Institutes) with valid recognition (updated up to February, 2001) under Environment (Protection) Act, 1986 are as below:

S. No.	Name of laboratory	Gazette notification no. and date	Validity up to
1.	Central Laboratory National Fertilizers Limited Gohana Road, Panipat-132 106, Haryana	S.O. 631(E) dated 31st May, 1998	30 May 2003 (5 years)
2.	Environmental Engineering Laboratory Richardson & Cruddas (1972) Limited 68B, 69D, 69E, SIDCO Industrial Estate, Ambattur, Chennai-600 098	S.O. 631(E) dated 31st May, 1998	30 May 2003 (5 years)
3.	Environmental Science and Technology Study Centre Laboratory Bapuji Institute of Engineering & Technology Davangere-577 004, Karnataka	S.O. 631(E) dated 31st May, 1998	30 May 2003 (5 years)
4.	ITRC Laboratory Industrial Toxicology Research Centre Post Box No. 80, Mahatma Gandhi Marg Lucknow-226 001, U.P.	S.O. 631(E) dated 31st May, 1998	30 May 2003 (5 years)
5.	Central Pollution Control Board `Parivesh Bhavan' , CBD-cum-Office Complex East Arjun Nagar, Delhi-110 032	S.O. 631(E) dated 31st May, 1998	30 May 2003 (5 years)
6.	Central Laboratory, Maharashtra SPCB CIDCO Bhavan, 5th Floor South Wing, Belapur, C.B.D., Navi Mumbai-400 614	S.O. 336(E) dated 1st January, 1999	31December 2003 (5 years)
7.	Pollution Monitoring Laboratory Fisheries Research Station Gujarat Agriculture University Port Okha-361 350, Dist. Jamnagar , Gujarat	S.O. 336(E) dated 1st January, 1999	31December 2003 (5 years)
8.	Central Laboratory, M.P. SPCB Paryavaran Parisar E-5, Arera Colony Bhopal-462 016, M. P.	S.O. 336(E) dated 1st January, 1999	31 December 2003 (5 years)

9.	Regional Office Laboratory M. P. Pollution Control Board Plot No. 455/456 , Vijay Nagar Jabalpur-482 002, M. P.	S.O. 336(E) dated 1st January, 1999	31 December 2003 (5 years)
10.	Regional Laboratory, M.P. SPCB 490, State Bank Officer Colony Vinoba Nagar, Bilaspur-495 001, M. P.	S.O. 336(E) dated 1st January, 1999	31December 2003 (5 years)
11.	Environmental Laboratory Mathura Refinery Indian Oil Corporation Ltd. P.O. Mathura Refinery, Mathura-281 005, U. P.	S.O. 336(E) dated 1st January, 1999	31December 2003 (5 years)
12.	Central Laboratory, Orissa SPCB Paribesh Bhawan A/118, Nilkanthanagar, Unit-VIII Bhubaneswar-751 012, Orissa	S.O. 336(E) dated 1st January, 1999	31 December 2003 (5 years)
13.	Board Laboratory, Karnataka SPCB 7th Floor, Public Utility Building Mahatma Gandhi Road Bangalore-560 001, Karnataka	S.O. 336(E) dated 1st January, 1999	31December 2003 (5 years)
14.	Environmental Engineering Laboratory Metallurgical & Engineering Consultants (India) Limited P.O. Doranda, Ranchi-834 002, Bihar	S.O. 336(E) dated 1st January, 1999	31December 2003 (5 years)
15.	Environmental Laboratory Steel Authority of India Limited Research & Development Centre for Iron & Steel P.O. Doranda, Ranchi-834 002, Bihar	S.O. 336(E) dated 1st January, 1999	31 December 2003 (5 years)
16.	Smelter Laboratory National Aluminium Company Limited Nalconagar-759 145, Angul, Orissa	S.O. 336(E) dated 1st January, 1999	31 December 2003 (5 years)
17.	Quality Control and R & D Centre Laboratory National Aluminium Company Limited M & R Complex, Damanjodi-763 008 Distt. Koraput, Orissa	S.O. 336(E) dated 1st January, 1999	31 December 2003 (5 years)
18.	Zonal Laboratory of CPCB Zonal office – Kanpur, 117/51, Q-Block Sharda Nagar, Kanpur-208 025, U. P.	S.O. 336(E) dated 1st January, 1999	31December 2003 (5 years)

19.	Regional Referral Laboratory of CPCB Zonal office - Calcutta 247, Deshpran Seshmal Road CIT Building, 1st Floor Calcutta-700 033, West Bengal	S.O. 336(E) dated 1st January, 1999	31December 2003 (5 years)
20.	Air and Water Pollution Control Laboratory Marathwada Institute of Technology P.B. No. 327 Aurangabad-431 005 Maharashtra	S.O. 336(E) dated 1st January, 1999	31December 2003 (5 years)
21.	Environmental Quality Offsite & Utilities Lab Indian Petrochemicals Corporation Limited Maharashtra Gas Cracker Complex Division Nagothane-402 125, Tal: Roha Dist. Raigad, Maharashtra	S.O. 336(E) dated 1st January, 1999	31December 2003 (5 years)
22.	Chemical Laboratory, Gujarat Refinery Indian Oil Corporation Ltd. P. O. Jawaharnagar Distt. Vadodara-391 320, Gujarat	S.O. 44(E) dated 1st August, 2000	31July 2005 (5 years)
23.	Public Health Engineering Laboratory Vadodara Municipal Corporation Public Health Engineering Laboratory Kadak Bazar , Sayajigunj, Vadodara-390 005	S.O. 44(E) dated 1st August, 2000	31July 2005 (5 years)
24.	Environmental Radiological Laboratory Health Physics Division Bhabha Atomic Research Centre Health Physics Division KAPP P.O. Anumala Dist. Surat-394 651, Gujarat	S.O. 44(E) dated 1st August, 2000	31 July 2005 (5 years)
25.	Zonal office - Laboratory of CPCB Zonal office – Vadodara, Choksi Premises Priya Laxmi Mill Road, Vadodara-390 003	S.O. 44(E) dated 1st August, 2000	31 July 2005 (5 years)
26.	Zonal office – Laboratory of CPCB Zonal office - Bangalore First Floor, 6, West of Chord Road II stage, Rajaji Nagar, Bangalore-560 086	S.O. 44(E) dated 1st August, 2000	31 July 2005 (5 years)
27.	Pollution Control Analytical Laboratory National Productivity Council Utpadakta Bhawan Lodhi Road, New Delhi-110 003	S.O. 44(E) dated 1st August, 2000	31 July 2005 (5 years)
28.	Central Laboratory of Kerala SPCB Gandhi Nagar, Cochin-682 020, Kerala	S.O. 44(E) dated 1st August, 2000	31 July 2005 (5 years)
29.	Regional Laboratory of Gujarat SPCB Gare Compound Race Course Road, Vadodara	S.O. 44(E) dated 1st August, 2000	31July 2005 (5 years)

30.	Regional Laboratory of Gujarat SPCB 338, Belgium Square Typical 1st Floor, Sliver Plaza Complex Opp. Linen Bus Stand, Ring Road, Surat	S.O. 44(E) dated 1st August, 2000	31 July 2005 (5 years)
31.	Regional Laboratory of Gujarat SPCB Race Course Ringh Road Near Hotel Durkush , Rajkot	S.O. 44(E) dated 1st August, 2000	31 July 2005 (5 years)
32.	Quality Control Laboratory Panipat Refinery, Indian Oil Corporation Limited P.O. Panipat Refinery Distt. Panipat-132 140 Haryana	S.O. 44(E) dated 1st August, 2000	31 July 2005 (5 years)
33.	Environmental Monitoring Laboratory Bhilai Steel Plant, Steel Authority of India Limited Bhilai-490 001, Distt. Durg, M.P.	S.O. 44(E) dated 1st August, 2000	31July 2005 (5 years)
34.	Environmental Laboratory Environmental Engineering Department, Rourkela Steel Plant Steel Authority of India Limited Rourkela-769 011, Orissa	S.O. 44(E) dated 1st August, 2000	31July 2005 (5 years)
35.	Laboratory of Himachal Pradesh SPCB S.C.F.-6-8, Sector-4, Parwanoo-173 220	S.O. 44(E) dated 1st August, 2000	31July 2005 (5 years)
36.	Research & Development Department Hindustan Copper Limited Khetri Copper Complex P.O. Khetri Nagar-333 504 Distt. Jhunjhunu	S.O. 44(E) dated 1st August, 2000	31 July 2005 (5 years)
37.	Process and Products Control Laboratory LPG/CSU Plant Oil and Natural Gas Corporation Limited Mumbai Regional Business Centre Uran-400 702, Maharashtra	S.O. 44(E) dated 1st August, 2000	31July 2005 (5 years)
38.	Chemical Laboratory Ore Dressing Division, Indian Bureau of Mines Plot No. L-8, MIDC, Hingna Road Nagpur- 440 016, Maharashtra	S.O. 44(E) dated 1st August, 2000	31July 2005 (5 years)
39.	Environmental Laboratory Central Mine Planning & Design Institute Limited Gondwana Place, Kanke Road Ranchi- 834 008, Bihar	S.O. 44(E) dated 1st August, 2000	31July 2005 (5 years)

40.	Hindustan Organic Chemicals Ltd. Laboratory Hindustan Organic Chemicals Limited Rasayani, Distt. Raigad-410 207, Maharashtra	S.O. 44(E) dated 1st August, 2000	31July 2005 (5 years)
41.	Chemical Laboratory Public Works Department Surface Ground and Surface Water Resources Data Centre, Hydrology Division PAP Campus, Pollachi-642 003, Tamil Nadu	Approved in 118th Board meeting and under notification	5 years from notification date
42.	Geochemical Laboratory Public Works Department Surface Ground and Surface Water Resources Data Centre, Ground Water Division Chennai-600 010 , Tamil Nadu	Approved in 118th Board meeting and under notification	5 years from notification date
43.	Geochemical Laboratory Public Works Department Hydrology Division Surface Ground and Surface Water Resources Data Centre Circuit House Road, Mannapuram Trichy-620 020, Tamil Nadu	Approved in 118th Board meeting and under notification	5 years from notification date
44.	Geochemical Laboratory Public Works Department Ground Water Division Surface Ground and Surface Water Resources Data Centre PWD Compound, Tallakulam Madurai-625 002, Tamil Nadu	Approved in 118th Board meeting and under notification	5 years from notification date

Annex 10: Assessment of Model

1. The overall objective of the project is to reduce and eliminate the use and releases of PCBs to the environment through promoting measures to minimize exposures and risks by introducing environmentally sound management and disposal of PCBs, PCB-containing equipment and PCB-containing mineral oils aiming at the final and virtual disposal of all PCBs inventory in India by 2025 and 2028, respectively

2. The immediate objectives of the project are to:

   - Strengthen the legal and regulatory framework for environmentally sound management (ESM) and disposal of PCBs waste
   - Improve institutional capacity at all levels of PCBs waste disposal management
   - Removal of 7,700 tones of PCBs wastes from targeted sites and transport them to disposal unit
   - Disposal of 7,700 tones PCB wastes in an environmentally sound manner

3. The major users of PCBs are power generation units and state electricity boards. There are at least 95 state electricity boards, transmission and distribution companies as well as at least 123 private sector utilities, power generating companies and independent power producers. These users do not store transformer oil. They have contracted service and maintenance of transformers and capacitors to local parties. Hence, they do not have PCBs storage facilities. Users of capacitors are large units who are not into the manufacturing of capacitors. Therefore, such units do not have stocks of PCBs in their premises. Further, PCB-containing oils that need to be replaced from time to time are collected by local agents. These local agents in turn sell these to oil reprocessing units wherein the moisture content only is removed. It is then repacked and sold in the market. The electricity companies auction the old and defunct transformers. Agents then buy these transformers and use these for reprocessing activities.

4. The project will mainly address electrical equipment, particularly PCB-containing transformers. After evaluating several options and in consultation with Central Power Research Institute (CPRI), UNIDO proposes to introduce a dechlorination system for the decontamination of PCB contaminated mineral oil and the destruction of pure PCB liquids in the project. This would be an innovative mobile processing system for the dechlorination and reclamation of the contaminated dielectric fluids. Dechlorination of PCB-containing mineral oil is a standard practice in use in the USA, Canada, Europe and other countries.

5. The disposal of 7,700 metric tons of PCB wastes, particularly PCB-containing transformers represents only a fraction of the total PCB inventory in India. In addition to the PCB-containing transformers, it is expected that other PCB-containing equipment and materials will also become available for disposal in the proposed facilities.

6. In order to address this increasing volume and variability of PCB wastes to be disposed in the proposed facilities, the operating entities of these facilities will require to upgrade their original facilities to properly handle the additional demand and ensure India has the ability to properly handle all PCB wastes and meet the objectives of the Stockholm Convention.

7. The geographic and industrial distribution characteristics of India represent a significant challenge for the proper selection of the sites for the proposed facilities. Therefore, the selection of the disposal facilities will be based on the updated PCB inventory that would not only include transformers but also other electrical equipment containing PCBs and on the assessment of the total power consumption, the total number of electrical installations and the level of electrical infrastructure of the states Three disposal facilities are proposed to be set

up, one in each of the selected 3 regions, preferably located centrally in the regions. At the planning stage of setting up 3 disposal facilities at least the following technical, economic and financial aspects pertaining to the establishment and operation of these facilities will be assessed:

- business model for various technology options, including operation modalities such as formation of consortia;
- services provided, including removal, packaging, transport and storage of PCBs;
- responsibilities of various partners in operating the facilities;
- investment strategies of private sector technology providers;
- use of GEF funds;
- private sector engagement;
- analysis of cost-effectiveness and sustainability of disposal facilities; and
- end of project scenario

8. The different options to be received from technology vendors and operating entities will be assessed in their proposed technical solutions and their business approach. The knowledge of the market segment and the need to offer economical alternatives for the disposal of PCB wastes to be available or generated in the given region would be of significant importance.

9. It is expected that the operating entity shall identify the site for the destruction facility within its establishments. The operating entity, being the facility operator, and initially using its own database, will directly negotiate with the generators/ owners of PCBs in order to dispose the PCB-containing equipment in an environmentally sound manner. This requires the operating entity to be familiar with industrial and service sector covering the territory of its PCB business offering.

10. The proper management of PCBs requires not only the existence of proper disposal solutions in the country, but also the establishment of proper storage, transportation and handling facilities to ensure the protection of the environment. In addition, procedures are not effective if the personnel operating these facilities are not properly trained to operate and to protect themselves and the environment. Therefore, the assessment of the proposed solution will consist of a comprehensive package solution to include not only the PCB treatment technology, but also additional services such as handling, packaging and transportation and assess the experience and track record of Technology Vendors and proposed operating entities.

11. The Operating entities would also be able to hire the support services such as handling at clients' sites, packaging, labeling and transportation of PCB wastes from service providers duly accredited with CPRI. In the selection of the mode of offering these additional services (within the operating entity or purchase of service from external companies) necessary to provide a comprehensive environmentally sound PCB service, the operating company would have the ability to select the most economically effective and acceptable option.

12. The size of the potential PCB market in India represents a significant business opportunity for private sector involvement. Therefore, it is reasonable to expect that the seed money contributed by GEF funds to establish PCB disposal facilities in the country will be complemented with private capital to expand the business offering and have comprehensive PCB disposal facilities to meet the need of the country and compliance with the Stockholm Convention. The assessment of the proposed solution will consider details on future investment and expansion strategies included in the proposals.

13. Although during the demonstration phase of the project CPRI will coordinate the signing of service agreement for the use of the facilities by PCB owners that have committed to the disposal of PCBs in the proposed facilities at a pre-determined price, the operating entities will be able to adjust their prices once the demonstration phase is completed and the

commercial operation system is initiated. It is expected however that operating entities will maintain a price structure that provides an incentive to PCB owners to disposed their wastes in the proposed facilities.

14. A proper operating cost structure that ensures an on-going economical alternative for the disposal of PCB wastes in the proposed facilities is essential for sustainability of the project. The proper cost structure will guarantee the business objective of the operating entity and provide PCB owners with an economically attractive package for the proper disposal of their PCB wastes. Therefore, an essential characteristic of the proposed facilities is a cost structure that will continue to provide PCB disposal options to PCB owners in India at a much lower rate than that being offered for exporting the waste to European incinerators. The assessment of the proposed solutions will include estimated operating cost and guarantee of a pricing structure that would appeal to PCB owners.

15. The ultimate success of this project would not only be measured by the ability to implement and achieve the disposal of the 7,700 metric tons of PCB wastes in India within the proposed time frame and budget, but also by its sustainability beyond the project's duration. An essential measure of the success of GEF's involvement in assisting the establishment of environmentally sound PCB disposal facilities is the ability of these facilities to maintain the business offering and to ensure that the country can meet the obligations under the Stockholm Convention. India, with potentially a much larger PCB inventory than that to be disposed under this project, represents a unique