REQUEST FOR CEO APPROVAL

PROJECT TYPE: Full-sized Project
TYPE OF TRUST FUND:GEF Trust Fund

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PART I: PROJECT INFORMATION

Project Title: Environmentally Sound Management and Final Disposal of Polychlorinated Biphenyls (PCBs)			
Country(ies):	Ukraine	GEF Project ID:[1]	4386
GEF Agency(ies):	UNIDO (select) (select)	GEF Agency Project ID:	140124
Other Executing Partner(s):	Ministry of Ecology and Natural Resources	Submission Date:	07-17-2014
GEF Focal Area (s):	Persistent Organic Pollutants	Project Duration(Months)	48
Name of Parent Program (if applicable): ➢ For SFM/REDD+ ☐ ➢ For SGP ☐ ➢ For PPP ☐		Project Agency Fee ($):	525,000

A. FOCAL AREA STRATEGY FRAMEWORK[2]

Focal Area Objectives	Expected FA Outcomes	Expected FA Outputs	Trust Fund	Grant Amount ($)	Cofinancing ($)
CHEM-1	Outcome 1.4: POPs waste prevented, managed and disposed of and POPs contaminated sites managed in an environmentally sound manner	Output 1.4.1: PCB management plans under development and implementation	GEF TF	5,250,000	21,000,000
			(select)		
(select) (select)			(select)		
(select) (select)			(select)		
(select) (select)			(select)		
(select) (select)			(select)		
(select) (select)			(select)		
(select) (select)			(select)		
		Total project costs		5,250,000	21,000,000

[1] Project ID number will be assigned by GEFSEC.
[2] Refer to the Focal Area Results Framework and LDCF/SCCF Framework when completing Table A.

B. PROJECT FRAMEWORK

Project Objective: The proposed project will establish an environmentally sound management (ESM) system for PCBs, improve compliance to PCBs related obligations under the Stockholm Convention (SC) and promote local use of non-combustion technologies in the disposal of 3,000 tons of PCBs contaminated equipment.						
Project Component	**Grant Type**	**Expected Outcomes**	**Expected Outputs**	**Trust Fund**	**Grant Amount ($)**	**Confirmed Cofinancing ($)**
1. Institutional, regulatory and human capacity building for PCB management	TA	Strengthening of legal framework and institutional capacities for efficient PCB management and disposal	1.1 PCB-related legislation including technical guidelines updated and in place 1.2 Staff of government agencies, customs, NGOs and PCB owners trained to implement the regulation; 1.3 Methods for PCBs analysis adopted and 3-4 laboratories accredited for PCB analysis; 1.4 ESM system for the use and disposal of PCBs including related occupational safety measures implemented and published in a guideline; 1.5 Operating procedures and trainings for enforcement authorities to carry out inspections related to the ESM system standardized; 1.6 Emergency response measures developed and in place for transformer fires and leakages	GEF TF	300,000	1,000,000
2. Defining priority measures based on reliable in-depth inventory and national management plan for PCBs	TA	Establishment of in-depth inventory of the major owners of contaminated equipment and development of the national management plan for PCB disposal	2.1 At least 10,000 PCB analysis conducted and organized in a database as an instrument for environment control authorities to plan PCB phase out and disposal; 2.2 Inspected	GEF TF	1,400,000	5,800,000

			equipment labelled and prioritized for decontamination or disposal; 2.3 Current management practices for electrical equipment identified and documented; 2.4 PCBs phase out and disposal plans developed; 2.5 Potentially contaminated sites identified and recorded			
3. Environmentally sound management system (ESM) and disposal of PCBs including technology transfer and implementation	TA	Demonstration of ESM and disposal of PCBs by decontamination and extension of life cycle of some operational equipment, recycling of mineral oil and secondary metals to enable elimination of PCB releases into the environment	3.1 Demonstration technologies selected and procured for the decontamination of PCB-contaminated oil; 3.2 BAT technologies for pre-treatment of PCB-containing wastes selected; 3.3 Technology options for the disposal of high concentration PCBs oils and other PCB wastes selected and implemented; 3.4 3,000 tons of PCBs oil, PCB-containing equipment and wastes disposed of; 3.5 Training and awareness raising for relevant stakeholders and PCB owners on ESM system and occupational safety undertaken at country level	GEF TF	3,000,000	12,700,000
4. Impact monitoring and evaluation	TA	Adherence to project document and attainment of project objective	4.1 Baseline indicators verified; 4.2 Project impact monitoring system, evaluation of the achieved results and introduction of corrections if required; 4.3 Dissemination of	GEF TF	300,000	500,000

			project related information and results to local stakeholders			
				Subtotal	5,000,000	20,000,000
				Project management Cost (PMC)[3]	GEF TF 250,000	1,000,000
				Total project costs	5,250,000	21,000,000

C. SOURCES OF CONFIRMED COFINANCING FOR THE PROJECT BY SOURCE AND BY NAME ($)

Sources of Co-financing	Name of Co-financier (source)	Type of Cofinancing	Cofinancing Amount ($)
National Government	Ministry of Ecology and Natural Resources	Cash	11,100,000[4]
Privte Sector	"Tarkom Ekoservis" LLC	Cash	4,250,000
Privte Sector	Metinvest Holding	Cash	125,000
Privte Sector	Metinvest Holding	In-kind	200,000
Privte Sector	DTEK Holding	Cash	5,125,000
Privte Sector	DTEK Holding	In-kind	100,000
Other Multilateral Agency (ies)	UNIDO	Cash	50,000
Other Multilateral Agency (ies)	UNIDO	In-kind	50,000
Total Co-financing			21,000,000

D. TRUST FUND RESOURCES REQUESTED BY AGENCY, FOCAL AREA AND COUNTRY[1]

GEF Agency	Type of Trust Fund	Focal Area	Country Name/ Global	(in $)		
				Grant Amount (a)	Agency Fee (b)[2]	Total c=a+b
Total Grant Resources						

[1] In case of a single focal area, single country, single GEF Agency project, and single trust fund project, no need to provide information for this table. PMC amount from Table B should be included proportionately to the focal area amount in this table.

[2] Indicate fees related to this project.

F. CONSULTANTS WORKING FOR TECHNICAL ASSISTANCE COMPONENTS:

Component	Grant Amount ($)	Cofinancing ($)	Project Total ($)
International Consultants	532,000	500,000	1,032,000
National/Local Consultants	1,003,000	4,050,000	5,053,000

G. DOES THE PROJECT INCLUDE A "NON-GRANT" INSTRUMENT? (Select)

(If non-grant instruments are used, provide in Annex D an indicative calendar of expected reflows to your Agency and to the GEF/LDCF/SCCF/NPIF Trust Fund).

[3] PMC should be charged proportionately to focal areas based on focal area project grant amount in Table D below.

[4] The co-financing letter of Ministry of Ecology and Natural Resources indicates 28 million US$. 11.1 million US$ will be used for the GEF project implementation, while the remaining 16.9 million US$ will be allocated to a Public and Private Partnership project to dispose of high concentration PCB wastes outside of the GEF project.

PART II: PROJECT JUSTIFICATION

A. DESCRIBE ANY CHANGES IN ALIGNMENT WITH THE PROJECT DESIGN OF THE ORIGINAL PIF[5]

1. The PIF foresaw the establishment of one technical team to support project implementation. Because different project components require diverse expertise, based on the recommendation of the project preparation team three technical teams will be formed, one will work on legislative measures, standards and trainings, the other will be responsible to support the inventory process, while the third will facilitate the implementation of the ESM system and PCB disposal operations. This is represented in the project management section of the project document.
2. The composition of technical partners changed during the process of negotiating their participation in the project. The priority was given to those companies, which were trend to apply BAT/BEPs for PCB disposal and were ready to contribute in the activities of the project. There are several hazardous waste management enterprises in Ukraine, however these companies either landfill hazardous waste (HW) or export it abroad for incineration. A good example is Tarkom LLC, which avoids landfilling the contaminated wastes and invested recently in establishing a modern incineration facility. It is expected to start its operation in May 2014. The achievements of other selected technical partners are given in the relevant annexes to this project.

A.1 National strategies and plans or reports and assessments under relevant conventions, if applicable, i.e. N NBSAPs, national communications, TNAs, NCSA, NIPs, PRSPs, NPFE, Biennial Update Reports, etc.

3. During the time that had passed since the submission of PIF to the GEF a number of legal measures were adopted to solve the PCB-related problems, such as the budgetary needs of the implementation of the NIP were approved and the harmonization of the local legislation with the SC and EU was initiated.
4. Cabinet of Ministers approved the National Implementation Plan (NIP) for the Stockholm Convention (SC) with the order № 589-p of 25.07.2012. The PCB action plan of the NIP includes detailed measures the government intends to undertake to solve the PCB problem. According to this plan the government will allocate approximately 28,000,000 USD to PCB management, which is presented in Annex I. The part of this allocation (US$11,100,000) is to be provided as co-financing of this GEF project and the remaining (US$ 16,900,000) will be used to scale up the disposal of the high concentration PCBs in a Public and Private Partnership project.
5. The project design is consistent with these measures and this amount, which is reflected in the co-financing letter of Ministry of Ecology and Natural Resources (MENR). All project components and outputs defined in the PIF and now in the project document have corresponding Co-financing in the NIP.
6. In parallel with the approval of the NIP by the Cabinet of Ministers, the Government decided to postpone its submission to the Secretariat of the Stockholm Convention until it was undated with "new" POPs. The activities for updating were initiated. In particular, the Ministry of Ecology applied to UNIDO for assistance to develop a similar GEF project.
7. Ukraine is also a party to Basel Convention on the Control of Trans boundary Movement of Hazardous Waste and their Disposal, hence the proposed project is consistent and in line with global environmental policies and political commitments of the country.
8. Environment and safety standards in PCB management are managed by "technical regulations" in Ukraine. Currently within the framework of EU-funded Technical Assistance Project "Complementary Support

[5] For questions A.1 –A.7 in Part II, if there are no changes since PIF and if not specifically requested in the review sheet at PIF stage, then no need to respond, please enter "NA" after the respective question.

to the Ministry of Ecology and Natural Resources of Ukraine for the Sector Budget Support Implementation" several dozens of technical regulations are developed, which are analogues of the relevant EU Directives (for example, Directive on the incineration of waste). In this context technical regulations for Ukraine will be developed on basis of the Directive 96/59/EC on the disposal of polychlorinated biphenyls and polychlorinated terphenyls (PCB/PCT), including other PCB-related Directives and standards. The project is in line with this initiative.

A.2. GEF focal area and/or fund(s) strategies, eligibility criteria and priorities.

9. The proposed project is consistent with GEF-5 Chemicals FA Objective CHEM-1: "Phase out POPs and reduce POPs releases", Outcome 1.4 "POPs waste prevented, managed, and disposed of and POPs contaminated sites managed in an environmentally sound manner", Output 1.4.1 "PCB management plans under development and implementation". The project is facilitating government and private sector efforts in making inventories of potentially PCB-containing equipment, undertaking environmentally sound management of PCB positive equipment, development of PCB phase-out plans and disposing of PCBs in an economic and environmentally sound manner. The project has outputs that directly address prevention of new PCB cross-contaminations and promoting private sector investments in establishing/upgrading technologies for the disposal of PCB related wastes. The project therefore is strongly in line with GEF 5 chemical strategy.

A.3 The GEF Agency's comparative advantage.

10. UNIDO is within the comparative advantage matrix set out in GEF/C.31/5 rev.1. The Agency has extensively carried out projects in the POPs focal area of GEF. UNIDO has implemented many GEF projects in the field of PCB management including regulatory reforms, PCB inventories, development and implementation of environmentally sound management practices for PCBs, PCB phase-out and disposal. UNIDO has built a solid portfolio in the area of PCB management comprising about 35% of current post-NIP projects. These include successful implementation of PCB projects in Armenia, Romania and Azerbaijan. It also has ongoing PCB projects in Macedonia, Mongolia, Philippines, Peru, India, Nepal, Morocco, Laos and Russia.

11. In general, UNIDO's PCB management and disposal projects aim to create fundamental capacities within governments, institutions and PCB owners to comply with the PCB-related obligations under the Stockholm Convention on POPs. These projects enhance the regulatory and legislative infrastructures and strengthen institutions at national and local levels to assure that the management of PCB-containing equipment and waste is undertaken in an environmentally sound manner.

12. UNIDO has vast experience in building capacities in local laboratories to efficiently support PCB inventory exercises, transfer of technologies for handling PCB-containing equipment with special emphasis on economic feasibility. UNIDO has provided trainings for national counterparts to undertake inspections at PCB owners, thus assuring compliance to the PCB-related legislations. Environmentally sound PCB management practices have always been part of these projects with the aim of reducing risks of PCB releases into the environment and exposure to humans and biota. Raising targeted public awareness and dissemination of information is always a major component of all UNIDO PCBs projects. The tools and methodologies developed joinlty with the national stakeholders in earlier UNIDO projects culminated into readily available knowledge that can easily be adapted to the needs of future projects, stakeholders or industries. This knowledge is one of UNIDO's major comparative advatages.

13. The project will be implemented by UNIDO. UNIDO has built solid reputation as a competent and knowledgeable interonational agency working in the field of environmental protection, as well as with industrial enterprises which own or dispose of hazardous wastes. UNIDO focuses on the provisions of the SC that are directly related to the industrial development sector and provides technical assistance based on environmentally sustainable approaches including POPs, pollution reduction/elimination, industrial process changes, modified or substitute materials and products, BAT/BEP and ESM of POPs.

14. UNIDO has a solid background for successful project implementation even in times when political imbalances can be felt in the region. This background and experience will be used in the efficient implementation of this project.

15. UNIDO is represented in the country with the National Cleaner Production Center, which has good contacts with local industries and, in particular, with the local industrial NGOs. Their capacity will be used in the awareness raising campaign. Further involvement of the NCPC in the project execution will be considered in the inception phase of the project.

A.4. The baseline project and the problem that it seeks to address:

A.4.1 Baseline scenario:

a: Overview

16. According to the Law of Ukraine "On Ratification of the Stockholm Convention on Persistent Organic Pollutants" (Verkhovna Rada/Parliament of Ukraine, the Law of 18.04.2007 № 949-V) Ukraine has acquired status of the Party of the Stockholm Convention on December 25, 2007. In accordance with Article 7 of the Convention, the National Implementation Plan for the Stockholm Convention was developed in 2009 and is at the stage of transmission to the Conference of the Parties. In explanatory note to the National Implementation Plan (NIP) a national strategy, policy, objectives and priorities for the implementation of the Stockholm Convention on POPs are identified. In 2012 the Action Plan for the Stockholm Convention (APSC) was approved by the Order of the Cabinet of Ministers of 25.07.2012 № 589-r in Ukraine. APSC legislatively approved sources and amounts of financing to address the problem of POPs, and PCB in particular.

17. The Government understands the need to develop practical measures for implementing the above action plan to address the PCB issues and strengthen the capacity of authorities and stakeholders for handling PCBs at all of their life cycle stages. The project "Environmentally Sound Management and Final Disposal of Polychlorinated Biphenyls (PCBs)" aims to assist the Government in making these measures maximum effective.

b: Barriers and gap analysis

18. The following table presents the barrier and gap analysis of the project:

Interventions	**Barriers / Gap analysis**
Outcome 1: Strengthening of legal framework and institutional capacities for efficient PCB management and disposal	Ukrainian legislation on PCBs needs review for compliance with the SC. Analytical backup for enforcement duties needs upgrading.
Output 1.1: PCB-related legislation including technical	Legal measures related to chemicals management miss PCBs and PCB-containing

Interventions	Barriers / Gap analysis
guidelines updated and in place	equipment. Adoption of SC and EU standards for PCB management is pending.
Output 1.2: Staff of government agencies, customs, NGOs and PCB owners trained to implement the regulation	The information and knowledge of government staff, particularly inspectors at the local levels on PCB- related enforcement requirements is scarce. Project staff is not trained on sampling of oil containing equipment and they are not aware of human health and environmental exposure risks, particularly their mitigation and emergency response.
Output 1.3: Methods for PCBs analysis adopted and 3-4 laboratories accredited for PCB analysis	Current laboratory capacity is not enough to handle 10,000 PCB samples. Accreditation for PCB analysis is also missing, thus inspections do not have a scientific background.
Output 1.4: ESM system for the use and disposal of PCBs including related occupational safety measures implemented and published in a guideline	PCB owners generally believe that their mineral oil containing electrical equipment is free of PCBs. Therefore analyses for PCBs are not taken when the equipment is in service. They do not have separate procedures for working with PCB positive and PCB free equipment. Current transformer management practices allow for further cross-contamination of PCB free equipment.
Output 1.5: Operating procedures and trainings for enforcement authorities to carry out inspections related to the ESM system standardized	Site inspection procedures for enforcement authorities are compiled with the order No483 dated 2.10.2012 of MENR. This order contains the checklist of site inspection and forms for reporting. This order is missing inspection procedures for PCB-containing equipment and wastes.
Output 1.6: Emergency response measures developed and in place for transformer fires and leakages at the State Agency for Emergency Situations	Fire brigades do not have appropriate emergency measures for transformer fires, particularly for those that contain PCBs.
Outcome 2: Establishment of in-depth inventory of the major owners of contaminated equipment and development of the national management plan for PCB disposal	A large and countrywide sampling and analysis of PCBs has never been undertaken. Existing PCB inventories are mainly based on questionnaires and small scale analysis.
Output 2.1: At least 10,000 PCB analysis conducted and organized in a database as an instrument for PCB phase out and disposal planning	There is no accurate information within the Government on PCB amounts in Ukraine.

Interventions	Barriers / Gap analysis
Output 2.2: Inspected equipment labeled and prioritized for decontamination or disposal	Transformers and other oil containing equipment that may contain PCBs are not labeled.
Output 2.3: Current management practices for electrical equipment identified and documented	Currently PCB-owners pay little or no attention to a possibility that their transformers might be contaminated with PCBs. They do not test transformer oil for PCBs during service, thus the likelihood of PCB contamination and cross-contamination of transformer oil is present. This activity would record such practices and would recommend alternative transformer maintenance options with the view to immediately stop the risk of further cross-contamination.
Output 2.4: PCBs phase out and disposal plans developed	Since transformers are critical devices for the constant supply of electricity, in most cases their immediate replacement cannot be undertaken. Owners of such devices need to plan for maintenance, phase-out and replacement. Especially when transformers supply key industries that need to operate 24/7. Project will develop criteria to prioritize what transformers could be disconnected and replaced on short notice to the users and what users need to be involved in planning the schedule for disconnection.
Output 2.5: Potentially contaminated sites identified and recorded	Potentially PCBs contaminated sites have not yet been inventoried. Because the contaminated hotspots are not known, PCB releases from these sites may expose local communities, humans, women and children. Immense, long-term and unnoticed exposure to PCBs may have significant socioeconomic impacts particularly on women and children.
Outcome 3: Demonstration of ESM and disposal of PCBs by decontamination and extension of life cycle of some operational equipment, recycling of mineral oil and secondary metals to enable reduction / elimination of PCB releases into the environment	Ukraine is lacking appropriate hazardous waste disposal facilities. Consequently the disposal of PCBs cannot be solved on the local level. Export disposal operations are costly, which hinders enterprises phasing out of PCB-containing equipment. In 2014 Tarkom Ekoservis LLC will open a new HW incinerator. The throughput of this facility will be low for the high amount of PCBs in the country. PCB contaminated material is currently not treated in compliance with SC BAT/BEP.
Output 3.1: Demonstration technologies selected and procured for the decontamination of PCB-contaminated oil	The only available safe disposal option currently is export of PCB containing wastes to a qualified incineration company abroad. This option is not completely environment safe because the valuable transformer oil, as a rule, is burnt, thus increasing CO2 emissions. This method is expensive and cannot be used by many companies. There is no experience (pilot/demonstration decontamination unit) to show the possibility of local safe and economic disposal.

Interventions	Barriers / Gap analysis
Output 3.2: BAT technologies for pre-treatment of PCB-containing wastes selected	Currently PCB-contaminated wastes are sent for incineration abroad. The cost of incineration depends on the weight of the waste sent to the incinerator. With this practices PCB owners pay 6-8 USD/kg for the metal parts of transformers and other PCB-contaminated wastes, while these waste streams can be recovered after the incineration and sold.
Output 3.3: Technology options for the disposal of high concentration PCBs oils and other PCB wastes selected and implemented	Hazardous Waste management in Ukraine is currently building up. Understanding the need for local technologies for treating HW Tarkom LLC has recently invested in establishing an incineration facility. It is expected to start its operation in May 2014.
Output 3.4: 3,000 tons of PCBs oil, PCB-containing equipment and wastes disposed of	Safe disposal of PCB-contaminated equipment is a rare initiative of the private sector rather than a regular business due to lack of local technologies. The price of PCB disposal is high due to international transport and incineration costs.
Output 3.5: Training and awareness raising for relevant stakeholders and PCB owners on ESM system and occupational safety undertaken at country level	Currently information of potential project stakeholders and PCB owners on the Best Environmental Practices (BEP) concerning PCBs and potentially PCB-containing equipment is scarce.

c: Details of baseline scenario

19. PCBs have never been synthesized and PCB-containing equipment has not been manufactured in Ukraine. The synthetic PCBs, transformers, capacitors and other equipment in and outside the power sector were produced in Ukraine, Russia, Kazakhstan and Armenia or imported from Poland or Czechoslovakia.

20. Currently Ukraine has the outdated and ineffective regulatory and legal framework for hazardous waste and chemicals handling, including PCB. However, there is a number of documents related to environmental protection, industrial safety and work safety, as well as organizational and executive documents related to these issues. These legal measures are however not fully in line with the Stockholm Convention or do not allow the smooth integration of applicable SC measure into the current legislative infrastructure. Regulatory and legal framework is characterized by the following features.

21. Regulation is mainly carried out in three mutually subordinate and partially intersecting levels:

    -legislative acts;

    -regulatory and legal documents related to regulation of liability and interaction of state and regional governing bodies;

    -technical and standard documents that define specific requirements, limit parameters and other measures of technical and environmental nature.

22. Most of the primary legislative acts are from the 1990's, while the majority of the regulatory and technical documents were adopted in 1970-1980's. Difference in time of adoption of these documents shows that is a

significant delay in the development of technical legislations related to PCB, PCB-containing materials and waste.

23. It is difficult to determine the way of enforcement because the legal measures have many times been modified, amended, governmental bodies were renamed, obligations a responsibilities were re-allocated, thus private sector stakeholders have difficulty in understanding and complying to these obligations.

24. There is a conflict of interest and distinction of liability of governing bodies to implement any new or amendment measures at their technical levels because of the repeated transformations of the governing bodies and re-distribution of their functions. These changes in recent years have seriously made impacts on the ministries and agencies dealing with ecology and natural resources.

25. In process of preparation for the signing and ratification of the Stockholm Convention on POPs in Ukraine several scientific and technical centers have been formed.

26. In the area of impacts of POPs on human health and the environment the Institute of Ecological Hygiene and Toxicology, Ministry of Health of Ukraine plays the key role. The Institute participated in almost all complexes scientific and research programs concerning POPs. During development of NIP the "Guidelines for safety of treatment of objects containing polychlorinated biphenyls (PCBs)" have been developed in this Institute.

27. In the area of scientific and technical support to introduce BAT/BEP for handling POPs the key position is held by the Gas Institute of National Academy of Sciences of Ukraine. The Institute developed guidelines on the application of BAT/BEP for reduction of POPs releases by entities of steel and energy sectors. Scientific and technical aspects the use of steam-plasma medium and molten salts of alkali metals for disposal of toxic organochlorine compounds, including PCBs, have also been developed. Specialists of the Institute participated in the development of NIP and preliminary inventory of PCBs.

28. In the area of scientific and technical support to monitoring of environmental impacts of POPs the Institute of Environmental Geochemistry has the key position. The Institute has a dual subordination to the National Academy of Sciences of Ukraine and the State Service of Ukraine for Emergency Situations. Specialists of the Institute are part of leading scientific and technical panel in field of analytical control "Chromatographic Society of Ukraine" have practical experience in the assessment of POPs content of environmental matrices. They have been involved in the export disposal of hexachlorobenzene waste which was found in the landfill close to Kalush.

29. In many complex projects, research and development in the area of POPs and chemicals, coordinating functions are with the State Ecological Academy (SEA) of Ministry of Ecology and Natural Resources. In addition, the Academy has the relevant infrastructure to conduct information and awareness activities and experience in environmental education for professionals from different sectors of industry. The Academy hosts a Technical Committee of Standardization "Environmental Protection of Ukraine" (TC 82), which has a subcommittee SC 4 "Management of waste, its disposal and recycling". The project will involve SEA in training employees of governmental agencies and owners of PCBs.

30. There are a number of active NGOs in the field of waste management such as Resource and Analysis Center "Society and Environment", All-Ukrainian Charitable Fund "Ecological Ukraine", NGO "Center for Environmental Research and Development", Ukrainian Association of Entreprises of Ferrous Metallurgy "UkrMet", etc.

31. Ukrainian Association of Entreprises of Ferrous Metallurgy "UkrMet" is an important industrial association and source of business and environmental related information for their members. These NGOs have long-life cooperation and strong influence on the industrial sectors. Currently they do not have any information and

programs on PCBs. In the baseline project these NGOs would address the PCB problem and would probably advice their members to undertake detailed inventories and to develop PCB phase-out plans. The inventory process however would follow the methodologies of the NIP, which included only "paper" inventory and the express analysis of limited volumes of equipment and oil and thus would be inaccurate. Consequently the implementation of PCB management practices and phase-out plans would not be comprehensive.

32. The preliminary inventory done during the NIP preparation includes information on 4,240 tons of PCBs from 1,002 transformers of 27 different models and from 102,032 capacitors of 157 different models and 250 tons of PCB waste oil. The inventory was based on initial technical documentation of the PCB-containing equipment. Information collection was organized according to the "Methods and Guidelines for Detection and Identification of Polychlorinated Biphenyls (PCBs)" which was developed in 2003 within framework of the Project "Inventory of PCBs in Ukraine" in accordance with the main provisions of UNEP Chemicals Guidelines. Information collection considered ministries and local authorities in different regions. National experts have identified and recorded the brand names and types of electrical equipment and synthetic fluids containing PCBs. Inventory exercise considered the transport, industrial, agribusiness, fuel and energy sectors and defense complexes of Ukraine.

33. A pilot interim storage site was established to remove the transformer oils. So far waste transformer oils, PCB-containing transformer oils have been exported for incineration.

34. Hazardous waste (HW) management in Ukraine is building up. Generally appropriate infrastructure for hazardous waste management is lacking. There are no strong enterprises with developed infrastructure and sufficiently large experience in providing services for disposal of hazardous waste. This can be explained by the imperfect economic and legal mechanisms for regulation of activity in this field. In recent years, significant investments in the development of modern production infrastructure for hazardous waste recycling were made by "Tarkom Ekoservis" LLC, in particular, the site for thermal disposal of hazardous wastes was put into operation. "Tarkom Ekoservis" LLC has obtained a license from the Ministry of Ecology and Natural Resources for complex operations with hazardous wastes (collection, storage, transportation, processing), including waste containing PCBs, and is recognized by respective governmental authorities as a leading enterprise in the field of hazardous waste management.

35. Determination of the amount of transformer oils contaminated with PCBs in Ukraine conducted during the NIP inventory is not complete. Based on the experts' conclusions, the largest number of transformers with oils contaminated by PCBs should be expected in the electricity generation and distribution system and in transport sectors, particularly on the railways. A significant share of transformers are operated in electrical grids of regional power supply companies "DniproOblEnergo", "DonetskOblEnergo", "KyivEnergo" that are part of the DTEK Holding. During the PPG stage the national project team made the inventory of 500 transformers in Kiev and its vicinity.

36. In the long term strategy of the holding the emphasis is made on environmental protection, including implementation and continuous improvement of environmental management systems (EMS) in accordance with the requirements of ISO 14001:2004 and the implementation of environmental programs in the electricity generation to reach compliance with legislative requirements and provisions of the Directive 2001/80/EC.

37. Local hazardous waste management companies are interested in establishing their own disposal technologies to cover the local market of hazardous wastes. These companies generally have the financial capitals but lack the technical expertise in selecting the technologies and running them cost-effectively. Generally, the hazardous waste management sector is weak and lacks the technical and human resources expertise to operate according to international standards.

38. The NIP also provided detailed information on the available POPs disposal options including several local initiatives for the treatment of highly chlorinated wastes. Due to the high amount of obsolete pesticides in the country, the Government strongly supported local research and development of new technologies for their treatment. One private initiative financed the development of a continuous type molten salt dechlorination plant with 100kg/hour capacity. The development of the plasma arc technology for hazardous wastes disposal with a capacity of 100kg/hour has been financed from the state budget. As the pressure of the local communities increases to solve the accumulated hazardous waste problem, the political decision gave priority to export treatment and these promising initiatives are awaiting commercialization.

d: Baseline project

Institutional, regulatory and human resources support for PCB management.

39. As part of the baseline project, the Government will develop the legal framework in adopting the PCB related obligations of the Stokhom Convention. Without the appropriate regulatory framework, enterprises will continue to manage PCBs and PCB-containing equipment and wastes in an unsound manner. PCBs will continue to be released into the environment and additional number of transformers will be cross-contaminated. This would worsen the inventory figures and increase the total cost of PCB phase out and disposal. Further, the Government will set up a national register of enterprises that own PCB-containing equipment including the location of the stockpiles of PCB-containing equipment and wastes. It also includes the development of an electronic database for the national register and its maintenance.

40. State Ecological Inspectorate under Ministry of Ecology and National Resources (MENR) has an environmental laboratory and the Government intends to strengthen the laboratory particularly in the field of CO2 emission analysis. This and other state-owned laboratories lack the appropriate technical and human resources for PCB analysis. The Government will allocate resources for upgrading laboratories for PCB analysis and this will be done solely for enforcement reasons, entailing the adoption/development of an official PCB analytical method. Accreditation of the laboratories would however be missing. There are no standards and approved requirements for private laboratories on how to analyze PCB-containing materials; therefore, they may not provide PCB-related analytical services. Until PCB and owners start regular analysis for PCBs for their oil containing equipment these laboratories will not be able to cope with the increased workload, particularly because they do not have rapid screening equipment and methods for PCBs.

41. State Ecological Academy would provide basic training of the trainers on PCB related measures and their incorporation in the regular work of inspectors. This would permit the enforcement authorities to check the compliance with the requirements of the regulatory measures. With this fundamental milestone, PCB-related enforcement will be established; regular inspections for PCBs will be undertaken in a planned and coordinated manner. Without this compliance in this regard would remain low.

42. The Ministry of Ecology and Natural Resources (MENR) is responsible for environment related inspections. The current inspection guidelines for an environmental inspector does not include the need to check for PCBs and, therefore, no regular inspections for PCBs are undertaken, thus compliance in this regard will remain low.

43. Local environmental NGOs would design their own programs on POPs, which would concentrate on the hazards of POPs, but would lack the vision of the way forward. They would continue to sensitize local communities probably against the use of POPs but would leave the PCB owner sectors untapped. Without the GEF project these NGOs would continue to work parallel to the Government but their programs would lack coherent coordination with the ongoing/planned Government initiatives. PCB-related awareness programs of these NGOs would continue to be insignificant and small-scale.

44. To overcome these legal and institutional barriers in the field of PCB management the followings measures are necessary:

- Creating legal prerequisites for inventory of all equipment and sites that may be contaminated with PCBs based on mandatory self-reporting and a PCB registry;
- Creating legal prerequisites to stimulate companies - owners of PCB-containing equipment for decommissioning PCB-containing equipment and the consequent disposal of PCBs;
- Development of regulatory documents that will ensure occupational and environmental safety while handling PCBs.

45. Since PCBs are classified as hazardous chemicals and hazardous wastes, improvement of the current legislation should also be updated in two directions. The first is chemical safety measures for PCB-containing materials and the other is hazardous waste related measures addressing PCB.

46. The following measures are considered for improving the legislation:

- Ministry of Health of Ukraine is to include PCBs in the list of hazardous chemicals banned for use;
- The procedure for record keeping of equipment and materials that contain banned or severely restricted hazardous chemicals should be developed and approved through a Resolution of Cabinet of Ministers of Ukraine;
- In pursuant to this Resolution the procedure and instruction for inventory and self-reporting of PCB-containing equipment and wastes should be developed. This would allow for undertaking the regular reporting to the Stockholm Convention on PCB amounts. This part of legislation should be approved by joint order of the Ministry of Ecology and Natural Resources, Ministry of Health, Ministry of Energy and Mining Industry, Ministry of Industrial Policy.
- At the level of normative support for the management of PCB and PCB-containing equipment it is advisable to develop national standards harmonized with European standards. In particular, the following European standards, mentioned in the NIP, need to be introduced in the Ukrainian regulatory framework:
- EN 50195:1998 Norms and Regulations for Safe Use of Completely Closed Ascarel Containing Electric Equipment;
- EN 50225:1998 Norms and Regulations for Safe Use of Completely Closed Electric Equipment filled with Oils that may be contaminated with PCBs;
- EN 1528-1/2/3/4:2000 Fat products. Determination of Pesticides and Polychlorinated Biphenyls (PCBs). Part 1: General Provisions. Part 2: Removal (Extraction) of Fat, Pesticides, and PCBs, and Determination of Composition of Fat. Part 3: Purification Methods. Part 4: Determination and Test for Conformity with Technical Specifications;
- EN ISO 15318:2002 Pulp, Paper, and Papery Products. Determination of 7 Specific Polychlorinated Biphenyls (PCBs);
- EN 12766-1/2:2002 (U) Mineral Oils and Oils Being Used. Determination of PCBs and Similar Compounds. Part 1: Extraction and Determination of Some Substances of PCBs Class with Gas Chromatography using Electron Capture Detector. Part 2: Calculation of Polychlorinated Biphenyl (PCB) Content.

- According to the APSC (by Resolution of the Cabinet of Ministers of Ukraine dated July 25, 2012 No.589-r) legal framework for hazardous waste management must be supplemented by the normative documents concerning:
  - creating, implementing, updating and maintaining the register of enterprises that use equipment containing polychlorinated biphenyls and sites for storing of equipment and waste containing PCBs;
  - utilization, storage, labeling, removal, disposal/destruction of equipment and waste containing polychlorinated biphenyls.
- Resolution of the Cabinet of Ministers No. 1360 of 31.08.98 on Registers of facilities for generation, processing and disposal of waste and Resolution of the Cabinet of Ministers No. 1360 of 31.08.98 on Registers of sites for waste disposal needs to be amended and PCB related information included.
- A Technical Regulation on "Management of PCB waste" is planned to be developed which discusses the requirements for managing PCB-wastes.

Defining priority measures based on reliable in-depth inventory and national management plan for PCBs.

47. The inventory exercise undertaken during the NIP development provided general and preliminary information on the locations and owners of PCBs and PCB-containing equipment and wastes and is lacking any data on the equipment contaminated during services or maintenance. The information collected has been done through desk studies from name plates of electrical equipment and records at the time of the commissioning of the equipment.

48. According to the preliminary inventory, a total amount of 4,240 tons of PCBs from 1,002 transformers of 27 different models and from 102,032 capacitors of 157 different models have been identified. Additionally, 250 tons of PCB waste liquids have been recorded as stored in different owners. However, the total amount of PCBs reported in the NIP could be much higher as per the following table:

Type of equipment	Number (piece)	Weight of PCBs (ton)	Total weight (ton)
Transformers	1,500-3,000	3,000-6,000	8,300-16,600
Capacitors	150,000-200,000	2,850-3,800	9,000-12,000
PCB wastes		400-600	

49. The inventory data was organized into a database. The database software "PCBs in Ukraine" was also developed as part of the NIP project. The inventory includes information about the manufacturer of the equipment, its application, dielectric composition, quantity of PCBs and the brand name of the PCB applied. The inventory contains information on PCB contaminated wastes as well. This database was used for additional data collection done during the PCB phase.

50. Preliminary inventory information is organized according regions and industrial sectors ownership, etc. A collection and processing of data on the sources of PCBs in Ukraine have been received from more than 4500 major industrial enterprises with the assistance of a number of central bodies of state executive power. The inventory however does not have information about cross-contamination of mineral oil transformers during maintenance operations. This is the reason why the transformers in the power distribution sector show very low contents of PCB.

51. During development of the NIP, the annual PCBs leakages from operating equipment have been assessed. In the case of transformers, it was estimated at 0.06kg/ton and 0.8 kg/ton for capacitors, thus approximately 180-360 kg of PCBs are released from transformers and approximately 2,280-3,040 kg PCBs are released from capacitors into the environment annually. This immense and constant PCB release from PCB-containing equipment has negative impacts not only on the environment, but on the local communities living close to such places, particularly on women and children. During the baseline project these locations, including potentially contaminated sites would not be identified and recorded. Furhter measures to protect sensitive populations would not be undertaken.

52. PCB contamination of mineral oil transformer has not been studied. Based on the experts' conclusions, the largest number of transformers with oils contaminated by PCBs should be expected in the energy and transport sectors, such as electricity generation, transition and distribution and at the railways. A significant share of transformers are operated in electrical grids of power supplying companies such as "DniproOblEnergo", "DonetskOblEnergo", "KyivEnergo", which are part of the DTEK Holding LLC.

53. Based on results of the PCB inventory conducted in 2003, the highest amount of high concentration oil is located at metallurgical plants in transformers. OJSC "Illich Iron & Steel Works" and OJSC "Azovstal Iron & Steel Works" had the largest number of PCB containing transformers in 2003. Both steel plants are part of the Metinvest Holding which will be an important private sector stakeholder of the project. Metinvest Holding is member of the Committee on Industrial Safety and Environment.

54. According to the NIP, 72% of the identified PCBs in the country are located at the most power consuming industries such as metallurgy, engineering, mining, rubber and plastic and food sectors. From experience, it is assumed that the energy sector owns the largest amount of PCB-contaminated equipment and therefore should receive broader attention than it has in the NIP and its action plans.

55. The baseline project would continue the inventory in the Kiev area, where the additional inventory took place during the PPG phase. DTEK Holding LLC and other enterprises involved in the power generation, transmission and distribution would continue the PCB inventory without focusing on the mineral oil transformers. The inventory would gradually move into other regions of the country.

56. The inventory will be extended to other sectors not covered by the NIP such as electrical, commercial and transport sectors. The critical points such as cross-contamination, potentially contaminated sites or excess occupational risks probably will be still missed. These inventories conducted by the PCB owners will be done without chemical analysis of oil for PCBs. This would not allow the real mapping of the PCB problem. PCB containing transformers would probably be labeled, but the PCB concentration of oils would not be recorded.

57. Based on the updated inventory data a country-wide PCB phase out and disposal plan would be developed but due to the lack of important information such as the degree of contamination and the amount of cross-contaminated equipment, this plan would not allow for the selection of the most cost-efficient disposal options.

The system of environmentally sound management (ESM) and removal of PCBs, including transfer of technology and its introduction.

58. The Government, as a general regulator, does not provide detailed technical guidance to the PCB-owners how PCB-containing equipment should be managed in an environmentally sound manner. The baseline project will concentrate in the first run on addressing the most pressing problems, such as leaking equipment and PCB wastes stored open-air as these create public concerns. The lack of a technically competent ESM system for PCBs will prolong exposure of workers and local communities to PCB-containing equipment.

59. The baseline project would favor export treatment of the PCB wastes, as it is a quick and publicly well-accepted solution and the Government could facilitate it through relevant administrative measures. This however, is not a cost-effective option for the whole PCB problem. The average cost of this disposal option would remain in the range of US$6-8/kg, which would not allow for gradual increase in the pace of phase-out and disposal jeopardizing of Ukraine meeting the SC deadline for PCB phase-out and elimination.

60. The hazardous waste management enterprises would probably take the waste from the owners and export them abroad. Limited investments will be in research and development and technology transfer in order to reduce the cost of PCB disposal. These initiatives would however concentrate on local pre-processing and would lack international environmental standards and BAT/BEP. Without the GEF project the commercialization of promising local initiatives would remain slow. This would negatively influence the cost reduction in PCB disposal, which is generally achieved with local disposal technologies, and thus the pace of phase-out and disposal would be steady and slow.

61. "Tarkom Ekoservis" has received operating license for their thermal disposal of hazardsous wastes. In the baseline project they would increase their capacity as the need for hazardous waste management in Ukraine is increasing. Their technology would however be lacking the special tools for draining, dismantling transformers, and incinerating capacitors. Their incineration technology would be unable to treat highly chlorinated aromatic wastes such as PCBs in large concentration and in large amount without excess releases of enviromnmental pollutants. Since "Tarkom Ekoservis" possesses all needed organizational, technical and human resources and has sufficient expertise, it is suggested that it would carry out activities for cleaning, disposal and decontamination of PCB-containing oils and wastes in the GEF project.

A. 5. Incremental /Additional cost reasoning: describe the incremental (GEF Trust Fund/NPIF) or additional (LDCF/SCCF) activities requested for GEF/LDCF/SCCF/NPIF financing and the associated global environmental benefits (GEF Trust Fund) or associated adaptation benefits (LDCF/SCCF) to be delivered by the project:

62. Without the implementation of the proposed project, the management of PCBs in Ukraine is expected to continue slowly as it has been in the past, without large positive changes. The status quo can be summarized as follows:

-The absence of analytical techniques, both as screening tests and detailed PCB analysis, will prevent the identification of PCB contaminated material, particularly transformer oils, therefore cross contamination and environmental releases of PCBs will continue unnoticed.

-Workers, particularly in the electrical utility industry, will continue to be exposed to PCBs without using the required protective equipment when handling PCB contaminated material.

-Oil leaks are usually present in large transformers that are exposed to significant swings in ambient temperature. Ukraine's climate conditions with extremely winter temperatures and moderately high summer temperatures changes result in leaking through rubber gaskets in electrical transformers. Without proper testing and proper management of the leaking transformers, the PCB contaminated oil will continue to pollute the ground and water around these electrical units.

-Without proper testing of the transformers, machine shops that repair these units will continue to handle PCB contaminated oil and other transformers components without proper procedures and dispose PCB contaminated materials in an unsafe manner. Furthermore, the existing facilities used now to recover copper by burning transformer cores to eliminate varnishes and insulating paper coating the copper will continue to operate and to generate hazardous wastes, like dioxins and furans. It is well know that the improper incineration of PCBs may cause the even larger damage to environment and human health.

-PCB contaminated material, particularly from PCB contaminated mineral oil transformers, will continue to be disposed in an unsafe manner and/or released into the environment.

-Without PCB specific legislation that creates the legal framework for the proper management of the PCBs in Ukraine, the use, handling and disposal of PCBs in the country will continue to be unregulated making very difficult for Ukraine to comply with its obligations under the Stockholm Convention.

-Without the GEF intervention it is unlikely that BAT/BET PCB disposal and/or treatment technologies be transferred and installed in Ukraine. The treatment of 3000 metric tons of PCB containing material, as proposed in this project, not only would dispose a significant volume of the existing PCB inventory in Ukraine, but it would also provide a significant business incentive for proponents or owners of PCB treatment technologies to transfer their technologies into the country.

-Without GEF intervention, Ukrainian PCB users have the incinerators in Europe as the only alternative for the disposal of PCBs. The cost associated with such alternatives and the environmental risk due to the transportation of PCB containing material, would make the use of such alternative unlikely and therefore, PCBs will continue to be disposed of in an unsafe manner increasing the risk of environmental and human contamination. Through the project, proven and environmental friendly PCB treatment/disposal options will be installed in Ukraine, offering PCB users with economical and environmentally safe options to dispose their waste within the country.

-Without GEF intervention, PCB Users in Ukraine will continue to dispose of their wastes in an unsafe manner greater the risk of environmental and human exposure to these toxic chemicals. The cost associated with environmental site remediation is usually very high; similarly the medical treatment for people who have developed diseases and conditions due to their exposure to PCBs is also significant. Therefore, GEF intervention can significantly reduce environmental releases of PCBs and human exposure to these chemicals and therefore reducing potential expenditure for the unsafe handling of PCBs.

-Without GEF intervention it is unlikely that owners of environmentally friendly technologies for the treatment and disposal of PCBs decide to transfer their technologies to Ukraine. In addition to the extra cost associated with the use of the European incinerators for the disposal Ukrainian PCB wastes, the absence of the technology transfer to be brought by the project will prevent the creation of jobs and the economic activities related to the use of these state of the art technologies in the country.

63. The proposed project will mobilize the local financial resources at the rate of 1:7.2 and create a model for expansion to other PCB owners. The technical experience of UNIDO will be used in identification and application of relevant BAT/BEPs for the most economically and environmentally efficient methods of disposal. The project will be built on the efforts of the country to promote environmentally sound industrial and economic development, to strengthen an already existing regulatory framework on chemicals, to create an appropriate information platform to manage PCBs based on already existing inventories, and to strengthen the already existing institutions involved in PCB management, to transfer BAT/BEPs and advanced analytical capacities. Furthermore, instead of funding the export of all PCBs for disposal abroad, the GEF grant will be applied as the seed resource to bring to the country the BATs for sufficient disposal capacities. It helps to create and demonstrate conditions to facilitate safe handling of PCBs for replication. The project will lay the groundwork for the total elimination of PCBs by 2028. The sustainability of the project activities will be assured by the updated regulation, demonstration of economically attractive methods for decontamination of the equipment and disposal of wastes, availability of technologies for safe disposal and trained staff for implementing the environmentally safe management of PCBs in Ukraine.

64. Environmental benefits of the project are as follows:

(a) at least 3 laboratories accredited to test the PCBs in transformer oil;

(b) upgraded national database of transformers and capacitors with 10,000 entries and initial information on potentially PCB-contaminated locations;

(c) environmentally safe disposal of 3,000 tons of PCBs, PCB contaminated equipment and wastes;

(d) experience in management and disposal of PCBs in an environmentally sound manner that will be used to facilitate the elimination of PCBs in the country as per the Stockholm Convention;

(e) saving of natural resources through recycling; creation of additional working and employment opportunities in the hazardous waste management and laboratory sectors;

(f) the selection of non-combustion technologies will reduce the generation of GHG; and

(g) prevention of cross-contamination and daily leakages from the operational equipment and storage of contaminated wastes.

The GEF Project

Component#1- Institutional, regulatory and human resources support for PCB management.

65. GEF assistance will be used to eliminate the overlapping and many times conflicting legal measures in the management of PCBs. The necessary technical regulations, standards and norms for PCB analysis will be adopted and submitted for approval. PCB sampling of mineral oil containing transformers will be included in the maintenance guidelines of oil-containing electrical equipment. This step will significantly reduce the risk of further cross contamination of mineral oil containing equipment. PCB reporting procedures will also be developed which will enable the government to collect, analyze and report PCB related stocks to the SC and to use this information for decision making. This will create an appropriate legal infrastructure which integrates PCB-related measures and requirements of the SC in comprehensive manner into the general regulatory framework of Ukraine. Output 1.1 will be coordinated with MENR.

66. The GEF project will have strong tranining activities in order to assure that project achivements are widely known, understood and replicated at the national and local levels. To strengthen national ownership of the project training programs will be developed and presented by the national stakeholders. International consultants would only assist in planning the structure and core content of the training programs. The training workshops will train trainers. Trained trainers will then train people within their organizations. This will maximize the impact of information dissemination at the local levels and is a key to project sustainability after its completion. The GEF project will collect information on the gender distribution of the praticipants of the training workshops with the intention to increase the involvement of women.

67. A training workshop is planned for PCB owners, scientific community, NGOs and other project stakeholders such as the Ukraine Association of the Enterprises of the Ferrous Metallurgical Industry, National Nuclear Energy Company a state own enterprise and all project stakeholders (DTEK, Metinvest, Ukrainian railways) to inform them about the updated regulatory measures on PCBs and the SC. This will increase their commitment for the project and they will mainstream this information to the private sector stakeholders.

68. The invited NGOs will be partners of the Ukrainian Chamber of Commerce and Industry. This chamber according to the Law is a non-government non-profit self-governing organization incorporating on a voluntary basis legal entities and Ukrainian citizens registered as entrepreneurs as well as their associations. Nearly 10,000 enterprises and companies of different forms of property are now members of the Ukrainian Chamber of Commerce and Industry. Project intention is to create awareness on the new legal measures concerning PCBs. Environmental NGOS, such as the Ukraine Nature Conservation Society (UkrTOP), will

also be invited to failitate PCB-related information sharing and dissemination within the environmental NGO community.

69. One training workshop for State Ecological inspectors dealing with PCB management is planned for local inspectors of all regions of Ukraine plus inspectors from the maritime organization and customs to be trainers in their respective offices. The objective of the training is to support the implementation of the revised site inspection operating procedures of the State Ecological inspectors.

70. One training workshop for Sanitary and Epidemiological Service will be held on PCB related matters for the employees of the Ministry of Health. It will include representatives of all regions of Ukraine including maritime inspections. The training is expected to introduce new inspection procedures for those enforcement bodies of the government that are not directly involved with environment. The training is expected to train trainers. The meeting is planned in Kiev.

71. The project also expects to train the project staff on sampling potentially PCB-containing matrices. The training will also address the related human health, environmental health and safety matters. This is expected to facilitate the inventory process and to reduce the risks of exposure of technical staff. Key technical partner for output 1.2 will be the MENR. By the end of the training the project staff is expected to understand their technical role in the project, on how to take samples from mineral oil transformers, on undertaking rapid determination of PCBs, on avoiding potential environmental and health risks.

72. The project is expected to build the necessary laboratory capacity to analyze large amount of PCB samples. The upgraded laboratories will be able to backup regulatory inspections. The project plans to assist the selected laboratories in establishing PCB analytical methods and in accrediting the laboratories for PCB analysis. GEF assistance will enable these laboratories to provide these services to PCB-owners. This is expected to generate more revenue in the laboratory sector at the same time. It will generate employment particularly for women, which is an important socio-economic aspect.

73. Implementing output 1.3 State Ecological Inspectorate of Ukraine, Ukrainian Scientific Research Institute of Environmental Problems "UkrNDIEP", EkoHiToks and the Institute of Environmental Geochemistry, NAS of Ukraine/State Service of Ukraine for Emergency Situations could be the technical partners.

74. The project technical partners in consultation with the private sector and NGOs will develop a comprehensive ESM system for PCBs. It will include (a) brief explanation of the PCB-related obligations; (b) guidelines for PCB identification and analysis, including official analytical methods and accreditation system for PCB testing labs; (c) labelling instructions for PCB-containing equipment; (d) guidelines for PCB-related reporting obligations; (e) management of PCB-containing equipment; (f) guidelines for planning for a gradual PCB phase-out; (g) PCB-related risk assessment and management; (h) proposal for in-house staff training on PCBs; (i) record keeping options; and (j) information on local PCB treatment option. The system will assist the PCB owners and the regulatory authorities to have the clear working environment and responsibility sharing. It will allow the safe operation of PCB-containing equipment and their gradual phase-out at a much lower cost than without the GEF support. Enterprises will have more advanced information for the preparation of the phase-out and disposal of PCBs. The details of the ESM system for PCBs will be compiled in the administrative and technical guidelines, which will be provided to inspectors, PCB owners and NGOs active in the field of environment. The decontamination of PCB-containing equipment and destruction of PCB-containing wastes are the priority actions to be implemented. After the implementation of the ESM system cross-contamination of mineral oil transformers will be prevented. Due to stringent control on PCB-containing equipment PCB releases into the environment will also be reduced. Pursuant to Output 1.4 the Guidance document on BAT/BEP in the PCB management will be developed and approved by the Ministry of

Ecology of Ukraine. Technical partners include Gas Institute, EkoHiToks, Institute of Environmental Geochemistry, NAS of Ukraine/State Service of Ukraine for Emergency Situations.

75. The project scenario will include the development of standard operating procedures (SOP) on PCB-related inspection practices for the concerned enforcement authorities. The targeted PCB related enforcement program and training will also be undertaken to guarantee adherence to the PCB-related legislations and the replicability of the SOP. Output 1.5 will be coordinated by the State Ecological Inspectorate of Ukraine, SEA.

76. In 2003 there was a serious PCB transformer explosion in the country and the fire brigade did not have appropriate emergency response measures in place, particularly for PCB-containing equipment. Appropriate procedures for such situations are yet to be developed. The proposed project will assist in developing the emergency response measures for the State Service of Ukraine for Emergency Situations for fires of oil containing equipment. This will allow to reduce releases of PCBs and reduced health risks in case of emergency situations. Output 1.6 will be led by the Institute of Environmental Geochemistry, NAS of Ukraine/State Service of Ukraine for Emergency Situations.

Component#2. Defining priority measures based on reliable in-depth inventory and national management plan for PCBs.

77. The Government of Ukraine budgeted the development of the national register for PCB-containing equipment items and wastes. It will contribute in preparing the full PCBs inventory and labeling of PCB-containing equipment in line with the Stockholm Convention requirements and promoting the creation of the technological base for decontamination of PCB-containing equipment and solid waste and destruction of PCBs wastes. The register will be on the results of inventory, which will be organized in the database initiated by the project. The register will be administrated by the MENR or another environmental organization nominated by the Ministry. Its role will be defined during updating the legislation.

78. The technology introduction phase of the project requires strong private sector involvement and information sharing particularly on their management practices of oil-containing electrical equipment. The private sector will benefit from the technical assistance of the project in adopting the ESM system for PCBs and developing their PCB-phase-out plans. Project scenario will document all potentially contaminated locations to further enhance the PCB inventory.

79. The proposed project targets the testing of 10,000 mineral oil filled electrical transformers. As in most countries, a significant number of these transformers are expected to contain PCBs above the 50 mg/kg threshold limit. These transformers, currently in service, may be located in sensitive areas, leaking or burning, without the owners or people around them being aware of the risk associated with the exposure to these toxic materials. Without GEF intervention, it is unlikely that similar effort is undertaken and therefore, corrective measures to prevent such incidents will not be taken, resulting in undesirable human and environmental exposures to PCBs.

80. Six to eight technical teams will be formed to travel in the country to collect 10,000 samples of transformer oil. Task teams will receive rapid PCB analyzers in order to screen the collected samples. Only those samples will be sent for GC analyses which are close the 50 mg/kg threshold limit. With this the cost of the inventory could be significantly reduced.

81. All transformers that were sampled during the inventory process will receive a label clearly showing whether the equipment is PCB free or PCB contaminated. During the preliminary inventory a small database was developed for storing the inventory data. This database will be further developed into a database that could be reached on-line, allows extraction of information in a way that can easily support decision making. The

database will initially be hosted by MENR, but later it will be maintained and owned by the State Ecological Inspectorate. In order to collect 3,000 metric tons of PCB-containing equipment, project stakeholders need to plan early. They need to take into consideration the geographical and climatic conditions. Therefore based on the inventory results, project stakeholders will develop phase-out, replacement and disposal plans in order to assure that project disposal targets are met. In these disposal plans priority will be to replace those leaking transformers that are located close to highly inhabited areas, schools, hospitals, etc.

82. Currently PCB-owners do not test transformer oil for PCBs during service, thus the likelihood of PCB contamination and cross-contamination of transformer oil is present. The GEF project will recommend alternative transformer maintenance options with the view to immediately stop the risk of further cross-contamination.

83. Since transformers are critical devices for the constant supply of electricity, in most cases their immediate replacement cannot be undertaken. Owners of such devices need to plan for maintenance, phase-out and replacement. Especially when transformers supply key industries that need to operate 24/7. Project will develop criteria to prioritize what transformers could be disconnected and replaced on short notice to the users and what users need to be involved in planning the schedule for disconnection. Owners of PCB-containing equipment develop phase-out plans for the PCB-containing equipment, procurement plans for the new equipment with the vision to maintain electricity as constant as possible. These plans will take into consideration the climate and geographic conditions of the locations.

84. Sampling for analysis pursuant to Output 2.1. will be carried out at the enterprises of Metinvest Holding, DTEK Holding, other partners identified during project implementation and selected Laboratories. Sampling will be taken by technical staff of PCB owners. For activities under Outputs 2.2., 2.3, 2.4 the technical partners will be the same as for Output 2.1.

85. It is crucial that during the inventory process all potentially contaminated locations are registered and mapped. To meet this objective a standardized information collection form will be designed. Inventory teams will record any locations where spillages or other signs could be detected that suspect contamination. The collected information will be recorded into the inventory database. Technical partners for Output 2.5. will be, DTEK Holding, Metinvest Holding and other partners identified during project implementation.

Component#3. The system of environmentally sound management (ESM) and removal of PCBs, including transfer of technology and its introduction.

86. The project will develop the system of environmentally sound management (ESM) and removal of PCBs. All components of the project will contribute in the development of this system, consisting of:

- the improved/updated legislation and the administrative mechanisms of the Government established to monitor the requirements of the updated regulation for operational equipment containing PCBs, its phasing out and safe disposal;
- the results of the inventory organized in the database for monitoring the decontamination of the equipment and disposal of PCB wastes. During the life of the project the database will permit to find the most economic and efficient approach to achieving the planned results of the project component 3 – decontamination and disposal of 3,000 t of PCBs, PCB-containing equipment and wastes;
- environmentally safe methods of collection, dismantling and transportation of contaminated equipment;
- environmentally safe technologies for decontamination of low-contaminated equipment and disposal of high-contaminated equipment;
- trained technical staff, protected from direct contacts with PCB-containing equipment;

- staff of the environmental authorities, trained to implement the requirements of the updated legislation;
- system of informing the general public on the danger, which PCBs represent to the people and environment and methods/precaution actions that could be used to reduce this danger.

87. The project proposed the safe disposal of 3,000 tons of PCBs, PCB-containing equipment and wastes. The contaminated equipment to be treated will be identified through the testing of the 10,000 mineral oil filled transformers. Dechlorination and decontamination technologies and procedures, proven in other countries and proposed to be transferred into Ukraine, will provide economical and environmentally friendly disposal alternatives, not only during the implementation of the project, but also beyond the project, providing Ukrainian PCB owners with within the countries acceptable and attractive options. The descriptions of the advanced technologies are given in the Annex P.

Comparative analysis for disposal of contaminated transformers in the country and abroad:

Transformer disposal operations	Disposal of a transformer abroad without dismantling	Dismantling of a transformer locally with partial incineration (locally or abroad)
Draining oil from transformer	Yes	Yes
Dismantling of a transformer	Not required	Yes
Loading oil to containers for transportation	Yes	Not required
Packaging and loading transformer in a container	Yes	Not required
Packaging and loading of solid wastes	Yes	Not required
Delivery of an empty container to the loading point	Yes	Not required
Delivery of the loaded container to the incineration facility abroad	Yes	Not required
Valuable recycling materials (cupper and transformer steel)	Collected and sold by the incineration company	Collected and sold by the local company
Incineration of PCB contaminated wastes	Yes	Decontamination of oil and incineration of insulation (10% by weight)

A transformer contains: oil – 30%; copper -30%; steel – 30%, insulation – 10%

88. Without this project, PCB owners in Ukraine do not have a within the country environmental safe alternative for the disposal of PCB wastes. European incinerators are the only alternatives that could be used to dispose of such a waste. Assuming a disposal cost of about 8 US $/kg, including packaging, transportation and disposal cost, the disposal/treatment of the 3000 metric tons of PCB wastes in Europe would have an estimated cost of US $ 24 Million. The expected average cost for the PCB containing material to be decontaminated/treated in Ukraine, with the technologies and solutions to be brought into the country by the project, is expected to be about US $ 3.0/kg. Therefore, GEF intervention will, just during the project, save about US $ 18 Million without counting the value of the recovered mineral oil that could be used in electrical transformers and the recovery of decontaminated metals (copper and carbon steel) from electrical equipment.

89. The project has further positive impact on greenhouse gas (GHG) emission, because the mineral oil content of the disposed transformers, roughly 30% of the total weight of the 3000 metric tons (~900 tons), will not be

incinerated. This will reduce the CO2 equivalent GHG emission of the GEF project by 2 863 tons compared to the baseline project[6].

90. The proposed use of dechlorination and decontamination options for metallic components will provide Ukraine the possibility to recycle in the country valuable resources such as oil, copper and carbon steel from transformers. It makes the environmentally friendly treatment of PCB contaminated transformers an economically attractive option for PCB owners. Two mobile units for dechlorination will be procured. The operators of these units will be defined after the completion of the inventory, depending on the volumes of contaminated equipment and readiness of a potential parner(s) for such operation to contribute in the disposal facility management. The relevant local legislation will be taken into consideration, like qualification requirements, availability of relevant cerifications and permissions, etc. The selection of the operator(s) will be done jointly with the Government, because after the completion of the project there will be applied a standard UNIDO procedure, when the project equipment is officially transferred to the Governement and the Government will implement the local legal procedures to transfer it to the qualified organizations.

91. The Ministry of Ecology and Natural Resources selected several technical partners of this project. The selection was done based on the availability of the large number of transformers and the responses of the companies on their willingness to participate in the project and to contribute in its activities even before the updated legislation is in force.

92. Project intends to establish several interim storage locations in the premises of selected PCB owners around the country. PCB-contaminated oil will be collected in these locations and the dechlorination mobile unit will be moved around these places. This will significantly reduce risk of environmental releases and waste transportation costs as ADR shipment is costly. The use of packaging materials will also be significantly less with this treatment concept. The facility of Tarkom Ekoservis LLC will be upgraded with (a) technology for decontamination of PCB contaminated oil, (b) pretreatment of waste PCB-containing electrical equipment, and (c) disposal of PCBs and PCB wastes.

93. Project will enhance the feasibility of operation of emerging and well established technologies in the Ukrainian context. It will support the wide distribution of BATs to interested investors, who will be able to use the practical experience to establish a similar technology at different regions of the country.

94. The GEF through UNIDO is expected to finance the feasibility studies, assessments, trainings and technical support for selection, upgrade evaluation and transfer of the demonstration technologies including the introduction of international working and occupational standards. The co-financing will mostly address the site development/upgrade, regulatory approvals, environmental impact assessments concerning the transferred technologies and the cost of disposal. The ESM system, once in place, will create the market for affordable disposal services and thus will assure project feasibility and sustainability. Lower disposal prices are expected to increase the pace of PCB phase-out and disposal.

95. DTEK Holding, Tarkom Ekoservis LLC and Metinvest Holding should be regarded as the most appropriate project partners to establish pilot facilities for inventory, cleaning of equipment contaminated with PCBs and disposal of wastes formed as a result of its cleaning. DTEK is the largest privately-owned vertically-integrated energy company in Ukraine with significant presence in the electricity and mining business area. With ownership of about 30% (18,000 MW) of the country's electrical generating capacity (54,000 MW). DTEK Holding represents the public electricity transmission and distribution network. Metinvest is the largest in Ukraine and one of the largest producers of iron ore raw materials and steel. The company is one of the top-ten producers of carbon steel plates in the world. Metinvest occupies the 28th place among the world

[6] CO2e conversion factor of the Department for Environment Food & Rural Affairs (DEFRA) of the United Kingdom was used for waste oils (3187.87kg CO2e/ton).

largest steel companies according to the World Steel Association (world steel). Metinvest Holding represents the private sector power generation and use in the project. Tarkom Ekoservis is a specialized hazardous waste management enterprise. It is approved to handle class 1-4 industrial and hazardous wastes according to the Ukrainian waste classification. Tarkom Ekoservis LLC represents the private sector driven hazardous waste disposal operastions in the project.

96. The GEF project will successfully demonstrate the adoption of BAT/BEP in Ukraine for the disposal of various concentrations of PCB liquids and for various types of PCB wastes. Within project timeframe 3,000 tons of PCB-containing equipment and wastes will be disposed of.

97. The most critical environmental and human health risks are with PCB-contaminated mineral oil transformers as they are unnoticed. Sovtol transformers and capacitors are well known and appropriate maintenance measures are in place. The GEF project therefore intends to highlight this problem and take most of the project disposal target from mineral oil transformers.

98. DTEK Holding and Metinvest Holding will be the primary project stakeholders in the inventory and phase-out of PCBs activities of the project. Tarkom Ekoservis LLC will be the primary project partner in establishing and operation of the technologies for cleaning of transformers, treating mineral oil transformers and disposal of PCB-containing wastes.

99. The GEF project plans to hold several training workshops for the technical partners, stakeholders and local communities on the ESM system in order to minimize environmental releases of PCB during transformer maintenance and disposal operations. Pursuant to Output 3.5, the State Ecological Academy of Ministry of Ecology and Natural Resources of Ukraine together with NGOs will conduct trainings and seminars, publish methodological documents and information newsletters.

100. All of the above measures will lead to the reduction of PCBs releases into the environment as well as improved living and working environment for local communities and workers.

101. Project will assist MENR in forming Public and Private Partnership (PPP) with disposal facilities such as Tarkom Ekoservis LLC to upgrade their facilities to higher throughput for high concentration PCBs such as Sovtol. Understanding the cost and benefit of having a local technology applying BAT/BEP for the disposal of highly chlorinated and high concentration wastes MENR has allocated an additional 16.9 million US$ for solving this problem on top of their 11.1 million US$ co-financing to the project (28 million US$ in total as per co-financing letter).

Component#4 Impact monitoring and evaluation

102. For Impact monitoring the Project Steering Committee (PSC) will be established by the MENR and will include all key stakeholders from the Government, PCB owners, NGOs and UNIDO. An Inception Workshop and a Terminal Workshop are planned to increase commitment for the project at the decision making levels and to disseminate project results to improve replicability of the projects outcomes.

A.6 Risks, including climate change, potential social and environmental risks that might prevent the project objectives from being achieved, and measures that address these risks:

RISKS	RISK LEVEL	MITIGATION MEASURES
Outcome 1: Strengthening of legal framework and institutional capacities for efficient PCB management and disposal		
Political imbalances hinder project implementation.	Medium	The political imbalances and security issues in Ukraine have been recognized during the development of the project document. Analysis of the situation with the national counterpart, the project development team concluded that majority of the implementation activities are planned to be undertaken in the territories which are not part of the conflict; the Eastern Ukrainian private sector partner is a minor stakeholder, therefore majority of the project outputs could be fulfilled with possible delys even if the situation worsen. Should the situation significantly deteriorate the geographical scope of the project including its workplan and timeline could be readjasted. Druing the PPG implementation a project team was working at the Ukrainian Gas Institute. They have day-to-day working relationship with project stakeholders. The current situation did not influence their activities under the PPG. The national consultants jointly with the staff of participating companies during March-July 2014 are collecting and analyzing 500 transformers for PCBs.
Lack of national support in the enactment of proposed PCB-related legislations and EMS system.	Low	The Ministry of Environmental Protection of Ukraine is the initiator of the proposed project and will ensure the active participation of all key stakeholders as full and equal partners. Local NGOs and civil societies will actively participate at all stages of the project implementation including the development of the proposed legislations, guidelines and technical documents. It will create understanding and strong support in the development and timely adoption of the ESM system.
Three laboratories will not be able to manage the load of PCB samples.	Low	The project intends to provide rapid PCB screening devices to the project stakeholders. Only those samples will be further analyzed in the laboratories which are close to the 50ppm limit.
Outcome 2: Establishment of in-depth inventory of the major owners of contaminated equipment and development of the national management plan for PCB disposal		
Private PCB owners will not report their PCB-containing and PCB contaminated equipment.	Low	The new legislation framework will require the reporting of PCBs and authorizes the concerned government institutions for on-site inspections. Private enterprises will be informed about their obligations under the law through series of training workshops.

		The ESM system for disposal and treatment of PCB wastes and potential recovery of valued metals and mineral oil to be developed will demonstrate to PCB owners and to the business community, the economic efficiency of undertaking such projects. It will highlight the economic gains through regeneration of contaminated oil, recovery of secondary metals and extending the operating life of some transformers. Likewise, it will help to overcome the reluctance of PCB owners to cooperate with the project. The Government will have the institutional capacity to make the reporting obligatory and to facilitate the implementation of the PCB-related regulation.
Accidental exposure to electrical shocks and/or PCB during transformer oil samples being taken during inventory exercise	Low	Service of transformers under voltage is a routine operation and normally the sample taking is not differing from many other operations done by the technical staff of electrical substations. However, to be on the safe side and in order to reduce further this risk the strict procedures for taking samples will be developed and their implementation will be controlled and recorded. Only technical personnel of sub-stations will be requested to take samples from powered appliances. Operators taken samples from transformers will be fully trained in working with or near energized transformers; the risk associated with exposure to PCBs and have to wear proper protective equipment when performing their duty.
Outcome 3: Demonstration of ESM and disposal of PCBs by decontamination and extension of life cycle of some operational equipment, recycling of mineral oil and secondary metals to enable reduction / elimination of PCB releases into the environment		
Technical staff, which can have direct contact with PCB-contaminated equipment, will be excessively exposed to PCB.	Low	The technical staff will have training in proper handling of PCB wastes and equipment. Relevant guidelines will be developed, installed, adjusted and introduced at the technical facilities of the proposed project and for the transportation teams. Protective gears and equipment will be provided to the technical staff. Places for PCB wastes storage will be properly guarded to prevent admittance of non-authorized staff. These measures will minimize the risk.
Excessive contamination of the environment during transportation/handling of the PCB-contaminated equipment. There is a danger that some wastes could be disposed illegally at unauthorized	Medium	The inventory will record volumes, weights and other conditions of PCB-contaminated equipment and wastes. MENR will have institutional capacity to facilitate the implementation of the PCB-related regulations. The cooperation of NGOs and local communities (through awareness programs) will be sought to identify such cases when they happen. So the possibility for irresponsible PCB owners to be fined for illegal disposal of wastes will be high and will not justify this risk.

places, thus increasing the pollution of the environment and creating new contaminated locations.		The project management team and the environmental authorities will be able to follow through the disposal paths of the PCB-containing equipment and wastes using GPS trucks until safely disposed of. Transport to the dismantling facilities will be done following the requirements for safe handling of PCB wastes as mentioned in the Basel Convention guidelines.
Accidental PCB releases due to PCB dechlorination and/or decontamination equipment break down.	Low	This risk as well is mostly related to human mistakes. Technology selection criteria will include requirements for proven commercial application with clean track records. The built system will contain protective measures to avoid such accidents, their operation will have contingency plan to protect the environment and human health. The constant retraining of operators to behave in emergency situation will be recommended to the owners of the treatment installations.
Outcome 4: Adherence to project document and attainment of project objective		
Delays in project implementation and weak coordination.	Low	Carefully selected national institutions specialized in PCB management, project personnel, success indicators and adaptive monitoring practice will enable timely implementation. UNIDO, as a GEF agency responsible for the project, will use the experience accumulated through other similar projects to facilitate accelerated and efficient implementation of the project.
Climate related risks		
Climate change risks	Low	The PCB-contaminated transformer oils will not be incinerated but mostly treated with alkali metals therefore the greenhouse gases emission will be lower in the GEF project than they would be in the baseline project. The regenerated, clean transformer oil can be reused in electrical equipment. Paper and porous materials will either be decontaminated with alkali metals or incinerated. This however will be less than 10% of the total weight of treated equipment; therefore climate change risks are low.
Climate vulnerability risks	Low	During the selection of interim storage locations for PCB-contaminated equipment and for prioritizing the PCB-contaminated equipment that need to be replaced, climate and environment vulnerability will be taken into consideration. From the practical point of view, the most important impact expected from Ukraine weather is the impact of swing summer and winter temperatures on electrical equipment, particularly gaskets in electrical transformers. The difference in expansion coefficient in rubbery gasket materials and metals usually make the transformers to develop leaks. Although some of these

		leaks may not be severe, leaking of PCB contaminated transformers represents a significant environmental risk. This risk is augmented if the transformers are located near open water, as the PCB will become transferred and accumulated in fish and other living organisms. From this point of view, the Ukrainian weather may represent a challenge that may not be present in other countries. The proposed project is expected to minimize the environmental release of PCBs into the environment by identifying PCB contaminated transformers in sensitive areas and accelerate their removal and/or their treatment.

A.7. Coordination with other relevant GEF financed initiatives

103. At the time of the development of the project document there were two GEF financed projects with possible linkages to PCB management. The following table summarizes the potential areas, where joint effort may lead to excessive result.

№	Project Name	GEF project ID	Project Status	Technical Agency	Coordination area
1	Improving Energy Efficiency and Promoting Renewable Energy in the Agro-Food and other Small and Medium Enterprises (SMEs) in Ukraine	3917 UNIDO	Under implementation	National Energy Efficiency Agency	The project aims to develop a market environment for introducing energy efficiencies and enhanced use of renewable energy technologies in the agro-food and other energy intensive manufacturing small and medium enterprises (SMEs) in Ukraine. Information exchange will consider PCBs in transformers and capacitors, which may be replaced during energy efficiency improvement.
2	Implementation of The Dnipro Basin Strategic Action Program for the reduction of persistent toxics pollution	2544 UNEP	Under Implementation	Ministry of Ecology and Natural Resources	The exchange of the information on: the monitoring policy on PCBs especially in the discharged wastes;

104. The national project team will coordinate all activities at the national level. They are committed to work with international experts on activities addressing technical services not available at UNIDO.

B. ADDITIONAL INFORMATION NOT ADDRESSED AT PIF STAGE:

105. The PIF was developed based mostly on the information available in the NIP. That information was not sufficient for drafting the present project document, so, as the first step of the PPG implementation a detailed study for attaining information on all aspects of PCB availability and management in Ukraine was launched. The received information was used for identification of primary issues to be dealt with in the project, identification of principle stakeholders and participants of the project, elaboration of the required inputs and their costs, defining other issues of the project implementation.

106. Additional information on details of potential contamination of energy equipment in Ukraine was received from the limited inventory done with express analysis. This inventory helped to calculate the scope of inputs required for technical components of the projects addressing the PCB disposal measures.

1 Describe how the stakeholders will be engaged in project implementation.

107. During the preparation of the NIP, the different government implementing agencies have worked in coordinated and collaborative manner and have met on a regular basis. Similar coordination activities have been mapped out for the proposed project. The MENR is the main agency responsible for the country's compliance to the Stockholm Convention on POPs, and therefore, it will be the UNIDO's key executing partner. This helps to ensure that there is no duplication of efforts in implementation of the Stockholm Convention. The project main stakeholders' matrix is as follows:

108. **UNIDO** will be the implementing agency (IA) of the project. In order to have direct control on the implementation process UNIDO will be a member of the Project Steering Committee.

109. **Ministry of Ecology and Natural Resources (MENR)**, formerly the Ministry of Environmental Protection, will be the national executing partner of the project. The MENR will be involved in developing/modification of the PCB-related regulations, relevant standards and norms in the field of PCB management, ESM system for PCBs and to make them compatible with the requirements of the SC on POPs. It will be responsible for establishing the requirements and stimulus for national industries to implement the SC compliance measures, for the in-depth inventory of PCB-contaminated equipment as well as for capacity building for PCB management.

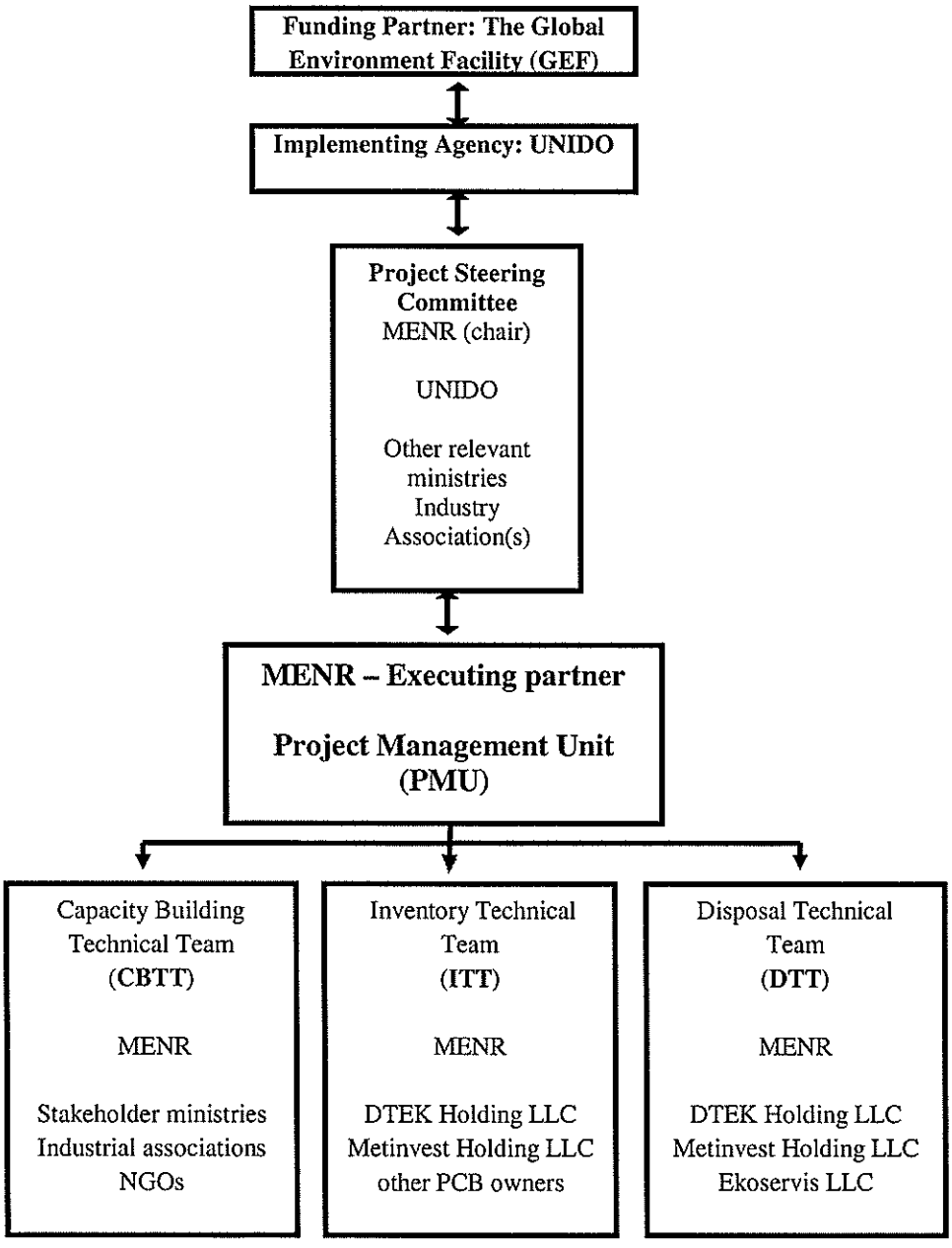
110. The **Ministry of Energy and Mining Industry (MoEMI)** will participate in developing technical standards and administrative guidelines and procedures for PCB-contaminated equipment. The Ministry of Health (MoH) will monitor the influence of the existing and new technologies on the health ofworkers at companies of PCB-containing equipment and wastes as well as the health of the population of the country. Representatives from both ministries will be included in the Project Steering Committee.

111. The **Project Steering Committee (PSC)** will be established by the MENR and will include MoEMI, MoH, key project partners, other stakeholders from the Government, Academia, PCB owners, NGOs and UNIDO. MENR will chair the PSC meetings.

112. UNIDO will assist MENR to establish a **Project Management Unit (PMU)**. The PMU will consist of a National Project Coordinator, a project assistant, economist, legal, technical and other relevant experts.

113. Three **project technical teams** will function under the guidance of the PMU. There will be a Capacity Building Technical Team (CBTT) working on legislation, standards and training related matters. Inventory Technical Team (ITT) will facilitate the inventory process of oil containing equipment. Disposal Technical Team (DTT) will provide technical support for implementing ESM system and PCB disposal operations.

114. During the life of the project, these teams will provide the key technical backup for all PCB related activities such as legislation updating and technical guidelines development, inventory, labeling and database compilation, assessment and selection of technologies. Other ad-hoc groups will be formed if required. Upon completion of the project enforcement and monitoring activities will be transferred to relevant departments of the MENR and other enforcement agencies. The updated/improved regulations will be organically integrated into the legal framework of Ukraine. PCB owners will have more economic options to eliminate their wastes than at project start, thus it is expected that the pace of PCB phase-out increases. The procured technologies will continue to operate on self-sustainable basis and will be available to all PCB owners at the cost recovering basis. Project management structure is presented in the following figure.



115. Development of guidelines, standards, methods, technical documents, manuals, traninig programs will be undertaken by various stakeholders such as the State Ecological Academy of MENR, State Ecological Inspetorate of Ukraine, Ukrainian Scientific Research Institute of Environmental Problems "UkrNDIEP", EkoHiToks and the Institute of Environmental Geochemistry, NAS of Ukraine/State Service of Ukraine for Emergency Situations and the Ukrainian Chamber of Commerce and Industry. These organizations could be in contractual arrangements with the IA.

116. Inventroy of transformers including the analysis of the collected samples, labeling the devices and the preparation and maintenance of the PCB database will require various expertises. The collective workof Metinves Holding, DTEK Holding, Laboratory for Ecological Hygiene and Toxicology of Hazardous Wastes and other partners identified during project implementation is crucial and could be undertaken in subcontracts.

117. The technology transfer and disposal component of the project builds on the activities of Tarkom Ekoservice LLC. Some of their duties could also be undertaken in a contractual arrangement.

Organization of the project

118. Important technical stakeholders and potential technical partners of the project are the following:

119. In the area of environmental and human exposure to PCBs the **Institute of Ecological Hygiene and Toxicology of the Ministry of Health** plays the key role. The Institute participated in almost all complex scientific and research projects concerning POPs. During development of NIP the "Guidelines for safety of treatment of objects containing polihlordyfenily (PCBs)" have been developed by the Institute.

120. In the area of scientific and methodical support to introduction of BAT/BEP for PCB management the key position is held by the **Gas Institute of National Academy of Sciences**. The Institute developed methodical guidelines on the application of BAT/BEP for reduction of POPs releases by entities of steel and energy sectors. Scientific and methodical basis for the use of steam-plasma medium and molten salts of alkali metals for disposal of toxic organochlorine compounds, including PCBs, has also been developed. Specialists of the Institute participated in the development of NIP and preliminary inventory of PCBs.

121. In the area of scientific and research and development for monitoring of impacts of POPs on the environment the **Institute of Environmental Geochemistry** has a key position. The Institute has a dual subordination to the National Academy of Sciences of Ukraine and the State Service of Ukraine for Emergency Situations. Specialists of the Institute are part of leading scientific and methodical structure in field of analytical control "Chromatographic Society of Ukraine" and have practical experience in assessment of the content of POPs in the environmental objects, particularly in the elimination of landfill of hexachlorobenzene waste in the town of Kalush.

122. In many complex projects, carrying out research in the above areas, coordinating functions are performed by the **State Ecological Academy of the Ministry of Ecology and Natural Resources of Ukraine**. In addition, the Academy has the relevant infrastructure to conduct information and awareness activities and experience in environmental education for professionals from different sectors of industry. The Academy hosts a Technical Committee of Standardization "Environmental Protection of Ukraine" (TC 82), which has a subcommittee SC 4 "Management of waste, its disposal and recycling". SEA together with NGOs will conduct training seminars, publish methodological documents, information newsletters.

123. The project will work in strong consultation with the private sector that own PCBs. During the development of the project document the following stakeholders were identified as key partners, however during the implementation other major owners of transformers and electrical equipment will be identified and invited.

124. **Tarkom Ekoservis LLC** is a specialized enterprise that provides services for the collection, transportation, storage and further disposal of hazardous wastes (industrial and household) of class 1-4 under Ukrainian classification. It holds an operating license issued by Ministry of Ecology and Natural Resources of Ukraine. Tarkom Ekoservis LLC is the main project partner in technology transfer for disposal of PCBs. Detailed information on Tarkom Ekoservis LLC is presented in Annex J.

125. **DTEK Holding** is the largest private energy company in Ukraine. DTEK is involved in coal mining, generation of electricity, and distribution of electricity. It provides the largest industries and Kiev city among others with electricity. DTEK distributes approximately 20% of Ukraine electricity. Detailed stakeholder analysis is attached in Annex L.

126. **Metinvest Holding LLC** is an international steel and mining company. They mine coal, produce coke, semi-finished and finished steel products. They have five mining companies and five metallurgical enterprises in Ukraine. They export to 75 countries to more than 1,000 customers. Metinvest LLC has identified several PCB-contaminated units of equipment in their premises. Company profile of Metinvest LLC is attached as Annex K.

127. Besides Metinvest LLC and DTEK holding LLC the PMU will make efforts to include other stakeholder in the project that own PCBs such as UZ Ukrainian Railways.

128. **Laboratory partners.** The following laboratories have been selected to provide the analytical backup of the project. The selection process took into consideration their technical capacities and experiences with PCBs and other POPs.

129. One of the leading analytical centers for POPs analysis in Ukraine is the Institute of Ecological Hygiene and Toxicology of the Ministry of Health. The laboratory gained experience in studying the contamination, accumulation and migration patterns of chemicals, resistance of agrochemicals, pesticides, biological products, dioxins, polychlorinated biphenyls, components of polymeric materials and other chemical substances in the environment (air, water reservoirs, groundwater, and soil) and in products. In 2009 the Institute opened its Dioxin Center, which was accredited through the MLA/MPA international system. Ministry of Health has an extensive network of regional laboratories of sanitary and epidemiological service; most of them have worked on PCBs during the NIP inventories.

130. Ukrainian Scientific Research Institute of Environmental Problems "UkrNDIEP" under MENR is responsible for monitoring environmental pollution. The Analytical Center of the Institute has been accredited by the State Standard of Ukraine (DSTU) for the right to carry out occupational health related measurements, to control the quality and safety of food and to monitor the state of environment. The structure of the MENR also includes the State Ecological Inspectorate, which also has an extensive network of regional laboratories.

131. National Academy of Sciences of Ukraine has also a well-known laboratory of the Institute of Environmental Geochemistry. This lab has experience with studies on contamination of the environment and equipment by POPs. This is the Institute is subordinated to both NAS and SAES of Ukraine, and has already been mentioned as a scientific and methodical organization. Institute of Colloid Chemistry and the Chemistry of Water, NAS of Ukraine also has experience in measurement of POPs content in the water. Detailed information on the laboratories is presented in Annex M.

132. The proposed project aims to involve NGOs specialized on metallurgical, engineering and electrical industries such as the Ukrainian Association of Enterprises of Ferrous Metallurgy Enterprises, National

Nuclear Energy Company. These NGOs will be important advisers in selecting project participating entities, demonstration sites and for bringing project related information to the attention of PCB owners. Environmental NGOs such as, Resource and Analysis Center "Society and Environment" will be invited to participate in the development of the ESM system and in awareness raising activities.

133. Resource and Analysis Center "Society and Environment" is a think-tank non-profit organization focusing on environmental policy research, capacity building and implementation of innovative initiatives in Ukraine and regionally (Eastern Europe, Caucasus and Central Asia). The center is registered and based in Lviv, Ukraine. It has two work programs are European Integration Processes and Human Rights & Environment. The Human Rights and Environment program brings together three related priority issues: national environmental policies research, promotion of implementation of and compliance with multilateral environmental agreements, and assessment of national environmental case-law and practice.

134. The involvement of other environmental NGOs in the proposed project will permit to find better common solutions for the existing problems and through this to overcome the existing (mostly non-technical) barriers easier and quicker than might be expected in the baseline scenario.

135. The NCPC established by UNIDO at the Kiev University will assist in contacts with industries and NGOs to promote the awareness raising campaign, and replicating project activities at the national level.

136. The financing of participation of the above organizations will be mostly from the co-financing budget, which is monitored by MENR. The complimentary services to be financed from the GEF/UNIDO budget (foreseen in Annex G) will be agreed in respective Letters of Agreement, Memorandums or individual contracts for recruiting national consultants or procurement of services and goods.

B.2 Describe the socioeconomic benefits to be delivered by the Project at the national and local levels, including consideration of gender dimensions, and how these will support the achievement of global environment benefits (GEF Trust Fund/NPIF) or adaptation benefits (LDCF/SCCF):

137. The socioeconomic problems represented by the availability of PCBs are: needs to improve the occupational safety practice, prevent leakages of PCBs and direct contacts of technical staff and general public with PCB-containing equipment or spots, low awareness of population and, in particular, women groups. These issues will receive priority attention in the project. The project is expected to deliver socioeconomic benefits to these groups. It is crucial to collect and report such value added benefits of the implementation to the IA and GEF. Gender issues will be measured at baseline i.e. project inception, such as the gender ratio of participants at the worksops and awareness programs. During the implementation PMU will facilitate the improvement of the baseline gender ratio, while at project closure these values will be reassessed and anlysed.

138. The most important socioeconomic benefits of the proposed project will be the reduced amount of PCB releases in the environment and consequently the reduction of human exposures.

139. The main reason behind the decision of the Government to remove all hazardous waste stockpiles in the country is high public concern. The proposed project is in line with this movement and creates an enabling environment for local communities to learn and follow the PCB disposal actions. In several cases, communities blocked the relocation of hazardous wastes within the country due to environmental and health concerns. The inclusion of environmental NGOs in the demonstration activities and the use of mobile technologies, which can be moved close to the wastes sites, are expected to reduce the environmental and health risks and will assure the support of the local communities.

140. The project will create an enabling environment for local communities to participate in the project, such as selection of priority actions and demonstration areas, selection and approval of technologies for local use and subsequent stages of project implementation.

141. The economically and environmentally efficient management of PCB wastes at the national and local levels will contribute towards the mitigation of global environmental problems. In particular the prevention of PCB leakages will reduce its amount available for local and transboundary movements. This will create a greener, cleaner and healthier environment to live. The occupational safety measures will be strengthened at the stakeholders and will have the positive impact on their working environment.

142. The project also foresees the creation of at least 15 new working places at Government institutions, laboratories, waste management enterprises, industrial and environmental NGOs. These human resource development initiatives are open for all genders and would encourage the participation of women. Theproject will report on how many men and women were employed in the newly created workplaces.

143. The proposed project will ensure collection of adequate data that will enable continuous monitoring of socioeconomic impacts by all stakeholders involved including NGOs and local communities. The local communities will have the information to participate in the decision making process.

144. Instead of financing the collection and disposal of PCBs, the GEF's funding will be applied as the seed funding to enable stakeholders to subsequently proceed with disposal of PCBs. They will receive an example of financially viable PCB disposal technologies facilitated by other components of ESM. In order to lay the groundwork for the total PCB elimination, the project will partner with technology providers to evaluate and to transfer to the country the best alternatives for decontamination and disposal of equipment with low and high concentration of PCBs. The local production of the disposal equipment based on BAT/BETs will be encouraged. The demonstration project will help to determine the technical, economical and environmental requirements for the application of disposal technologies that will fit the country's requirements. At the stage of the project formulation, due to a lack of information on details of contamination of the electricity equipment by PCB (this information will be updated through the inventory) and the unavailability of the legislation with the legal requirements for decontamination/disposal, it is difficult to assess the cost/benefit ration of implementing the PCB disposal programme on the national level. At the initial stage of the project the study for evaluation of the nation-wide benefits will be launched in order to support the approval of the new legislative demands and to get interest of business community in investments into PCB identification and disposal activities. It assists the project team, based on the achievements of the project, to continue looking for additional technical partners/participants of the project. Further economic benefits of the project will be the generation of new workplaces in the laboratory and hazardous waste management sectors.

145. Industrial Associations, and the Ukrainian Chamber of Commerce and Industry will have better capacities to boost private sector investments and activities in PCB management. The project will measure this on the number of enterprises adopting BAT/BEP which is expected to be at least ten and the number of businesses engaging into PCBs management for which the project target is eight.

146. The project will also measure and report the commercial value of the recycled mineral oil and metals, etc. People's awareness of the environmental and health risk associated with PCBs will reduce human's exposure to these toxic materials. By reducing or eliminating human exposure to these chemicals, the risk of development diseases caused by the exposure to these compounds is reduced, therefore people's health is protected. The reduction of diseases and preservation of human health will reduce the demand for resources of the public health system that otherwise have to be spent on providing health care to sick people due to exposure to PCBs and other POPs. The occupational safety and preventive measure to reduce leakages to the environment will be planned and implemented on the priority basis. The project will monitor gender issues during the public awareness programs.

147. Because the training activities of the project will be a training of trainers, the project will have direct

benefits of at least 40 trained trainers. They will train people in their respective organizations, thus an indirect impact of the project will be at least 300 trained people. The gender ratio among trainers and trainees will be monitored and reported.

148. The other economic benefits are mentioned in section B.3 hereafter.

B.3. Explain how cost-effectiveness is reflected in the project design:

149. Project cost-effectiveness is based on the assumption that as per the baseline project PCBs and PCB-contaminated materials would be disposed of abroad by means of incineration. Assuming that export incineration would cost 8 US$/kg, including packaging, transportation and disposal cost, the disposal/treatment of the 3000 metric tons of PCB wastes abroad would have an estimated cost of US$ 24 million. The project thinking is that the expected average disposal cost for the PCB containing material with the technologies and solutions to be brought into the country is expected to be about US$ 3.0/kg. Therefore, GEF intervention will save the national economy about US$ 18 Million without counting the value of the recovered mineral oil that could be used in electrical transformers nor the recovery of decontaminated metals from electrical equipment. Locally available disposal technologies have significant cost advantages, because they are less influenced by international markets and economies. Increasing tolls for road transportation in the region is common, increasingly stringent regulatory measures on licensing and operating hazardous waste management enterprises will further increase the cost of disposal. These risks will be eliminated by having domestic pre-processing and disposal technologies.

C. DESCRIBE THE BUDGETED M &E PLAN:

150. Monitoring and evaluation will facilitate tracking implementation progress toward the outcomes and objectives. Likewise, it will facilitate learning, feedback, and knowledge sharing of results and lessons among the primary stakeholders to improve knowledge and performance. This section of the project document presents a concrete and fully budgeted monitoring and evaluation plan of the project.

151. Formal monitoring and evaluation (M&E) of the project will follow the principles, criteria and minimum requirements set out in the GEF Monitoring and Evaluation policy and the respective guidelines and procedures issued by the GEF Evaluation Office and the GEF Secretariat. At the same time, M&E will comply with the rules and regulations governing the M&E of UNIDO technical cooperation projects, in particular the UNIDO Evaluation Policy and the Guidelines for Technical Cooperation. The overall objective of the monitoring and evaluation process is to ensure successful and quality implementation of the project by:

i) Tracking and reviewing project activities execution and actual accomplishments;

ii) Leading the project processes so that the implementation team can take early corrective action if performance deviates significantly from original plans;

iii) Adjust and update project strategy and implementation plan to reflect possible changes on the ground, results achieved and corrective actions taken; and

iv) Ensure linkages and harmonization of project activities with that of other related projects at national, regional and global levels.

According to the Monitoring and Evaluation policy of the GEF and UNIDO, follow-up studies like Country

Portfolio Evaluations and Thematic Evaluations can be initiated and conducted. All project partners and contractors are obliged to prepare studies, reports and other documentation related to the project, and facilitate interviews with staff involved in the project activities. A detailed monitoring plan for tracking and reporting on project time-bound milestones and accomplishments will be prepared by UNIDO in collaboration with the Project Management Unit (PMU) and project partners at the beginning of project implementation and then periodically updated.

Monitoring and evaluation budget and timeframe

Monitoring and evaluation	GEF	Cofinancing	Time frame
Measure impact indicators	40,000	190,000	Baseline indicator will be measured within first three months of project start up, progress indicators will be measured annually
Regular monitoring and analysis of performance indicators	70,000	250,000	Regularly, based on the project logical framework, to feed into project management and Annual Project Review
Annual Project Review to assess project progress and performance	55,000	200,000	Annually prior to the finalization of APR/PIR and to the definition of annual work plans
Mid-term Review	30,000	140,000	Midterm of project implementation
Terminal Project Evaluation	55,000	220,000	Evaluation at least one month before the end of the project; report at the end of project implementation
TOTAL indicative cost	250,000	1,000,000	

Monitoring responsibilities and events

152. Day to day monitoring of project execution progress will be the responsibility of the National Project Coordinator (NPC) based on the project's Annual Work Plan (AWP) and its indicators. The Project Management Unit (PMU), via the NPC, will inform UNIDO of any delays or difficulties faced during execution so that the appropriate support or corrective measures can be adopted in a timely and remedial fashion.

153. Targets and indicators will be reviewed annually as part of the internal evaluation and planning processes undertaken by the Project Management Unit (PMU).

154. UNIDO through meetings with project counterparts as frequent as deemed necessary but not less than twice per year 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.

155. UNIDO 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 not less than one month after the visit.

156. Annual Monitoring will occur through PSC meetings, which will take place at least once every year. The national project coordinator will prepare an Annual Project Report (APR) and submit it to UNIDO at least two weeks prior to the PSC for review and comments.

Key impact indicators for the project

157. As the primary objective of this project is to introduce in the country the system for PCB management and to carry out ESM disposal of PCBs and PCB-containing equipment, oil and wastes, the most direct indicators to characterize project impacts should include the institutional capacities, accredited laboratories to measure PCBs, the number of conducted PCB analysis, the nation-wide register of contaminated equipment and wastes and metric tons of decontaminated dielectric oils in PCB-containing equipment and PCB-containing mineral oil and wastes.

158. Other important indicator is the number of labeled PCBs contaminated equipment and their inclusion into the project database (register). This indicator reflects the fact that PCB-contaminated equipment have been identified, kept under control and are currently pending disposal. Securing stockpiles for future disposal is one of the most important tasks in any POPs management project; the amount of PCBs equipment secured for future disposal has also to be considered an indicator of the soundness and practicability of the PCB management plan.

159. The project implementation will also collect information on socioeconomic aspects of the interventions. As part of this the number of enterprises adopting BAT/BEP, the number of businesses engaged in PCB managenet, the number of jobs created with gender information, the number of trained specialists, the commercial value of the recycled materials will be tracked and reported.

160. Key project impacts will be monitored by the POPs tracking tool (POPTT) which is attached to the project document. The specific GEF and the IA's indicators are stipulated in the project logical framework.

Terminal Project Workshop

161. The terminal project meeting will be held in the last month of project operation. A draft final report will serve as the basis for discussions in the final workshop. This will serve as a venue to consider 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 mean, where lessons learned can be captured for use in other projects under implementation or formulation.

Project Monitoring Reporting

162. The Project Management Unit in conjunction with the UNIDO will be responsible for the preparation and submission of the by annual project report.

163. The format of the report is flexible but should include the following:

(a) Analysis of project performance over the reporting period, including outputs produced and information on the status of the outcome;

(b) Constraints experienced in the progress towards results and the reasons for these;

(c) Expenditure reports;

(d) Co-financing accounting (resources provided both as in kind or cash contribution);

(e) Lessons learned;

(f) Recommendations to address key problems in lack of progress, if applicable; and

(g) Project Implementation Review.

164. 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 and ideally, immediately prior to the PSC.

Evaluations

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

(a) Mid-term review. Mid-Term Evaluation will be undertaken at half way 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. Final Evaluation will take place 2-3 months prior to the completion of the project implementation, and will focus on the same issues as the mid-term evaluation, with a greater focus on project 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 future projects, based on lesson learned and success stories. 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.

166. The Project Management Unit will disseminate project impact indicators, results, decisions and relevant documentation on a website designed for the project. PM and the project management team should ensure that relevant and public information is regularly placed on the website and updated frequently.

167. According to the Monitoring and Evaluation policy of the GEF and UNIDO, follow-up studies like Country Portfolio Evaluations and Thematic Evaluations can be initiated and conducted. All project partners and contractors are obliged to (i) make available studies, reports and other documentation related to the project and (ii) facilitate interviews with staff involved in the project activities.

Legal Context:

168. The Government of Ukraine agrees to apply to the present project, mutatis mutandis, the provision of the Standard Basic Assistance Agreement between the United Nations Development Programme and the Government, signed and entered into force on 18 June 1993.

PART III: APPROVAL/ENDORSEMENT BY GEF OPERATIONAL FOCAL POINT(S) AND GEF AGENCY(IES)

A. RECORD OF ENDORSEMENT OF GEF OPERATIONAL FOCAL POINT(S) ON BEHALF OF THE GOVERNMENT(S):): (Please attach the Operational Focal Point endorsement letter(s) with this form. For SGP, use this OFP endorsement letter).

NAME	POSITION	MINISTRY	DATE *(MM/dd/yyyy)*
Vadym Pozharskyi	GEF Operational Focal Point	STATE ENVIRONMENTAL INVESTMENT AGENCY OF UKRAINE, MINISTRY OF ECOLOGY AND NATURAL RESOURCES OF UKRAINE	02/11/2011

B. GEF AGENCY(IES) CERTIFICATION

This request has been prepared in accordance with GEF/LDCF/SCCF/NPIF policies and procedures and meets the GEF/LDCF/SCCF/NPIF criteria for CEO endorsement/approval of project.

Agency Coordinator, Agency Name	Signature	Date *(Month, day, year)*	Project Contact Person	Telephone	Email Address
Mr. Philippe Scholtès, Managing Director, Programme Development and Technical Cooperation Division-PTC, UNIDO GEF Focal Point		07/15/2014	Mr. Zhengyou Peng	+43-1-26026-3831	z.peng@unido.org

ANNEX A: PROJECT RESULTS FRAMEWORK (either copy and paste here the framework from the Agency document, or provide reference to the page in the project document where the framework could be found).

Interventions	Indicators	Baseline	Target	Sources of Verification	Assumptions
Project Objective	**To establish an environmentally sound management (ESM) system for PCBs, improve compliance to PCBs related obligations under the Stockholm Convention (SC) and promote local use of non-combustion technologies in the disposal of 3,000 tons of PCBs contaminated equipment.**				
Outcome 1: Strengthening of legal framework and institutional capacities for efficient PCB management and disposal	The text of a new set of regulatory instruments in compliance with requirements of SC on PCBs (Annex A, part II) adopted. Legal measures or guidelines.	Ukrainian legislation on PCBs is scattered and non-comprehensive with the SC.	Regulatory instruments, official guidance on PCB management is adopted and guidelines adopted by the end of the project.	Official gazette.	The government of Ukraine is committed to meet the requirements of the Stockholm Convention and develop guidance documents and a new regulation that will require stakeholders to manage PCBs in an environmental sound manner. Agreement among stakeholders on the content of the regulatory tools will be reached rapidly and efficiently.
Output 1.1: PCB-related legislation including technical guidelines updated and in place	Technical regulations, standards and norms are developed and adopted. Legal instrument for self-reporting of PCBs is enacted.	Legal measures related to chemicals management mis PCBs and PCB-containing equipment. Adoption of SC and EU standards for PCB management is pending.	PCB related legislations are fully in-line with the requirements of the SC. Ukraine has appropriate legal infrastructure which integrates PCB-related measures and requirements of the SC in comprehensive manner.	Copy of the submitted standards and norms, copy of the maintenance manuals of oil containing electrical equipment.	Political changes within the government mainly consider high level officials. Since this project is rather technical, at technical level changes within governmental infrastructure is unlikely.

Interventions	Indicators	Baseline	Target	Sources of Verification	Assumptions
Output 1.2: Staff of government agencies, customs, NGOs and PCB owners trained to implement the regulation	State Ecological Inspectors, Sanitary and Epidemiological Service staffs are trained to implement PCB related regulations. Numbers of PCB owners, scientific community, NGOs are trained on the PCB-related measures. Project staff is trained on how to mitigate human and environmental exposure risks of PCBs. Number of official trained staff (male/female).	The information and knowledge of government staff, particularly inspectors at the local levels on PCB-related enforcement requirements is scarce. Project staff is not trained on sampling of oil containing equipment and they are not aware of human health and environmental exposure risks, particularly their mitigation and emergency response.	Local environmental inspectors representing all regions of Ukraine including inspectors from maritime organization will be trained to be trainers in their respective offices. Directly trained: 50 people Trained at the national level: 500 people Male/Female ratio is recorded at project start and closure.	Technical reports and/or certificates of attendance detailed by gender.	Government staff is highly supportive to the project and allocate their staff for the trainings. PCB owners are also supportive to the project and participate in large number at the trainings.
Output 1.3: Methods for PCBs analysis adopted and 3-4 laboratories accredited for PCB analysis	Numbers of laboratories are accredited for PCB analysis.	Current laboratory capacity is not enough to handle 10,000 PCB samples. Accreditation of PCB analysis is also missing, thus inspections do not have a scientific background.	The project is expected to build the necessary laboratory capacity to analyze large amount of PCB samples and to be able to backup regulatory inspections and to monitor PCB releases during the operation. At least 3 laboratories are accredited for PCB analysis.	Copies of accreditation certificate.	Laboratories are interested in expanding their expertise in PCB analysis.

Interventions	Indicators	Baseline	Target	Sources of Verification	Assumptions
Output 1.4: ESM system for the use and disposal of PCBs including related occupational safety measures implemented and published in a guideline	Environmentally sound management of PCB-containing equipment is in place which provides guidance on handling, maintenance, phase-out, disposal, occupational and environmental safety measures of PCB-containing electrical equipment. Number of enterprises adopting BAT/BEP .	PCB owners generally believe that their mineral oil containing electrical equipment is free of PCBs. Therefore analysis for PCBs is not undertaken when the equipment is in service. They do not have separate procedures for working with PCB positive and PCB free equipment. Current transformer management practices allow for further cross-contamination of PCB free equipment.	After the implementation of the ESM system cross-contamination of mineral oil transformers will stop. Due to stringent control on PCB-containing equipment PCB releases into the environment will also reduce. 10 enterprises adopting BAT/BEP.	Copy of the ESM guidelines. Inspection reports	PCB owners will strongly support the implementation of the ESM system as their environmental compliance and occupational safety standards will improve.
Output 1.5: Operating procedures and trainings for enforcement authorities to carry out inspections related to the ESM system standardized	Standardized operating procedures for enforcement authorities are in place.	Site inspection procedures for enforcement authorities are compiled in order No483 dated 2.10.2012 of MENR. This order contains the checklist of site inspection and forms	Order No483 dated 2.10.2012 of MENR is amended with checklist of site inspection and forms for reporting PCB-containing equipment and wastes.	Copy of the operating procedures, with site inspection forms and reporting forms.	MENR is committed to amend current inspection procedures with PCB-related procedures.

Interventions	Indicators	Baseline	Target	Sources of Verification	Assumptions
		for reporting. This order is missing inspection procedures for PCB-containing equipment and wastes.			
Output 1.6: Emergency response measures developed and in place for transformer fires and leakages at the State Agency for Emergency Situations	Emergency response measures for transformer fires are developed and adopted.	Fire brigades do not have appropriate emergency measures for transformer fires, particularly for those that contain PCBs.	Fire brigades are appropriately prepared for handling transformer fires.	Copy of the emergency response measures.	State Agency for Emergency Situations will implement the updated emergency response measures quickly.
Outcome 2: Establishment of in-depth inventory of the major owners of contaminated equipment and development of the national management plan for PCB disposal	Ad-hoc inventory teams formed to carry out sampling and labeling of 10,000 transformers throughout the country, trained on the overall procedure for PCB equipment identification, labeling and tracking with proper technical code of practices. Extended inventory including 10,000 analyses throughout the country is carried out.	A large and countrywide sampling and analysis of PCBs has never been undertaken. Existing PCB inventories are mainly based on questionnaires and small scale analysis.	Working procedures for identifying, labeling, of transformers are drafted. At least 8 ITTs are formed and trained on inventory taking throughout the country. Inventory including sampling and analysis of 10,000 transformers is carried out and entered into a registry.	Progress report and training reports, database entries.	Project timeframe is enough for completion of the inventory. ITTs will be committed and will work efficiently in the field to collect the samples. Mobile rapid PCB detection systems will be used to fast-screen mineral oil samples. Labels will also be attached by the same teams.

Interventions	Indicators	Baseline	Target	Sources of Verification	Assumptions
Output 2.1: At least 10,000 PCB analysis conducted and organized in a database as an instrument for PCB phase out and disposal planning	Number, weight, type of equipment with -PCB concentrated oils -PCB contaminated oils -PCB containing wastes.	There is no accurate information within the Government on PCB amounts in Ukraine.	10,000 potentially PCB - containing equipment are analyzed. Information on the number weight and type of equipment and wastes contaminated with PCBs are recorded. The PCB registry database is in place and PCB related information is available for decision making.	Analytical reports and database entries.	Allocated timeframe for inventory taking will be enough to undertake 10,000 analyses.
Output 2.2: Inspected equipment labeled and prioritized for decontamination or disposal	Number of labeled oil containing equipment. Number of PCB-containing equipment prioritized and selected for Phase-out.	Transformers and other oil containing equipment that may contain PCBs are not labeled.	10,000 oil containing electrical equipments are labeled. 3,000 tonnes of the PCB-containing equipment are prioritized for phase-out and disposal.	Progress reports	ITTs will be efficient and will complete the tasks on time.
Output 2.3: Current management practices for electrical equipment identified and documented	The participating companies implementing different management practices for PCB positive and PCB free oil containing equipment.	Currently PCB-owners treat transformers uniformly. They do not test transformer oil for PCBs during service, thus the likelihood of PCB contamination and cross-contamination of transformer oil is present. This activity	Each time a mineral oil transformer is serviced the oil is checked for PCBs. PCB positive and PCB negative transformers are handled differently. Cross contamination of mineral oil transformers ceased.	Progress reports of enterprises adopting separate lines for PCB free and PCB positive equipment, Number of PCB positive transformers that are	PCB owners will understand the environmental and economic consequences of PCB cross contamination. This will increase they commitment in adopting BEP in transformer management.

Interventions	Indicators	Baseline	Target	Sources of Verification	Assumptions
		would record such practices and would recommend alternative transformer maintenance options with the view to immediately stop the risk of further cross-contamination.		managed according to BEP.	
Output 2.4: PCBs phase out and disposal plans developed	Number of phase out plans developed for PCB-containing equipment.	Since transformers are critical devices for the constant supply of electricity, in most cases their immediate replacement cannot be undertaken. Owners of such devices need to plan for maintenance, phase-out and replacement. Project will develop criteria to prioritize what transformers could be disconnected and replaced on short notice to the users and what users need to be involved in	PCB owners integrate the development of PCB phase out plans within their regular operating procedures. The pace of PCB removal from the electrical system gradually increases. Phase-out plans take into consideration environmental, climatic, financial and technical questions during prioritizing equipment for phase-out. During the process of phase-out plan development environmental, climatic, technical and economic aspects are taken into consideration. The target number of phase out plans will be set during	Copies of phase-out plans.	Project stakeholders strongly support and expeditiously implement the concept of developing phase-out plans.

Interventions	Indicators	Baseline	Target	Sources of Verification	Assumptions
		planning the schedule for disconnection.	implementation.		
Output 2.5: Potentially contaminated sites identified and recorded	Number of potentially PCB-contaminated sites are identified and recorded in the PCB registry.	Potentially PCBs contaminated sites have not yet been recorded.	Inventory Technical Teams will record any locations where spillages or other signs could be detected that suspect contamination. The collected information will be recorded into the inventory database.	Progress reports on the identification of potentially contaminated sites.	Technical Teams will record all required information on potentially contaminated sites.
Outcome 3: Demonstration of ESM and disposal of PCBs by decontamination and extension of life cycle of some operational equipment, recycling of mineral oil and secondary metals to enable reduction / elimination of PCB releases into the environment	Proof of performance test of the selected technologies and services comply with BAT/BEP Number of newly created jobs. Number of enterprises engaged in PCB management. Amount of incremental	Ukraine is lacking appropriate hazardous waste disposal facilities. Consequently the disposal of PCBs cannot be solved on the local level. Export disposal operations are costly, which hinders enterprises phasing out of PCB-containing equipment. In 2014 Tarkom Ekoservis	Technologies applying BAT/BEP are available in Ukraine to treat PCBs. PCB disposal prices are reduced, which increases the pace of PCB elimination. At least 15 new jobs created (gender ratio recorded). 8 enterprises are engaged in PCB management. 9 860 000 US$ (equals to the private sector cofiancing).	Selected technologies comply with BAT/BEP.	The project partners are committed to provide a significant financial and technical support to ensure the successful implementation and demonstration of technologies for the ESM disposal of PCB. The required technologies, aimed mainly at treating PCB low contaminated oil, porous material and transformer carcasses can be established and operated with the available financial resources and within the project timeframe

Interventions	Indicators	Baseline	Target	Sources of Verification	Assumptions
	financial investments in US$.	LLC will open a new HW incinerator. The throughput of this facility will be low for the high amount of PCBs in the country. PCB contaminated material is currently not treated in compliance with SC BAT/BEP.			
Output 3.1: Demonstration technologies selected and procured for the decontamination of PCB-contaminated oil	Numbers of companies with decontamination of mineral oils are procured and operating.	The only available option currently is export disposal of PCB containing wastes. With this practice valuable mineral oil dielectric is burnt. This increases the CO2 emissions and makes the replacement of transformers even more expensive.	Two companies adopting best environmental practices for contaminated mineral oil clean and reutilize in the electrical network.	Copy of approval of operation documents.	The procurement will be successful and two treatment units could be procured. The treatment price will be reduced to 3 USD/kg.
Output 3.2: BAT technologies for pre-treatment of PCB-containing wastes selected	Number of transferred technologies.	Currently PCB-contaminated wastes are sent for export disposal, which most of the times means incineration. The cost	PCB-contaminated metal parts will be locally pretreated, cleaned and the valuable copper, steel and aluminum parts sold. This practice will drastically	Copy of approval of operation documents.	Private sector stakeholders will realize the economic potential in pre-treating PCB wastes and selling valuable metals. This will facilitate their commitment for the project, and will ensure that they will carry on these activities after

Interventions	Indicators	Baseline	Target	Sources of Verification	Assumptions
		of incineration depends on the weight of the waste sent to the incinerator. With this practices PCB owners pay 6-8 USD/kg for the metal parts of transformers and other PCB-contaminated wastes, while these waste streams can be recovered after the incineration and sold.	reduce the cost of disposal operations. Two mobile units for the pre-treatment of PCB-containing wastes are procured and are in operation applying BAT/BEP.		project completion.
Output 3.3: Technology options for the disposal of high concentration PCBs oils and other PCB wastes selected and implemented	The feasibility of local disposal of high concentration PCBs have been demonstrated. Pilot project for solving high concentration PCB disposal through PPP is developed.	Hazardous Waste management in Ukraine is currently building up. Understanding the need for local technologies for treating HW Tarkom LLC has recently invested in establishing an incineration facility. It is expected to start its operation in May 2014.	Project will assist MENR in forming Public and Private Partnership (PPP) with disposal facilities such as Tarkom Ekoservis LLC to upgrade the facility to higher throughput for highly chlorinated chemicals. One stationary unit is under operation for disposal of high concentration PCBs.	Copy of pilot project document.	High concentration PCB disposal operation is demonstrated in the project and project stakeholders will continue the elimination as part of a PPP.

Interventions	Indicators	Baseline	Target	Sources of Verification	Assumptions
Output 3.4: Safe disposal of PCBs oil, PCB-containing equipment and wastes.	Weight of disposed of PCBs.: -PCB concentrated oils -PCB contaminated oils -PCB containing equipment and wastes. -material recycled. -commercial value of recycled materials Equivalent CO^2 emission prevented tons/ CO^2.	Economic and safe disposal is prevented due to lack of local technologies. The price of PCB disposal is high due to international transport and incineration costs.	3000 tons of PCB containing equipment and wastes. To be refined after the inventory is completed.	PIR reports.	The disposal technologies will be successfully tested, permitted and will work reliably maintaining the required disposal capacity. PCB owners will maintain their commitment to dispose their PCBs under the project.
Output 3.5: Training and awareness raising for relevant stakeholders and PCB owners on ESM system and occupational safety undertaken at country level	Number of training workshops held, number of trained stakeholders (male/female). Project stakeholders and PCB owners know about PCBs, they are aware of their environmental, occupational safety implications.	Currently information of potential project stakeholders and PCB owners on the Best Environmental Practices (BEP) concerning PCBs and potentially PCB-containing equipment is scarce.	Project stakeholders are appropriately trained on the ESM system. Environmental releases of PCB during transformer maintenance and disposal operations are minimized. Occupational health related standards of the ESM are adhered to. Directly trained or participated: 150 people Trained and informed at the national level: 1500 people Male/Female ratio is	Workshops trainings reports. Number of companies with trained employees.	The project partners are committed to provide a significant financial and technical support to ensure the successful implementation and demonstration of technologies for the ESM disposal of PCB. Participation in the training workshops will be high.

Interventions	Indicators	Baseline	Target	Sources of Verification	Assumptions
			recorded at project start and closure.		
Outcome 4: Adherence to project document and attainment of project objective	Implementation follows the workplan and budget.	Baseline indicators are assessed and documented at project startup.	Monitoring and evaluation team established in due time. All Project reports (APRs, AWPs, PIRs) effectively drafted and timely delivered	Monitoring and evaluation team established in due time. All Project reports (APRs, AWPs, PIRs) effectively drafted and timely delivered	IR, APRs, AWP, PIRs, evaluation reports will be timely drafted and their content properly communicated and used for an effective project management

ANNEX B: RESPONSES TO PROJECT REVIEWS (from GEF Secretariat and GEF Agencies, and Responses to Comments from Council at work program inclusion and the Convention Secretariat and STAP at PIF).

The comments by GEFSEC have been fully considered at the stage of the formulation of the PIF.
The following table lists how STAP comments have been taken into consideration in the development of the project document.

Comment by STAP	Consideration of the project
The project approach appears to be quite comprehensive, though it would be good to highlight what role the national labs can play in monitoring PCBs. The NIP outlined an apparent gap in capacity to analyse POPs, and if there is to be an ESM system that operates post project, with attendant regulatory support, then there must be a way to measure PCB levels on equipment, in wastes, contaminated areas etc. It is not clear whether this gap is being satisfied through other funded activities, and represents a significant omission in an otherwise comprehensive document - and should be addressed in the full project document. It is difficult to see how ESM will continue post project if the government is unable to ensure the monitoring data necessary to enact or enforce regulatory measures to control PCB releases.	Through the project, a national registry for PCB containing equipment will be established and maintained. The labs and analytical testing procedures being established and used during the project will continue to be used by owners of electrical equipment (transformers) to test their equipment and determine the PCB level. The information gathered will be used by owners of equipment containing PCBs to take actions to minimize releases from these equipment and ultimately to plan and implement treatment or replacement of the PCB containing equipment.
As a reminder, the STAP hopes that the eventual project document will also consider all of the elements that constitute environmentally sound disposal. The STAP Advisory document on POPs Disposal Technology in GEF Projects focuses on what exactly constitutes environmentally sound disposal of POPs, and what disposal technologies are best able to achieve it. This follows initial contributions from the GEF (through the STAP) in 2003/2004 in relation to available non-combustion technologies for POPs disposal; and apart from this, the Basel Convention, acting in concert with the Stockholm Convention, has issued and periodically updates technical BAT/BEP guidelines on POPs management. This guidance includes disposal requirements and listings of technologies that may be applicable. To date, these guidelines have been generally adopted by the Stockholm Convention as the standard reference. There have also been comprehensive reviews of technologies which are periodically published, and on-line libraries of technology data sheets are maintained by the Basel Convention and supporting organizations. The Fifth Conference of the Parties (COP-5) to the Stockholm Convention invited the Basel Convention to continue this work, specifically with respect to establishing the levels of destruction and irreversible transformation of chemicals to ensure POPs characteristics are not exhibited; considering methods that constitute environmentally sound disposal; defining low POP-content in wastes; and updating general technical guidelines as well as preparing or updating specific technical guidelines for environmentally sound waste management (SC-5/9). Likewise, in its decision SC-5/20, COP-5 further encourages	It is well accepted that there is no universal solution that it is the optimum alternative for the disposal or treatment of all streams containing PCBs. Thus, dechlorination methods for the decontamination of PCB contaminated mineral oil may be the most economical and economically attractive alternative for the treatment of this waste stream, but it at best more expensive than plasma and/or incineration as alternativies for the disposal of PCB dielectric fluids such as Askarels, Sovtols, Delors. Similarly, decontamination methods for PCB contaminated metals, with the advantage of allowing the recovery of the metals, are also more economical and environmentally friendlier alternatives than incineration for cleaning of PCB contaminated metals from electrical equipment. Annex P provides a summary of those technologies that may be appropriate for the disposal tasks of the project. This project will determine the potential spread of PCB contamination in electrical equipment and sites and implement an arrangement of BAT/BET solutions to satisfy the needs of Ukraine, as determined through the extended inventory activity. The treatment options, being established as part of this project will continue to be used in Ukraine beyond the duration of the project, demonstrating the sustainability of the project.

the GEF and parties in a position to do so to facilitate the transfer of appropriate technologies to developing countries and countries with economies in transition (CEITs).	
The findings of the document state, inter alia, that: "…. the destruction or irreversible transformation of POPs in an environmentally sound manner is not limited by the availability of appropriate technologyâ€"there are a number of such technologies. Rather, it is limited by the practical ability to assemble and apply them--particularly in developing countries and CEIT's - in a manner that is environmentally effective, timely, and cost effective….. Destruction cannot be addressed in isolation. The application of POPs disposal technology should be viewed as one part of an overall POPs management process or system. This system includes steps taken in advance of the actual disposal or destruction to identify, capture, secure, and prepare POPs stockpiles and wastes for disposal. It also includes post-destruction steps to manage emissions, by-products and residuals. The management process depends upon high-quality information regarding POPs stockpiles and waste, and the effectiveness of the institutional and regulatory framework under which POPs management is undertaken." Therefore based on the aforementioned background: a) In developing the project document and determining disposal options, action should be taken to incorporate the Stockholm/Basel and GEF guidance on technology selection for POPs disposal and the overall development of the ESM system for PCBs. This would ensure that a comprehensive set of parameters be used to select technologies for GEF investment (e.g. environmental performance, ability to manage residuals and transformation products of the destruction and decontamination processes, full assessment of pre-treatment steps required and attendant associated risks, and required resources and capacities to manage them). Explicitly following of the aforementioned scientific guidelines would be desirable in the course of project development, implementation, and monitoring and evaluation. This would also ensure that the true costs of a technology are brought to light since pre-destruction steps (eg. characterization of the PCB congeners to be handled, prioritization, capture and transport, containment and pre-treatment) can carry their own significant resource and capacity burdens, and can often be the barrier to implementation of technologies in	The current inventory indicates the presence of a significant number of PCB capacitors and transformers made with PCBs as the dielectric fluid, but there is no data on PCB contaminated mineral oil transformers. Mineral oil transformers contaminated with PCBs represent a significant environmental risk as they are usually install outdoors, in populated areas and sometimes near open waters. Because of the fire risks of these flammable transformers, the potential for PCDDs and PCDFs formation during a fire incident involving PCB contaminated transformers, human and environmental exposure to these toxic chemicals is quite possible. The analytical techniques (screening test and detailed PCB analysis) will be used to determine the extent of the PCB problem in Ukraine, particularly in mineral oil filled transformers. It is expected that as in most countries, Ukraine will also show that a significant number of mineral oil filled transformers are contaminated with PCBs. This realization will allow the project to adopt and implement comprehensive solutions to effectively and economically deal with Ukraine's PCB containing equipment and offer sustainable, local disposal/treatment options for PCB owners to safely and economically dispose of their PCB containing materials. The project is also intended to identify PCB contaminated electrical equipment from sensitive areas and accelerate their removal and/or treatment preventing the environmental release of these toxic compounds.

developing countries and CEITs. Definition of environmentally safe low POPs concentrations would also be clearer and kept consistent with best practices.	
b) The dangers of informal, repurposed use of POPs containing containers should be included in any targeted awareness in communities. There may be a large gender component to this (e.g. if women do water collection and other gathering of food etc using repurposed containers). But this may or may not be a problem in the Ukraine.	The project is not intended to recover PCB contaminated containers and repurposed them for the use of human, animal or agricultural activities. The project is intended to implement treatment solutions that can regenerate oil and metals that must pass decontamination criteria for reuse in industrial application. Thus, PCB-free mineral oil meeting the specifications of brand new oils can be re-used in electrical transformers as dielectric fluids. Similarly, PCB-free metals (specifically Copper and Carbon Steel) can be reprocessed and re-used in industrial applications. The project also intends to identify several interim storage locations to store PCB-contaminated equipment. A mobile decontamination unit will be moved around these locations for treatment of contaminated mineral oil and to clean the contaminated equipment and packaging materials (for example storage tanks, barrels can be washed with clean mineral oil and then decontaminated). This will significantly reduce the use of packaging materials for shipment, thus their later management will be cheaper and easier.
c) The need for enhanced analytical laboratory capacity is mentioned as a need (as well as creating opportunities for female capacity development), but how this would interact with the project is not clear. What is the role of national laboratories in this project? STAP suggests close interaction of such efforts with this project (or within the project if finances allow) to ensure characterization and quantification of PCBs, and measuring environmental levels of PCBs before, during, and after operation. This is also critical to the monitoring of operator exposures, as mentioned in the risk mitigation section. RECETOX in Brno hosts the Stockholm Convention Regional centre for capacity building and transfer of technology in Central and Eastern European countries, and could be approached for advice and possible deployment of relatively cheap and proven passive samplers.	The country's enhanced analytical capability will be in 2 steps. First, the implementation of screening tests that allow rapid determination of PCB presence in electrical transformers and therefore, in-situ segregation of PCBs from Non-PCB materials. Second, the establishment and maintenance of advanced PCB analytical capacity will be utilized to confirm the presence of PCBs in electrical transformers where rapid determination can not credibly do. Laboratories will also support the analysis of the output streams of the treatment technologies, such as the cleanliness of treated materials (decontaminated oil and metals); and the determination of environmental, workplace and human exposure to PCBs, PCDD/PCDFs. Project intends to develop national standards for PCB sampling and analysis. The project will not duplicate efforts and therefore will request information form the Stockholm Convention Regional Centre concerning the recommended analytical techniques and methods for analysis of environmental levels. As part of the licensing of waste treatment operations, MENR requires environmental impact assessments. This will be applicable for all interim storage locations and PCB-treatment sites. In the process of developing national standards for PCB analysis acceptable, commercially available options and/or existing analytical techniques adopted by European Union, the US Environmental Protection Agency and similar regulatory bodies

	will be consulted.
d) There is one very apparent anomaly in the text: in the 3rd paragraph of section B.1, mention is made of a seemingly high disposal cost of 6-8$/kg, while the 3rd paragraph of B.2 claims that introducing "local technologies" could result in a price drop "as low as" 6-8$/kg. This needs attention.	The duplication of the expected price of "6 -8$/kg" is an error. The expected treatment cost would depend on the waste stream being treated and the technology being used. Dechlorination cost of PCB contaminated mineral oil and metals is expected to in the order of "2.0-2.5 $/kg". Taking into consideration the much higher costs for dicontamination/disposal of porous materials, which depends on the original PCB level in the trnsformer, the avarage decontamination sost will be 2.5-3.0 $/kg. The decontamination of the porous material would be at worst case scenario competitive to incineration, however because the porous material represents only a small fraction of the overall transformer weight, specifically about 5%, the average disposal/decontamination cost of the equipment (metal+oil+porous matyerials) from the implementation of the proposed project would be a fraction (30 to 40%) of the potential disposal cost in European incinerators (approx.US$ 2-3/kg). Furthermore, the recovery of the mineral oil and metals, particularly copper, make the solutions to be implemented under the proposed project even more economically attractive

Comments by GEF Secretariat	Response
Question 31 (of the GEF Secretariat Review) Items to consider at CEO endorsement/approval: Clear description of the ESM	The following description of the system introduced in the text of the document: The project will develop the system of environmentally sound management (ESM) and removal of PCBs. All components of the project will contribute in the development of this system, consisting of: - the improved/updated legislation and the administrative mechanisms of the Government established to monitor the requirements of the updated regulation for operational equipment containing PCBs, its phasing out and safe disposal; - the results of the inventory organized in the database for monitoring the decontamination of the equipment and disposal of PCB wastes. During the life of the project the database will permit to find the most economic and efficient approach to achieving the planned results of the project component 3 – decontamination and disposal of 3,000 t of contaminated equipment; - environmentally safe methods of collection, dismantling and transportation of contaminated equipment; - environmentally safe technologies for

	decontamination of low-contaminated equipment and disposal of high-contaminated equipment; - trained technical staff, protected from direct contacts with PCB-containing equipment; - staff of the environmental authorities, trained to implement the requirements of the updated legislation; - system of informing the general public on the danger, which PCBs represent to the people and environment and methods/precaution actions that could be used to reduce this danger.
Clear description of the non-combustion technologies and how they will be transferred	The detail description of the non-com technologies are given under Annex P. The project foresees the procurement of 2 mobile installations as a part of establishing the EMS with a) associated infrastructure for their operations and safe transportation either the units to contaminated transformers or contaminated oil and wastes to the collection points, and b) trained and protected technical staff having contacts with contaminated materials and equipment.
Clear description of the socio-economic and gender dimensions of the project	The relevant descriptions are given under: - paragraph A 5, Component#3. The system of environmentally sound management (ESM) and removal of PCBs, including transfer of technology and its introduction on pages 22-24; - in the table Comparative analysis for disposal of contaminated transformers in the country and abroad; - para B2 and B3

ANNEX C: STATUS OF IMPLEMENTATION OF PROJECT PREPARATION ACTIVITIES AND THE USE OF FUNDS[7]

A.PROVIDE DETAILED FUNDING AMOUNT OF THE PPG ACTIVITIES FINANCING STATUS IN THE TABLE BELOW:

During the PPG phase a core of the national project team was created. The activities of the PPG were implemented mostly by them. In particular, the team contacted most of the large owners of transformers in the country and negotiated their participation in the project. They assured the commitments of several companies for co-financing of the project.

The project team was in permanent contacts with the Ministry of Ecology and Natural Resources of Ukraine, who coordinated, assisted and approved their activities in respect of the details of the future project.

The team undertook an extensive work in attaining additional information required for elaboration of the concept of the project, needed inputs, their costs, participants of each activity and other issues to be considered in the formulation of the project document.

The overarching study was prepared, which contains all available information related to legal, administrative, technical and social issues of PCB availability and contamination in the country (Annex H).

In view that no chemical analysis for PCB content was done during the preliminary inventory in the course of the NIP preparation, it was decided to undertake a limited inventory of 500 transformers with express-analysis kits in order to define a degree of contamination of transformers during their service (cross-contamination).

The information of the above study and the limited inventory permitted to justify the scope of activities and inputs required to reach the outputs of the project and will be used as a starting point in implementation of the project, when approved.

PPG Grant Approved at PIF:			
Project Preparation Activities Implemented	***GEF/LDCF/SCCF/NPIF Amount ($)***		
	Budgeted Amount	***Amount Spent To date***	***Amount Committed***
I. Development of national surveys and refining of the preliminary PCB inventory	150,000	120,000	30,000
II. Stakeholders analysis and mobilization of co-financing, including the definition of baseline and incremenal matrix required to develop the capacity for the environmentally sound management (ESM) and disposal of PCBs	50,000	40,000	20,000
III.Define the strategies for the sustainability of the environmentally sound management of PCBs and PCB-containing equipment and wastes, including the demonstration project for PCB management.	50,000	30,000	10,000
IV Development of FSP document and endorsement of stakeholders	0		
Total	**250,000**	**190,000**	**60,000**

[7] If at CEO Endorsement, the PPG activities have not been completed and there is a balance of unspent fund, Agencies can continue undertake the activities up to one year of project start. No later than one year from start of project implementation, Agencies should report this table to the GEF Secretariat on the completion of PPG activities and the amount spent for the activities.

ANNEX D: CALENDAR OF EXPECTED REFLOWS (if non-grant instrument is used)

Provide a calendar of expected reflows to the GEF/LDCF/SCCF/NPIF Trust Fund or to your Agency (and/or revolving fund that will be set up)

Annex E: Project Timeline

YEAR	1												2												3												4											
Quarter	1			2			3			4			1			2			3			4			1			2			3			4														
Month	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	#	#	#	1	2	3	4	5	6	7	8	9	10	11	12
Interventions																																																
Outcome 1: Strengthening of legal framework and institutional capacities for efficient PCB management and disposal																																															
Output 1.1: PCB-related legislation including technical guidelines updated and in place																																															
Activity 1.1.1: Develop technical regulation for PCB self-reporting and submit it to the Cabinet of Ministers																																															
Activity 1.1.2: Amend electrical equipment maintenance manuals in regard to requirements for PCB analysis																																															
Activity 1.1.3: Adopt PCB-related EU standards and norms for PCB control and monitoring																																															
Output 1.2: Staff of government agencies, customs, NGOs and PCB owners trained to implement the regulation																																															
Activity 1.2.1: Organize one training workshop for State Ecological inspectors dealing with PCB management																																															
Activity 1.2.2: Organize one training workshop for Sanitary and Epidemiological Service on PCB related matters																																															
Activity 1.2.3: Organize one training workshop for PCB owners, scientific community, NGOs and other project stakeholders																																															
Activity 1.2.4: Train project staff on sampling potentially PCB-containing matrices including the related human health, environmental health and safety matters																																															
Output 1.3: Methods for PCBs analysis adopted and 3-4 laboratories accredited for PCB analysis																																															
Activity 1.3.1: Adopt PCB analytical methods in selected laboratories																																															
Activity 1.3.2: Upgrade analytical capacities of the selected laboratories																																															
Activity 1.3.3: Facilitate accreditation																																															

YEAR	1												2												3												4											
Quarter	1			2			3			4			1			2			3			4			1			2			3			4			1			2			3			4		
Month	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	#	#	#	1	2	3	4	5	6	7	8	9	10	11	12
of the laboratories for PCB analysis																																																
Output 1.4: ESM system for the use and disposal of PCBs including related occupational safety measures implemented and published in a guideline																																																
Activity 1.4.1: Establish a resource group to support ESM development and implementation																																																
Activity 1.4.2: Develop and publish the ESM guidelines including BAT/BEP for PCB management																																																
Output 1.5: Operating procedures and trainings for enforcement authorities to carry out inspections related to the ESM system standardized																																																
Activity 1.5.1: Amend/revise the documents regulating ecological inspection porcedures and their reporting																																																
Output 1.6: Emergency response measures developed and in place for transformer fires and leakages at the State Agency for Emergency Situations																																																
Activity 1.6.1: Amend/revise current emergency response measures with PCB-related dangers																																																
Outcome 2: Establishment of in-depth inventory of the major owners of contaminated equipment and development of the national management plan for PCB disposal																																																
Output 2.1: At least 10,000 PCB analysis conducted and organized in a database as an instrument for PCB phase out and disposal planning																																																
Activity 2.1.1: Set up team and provide training on sampling and analysis of oil from electrical transformers																																																
Activity 2.1.2: Establish guidelines for submitting samples that show positive PCB presence in screening test for further detailed analysis																																																
Activity 2.1.3: Conduct sampling of electrical equipment, analyze the samples and record the results in the PCB database																																																
Output 2.2: Inspected equipment labeled and prioritized for decontamination or disposal																																																

YEAR	1												2												3												4											
Quarter	1			2			3			4			1			2			3			4			1			2			3			4			1			2			3			4		
Month	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	#	#	#	1	2	3	4	5	6	7	8	9	10	11	12
Activity 2.2.1: Label transformers according to analytical result																																																
Activity 2.2.2: Establish and maintain a register of PCB containing equipment																																															
Activity 2.2.3: Develop disposal plan to provide the 3000 metric tonnes of PCB containing equipment to be treated by the project																																															
Output 2.3: Current management practices for electrical equipment identified and documented																																															
Activity 2.3.1: Review and amend current operating manuals and procedures to incorporate segregation of PCBs and non-PCB contaminated equipment																																															
Output 2.4: PCBs phase out and disposal plans developed																																															
Activity 2.4.1: Develop criteria for prioritization of PCB containing equipment for phase out																																															
Activity 2.4.2: Develop and implement phase out plans for PCB containing equipment																																															
Output 2.5: Potentially contaminated sites identified and recorded																																															
Activity 2.5.1: Develop data collection forms for potentially contaminated sites																																															
Activity 2.5.2: Identify and record potentially contaminated sites																																															
Outcome 3: Demonstration of ESM and disposal of PCBs by decontamination and extension of life cycle of some operational equipment, recycling of mineral oil and secondary metals to enable reduction / elimination of PCB releases into the environment																																															
Output 3.1: Demonstration technologies selected and procured for the decontamination of PCB-contaminated oil																																															
Activity 3.1.1: Develop Terms of Reference for the procurement of a PCB contaminated oil treatment system																																															
Activity 3.1.2: Procure PCB contaminated oil treatment system																																															
Output 3.2: BAT technologies for pre-treatment of PCB-containing wastes																																															

YEAR	1												2												3												4											
Quarter	1			2			3			4			1			2			3			4			1			2			3			4			1			2			3			4		
Month	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	#	#	#	1	2	3	4	5	6	7	8	9	10	11	12
selected																																																
Activity 3.2.1: Develop Terms of Reference for the procurement of pre-treatment technology for solid material from electrical equipment																																															
Activity 3.2.2: Procure a pre-treatment system and/or service for solid material from electrical equipment																																															
Output 3.3: Technology options for the disposal of high concentration PCBs oils and other PCB wastes selected and implemented																																															
Activity 3.3.1: Develop Terms of reference and PPP project concept for MENR for disposal of high concentration PCB liquid wastes																																															
Activity 3.3.2: Procure a system or service for the disposal of high concentration PCB liquid wastes																																															
Output 3.4: 3,000 tonnes of PCBs oil, PCB-containing equipment and wastes disposed of																																															
Activity 3.4.1: Select a location for the establishment of PCB disposal systems, interim storages and services (treatment site)																																															
Activity 3.4.2: Transport PCB wastes to treatment sites and/or facilities or transport mobile processing unit to interim storage sites																																															
Activity 3.4.3: dispose of 3000 metric tonnes of PCB wastes in an environmentally sound manner																																															
Output 3.5: Training and awareness raising for relevant stakeholders and PCB owners on ESM system and occupational safety undertaken at country level																																															
Activity 3.5.1: Train project stakeholders and State Ecological Inspectors on the ESM guidelines and emergency response measures																																															
Outcome 4: Adherence to project document and attainment of project objective																																															
Output 4.1: Baseline indicators assessed																																															
Activity 4.1.1: Establish Project Steering Committee (PSC) and Project Management Unit (PMU)																																															

YEAR	1												2												3												4											
Quarter	1			2			3			4			1			2			3			4			1			2			3			4			1			2			3			4		
Month	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	#	#	#	1	2	3	4	5	6	7	8	9	10	11	12
Activity 4.1.2: Establish methodology for assessing impact indicators																																															
Activity 4.1.3: Measure baseline indicators																																															
Output 4.2: Project impact monitoring system, evaluation of the achieved results and introduction of corrections if required																																															
Activity 4.2.1: Measure impact indicators																																															
Activity 4.2.2: Hold PSC meetings to review implementation progress																																															
Activity 4.2.3: Prepare Annual Project Reports and Project Implementation Reviews																																															
Activity 4.2.4: Carry out mid-term external evaluation																																															
Activity 4.2.5: Carry out final external evaluation																																															
Activity 4.2.6: Complete Project Terminal Report																																															
Output 4.3: Dissemination of project related information and results to local stakeholders																																															
Activity 4.3.1: Organize Inception Workshop																																															
Activity 4.3.2: Hold project management training for project management staff as the first PSC meeting																																															
Activity 4.3.3: Organize Project Terminal Workshop																																															

Annex F: SUMMARY OF FUND DISTRIBUTION

Interventions	Financing (USD)		
	GEF	Co-financing	Total
Outcome 1: Strengthening of legal framework and institutional capacities for efficient PCB management and disposal	300,000	1,000,000	1,300,000
Output 1.1: PCB-related legislation including technical guidelines updated and in place	35,000	100,000	135,000
Activity 1.1.1: Develop technical regulation for PCB self-reporting and submit it to the Cabinet of Ministers	15,000	40,000	55,000
Activity 1.1.2: Amend electrical equipment maintenance manuals in regard to requirements for PCB analysis	10,000	30,000	40,000
Activity 1.1.3: Adopt PCB-related EU standards and norms for PCB control and monitoring	10,000	30,000	40,000
Output 1.2: Staff of government agencies, customs, NGOs and PCB owners trained to implement the regulation	26,000	120,000	146,000
Activity 1.2.1: Organize one training workshop for State Ecological inspectors dealing with PCB management	7,000	30,000	37,000
Activity 1.2.2: Organize one training workshop for Sanitary and Epidemiological Service on PCB related matters	7,000	30,000	37,000
Activity 1.2.3: Organize one training workshop for PCB owners, scientific community, NGOs and other project stakeholders	7,000	30,000	37,000
Activity 1.2.4: Train project staff on sampling potentially PCB-containing matrices including the related human health, environmental health and safety matters	5,000	30,000	35,000
Output 1.3: Methods for PCBs analysis adopted and 3-4 laboratories accredited for PCB analysis	214,000	680,000	894,000

Interventions	Financing (USD)		
	GEF	Co-financing	Total
Activity 1.3.1: Adopt PCB analytical methods in selected laboratories	20,000	100,000	120,000
Activity 1.3.2: Upgrade analytical capacities of the selected laboratories	179,000	480,000	659,000
Activity 1.3.3: Facilitate accreditation of the laboratories for PCB analysis	15,000	100,000	115,000
Output 1.4: ESM system for the use and disposal of PCBs including related occupational safety measures implemented and published in a guideline	15,000	50,000	65,000
Activity 1.4.1: Establish a resource group to support ESM development and implementation	1,000	10,000	11,000
Activity 1.4.2: Develop and publish the ESM guidelines including BAT/BEP for PCB management	14,000	40,000	54,000
Output 1.5: Operating procedures and trainings for enforcement authorities to carry out inspections related to the ESM system standardized	5,000	20,000	25,000
Activity 1.5.1: Amend/revise the documents regulating ecological inspection procedures and their reporting	5,000	20,000	25,000
Output 1.6: Emergency response measures developed and in place for transformer fires and leakages at the State Agency for Emergency Situations	5,000	30,000	35,000
Activity 1.6.1: Amend/revise current emergency response measures with PCB-related dangers	5,000	30,000	35,000
Outcome 2: Establishment of in-depth inventory of the major owners of contaminated equipment and development of the national management plan for PCB disposal	1,400,000	5,800,000	7,500,000

Interventions	Financing (USD)		
	GEF	Co-financing	Total
Output 2.1: At least 10,000 PCB analysis conducted and organized in a database as an instrument for PCB phase out and disposal planning	820,000	3,900,000	4,920,000
Activity 2.1.1: Set up team and provide training on sampling and analysis of oil from electrical transformers	15,000	70,000	85,000
Activity 2.1.2: Establish guidelines for submitting samples that show positive PCB presence in screening test for further detailed analysis	5,000	30,000	35,000
Output 2.1.3: Conduct sampling of electrical equipment, analyze the samples and record the results in the PCB database	800,000	3,800,000	4,800,000
Output 2.2: Inspected equipment labeled and prioritized for decontamination or disposal	495,000	1,375,000	1,970,000
Activity 2.2.1: Label transformers according to analytical result	350,000	945,000	1,395,000
Activity 2.2.2: Establish and maintain a register of PCB containing equipment	115,000	255,000	370,000
Activity 2.2.3: Develop disposal plan to provide the 3000 metric tons of PCB containing equipment to be treated by the project	30,000	175,000	205,000
Output 2.3: Current management practices for electrical equipment identified and documented	5,000	20,000	25,000
Activity 2.3.1: Review and amend current operating manual and procedures to incorporate segregation of PCBs and non-PCB contaminated equipment	5,000	20,000	25,000
Output 2.4: PCBs phase out and disposal plans developed	30,000	175,000	205,000
Activity 2.4.1: Develop criteria for prioritization of PCB containing equipment for phase out	5,000	25,000	30,000

Interventions	Financing (USD)		
	GEF	Co-financing	Total
Activity 2.4.2: Develop and implement phase out plans for PCB containing equipment	25,000	150,000	175,000
Output 2.5: Potentially contaminated sites identified and recorded	50,000	330,000	380,000
Activity 2.5.1: Develop data collection forms for potentially contaminated sites	5,000	30,000	35,000
Activity 2.5.2: Identify and record potentially contaminated sites	45,000	300,000	345,000
Outcome 3: Demonstration of ESM and disposal of PCBs by decontamination and extension of life cycle of some operational equipment, recycling of mineral oil and secondary metals to enable reduction / elimination of PCB releases into the environment	3,000,000	12,700,000	15,700,000
Output 3.1: Demonstration technologies selected and procured for the decontamination of PCB-contaminated oil	1,605,000	1,910,000	3,515,000
Activity 3.1.1: Develop Terms of Reference for the procurement of a PCB contaminated oil treatment system	5,000	10,000	15,000
Activity 3.1.2: Procure PCB contaminated oil treatment system	1,600,000	1,900,000	3,500,000
Output 3.2: BAT technologies for pre-treatment of PCB-containing wastes selected and procured	505,000	2,010,000	2,515,000
Activity 3.2.1: Develop Terms of Reference for the procurement of pre-treatment technology for solid material from electrical equipment	5,000	10,000	15,000
Activity 3.2.2: Procure a pre-treatment system and/or service for solid material from electrical equipment	500,000	2,000,000	2,500,000
Output 3.3: Technology options for the disposal of high concentration PCBs oils and other PCB wastes selected and implemented	525,000	1,100,000	1,625,000

Interventions	Financing (USD)		
	GEF	Co-financing	Total
Activity 3.3.1: Develop Terms of reference and PPP project concept for MENR for disposal of high concentration PCB liquid wastes	25,000	80,000	105,000
Activity 3.3.2: Procure a system or service for the disposal of high concentration PCB liquid wastes	500,000	1,020,000	1,520,000
Output 3.4: 3,000 tons of PCBs oil, PCB-containing equipment and wastes disposed of	360,000	7,640,000	8,000,000
Activity 3.4.1: Select a location for the establishment of PCB disposal systems, interim storages and services (treatment site)	10,000	300,000	310,000
Activity 3.4.2: Transport PCB wastes to treatment sites and/or facilities or transport mobile processing unit to interim storage sites	50,000	1,000,000	1,050,000
Activity 3.4.3: dispose of 3000 metric tons of PCB wastes in an environmentally sound manner	300,000	6,340,000	6,640,000
Output 3.5: Training and awareness raising for relevant stakeholders and PCB owners on ESM system and occupational safety undertaken at country level	5,000	40,000	45,000
Activity 3.5.1: Train project stakeholders and State Ecological Inspectors on the ESM guidelines and emergency response measures	5,000	40,000	45,000
Outcome 4: Adherence to project document and attainment of project objective	300,000	500,000	800,000
Output 4.1: Baseline indicators assessed	195,000	70,000	265,000
Activity 4.1.1: Establish Project Steering Committee (PSC) and Project Management Unit (PMU)	185,000	20,000	205,000
Activity 4.1.2: Establish methodology for assessing impact indicators	5,000	30,000	35,000

Interventions	Financing (USD)		
	GEF	Co-financing	Total
Activity 4.1.3: Measure baseline indicators	5,000	20,000	25,000
Output 4.2: Project impact monitoring system, evaluation of the achieved results and introduction of corrections if required	90,000	280,000	370,000
Activity 4.2.1: Measure impact indicators	30,000	20,000	50,000
Activity 4.2.2: Hold PSC meetings to review implementation progress	10,000	40,000	50,000
Activity 4.2.3: Prepare Annual Project Reports and Project Implementation Reviews	15,000	60,000	75,000
Activity 4.2.4: Carry out mid-term external evaluation	15,000	60,000	75,000
Activity 4.2.5: Carry out final external evaluation	15,000	50,000	65,000
Activity 4.2.6: Complete Project Terminal Report	5,000	50,000	55,000
Output 4.3: Dissemination of project related information and results to local stakeholders	15,000	150,000	165,000
Activity 4.3.1: Organize Inception Workshop	5,000	50,000	55,000
Activity 4.3.2: Hold project management training for project management staff as the first PSC meeting	5,000	50,000	55,000
Activity 4.3.3: Organize Project Terminal Workshop	5,000	50,000	55,000
Total	**5,000,000**	**20,000,000**	**25,300,000**
Project Management Costs:	250,000	1,000,000	1,250,000
Total Project Costs:	**5,250,000**	**21,000,000**[8]	**26,550,000**

[8] THIS AMOUNT DOES NOT INCLUDE US17.0 MLN OF CO-FINANCING FROM THE MINISTRY OF ENVIRONMENT AND NATURAL RESOURCES FOR PPP OFF-SPRING PROJECTS. PLEASE REFER TO EXPLANATION ON PAGE 5 AND THE DRAWING ON PAGE 22.

ANNEX G: GEF PROJECT BUDGET

GEF Outputs/Inputs	Budget lines	Description	Year 1		Year 2		Year 3		Year 4		Total	
			US$	w/m	US$	w/m	US$	w/m	US$	w/m	US$	w/m
Output 1.1: PCB-related legislation including technical guidelines updated and in place	11-00	Consultants	5,000	0.4							5,000	0.4
	17-00	Nat. Experts	12,000	30.0							12,000	30.0
	51-00	Sundries										
	15-00	Project Staff travel										
	45-00	Equipment										
	30-00	Workshops	18,000								18,000	
	21-00	Subcontracts										
		Sub-total	*35,000*	*30.4*							*35,000*	*30.4*
Output 1.2: Staff of government agencies, customs, NGOs and PCB owners trained to implement the regulation	11-00	Consultants	2,000	0.2	2,000	0.2					4,000	0.3
	17-00	Nat. Experts	2,000	5.0	8,000	20.0					10,000	25.0
	51-00	Sundries										
	15-00	Project Staff travel			4,000						4,000	
	45-00	Equipment										
	30-00	Workshops			8,000						8,000	
	21-00	Subcontracts										
		Sub-total	*4,000*	*5.2*	*22,000*	*20.2*					*26,000*	*25.3*
Output 1.3: Methods for PCBs analysis adopted and 3-4 laboratories accredited for PCB analysis	11-00	Consultants	10,000	0.8							10,000	0.8
	17-00	Nat. Experts	45,000	112.5	7,000	17.5					52,000	130.0
	51-00	Sundries	15,000								15,000	
	15-00	Project Staff travel	15,000		5,000						20,000	
	45-00	Equipment	80,000		30,000						110,000	
	30-00	Workshops										
	21-00	Subcontracts	7,000								7,000	
		Sub-total	*172,000*	*113.3*	*42,000*	*17.5*					*214,000*	*130.8*

GEF Outputs/Inputs	Budget lines	Description	Year 1		Year 2		Year 3		Year 4		Total	
			US$	w/m	US$	w/m	US$	w/m	US$	w/m	US$	w/m
Output 1.4: ESM system for the use and disposal of PCBs including related occupational safety measures implemented and published in a guideline	11-00	Consultants	7,000	0.6							7,000	0.6
	17-00	Nat. Experts	8,000	20.0							8,000	20.0
	51-00	Sundries										
	15-00	Project Staff travel										
	45-00	Equipment										
	30-00	Workshops										
	21-00	Subcontracts										
		Sub-total	***15,000***	***20.6***							***15,000***	***20.6***
Output 1.5: Operating procedures and trainings for enforcement authorities to carry out inspections related to the ESM system standardized	11-00	Consultants										
	17-00	Nat. Experts			3,000	7.5					3,000	7.5
	51-00	Sundries										
	15-00	Project Staff travel										
	45-00	Equipment										
	30-00	Workshops			2,000						2,000	
	21-00	Subcontracts										
		Sub-total			***5,000***	***7.5***					***5,000***	***7.5***
Output 1.6: Emergency response measures developed and in place for transformer fires and leakages at the State Agency for Emergency Situations	11-00	Consultants										
	17-00	Nat. Experts	5,000	12.5							5,000	12.5
	51-00	Sundries										
	15-00	Project Staff travel										
	45-00	Equipment										
	30-00	Workshops										
	21-00	Subcontracts										
		Sub-total	***5,000***	***12.5***							***5,000***	***12.5***
Output 2.1: At least 10,000 PCB analysis	11-00	Consultants	30,000	2.5	8,000	0.7	8,000	0.7			46,000	3.8

GEF Outputs/Inputs	Budget lines	Description	Year 1		Year 2		Year 3		Year 4		Total	
			US$	w/m	US$	w/m	US$	w/m	US$	w/m	US$	w/m
conducted and organized in a database as an instrument for PCB phase out and disposal planning	17-00	Nat. Experts	150,000	375.0	150,000	375.0	100,000	250.0	80,000	6.7	480,000	1,006.7
	51-00	Sundries	25,000		5,000		3,000		3,000		36,000	
	15-00	Project Staff travel	60,000		60,000		40,000		30,000		190,000	
	45-00	Equipment	120,000		60,000						180,000	
	30-00	Workshops	8,000		4,000		4,000		2,000		18,000	
	21-00	Subcontracts	25,000		25,000		15,000		5,000		70,000	
		Sub-total	*418,000*	*377.5*	*312,000*	*375.7*	*170,000*	*250.7*	*120,000*	*6.7*	*1,020,000*	*1,010.5*
Output 2.2: Inspected equipment labeled and prioritized for decontamination or disposal	11-00	Consultants	20,000	1.7	40,000	3.3	15,000	1.3	15,000	1.3	90,000	7.5
	17-00	Nat. Experts	10,000	25.0	40,000	100.0	45,000	112.5	70,000	5.8	165,000	243.3
	51-00	Sundries	6,000		6,000		6,000		6,000		24,000	
	15-00	Project Staff travel	5,000		3,000		3,000		3,000		14,000	
	45-00	Equipment	60,000		70,000		70,000		70,000		270,000	
	30-00	Workshops	3,000				4,000		5,000		12,000	
	21-00	Subcontracts					20,000				20,000	
		Sub-total	*104,000*	*26.7*	*159,000*	*103.3*	*163,000*	*113.8*	*169,000*	*7.1*	*595,000*	*250.8*
Output 2.3: Current management practices for electrical equipment identified and documented	11-00	Consultants										
	17-00	Nat. Experts	5,000	12.5							5,000	12.5
	51-00	Sundries										
	15-00	Project Staff travel										
	45-00	Equipment										
	30-00	Workshops										
	21-00	Subcontracts										
		Sub-total	*5,000*	*12.5*							*5,000*	*12.5*
Output 2.4: PCBs phase out and disposal plans developed	11-00	Consultants	5,000	0.4	5,000	0.4					10,000	0.8
	17-00	Nat. Experts	8,000	20.0	8,000	20.0					16,000	40.0

GEF Outputs/Inputs	Budget lines	Description	Year 1		Year 2		Year 3		Year 4		Total	
			US$	w/m	US$	w/m	US$	w/m	US$	w/m	US$	w/m
	51-00	Sundries	2,000								2,000	
	15-00	Project Staff travel										
	45-00	Equipment										
	30-00	Workshops	2,000								2,000	
	21-00	Subcontracts										
		Sub-total	***17,000***	***20.4***	***13,000***	***20.4***					***30,000***	***40.8***
Output 2.5: Potentially contaminated sites identified and recorded	11-00	Consultants	5,000	0.4							5,000	0.4
	17-00	Nat. Experts	2,000	5.0	7,000	17.5	7,000	17.5	7,000	0.6	23,000	40.6
	51-00	Sundries										
	15-00	Project Staff travel			1,000		1,000		1,000		3,000	
	45-00	Equipment	8,000								8,000	
	30-00	Workshops	7,000						4,000		11,000	
	21-00	Subcontracts										
		Sub-total	***22,000***	***5.4***	***8,000***	***17.5***	***8,000***	***17.5***	***12,000***	***0.6***	***50,000***	***41.0***
Output 3.1: Demonstration technologies selected and procured for the decontamination of PCB-contaminated oil	11-00	Consultants	5,000	0.4	25,000	2.1					30,000	2.5
	17-00	Nat. Experts	10,000	25.0	10,000	25.0					20,000	50.0
	51-00	Sundries										
	15-00	Project Staff travel	30,000		10,000						40,000	
	45-00	Equipment	1,500,000								1,500,000	
	30-00	Workshops	15,000								15,000	
	21-00	Subcontracts										
		Sub-total	***1,560,000***	***25.4***	***45,000***	***27.1***					***1,605,000***	***52.5***
Output 3.2: BAT technologies for pre-treatment of PCB-containing wastes selected	11-00	Consultants	5,000	0.4	8,000	0.7					13,000	1.1
	17-00	Nat. Experts										
	51-00	Sundries										

GEF Outputs/Inputs	Budget lines	Description	Year 1		Year 2		Year 3		Year 4		Total	
			US$	w/m	US$	w/m	US$	w/m	US$	w/m	US$	w/m
	15-00	Project Staff travel	5,000		2,000						7,000	
	45-00	Equipment	485,000								485,000	
	30-00	Workshops										
	21-00	Subcontracts										
		Sub-total	***495,000***	***0.4***	***10,000***	***0.7***					***505,000***	***1.1***
Output 3.3: Technology options for the disposal of high concentration PCBs oils and other PCB wastes selected and implemented	11-00	Consultants	13,000	1.1							13,000	1.1
	17-00	Nat. Experts										
	51-00	Sundries										
	15-00	Project Staff travel	4,000								4,000	
	45-00	Equipment	500,000								500,000	
	30-00	Workshops	8,000								8,000	
	21-00	Subcontracts										
		Sub-total	***525,000***	***1.1***							***525,000***	***1.1***
Output 3.4: 3,000 tons of PCBs oil, PCB-containing equipment and wastes disposed of	11-00	Consultants	15,000	1.3	22,000	1.8	12,000	1.0	12,000	1.0	61,000	5.1
	17-00	Nat. Experts	10,000	25.0	10,000	25.0	18,000	45.0			38,000	95.0
	51-00	Sundries										
	15-00	Project Staff travel	22,000		12,000		18,000		8,000		60,000	
	45-00	Equipment	50,000		22,000						72,000	
	30-00	Workshops	2,000						2,000		4,000	
	21-00	Subcontracts	35,000		30,000		30,000		30,000		125,000	
		Sub-total	***134,000***	***26.3***	***96,000***	***26.8***	***78,000***	***46.0***	***52,000***	***1.0***	***360,000***	***100.1***
Output 3.5: Training and awareness raising for relevant stakeholders and PCB owners on ESM system and occupational safety undertaken at country level	11-00	Consultants										
	17-00	Nat. Experts			3,000	7.5					3,000	7.5
	51-00	Sundries										
	15-00	Project Staff travel										

GEF Outputs/Inputs	Budget lines	Description	Year 1		Year 2		Year 3		Year 4		Total	
			US$	w/m	US$	w/m	US$	w/m	US$	w/m	US$	w/m
	45-00	Equipment										
	30-00	Workshops			2,000						2,000	
	21-00	Subcontracts										
		Sub-total			***5,000***	***7.5***					***5,000***	***7.5***
Output 4.1: Baseline indicators assessed	11-00	Consultants	46,000	3.8							46,000	3.8
	17-00	Nat. Experts	88,000	220.0							88,000	220.0
	51-00	Sundries										
	15-00	Project Staff travel	22,000								22,000	
	45-00	Equipment										
	30-00	Workshops	21,000								21,000	
	21-00	Subcontracts	18,000								18,000	
		Sub-total	***195,000***	***223.8***							***195,000***	***223.8***
Output 4.2: Project impact monitoring system, evaluation of the achieved results and introduction of corrections if required	11-00	Consultants			18,000	1.5			14,000	1.2	32,000	2.7
	17-00	Nat. Experts	2,000	5.0	7,000	17.5	2,000	5.0	14,000	1.2	25,000	28.7
	51-00	Sundries										
	15-00	Project Staff travel	1,000		8,000		7,000		4,000		20,000	
	45-00	Equipment										
	30-00	Workshops										
	21-00	Subcontracts	5,000		3,000		2,000		3,000		13,000	
		Sub-total	***8,000***	***5.0***	***36,000***	***19.0***	***11,000***	***5.0***	***35,000***	***2.3***	***90,000***	***31.3***
Output 4.3: Dissemination of project related information and results to local stakeholders	11-00	Consultants										
	17-00	Nat. Experts										
	51-00	Sundries										
	15-00	Project Staff travel										
	45-00	Equipment										

GEF Outputs/Inputs	Budget lines	Description	Year 1		Year 2		Year 3		Year 4		Total	
			US$	w/m	US$	w/m	US$	w/m	US$	w/m	US$	w/m
	30-00	Workshops	6,000		2,000		2,000		5,000		15,000	
	21-00	Subcontracts			. .							
		Sub-total	*6,000*		*2,000*		*2,000*		*5,000*		*15,000*	
TOTAL PROJECT COSTS			**3,720,000**	**906.5**	**755,000**	**643.2**	**432,000**	**432.9**	**393,000**	**17.7**	**5,300,000**	**2,000.3**
Project Management Costs:	11-00	Consultants	40,000	3.3	40,000	3.3	40,000	3.3	40,000	3.3	160,000	13.3
	17-00	Nat. Experts	30,000	75.0			10,000	25.0	10,000	0.8	50,000	100.8
	51-00	Sundries										
	15-00	Project Staff travel	10,000		10,000				20,000		40,000	
	45-00	Equipment										
	30-00	Workshops										
	21-00	Subcontracts										
		Sub-total	*80,000*	*78.3*	*50,000*	*3.3*	*50,000*	*28.3*	*70,000*	*4.2*	*250,000*	*114.2*
GRAND PROJECT TOTAL			**3,800,000**	**984.8**	**805,000**	**646.5**	**482,000**	**461.3**	**463,000**	**21.8**	**5,550,000**	**2,114.4**

ANNEX H

Survey of potential availability of PCB contamination and wastes in the electricity equipment Ukraine and their owners (ATTACHED)

ANNEX I

MINISTRY OF ECOLOGY AND NATURAL RESOURCES OF UKRAINE

The Ministry of Ecology and Natural Resources (MENR) will be the Ukrainian executing partner for the proposed Environmentally Sound Management and Final Disposal of Polychlorinated Biphenyls (PCBs) project. In addition, this Ministry would play a key role in certain areas of the project, particularly in connection with regulatory issues and capacity building. The MENR, from the Government of Ukraine side, has the responsibility to prepare and issue guidelines, regulations and is the focal point for the Stockholm Convention, Basel Convention and other international agreements that the Government of Ukraine is signatory to.

The MENR is structured in such a way that all ecological and natural resources issues are represented within a working unit in the Ministry. Table 1 summarizes the current structure of the Ministry. It is expected that this project is managed through the Unit for Treatment of Waste and Hazardous Substances within the Ecological Safety and Permitting System Department.

The MENR has the resources and willingness to provide the proper support to project. Thus people from the Legal Department will be called upon to assist the Waste and Hazardous Substances unit to draft the necessary regulations for the management of the PCBs in Ukraine. Similarly, permitting required to handle, package, ship and/or dispose of PCBs waste will be handled by personnel in the Licensing and Permitting Unit within the Ecological Safety and Permitting System Department.

A brief description of the roles and responsibilities of some of the Departments within the MENR is given below:

a) **Ecological Safety and Permitting Department**

- Ensuring legal and regulatory governing for the issues of licensing conditions for economic activities in the area of treatment of hazardous waste, collection and stockpiling of certain waste as recycled resources (under the lists specified by the Cabinet of Ministers of Ukraine) and procedures of control of how they are met.
- Maintaining registers of waste disposal sites, waste generation, processing and recovery.
- Control of cross-boundary shipments of hazardous waste and their disposal/recovery.
- List of pesticides and agricultural chemicals and specific uses under Ukrainian laws.
- Development and implementation of rates and doses of harmful chemicals for physical and biological factors on the environment

- Approving and issuing operating licenses for the collecting, transportation and treating and/or disposal hazardous waste, certain wastes as recycled resources (under lists specified by the Cabinet of Ministers of Ukraine) and controlling compliance with licensing conditions.

- Cancelling and re-issuing as the case may be of permits for generation, storing, transportation, usage, disposal and recovery of toxic substances, including the products of biotechnology and other biological agents.

b) Air Protection

- Establishing regulatory limits for rates of emission of fixed sources for air pollutants.

- Establishing the procedures and criteria for state registration of sites that can negatively affect ambient air quality, specifying the types and volumes of pollutants being emitted.

- Establish and maintaining list of organizations approved to prepare draft documents for others on request for permits for emissions of air pollutants.

- Issuing, cancelling and re-issuing permit allowing discharges of air pollutants from fixed sources.

- Establish and maintain registry of air pollutant emissions.

c) Ozone Layer Protection

- Establishing regulations regarding the use, handling and disposal of Ozone Depleting Substances.

- Issuing, cancelling and re-issuing licenses for the export and import of Ozone Depleting Substances and products containing these substances b)Air Protection

d) Climate Change and Kyoto Protocol

- Issuing legal and regulatory requirements concerning monitoring, reporting and verification of data on emissions and absorption of green-house gases

- Rules of functioning of national system for trading of carbon units

- Establishing methods of calculating anthropogenic emissions by sources and absorption by absorbers of green-house gases

- Establishing selection criteria for projects targeting ecological (green) investments and activities related to the implementation of such projects.

- Coordinating action plans concerning implementation of projects of target ecological (green) investments.

- Reception and submission of national information on climate change according to the obligations under the UN Climate Change Framework Convention and the Kyoto Protocol.

- Coordinating the activities related to meeting the obligations of Ukraine under the UN Climate Change Framework Convention and the Kyoto Protocol.

e) Flora and fauna Protection

- Issuing legal and regulatory requirements related to the usage, protection and restoration of the flora and fauna.

- Establishing and maintaining an inventory of the flora and fauna in the country, and setting limit for the hunting of animals and fish.

- Registering and keeping wild animals that are withdrawn from the environment to help their survival and reproduction.

- Collecting technical, medicine, spicy, aromatic, food raw materials from wild plants

- Adopting the rate of wood cutting areas under procedure of main usage.

- Establishing the network of research land plots and plots with reference soils to monitor land at national level.

- Managing the creation, preservation and usage of national ecological network.

f) Water Protection

- Issuing legal and regulatory rules, standards and norms for the protection and restoration of water bodies

- Establishing limits for pollutants discharge into water bodies.

- Issuing, cancelling and re-issuing permits for work in water bodies.

- Establishing and maintaining the list of approved organization allow to determine the maximum permissible discharge of water pollutants from industrial of commercial activities.

g) Efficient usage of Mineral Resources

- Considering the documents, within its competence, issuing, terminating, cancelling, re-issuing, amending, prolonging the period of validity, issuing the copies and forms of special permits for usage of mineral resources and permits for commissioning of deposit or separate oil and gas field for pilot and industrial development.

- Registering the activities related to geological study of mineral resources

h) Environmental Protection Legislation

- Arranging and conducting inspections of business entities, local self-governance bodies and local executive authorities with regard to meeting the requirements of environment protection legislation and ecological safety laws

- Shutting down operation of business and/or pieces equipment for breaching environmental protection regulations.

- Verifying the ecological indicators of oil products being sold through wholesale and retail trade.

- Conducting state control on how the rules in the area of forestry, hunting and fishery are being met.

- Drafting the rules and procedure of sampling as well as determining and measuring the indicators of composition and features of facilities for control of waters, emissions, soils and waste.

- Conducting ecological and radiological control of transport vehicles and cargoes.

- Establishing the lists of goods, which are subject to ecological and radiological control in the checkpoints through the state border and on the customs territory of Ukraine.

- Drafting and submitting for consideration by the President of Ukraine and the Cabinet of Ministers of Ukraine the laws of Ukraine, decrees of the President of Ukraine and the Cabinet of Ministers of Ukraine

- Establishing and maintaining registers of components of network for observation of environment monitoring system.

- Issuing certificates for the right of ecological audit, maintaining the register of ecological auditors and legal entities that have the right to conduct ecological audit.

- Ensuring international cooperation within its competence, studying, generalizing and disseminating international experience, meeting the obligations of Ukraine under international agreements for the issues within its competence.

– Receiving and act on Citizens and Members of Parliament of Ukraine request for inquiries related to the environment.

PCB-related finances of the MENR are presented in the following table:

Measures	**Sources of financing**	**Amounts in USD**
1.1 establishing, implementing, updating and maintaining the register of enterprises that operate equipment containing polychlorinated biphenyls and storage sites for equipment and waste containing PCBs;	SFEP	5,000
1.2 Development of regulatory documents on operation, storage, labeling, removal, disposal/destruction of equipment and waste containing polychlorinated biphenyls	SB	22,000
	SFEP	20,000
1) cleaning of transformers of polychlorinated biphenyls and application of appropriate technologies to perform the whole complex of works for disposal of transformers where polychlorinated biphenyls detected, transportation of removed polychlorinated biphenyls to a place of destruction	SFEP	610,000
	LFEP	420,000
2) destruction of capacitors containing polychlorinated biphenyls, and use of appropriate technologies to perform the whole complex of works on safe decommissioning capacitors with PCBs, its storage and further transportation to a place of destruction	SFEP	790,000
	LFEP	490,000
3) destruction of polychlorinated biphenyls taking into account advanced technologies, which provide for environmentally sound destruction of polychlorinated biphenyls	SFEP	1,024,000
	LFEP	725,000
4) cleaning transformers using advanced technologies for conduction of such works	SFEP	182,000
	LFEP	975,000
1) development and introduction of schedule for replacement of capacitors with environmentally safe ones; arranging the collection, safe storage and disposal of capacitors containing polychlorinated biphenyls at the enterprise with the sites where not less than 10000 such capacitors are located	SFEP	610,000
	LFEP	390,000

Measures	Sources of financing	Amounts in USD
2) collection and disposal of stocks of synthetic fluids at the enterprise with the sites where not less than 60 tons of polychlorinated biphenyls are located	SFEP	1,463,000
	LFEP	756,000
3) introduction of schedule for replacement of transformers with PCBs with environmentally safe ones at the enterprise with the sites where 90 or more of such transformers are located	SFEP	1,100,000
	LFEP	610,000
4. Development and implementation of the plan for a phased decommissioning and disposal of capacitors, transformers and other equipment containing polychlorinated biphenyls	SFEP	7,320,000
5. Destruction of stockpiles of polychlorinated biphenyls and disposal of waste containing polychlorinated biphenyls	LFEP	4,880,000
6. Development of technologies for cleaning transformers of polychlorinated biphenyls and destruction of capacitors and equipment containing polychlorinated biphenyls	SB	41,000
5. Development of methodology for conducting inventory of areas that contain persistent organic pollutants and its preliminary environmental and geological assessment	SFEP	60,000
	LFEP	36,000
6. Establishment of the National Register of areas contaminated by persistent organic pollutants using geographic information systems	SFEP	121,000
	LFEP	75,000
7. Conducting inventory of areas contaminated by persistent organic pollutants	SFEP	207,000
	LFEP	167,000
8. Implementation of pilot projects for areas contaminated by persistent organic pollutants carrying out comprehensive environmental and geological assessment of these areas	SFEP	278,000
	LFEP	182,000
9. Conducting comparative analysis and selection of technologies and methods for rehabilitation of areas contaminated by persistent organic pollutants	SFEP	121,000

Measures	Sources of financing	Amounts in USD
	LFEP	46,000
10. Development of regional action plans for rehabilitation of areas contaminated by persistent organic pollutants taking into account specificity of regions	SFEP	141,000
	LFEP	97,000
11. Carrying out works on rehabilitation of areas contaminated by persistent organic pollutants taking into account specificity of regions	SFEP	1,724,000
	LFEP	537,000
12. Conducting the audit of chemical and analytical laboratories to determine the actual capabilities for measuring the level of persistent organic pollutants	SFEP	60,000
	LFEP	42,000
13. Creation of database of chemical and analytical laboratories conducting scientific research of persistent organic pollutants	SFEP	60,000
	LFEP	43,000
14. Development of proposals to improve system of monitoring and material and technical support of chemical and analytical laboratories that monitor persistent organic pollutants	SFEP	24,000
15. Establishing a single list of methodologies for determination of the level of persistent organic pollutants in accordance with international requirements, taking into account the results of its testing	SFEP	24,000
16. Development of unified requirements to a format of the conclusions of laboratory research in accordance with international standards	SFEP	18,000
17. Ensuring continuous functioning of the accredited chemical and analytical laboratories to determine polychlorinated dibenzo-n-dioxins/ polychlorinated dibenzofurans	SB	1,018,000
	LFEP	593,000
18. Assessment of the level of professional skills of chemical and analytical laboratories staff who conduct monitoring of persistent organic pollutants and development of proposals to improve the system of appraisal and advance of professional skills of laboratory staff	SFEP	24,000

Measures	Sources of financing	Amounts in USD
	LFEP	20,000
19. Organization of a system of professional development of the staff of chemical and analytical laboratories who are part of the system of monitoring of persistent organic pollutants	SFEP	24,000
	LFEP	12,000
Total:		28,000,000

SB- state budget
SFEP - State Fund for Environmental Protection
LFEP - Local Fund for Environmental Protection

Ministry of Ecology and Natural Resources
Organizational structure

MINISTER
FIRST DEPUTY MINISTER
DEPUTY MINISTER, HEAD OF STAFF
DEPARTMENT OF ORGANIZATION AND ANALYTICAL SUPPORT TO MINISTER'S ACTIVITIES
- *Organization and Analytical Unit*
- *Unit for Support to Activity of Minister and Economic Reforms (Patronage Service)*
- *Unit for Support to Document Turnover, Control and Dealing with Requests of Citizens*
- *Unit for Interaction with Mass Media and Consultancies with Public*
- *Unit for Record Keeping of Incoming and Outgoing Permitting Documents*
LEGAL DEPARTMENT
- *Legal and Regulatory Support Unit*
- *Unit for Expertise of Draft Regulations*
- *Unit for Representation of Interests of Ministry in Law Enforcement and Court Bodies*
- Unit for Interaction with the Verkhovna Rada of Ukraine and Regulatory Activity
DEPARTMENT OF ECOLOGICAL SAFETY AND PERMITTING SYSTEM
- *Ecological Safety Units*
- *Unit for Treatment of Waste and Hazardous Substances*
- *Sector of Control for Meeting the Licensing Conditions and Rationing in the Area of Waste Treatment*
- *Unit for Control of Circulation of Pesticides and Agricultural Chemicals*
- *Licensing and Permitting Units:*
DEPARTMENT FOR PROTECTION OF NATURAL RESOURCES
- *Eco-network and Bio-safety Development Units*
- *Unit of Water Ecosystems and Resources*
- *Sector of Land Resources*
- *Flora Protection Unit*
- *Fauna Protection Unit*
NATURE RESERVES DEPARTMENT
- *Nature and Reserve Fund Institutions Units*
- *Nature and Reserve Fund Development Unit*
- *Unit for State Management of Nature and Reserve Fund*
- *Unit for Rangers Service and State Cadastre of Nature and Reserve Fund*
- TECHNICAL REGULATION AND SCIENCE UNIT
- INTERNAL AUDITING AND CONTROL UNIT
STRATEGTIC PLANNING, ECONOMICS AND FINANCE DEPARTMENT

- *Strategic Planning Unit*
- *Target Ecological Programmes and Regional Development Unit*
- *Budget Execution and Planning Unit*
- *Salary and Social Issues Unit*
- *Ecological Funds Coordination Unit*
- *Institutions, Organizations and Enterprises Financing Coordination Unit*
STATE ECOLOGICAL AND GEOLOGICAL MONITORING DIVISION
- *Unit for Monitoring of Environment and Natural Resources*
- *Ambient Air Unit*
INTERNATIONAL ACTIVITY DIVISION
- *European Integration Unit*
- *Unit of International Cooperation, Protocol and Coordination of External Assistance Projects*
HUMAN RESOURCES DIVISION
- *Unit to Deal With Staff of Central Office of the Ministry*
- *Stuff Professional Training and Cooperation with Subordinate Institutions, Organizations and Enterprises Unit*
DIVISION OF FACILITIES MANAGEMENT, MATERIAL, TECHNICAL AND INFORMATION SUPPORT
- *Material and Technical and Information Support Unit*
- *Property and Labour Safety Unit*
ACCOUNTING AND FINANCIAL REPORTING UNIT
STATE ECOLOGICAL AND GEOLOGICAL EXPERTIZE UNIT
SECTOR FOR CONTROL AND VERIFICATION OF DECREES AND ORDERS OF HIGHER STATE AUTHORITIES
SECTOR FOR REGIME AND SECRET ACTIVITY
PROCUREMENT SECTOR
CHIEF EXPERT FOR MOBILIZATION

ANNEX J

TARKOM EKOSERVIS LLC

Tarkom Ekoservis LLC is a specialized company that provides services for the collection, transportation, storage and further disposal of hazardous waste (industrial and household) of class 1-4 under Ukrainian classification, throughout the country.

Tarkom Ekoservis LLC holds an operating license issued by Ministry of Ecology and Natural Resources of Ukraine. Based on this license Tarkom is authorized to conduct the following activities in the hazardous waste management field:

- Collection, packaging, transportation, storage, processing and utilization of hazardous wastes under license AE№199209, valid up to04.03.2018;

- Collection and storage of certain types of waste as secondary raw materials (polymeric waste, rubber waste, including used tires) Series AE № 199208, validity is unlimited.

The above-mentioned licenses cover the broadest list of hazardous wastes, including PCB-contaminated oil.

The company has two production facilities, one in Obukhiv (Kyiv oblast) equipped with an incinerator that includes a small fixed chamber where combustible solid wastes are fed and a secondary combustion chamber to provide enough residence time for the partially combusted gases are fully burnt and where waste liquids can be injected and also destroyed. The second facility is located in Odessa and this facility is equipped with a modern incinerating unit consisting of a rotary kiln and secondary combustion chamber. This incinerator also has a dry filter and scrubber that permits the cleaning of the byproduct gases being emitted through the stack. The incinerator in Kyiv has been in operation for several years, while the unit in Odessa, already built, would start operation in May 2014. The unit in Odessa will be permitted to incinerate chlorinated materials, including PCBs.

Based on the different waste streams that can be destroyed in these two facilities, the combined total production capacity of waste utilization is more than 30000 tons of waste per year.

The rotary kiln incinerator, equipped with the air pollution control system, meets current requirements for environmental, sanitary and epidemiological and fire safety and therefore, it has been granted the operating license by the Ministry of Ecology and Natural Resources.

Tarkom Ekoservis LLC high regard for the environment allows them to offer the highest quality service in an environmentally sound manner and in compliance with all requirements under existing environmental legislation.

ANNEX K

METINVEST HOLDING, LLC

Metinvest is an international vertically integrated steel and mining company owning assets in Ukraine, Europe and the United States and managing each link of the production chain – iron ore and coal mining and coke production through to semi-finished and finished steel production; including the manufacturing of plate and coil, pipe rolling, shapes and bars and other value-added products.

According to Forbes Metinvest is the largest company of Ukraine, and it occupies the 4th place among the largest companies in Central and Eastern Europe - Deloitte TOP-500 by results of 2012.

Metinvest is the largest in Ukraine and one of the largest CIS producers of iron ore raw materials and steel. The company is one of the top-ten producers of carbon steel plates. Metinvest occupies the 28th place among the world largest steel companies according to the World Steel Association (world steel). In November 2011, Metinvest has completed the merger with Ilyich Iron and Steel Works that doubled the company's crude steel production capacity to more than 18.5 M tons per year (taking into account "Zaporizhstal").

Metinvest produces a diversified range of products at competitive prices including iron ore products, coke and coal products, semi-finished and finished steel products, including rolled products and pipes. The Company exports a substantial portion of its steel products to over 1,000 customers located in more than 75 countries through its broad international sales network which covers most of the key regions in the world.

Being based in Ukraine enables Metinvest to maintain a relatively low cost base compared to many of its global competitors. Metinvest's production facilities are conveniently located to take advantage of relatively low cost sea and rail transportation. This allows for the inexpensive shipment of its products to both domestic and European markets as well as the fast-developing markets of the Middle East, South East Asia, the CIS and China.

Metinvest is striving to maintain the highest level of corporate governance and transparency of its operations and communications. Sustainable development of the company is based on the values of health, safety and environment. Metinvest is the first and the only Ukrainian company, whose efforts in the field of health, safety and environment received the world recognition. During 2009—2010 the company received two Climate Action Member Certificates of the World Steel Association (world steel). In 2011 Metinvest received from world steel one of the four awards for the best production safety improvement projects.

METINVEST HOLDING, LLC (the managing company of Metinvest Group) was founded in 2006. METINVEST HOLDING, LLC provides integrated management of the enterprises in coal, iron ore mining, coking and chemical, iron and steel making and pipe production segments.

Metinvest Group's major shareholders are SCM Group (71.25%) and Smart Holding (23.75%) participating in management of Metinvest on a partnership basis.

Metinvest consistently integrates the environmental principles into strategic goals and objectives of the whole Group.

Approaches:

- Voluntary broadening of the enterprises' environmental commitments;
- Environmental risks management;

- Environmental monitoring;
- Environmental impact prevention or mitigation;
- Environmental impact assessment of the investment projects;
- Efficient use of natural resources, raw materials and energy;
- Open dialogue with the society on environmental topics.

Industrial nature of Metinvest Group operations is linked with significant environmental impact. We strive for minimizing such impact in order to achieve improvement of the environmental performance.

Annually the Group's enterprises develop and implement environmental programs targeted at the reduction of existing and potential environmental impact. In addition to traditional environmental activities, the enterprises introduce new technologies allowing preventing pollution and waste recycling.

Metinvest has identified in some of their mining activities the existence of Sovtol transformers and capacitors. Because of the significant use of electricity in their mining business and therefore, large number of transformers and capacitors, it is expected that a significant number of these pieces of equipment would contain PCBs.

ANNEX L

DTEK LIMITED LIABILITY COMPANY

DTEK is the largest privately-owned vertically-integrated energy company in Ukraine with significant presence in the electricity and mining business area. With ownership of about 30% (18,000 MW) of the country's electrical generating capacity (54,000 MW), DTEK extracts the coal from mines to supply its generating stations and to export to neighbouring countries. The Company is the energy division of System Capital Management (SCM), one of Ukraine's leading financial and industrial groups.

Most of the coal mined at DTEK is prepared at the Company's own plants and supplied to enterprises in DTEK's generating division. Some of the coal is exported. The electrical power produced by DTEK is supplied to Ukraine's wholesale energy market, where DTEK is one of the key operators. Power purchased on the market is supplied by the Company's networks to Ukraine's largest industrial consumers.

DTEK activities in the electrical business include the generation, transmission and distribution of electricity. As indicated earlier, DTEK produces about 18,000 MW of electricity that is transmitted and distributed in its network lines of about 159,000 km. A large number of power, transmission and distribution transformers are used to carry the electricity from the generating stations to the end users.

A significant number of transformers from DTEK electrical network are expected to contain PCBs. Some of them would be transformers made with Sovtol as the dielectric fluid, while other would be mineral oil filled transformers that became contaminated with PCBs. In addition to transformers, DTEK is also expected to own a significant number of PCB filled capacitors.

In addition to the transformers being used in the grid network, the coal mines also utilizes transformers to provide the electricity requirements for equipment and lighting of the coal mines. Although some these transformers would also be mineral oil filled units contaminated with PCBs (outdoors transformers), it is expected because of the need to avoid the potential for fires due to failed transformers, that DTEK would have a significant number of Sovtol transformers in their mining operation.

DTEK is an environmentally responsible company. The Company's development strategy envisages further improvement of environmental safety and growth in assets' capitalisation due to reliable and environmentally friendly operations.

The Company seeks to prevent and minimize the environmental impact at all the stages of its production process: starting from coal extraction and processing to electricity generation and distribution.

The Policy on Environmental Protection Management determines the Company's long-term environmental objectives:

- prevention and minimization of the negative impact on the environment;
- introduction of a unified approach to environmental protection management at all DTEK enterprises based on an advanced environmental management system;
- creation of an efficient system for monitoring environmental impact and managing environmental hazards;
- checks of equipment and production processes for conformity with the requirements of applicable environmental laws.

DTEK pays particular attention to environmental management issues. The Company has a uniform Environmental Management System in place that conforms in full with the requirements of ISO 14001:2004.

The main trends of environmental activities in DTEK's distribution division are:

- minimization the use of hazardous substances and materials;

- improvement of a separate waste collection system for waste recycling;

- protection of biodiversity.

Because of their commitment to the environment and although Ukraine does not have PCB processing alternatives, DTEK has already designed a PCB Removal or treatment plan for the already identified PCB containment equipment.

PCB-containing equipment decommissioning and dismantling	Quantity of PCB-containing equipment, tonnes	Decontamination costs, UAH, VAT inclusive*
2014	13.726	257,840
2015	23.072	437,950
2016	3.016	37,700
2017	2.104	26,300
2018	1.872	23,400
2019	0.61	7,625
2020	0.61	7,625
2021	0.61	7,625
2022	0.61	7,625
TOTAL	46.23	813,690

Plan for PCB-containing Equipment Decommissioning (Dismantling) and Decontamination

* decontamination costs may change depending on the price for such services

Based on international experience where a significant number (8 to 20% depending on countries) of mineral oil filled transformers are contaminated with PCBs above the 50 ppm threshold level, it is expected that DTEK and other transformer owners would have a larger number of units contaminated above 50 ppm and will require treatment or replacement.

DTEK is committed to the project and it is expected that they would be the main partner from where the 3000 metric tonnes to be treated within the project would come from.

ANNEX M

LABORATORY FOR ECOLOGICAL HYGIENE AND TOXICOLOGY OF HAZARODUS WASTES

The Laboratory for Ecological Hygiene and Toxicology of Hazardous Wastes is part of the Scientific Centre of Preventive Toxicology, Food and Chemical Safety Department at the Ministry of Health of Ukraine.

The laboratory holds a Certificate of compliance with the requirements under the norm GLP No. G-042, dated on the 11.08.2011. This laboratory has also the accreditation under NAAU No. 2N375, dated on 10.04.2013.

The function of this laboratory is to conduct research and provide technical support to other groups and agencies in the area of PCBs, PCDDs and PCDFs analysis. It is the only laboratory in Ukraine equipped with the equipment required for Dioxins Furans analysis.

With a team of 7 people, the laboratory has the following analytical tools:

a) Six (6) Gas Chromatographs equipped with Electron Capture Detector. These units have been manufactured by Island Thermo Finnigan, Shimadzu

b) Three (3) Gas Chromatographs equipped with Mass Spectroscopy, Model MAT95, DSQ Polaris, manufactured by Island Thermo Finnigan, Shimadzu

The laboratory will be supporting the project and conduct PCB analysis and PCDDs and PCDFs, as required.

The laboratory may need the assistance of the project to acquire ancillary equipment such as automatic sample preparation, auto-samplers and consumables to support the project.

ANNEX N

Laboratory of Ecological and Analytical Research UkrNDIEP

The laboratory serves as the main organization of the metrological service of the Ministry of Ecology and Natural Resources of Ukraine, provides a methodical and regulatory basis for environmental protection activities, and has a depository of regulatory and methodical documents, including those on measurement techniques.

Laboratory

- carries out the development and validation of measurement techniques for indicators of the composition and properties of environmental objects, discharges, emissions and wastes (more than 250 methods were developed upon request of various agencies/departments and enterprises);
- organizes and conducts inter-laboratory comparison of the results of measurement of indicators of composition and properties of environmental objects for a wide range of ecological and analytical laboratories of Ukraine (by Order of UkrTsSM No. 295 of 18.10.2001 was assigned and registered as independent coordinator);
- acts as a third party in resolving conflicts between controlling bodies and enterprises-users of natural resources;
- conducts scientific and practical training in chemical and analytical control of environmental objects, discharges, emissions, waste and its metrological support.

Laboratory is equipped with modern highly efficient equipment, including:

- with 2 gas chromatograph-mass spectrometers - Agilent 5973N (with attachment for static vapor-phase input of samples for identification and determination of volatile and semi-volatile organic compounds) and Agilent 5975 (for analysis of prepared extracts of organic contaminants from various objects; additionally equipped with a dual channel flame-photometric detector for phosphorus and sulfur);
- with 2 liquid chromatographs - Agilent 1100 2D LC and Agilent 1100 3D LC (allows to obtain a full range of compounds in the area of UF-VIS in the process of chromatographic analysis);
- chromatographs "Tsvet 500" for determining pesticides and other organic compounds;
- atomic absorption spectrophotometer Z-8000 by "Hitachi" with flame and electro-thermal atomization for determination of heavy metals;
- photo-electric colorimeters KFK-3, KFK-2;
- atomic fluorescent analyzers - Millennium Merlin (for determination of arsenic, selenium) and Millennium Excalibur (for determination of mercury);
- pH meters and Ionomers, etc.

The laboratory has technical capability and experience in determining the content of polychlorinated biphenyls in waste, namely in the used transformer oil of power transformers. In the recent years we have analyzed 43 samples.

At present, there is Attestation/Validation Certificate No. 100-4150/2011, which is valid until 25.07.2015. It does not include PCBs, but their inclusion is foreseen during planned validation in 2015. If necessary, appropriate extension of area through extraordinary validation is possible.

Determination of the content of polychlorinated biphenyls is carried out on chromatography-mass spectrometer Agilent 6890N/5975B (Verification Certificate No. 84713/4, valid until 02.10.2014) using a library of mass spectra "Nist 05 Spectral Lib" and appropriate techniques of the United States Environmental Protection Agency (USEPA), namely:

EPA-600/4-81-045. Test Method. The Determination Polichlorinated Biphenyls in Transformer Fluid and Waste Oils;

Method 680. Determination of Pesticides and PCBs in Water and Soil/Sediment by Gas Chromatography/Mass Spectrometiy;

EXIBIT B. Project Specific PCB Homolog Analytical Method (USEPA Method 680).

Content of polychlorinated biphenyls is determined using standard samples of solutions of industrial compounds of polychlorinated biphenyls of Aroclor type by Supelco Company "PCB Kit".

ANNEX O

LABORATORY OF THE COMPREHENSIVE GEOCHEMICAL RESEARCHES

Laboratory of the comprehensive geochemical researches is a division of the Institute of Environmental Geochemistry, NAS Ukraine and engaged in chemical-analytical studies of the environment. Laboratory certified SE "Ukrmetrteststandard". Within the framework this activity in the laboratory are conducted the measurements of the content of persistent organic pollutants in the objects of the environment, including polychlorinated biphenyl (PCBs).

Laboratory staff of 7 people.

The laboratory has 2 gas chromatograph, 2 HPLC, spectrophotometers, analyzers and other laboratory equipment for research.

The laboratory will be supporting the project and conduct PCB analysis and other persistent organic pollutants, as required.

ANNEX P

TECHNOLOGICAL OPTIONS FOR THE DECONTAMINATION/DESTRUCTION
OF PCBs CONTAMINATED MATERIALS

1. INTRODUCTION

This project document "Environmentally Sound Management and Final Disposal of Polychlorinated Biphenyls" outlines UNIDO's proposal for the provision of technical assistance to public and private sector actors to increase the within the country capacity for the safe and sustainable management of PCB-containing materials in Ukraine.

According to the preliminary inventory there is an estimated total amount of 4240 metric tons of PCB containing equipment (transformers and capacitors) in Ukraine. This inventory was mainly based on the identification of equipment using PCBs as the dielectric fluid, as indicated in the equipment nameplate.

Based on experience in most other countries it is well known that PCB containing equipment is only one fraction of the total inventory of PCB contamination in any given jurisdiction. Thus, a significant number of mineral oil filled transformers is contaminated with PCBs in excess of the 50 mg/kg threshold limit established by the Stockholm Convention.

There is no certainty of the extent of contamination of the mineral oil transformers in Ukraine, it could be as low as 5 to 10% found in countries where the proper management of PCBs has been in place since the late 1980's to about 20 to 25% where practices to identify, segregate and properly manage PCB contaminated equipment are not present. In order to estimate the extent of contamination of transformers, the project will carry out sampling and testing of 10,000 units.

Through the introduction of screening tests, 10,000 transformers will be tested for PCBs and those giving borderline results (range of 35 to 70 ppm) will be further tested using detailed GC-ECD analysis. The result of this massive sampling and testing program

will be used to identify mineral oil transformers with PCB level above the 50 ppm level and will require special maintenance programs and decontamination.

The existence of PCB contaminated mineral oil transformers in any given jurisdiction is a complex problem due the number of transformers involved and the locations they 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 distribution 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 establish programs where medium and large size transformers are analyzed and depending of the PCB 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 appropriable.

The PCBs in electrical transformers is distributed in the different components inside the units. The largest fraction of the PCBs is dissolved and homogeneously distributed in the mineral oil, a smaller, but still significant fraction of the PCBs are absorbed by the porous material, namely paper and wood spacers, while a small fraction is adsorbed on the surface of the metallic components in contact with the oil.

The amount of PCBs held in each one of the components of the transformers will determine the potential solution that can be used to decontaminate the complete transformer. Although removal from PCBs from metallic surfaces is relatively fast and simple, removal of the PCBs absorbed by porous material is slow and depends on the method being used to achieve such removal.

Cleaning of metallic surfaces can be easily and rapidly achieved by the use of oil and solvents, the cleaning of porous material however is more complex and can be achieved by using multi-stage solvent extraction methods or thermal desorption. In order to remove PCBs from the porous material, the PCBs from the surface of the porous material is removed first, followed by the diffusion of the PCB molecules from the core of the porous material to the surface, from where it is released. The diffusion process is rather slow and depends on temperature and concentration of the PCBs in the extracting solvent.

Retrofilling of PCB contaminated transformers is a practical solution where the PCB contaminated dielectric oil is replaced by fresh, PCB-free oil. The PCB concentration gradient between the solid and the fluid make the PCBs to be transferred to the liquid reducing the residual PCBs in the solid. The leaching of the PCBs by the oil progresses until a new equilibrium stage where the PCBs are partitioned between the solid and liquid. After this equilibrium stage is reached the concentration of PCBs in the porous material and the oil remains unchanged. If the new PCB level in the retrofilled transformers is less than 50 mg/kg or ppm, then the retrofilled is deemed decontaminated and reclassified as non-PCB transformer. This method of managing low level PCB contaminated mineral oil from in-service electrical systems is widely used by the industry to convert PCB-contaminated equipment into non-PCB units.

Although in the mid 1980's retrofilling of PCB made transformers (Askarel transformers) was commercially available, this was soon discontinued as retrofilling of Askarel transformers suffered of several limitations, namely:

-The release of PCBs, as indicated earlier, is a very slow process and therefore, the dielectric fluid has to be replaced too many times to achieve the less than 50 ppm target level.
-In order to accelerate the decontamination process, an intermediary fluid, generally Perchloroethylene was used along an on-line distillation unit that continuously separated the extracted PCBs from the solvent.
-The dielectric properties of Perchloroethylene are different from those of the original Askarel, therefore the transformer has to be de-rated to maintain its integrity
-Perchloroethylene is a volatile solvent with low threshold exposure limit, therefore represented a health and safety hazard
-After the removal of the PCBs from the porous material, the intermediary dielectric has to be replaced by the permanent dielectric fluid, generally silicone-based dielectric, and the process the intermediary from the permanent fluids has to be repeated, also taking a significant period of time.
-Askarel filled transformers were generally older units with relatively short remaining life, therefore it was generally concluded that replacement the Askarel by a brand new transformer was a more attractive alternative.

Retrofilling is an economical and simple solution for the removal from in-service of PCB contaminated mineral oil. Depending of the original PCB level in the mineral oil in 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 2000 ppm will require two retro-fillings to achieve the less than 50 ppm target. However, transformers than contain between 2000 and 10000 pm will require retrofilling to be applied 3 times to achieve the 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-contaminated transformers into PCB-free units. Retrofilling when applied to PCB contaminated 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 contaminated 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.

Degreasing solvents and mineral oil have been used to dissolve the PCBs from the metallic surfaces, rendering a PCB-contaminated 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 contaminated 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 however where a smaller number of PCB contaminated transformers will require metal cleaning, it is conceived that rather than using the normal degreasing solvent such as Perchloroethylene, hot mineral oil 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 contaminated 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 transformer's metallic components.

The preliminary inventory revealed a significant number of PCB transformers and capacitors in Ukraine. It is expected that testing of the 10000 mineral oil transformers will provide accurate information about the extent of PCB contamination in the mineral oil transformers. The introduction of measures to manage the PCB containing material in an environmentally sound manner represents a significant economic and environmental challenge for the Ukrainian government, therefore GEF through this project is providing assistance and the through the successful completion of the activities established will assist the country to meet the commitments made under the Stockholm Convention.

The proposed UNIDO's project aims at establishing an Environmentally Sound Management system for PCBs that allows the complete destruction of PCBs and recovery, reclamation and recycling of valuable materials such as mineral oil and metals contained in the original PCB wastes, specifically:

- Introduction of Retrofilling as a practical means to treat and decontaminate in-service PCB contaminated mineral oil transformers.
- Establishment of facilities to drain, dismantle and decontaminate metallic and non-metallic components from PCB contaminated oil transformers.
- Establishment of a dechlorination plant to reclaim PCB contaminated mineral oil. This plant could be made fixed or mobile and would be used to clean PCB contaminated mineral oil from in-service transformers, as well as to clean the mineral oil used to clean the metallic components of surplus PCB contaminated transformers.

In order to assist countries like Ukraine to deal with the disposal of obsolete POPs, including PCBs, the Global Environmental Facilities, 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.

In addition, the project will also carry out limited disposal of high level PCB containing fluid and porous material in a local incineration unit. Before destroying any PCB waste in the incinerator, the unit would be properly analyzed to make sure its meet the established requirements of incinerators for the destruction of PCBs. This local, state of the art incinerator, has relatively low throughput capacity and therefore, the results of this test can be used by the government of Ukraine to allocate funds to build a larger incinerator system that can complement other technologies and provide economically attractive and environmentally solution for the disposal of PCBs within the country.

It is believe that the establishment of these facilities will provide Ukraine 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, if incinerated.
- 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.
- The testing of the small incinerator will provide actual data on the performance of the system and provide the basis for the construction of a larger unit using available government funds.
- Best social solution, as sustainable jobs are created within Ukraine to maintain the facilities and the PCB services being offered.

2. RETROFILLING

The existence of PCB containing transformers in any given jurisdiction is a complex problem due the number of transformers involved and the locations they 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 heavy users of electricity such as mining, steel and manufacturing facilities, while small distributions transformers are installed in the electrical distributions network covering the whole country.

The PCBs found in PCB contaminated transformers is distributed in the different components found in the units. Thus, PCBs are found in the oil, porous materials, metallic and other inert surfaces inside the transformers. To understand the mechanism of removing the PCBs from these matrices, it is necessary to understand the mechanism by which the contaminant is attached to the different matrices in the transformers.

The PCBs are dissolved in the mineral oil, while they are absorbed in organic solid such as paper, wood, rubber gaskets, etc. found in the transformers, and the PCBs are adsorbed in metallic inert surfaces such as steel, aluminum and naked copper. The copper conductor represents a special case as usually this material is coated with an organic varnish. This layer of organic material would have PCB absorbed, rather than adsorbed. However, because of the layer is thin, PCBs can be readily removed by organic solvents, the PCBs and solid surface interaction can be treated as an adsorption mechanism.

Although there are some variations of the composition of transformers based on size, manufacturer and dielectric fluid used in the construction of units, general estimated weight fractions for mineral oil filled transformers are given in Table 2.1.

Table 2.1. Weight Composition of oil filled electrical transformers and PCB-matrix interaction

Component	Weight Fraction (%)	PCB Retention in matrix
Varnished Copper/Aluminum conductor	15	Absorption in varnish/Adsorption on metal surface
Steel and other inert solids	58	Adsorption
Porous Material	4	Absorption
Mineral Oil	23	Dissolved in oil

Figure 2.1 shows some of the solid component used in pole mount distribution transformers. As previously indicated, larger distribution and transmission transformers are made maintaining similar ratios, however the size of the components (i.e. copper conductor) is larger, suitable for the much larger voltage and current that they carried.

Figure2.1. Pole Mount Distribution Transformer and its components

In any given PCB contaminated transformer, most of the PCBs is contained in the dielectric fluid, with the balance of the PCBs is contained absorbed in the porous material, and trace amounts being adsorbed in the metallic surfaces.

The practice of retrofilling of PCB contaminated consists of removing as much of the PCB contaminated dielectric fluid and replacing it with PCB-free mineral oil. After the drained transformer is retrofilled with PCB-free oil, PCB contaminated oil retained on the metallic surfaces and absorbed in the porous material is released into the fresh dielectric fluid increasing the level of PCBs from nothing to a fraction of the original PCB level in the oil (usually about 15%). That is if the PCB level in the transformer oil is 100 mg/kg or ppm, after the oil has been drained and replaced with PCB-free oil, the retrofilled transformer has attained the equilibrium status, the maximum or new equilibrium level of PCB in the oil would be about 15 ppm. Based on this distribution phenomenon, PCB contaminated transformers can be decontaminated applying the retrofilling practice. Table 2.2 summarizes estimated equilibrium levels for PCB contaminated transformers using PCB-free mineral oil as the new dielectric fluid.

Table 2.2 Estimated PCB equilibrium concentrations in mineral oil after the application of retrofilling to transformers containing different PCB contamination levels

ESTIMATED PCB DISTRIBUTION IN MINERALOIL TRANSFORMERS												
	MEDIUM	**PCB IN OIL (BULK) (ppm)**										
	PCB in Oil mg/kg or ppm	**50**	**100**	**150**	**250**	**260**	**500**	**800**	**1000**	**1200**	**1300**	**1500**
	Paper/Coil (Partition)	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
	Porous material (%)	4	4	4	4	4	4	4	4	4	4	4
	Metals (%)	73	73	73	73	73	73	73	73	73	73	73
	Mineral Oil (%)	23	23	23	23	23	23	23	23	23	23	23
	Total weight of transformer (kg)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
	Mineral Oil Kg	230	230	230	230	230	230	230	230	230	230	230
	PCB in Oil (mg)	11500	23000	34500	57500	59800	115000	184000	230000	276000	299000	345000
	Porous material kg	40	40	40	40	40	40	40	40	40	40	40
	PCB content in porous mg/kg	55	110	165	275	286	550	880	1100	1320	1430	1650
	PCB in porous material (mg)	2200	4400	6600	11000	11440	22000	35200	44000	52800	57200	66000
	PCBs in transformers (mg)	13700	27400	41100	68500	71240	137000	219200	274000	328800	356200	411000
98% 1st draining	PCB 1st drain removed from transformer (mg)	11270	22540	33810	56350	58604	112700	180320	225400	270480	293020	338100
	PCB remaining in transformer (mg)	2430	4860	7290	12150	12636	24300	38880	48600	58320	63180	72900
	PCB content equilibrium in oil (mg/kg)	**8.9**	**17.7**	**26.6**	**44.3**	**46.1**	88.7	141.9	177.4	212.8	230.6	266.1
	PCB content equilibrium in porous (mg/kg)	9.8	19.5	29.3	48.8	50.7	97.6	156.1	195.1	234.1	253.6	292.7
	PCBs in Oil equilibrium 1 (mg)	2040	4080	6119	10199	10607	20398	32636	40796	48955	53034	61193
	PCBs in porous equil 1 (mg)	390	780	1171	1951	2029	3902	6244	7804	9365	10146	11707
98% 2nd draining	PCB 2nd drain removed from transformer	1999	3998	5997	9995	10395	19990	31984	39980	47976	51974	59970

	(mg)											
	PCB remaining in transformer 2 (mg)	431	862	1293	2155	2241	4310	6896	8620	10344	11206	12930
	PCB content equilibrium in oil 2 (mg/kg)	1.6	3.1	4.7	7.9	8.2	15.7	25.2	31.5	37.8	40.9	47.2

As seen in Table 2.2, mineral oil PCB contaminated transformers containing up to about 260 ppm of PCBs can be efficiently decontaminated and reclassified as non-PCBs applying retrofilling only once as a decontamination method. For similar transformers but containing PCBs in the range of 260 and 1500 ppm, the retrofilling method has to be applied twice to attain the non-PCBs status.

From the economic and technical viewpoint, the practice of retrofilling PCB contaminated transformers is suitable to large transformers, filled with mineral oil and PCB levels not greater than 5000 ppm.

3. DECONTAMINATION OF PCB CONTAMINATED TRANSFORMER CARCASSES

Small distribution transformers containing PCBs, high level PCB contaminated transformers and all PCB contaminated transformers no longer in use and declared surplus must be decontaminated in approved government facilities prior to disposal or any recycling exercise.

As indicated in Table 2.1, the retention of the PCBs in the porous material is due to an absorption phenomenon and in order to remove the PCB from the solid, the PCBs must diffuse from the bulk of the solid onto its surface, where it is dissolved by a solvent. The diffusion mechanism is rather slow and depends on many factors such as pressure, temperature and the physical-chemical characteristics of the solid.

The retention of the PCBs by the metal on the other hand is a surface phenomenon where the PCBs are weakly retained by the surface tension between the liquid and the metal. Because of this phenomenon, the removal of PCBs from metallic surfaces can be achieved quite easily using a clean fluid with moderate PCB solubility.

Because of the high residual value of metals and mineral oil in PCB contaminated transformers, commercial services to decontaminate and reclaimed these materials have been commercially available in North America, Europe, Australia and in other jurisdictions for several years. The decontamination of porous material however, due to its amount in transformers and low value, has been developed in utilized as a method of disposal only in jurisdictions where incineration is not available or where incineration has been excluded as a disposal alternative.

For Ukraine, it is recommended that in addition to the dechlorination system for PCB contaminated oil, the proposed facilities for the disposal of PCB contaminated electrical equipment includes a decontamination system for metallic components only. Incineration as the disposal means for porous materials and dielectric fluid from high level PCB transformers and capacitors is the recommended option for these wastes. The testing of the existing incinerator in Ukraine will provide the technical basis for the design and construction of a larger unit that can provide an economically and safe disposal option within the country for the disposal of these toxic wastes.

In addition, rather than using more aggressive solvents such as Perchloroethylene or similar organic solvents, metallic components contaminated with PCBs be decontaminated using hot mineral oil. The spent mineral oil containing PCBs can be decontaminated using the dechlorination system that would be included in the proposed facilities.

4. NON COMBUSTION PCB DESTRUCTION TECHNOLOGIES

There is a number of non-combustion technologies that have developed and used for the treatment and destruction of PCB contaminated 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, and by UNIDO and FAO.

In addition to the STAP Workshop, a document prepared for the first meeting of the Technical Advisory Group of the UNIDO/UNDP/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* and *"Review of Emerging, Innovative Technologies for the Destruction and Decontamination of POPs and the Identification of Promising Technologies for Use in Developing Countries"* also contain 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 Ukraine. When available, additional information is presented for those technologies already identified.

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.

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

Based on the above-mentioned criteria, the following technologies meet are considered suitable for use in the UNIDO's PCB Management Project for Ukraine:

- Based Catalyzed Dechlorination
- Sodium Reduction Processes
- CDP Process
- Gas Phase Chemical Reduction Process
- Supercritical Water Oxidation
- Solvated Electron Process
- Plasma Arc

In addition to the above-mentioned technologies, a brief description of incineration using a rotary incinerator will be included, as the incinerator unit being considered for testing as part of this project includes a smaller rotary kiln incinerator.

4.1Based Catalyzed Dechlorination (BCD) Process

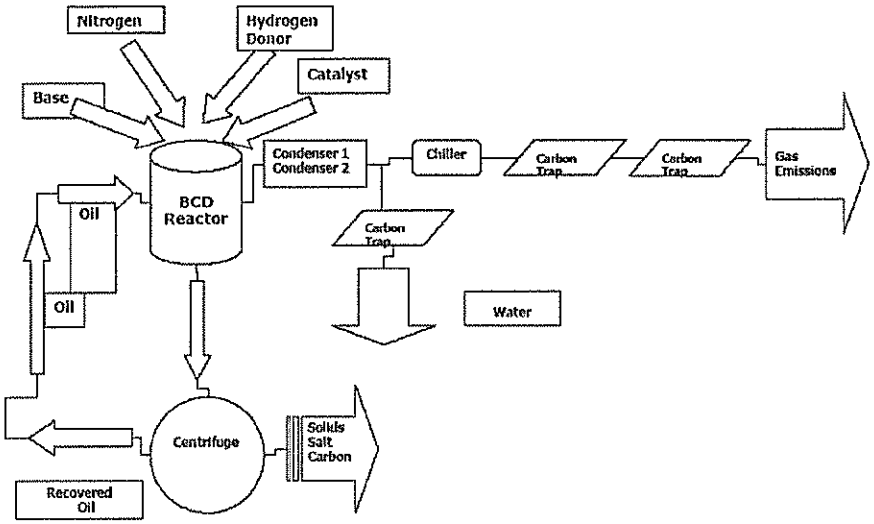
The BCD process was developed on the basis of earlier APEG dechlorination methodologies by EPA's Risk Reduction Engineering Laboratory from 1988 to 1993, in cooperation with the National Facilities Engineering Services Center (NFESC) of US Navy to remediate liquids, soils, sludge and sediments contaminated 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°C, called also 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, sludge, 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 °C. 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 licenses to operate the technology. Currently, licenses are held by companies based in Australia, Japan, Mexico and the United States.

4.2Sodium Reduction Method

The sodium-based reaction for the destruction of 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. More recently, UNIDO GEF funded project on the sound management of PCBs in the Philippines has demonstrated the ability of this method to efficiently destroy high level PCB liquid waste from Askarel transformers.

The sodium based reaction for the dechlorination of electrical insulating oils contaminated with low levels of polychlorinated biphenyls (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 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

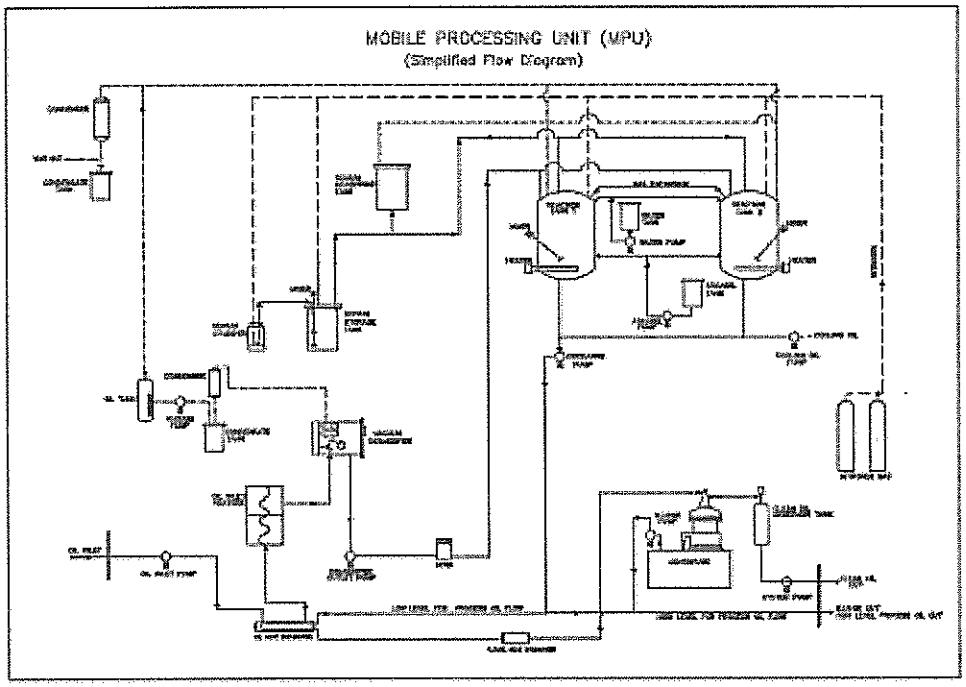
with nitrogen during the neutralization of the excess sodium used in the reaction. Obviously, the same level of control cannot achieve on a continuous process.

- 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 4.2.1

Figure 4.2.1 Simplified diagram of a sodium-based PCB destruction system



As shown in Figure 4.2.1, 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 contaminated 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 °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 is quickly settle and separated 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 3000 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, 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:

PCB Containment Technologies (Canada) – For oil containing up 5000 ppm

Kinectrics Inc. (Canada) – www.kinectrics.com – For oil containing up 100% or pure PCBs

SD Myers (USA) – For oil containing up to 5,000 ppm

Fluidex (South Africa) -

Nippon Soda (Japan) – For oil containing up 100% PCBs

EarthFax Engineering Inc. - www.earthfax.com; - For oil containing up to 5000 ppm

Powertech Labs Inc.- www.powertechlabs.com; -For oil containing up to 7,000 ppm

4.3 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 4.3.1.

The process use 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 catalyst..

During the continuous circulation, the insulating liquid is heated at a temperature between 80 and 100 °C 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;

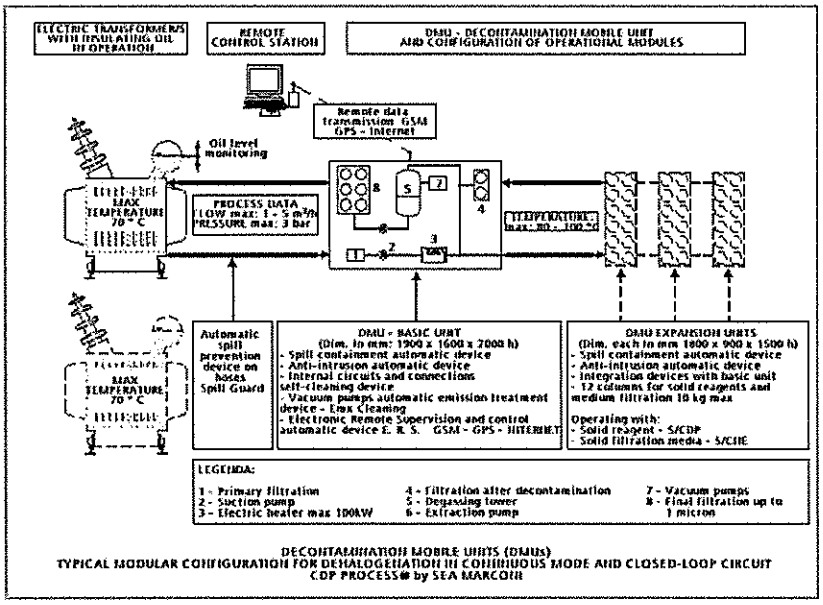
- Degassing, dehumidification under vacuum and micro filtration

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 are called Decontamination Mobile Units (D5MU) 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 D5MU indicates that they are able to effectively Diagnosis, Decontamination, Depolarisation, Dehalogenation and Detoxification of 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 4.3.1. 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 web page 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 case 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

4.4Supercritical 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°C 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 organic 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 (Modell 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
Foster 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	
ProchemTech, Inc.	1987	

4.5Solvated 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 ™). 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™ process is a total solution that incorporates pre- and post- treatments, where necessary for environmental cleanup. 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 cleanup 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™ 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 underutilized 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™ 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™ 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™ 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 4.5.I

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™ 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 I
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

5. HIGH TEMPERATURE ALTERNATIVES

In addition to incineration, there are two are other technologies that operate at high temperatures, they are the Gas Phase Chemical Reduction Process (GPCR) and plasma arc based technologies.

5.1Gas Phase Chemical Reduction (GPCR) Process

The technology was developed and commercialized by ELI Eco Logic International Inc. in Canada. It is claim 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°C 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 sludge.
- 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°C). 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°C needed for efficient destruction of organic wastes.

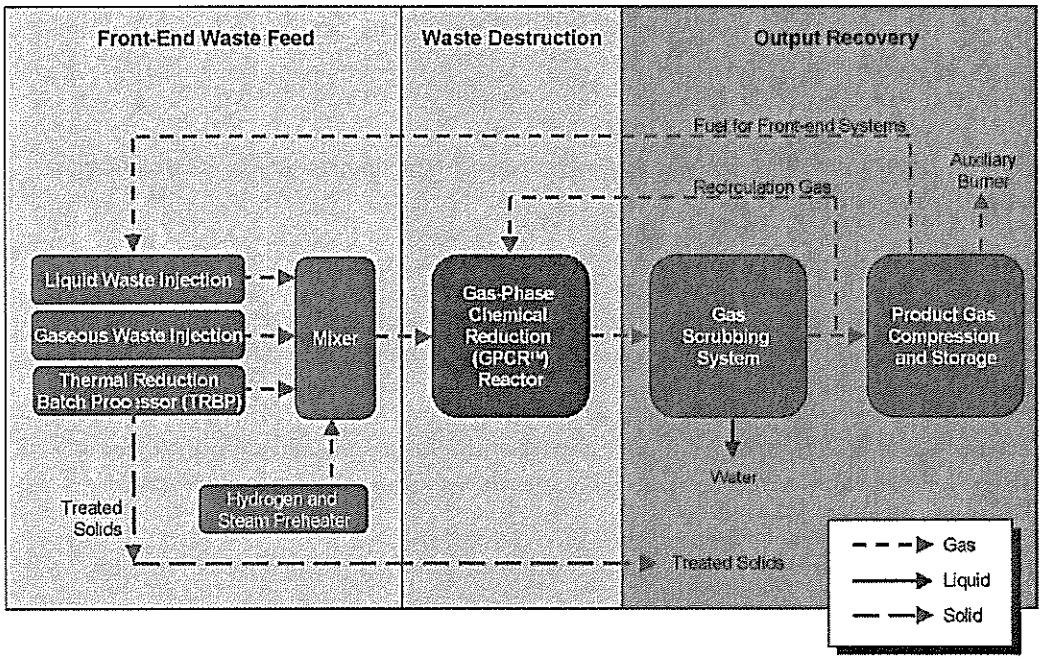
The general chemistry of conversion of a hydrocarbon structure containing chlorine and possibly oxygen can be expressed in the following way:

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

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

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

$CO + H_2O \rightarrow CO_2 + H_2$ (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 ton of soil treated to around 900 kWh per ton 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.

5.2Plasma Technologies

Generally, the plasma arc technologies can be classified as thermal destruction process ranging from pyrolysis to combustion that use heat generated by a plasma arc to destroy the organic waste content and to melt and vitrify the inorganic material. Various plasma reactors have been developed for the thermal destruction of hazardous waste, mainly in Australia (Plascon, Startech), USA (PACT, and PWC) Japan, Switzerland (Thermoselect) and Italy (CSM, Material Development Centre)

A plasma arc operates on principles similar to an arc-welding machine, where an electrical arc is struck between two electrodes. Resistance of the ionized gas to the flow of electrical current creates extremely high temperatures. Gases such as helium argon, nitrogen or air can be ionized to become the conductor. The plasma arc is enclosed in a chamber. Waste material is fed into the chamber and the intense heat of the plasma breaks down organic molecules (such as oil, solvents, and paint) into their elemental atoms. In a carefully controlled process, these atoms recombine into harmless gases such as carbon dioxide. Solids such as glass and metals are melted to form materials, similar to hardened lava, in which toxic metals are encapsulated. With plasma arc technology there is no burning or incineration and no formation of ash. There are two main types of plasma arc processes: plasma arc melter and plasma torch.

PLASCON technology uses the argon plasma arc process and is designed to process CFC and organic liquids, such as PCBs. The waste is fed directly into the plasma torch within the current of argon, where it is rapidly heated (one millisecond) up to 12,000°C and then passes into the flight tube where its pyrolysis occurs in nearly 20 ms at temperature of about 3,000°C. In the beginning of the flight tube oxygen is also added (limited amount) to ensure that any carbon formed during pyrolysis is then converted to carbon monoxide. The high temperature generated by plasma causes compounds to dissociate into their elemental ions and atoms. Recombination occurs in a cooler area of the reaction chamber, followed by rapid (2 ms) alkaline quenching from 1,500°C to less than 100°C. Such rapid quenching prevents the formation of dioxins and furans.

In Addition to the plasma torch, the waste treatment designed to destroy toxic chemicals also contains an air pollution control system that has filter, electrostatic precipitator and a quenching mechanism to rapidly cool down the gases and/or remove byproducts generated in the plasma unit.

The products of pyrolysis pass down a reaction tube that provides sufficient residence time to ensure the complete decomposition of the feed material. The hot gases (approx. 1,200°C) exiting the reaction tube are rapidly cooled in a caustic quench thus converting the hot acid gases to harmless neutral salts. The short residence time at the high temperature in the reaction tube (peak temperature >3,000°C) followed by rapid quenching prevents the formation/re-formation of dioxins/furans and other undesirable organic compounds. Atmospheric emissions from the process are typically argon, carbon dioxide and traces of carbon monoxide. Residual acid gases are neutralized in the gas scrubbing system.

In comparison with incineration processes, the off-gas volumes from PLASCON® are extremely low, as are residual ground level concentrations.

A significant advantage of the PLASCON system is the low process inventory. The process is electrically powered and can be shut down or started up in seconds. Process control interlocks are provided to prevent the release of incompletely treated waste, in the case of power failure or similar process upset. Other safety hazards relate to the storage of hazardous materials prior to treatment and the use of high temperatures. Emissions from the treatment system are limited to an emission to air containing argon, oxygen, water vapor and carbon dioxide, and a trade waste discharge containing a sodium halide salt. Dioxin formation is avoided by the use of pyrolysing conditions.

There is a risk of explosion from internal cooling water leaks and molten metal or slag discharges.

Destruction Efficiency definition: The overall destruction performance calculated on the basis of the total weight of waste input to the process, minus the sum of the waste in all products, by-products and environmental releases, divided by the waste input. (DE is reported as a percentage).

Pre-treatment is not required for most liquids. Solids and very viscous liquids or sludge thicker than 30 to 40 weight motor oil cannot be processed without pre-treatment. Solid organic matter should be crushed and dispersed in organic liquid and treated in a form of pumpable slurry or be evaporated via thermal desorption. Solids such as contaminated soils, capacitors and transformers can also be pre-treated using thermal desorption or solvent extraction.

PLASCON has been demonstrated with PCB oils containing 60% PCBs. Recently, a PLASCON plant in Australia has been configured to destroy pesticide wastes.

Emissions

Emissions include gases consisting of argon, carbon dioxide and water vapor. Residues include an aqueous solution of inorganic sodium salts, i.e. sodium chloride, sodium bicarbonate and sodium fluoride. Bench-scale tests with PCBs, showed PCDD levels in scrubber water and stack gases in the part per trillion (ppt) range. At a PLASCON plant in Australia used to destroy a variety of wastes, the level of PCBs in the effluent discharged complies with the 2 ppb limit. POP concentrations in solid residues are unknown.

Energy and Material requirements:

A 150 kW PLASCON unit requires 1000 to 3000 kWh of electricity per ton of waste. Currently, there is little information available regarding material requirements. However, it has been noted that this process does require argon gas, oxygen gas, caustic and cooling water

Capacity

It is reported that a 150 kW unit can process up to 70 kg/hr of pure POP waste at operating 24 hours per day.

Efficiency

Bench scale tests with PCBs have achieved destruction removal efficiencies ranging from 99.9999 to 99.999999% (UNEP, Report on PCB destruction capacity, 2004)

Case studies

Since 1993 extensive pilot tests for destruction of Halon compounds, herbicides and PCBs were conducted with PLASCON technology. The first pilot plant was installed in 1992 at Nufarm Ltd., a herbicide manufacturing works in Laverton, Victoria; in 1995, the second Nufarm PLASCON of higher throughput was installed. Another plant was commissioned at Australia's National Halon Bank in 1996 and since then about 1,000 tons of Halon 1011 and about 100 MT of CFCs have been destroyed. BCD Technologies purchased a license for PLASCON from SRL Plasma in 1997 to treat a range of concentrated chlorinated wastes including PCB's and organochlorine pesticides, which could not be treated with the same efficiency by the BCD technology. BCD Technologies operated two plasma plants in Australia: one in Brisbane for PCBs and POPs; and another in Melbourne for treating CFCs and Halons. Mitsubishi Chemical Corporation has installed a PLASCON plant in Japan to treat wastes consisting of, containing or contaminated with PCBs. Nine installed commercial PLASCON plants are still in operation. Four plants operate in Japan, one in United Kingdom, and four in Australia. Over 3,000 t of POPs have been treated.

Licensing: BCD Technologic Pty Ltd, PO Box 119, Narangba QLD 4504,Telephone: I 61 (0)7 3203 3400: fax: +61 (0)7 3203 3450.

Vendor (s): BCD Technologies Pty Ltd.

5.3Rotary Kiln Incineration

The inclusion of a section on rotary kiln incineration system is based on the proposed testing of the Tarkom Ekoservis LLC incineration system in Ukraine.

In a hazardous waste incineration a controlled flame combustion process is used to destroy organic contaminants. A common system to destroy organic contaminants in inert solids or sludge is a rotary kiln incinerator where the waste is fed into a rotating vessel and the organic materials get combusted assisted by the help of nozzles burning a fuel. The gas effluent, containing partially combusted compounds passes through a secondary combustion chamber or afterburner where complete destruction of the organic compounds is achieved

The temperature in the rotary kiln is usually greater than 850°C where the organic contaminants evaporate from the solid inert materials and get totally or partially combusted. The partially combusted gases from the rotary kiln then goes to the secondary combustion chamber where they are totally destroyed at a temperature of 1200°C or greater with a residence time of 2 seconds or greater.

The disposal of PCBs in incinerators is very well regulated and specific operating parameters must be complied with in order to obtain and maintained a license to destroy PCBs. Thus, the requirements for a PCB incinerator under the USA Toxic Substances Control Act (TSCA) are:

Continuous monitoring of O_2 and CO

Periodic monitoring of CO_2

Combustion Efficiency (CE) greater than 99.9% where CE = $[(CCO_2)/(CCO_2 + CCO)]*100\%$

Residence time of 2 second at 1200°C and 3% excess of O_2 in the stack gas, or

Residence time of 1.5 seconds at 1600°C and 2% excess of O_2 in the stack gas

The air mass emission for the incinerator must not be greater than 0.001 g of PCBs per Kg of PCB fed into the incinerator (Destruction and removal efficiency [DRE] of 99.9999%)

A diagram of Rotary Kiln incineration system is shown in Figure 5.3.1

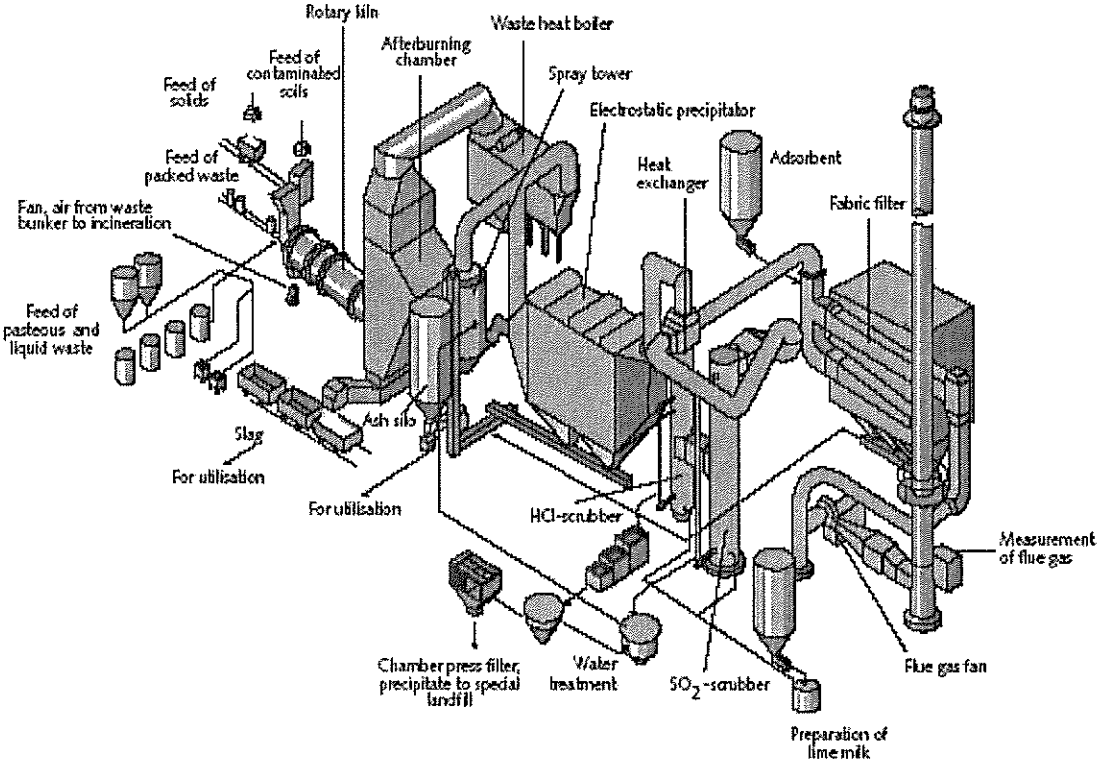


Figure 5,3,1 Rotary Kiln Incineration System Diagram

While Figure 5.3.2 shows the photograph of an actual rotary kiln incineration system

Figure 5.3.2. Photograph of Rotary Kiln Incineration System

A layout of Tarkom Ekoservis rotary kiln incinerator with a capacity of 500 kg of waste per hour is shown in Figure 5.3.3

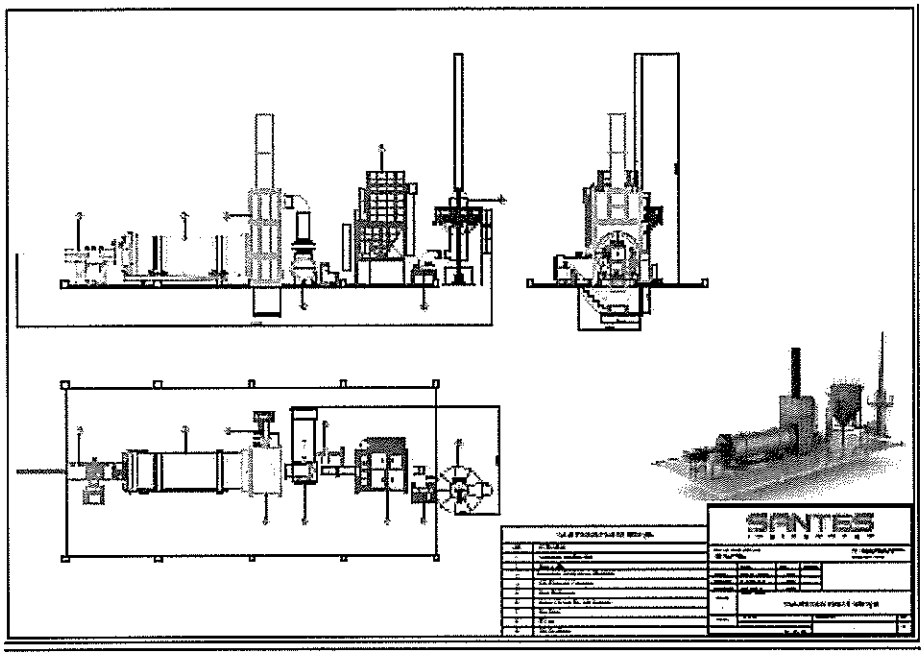


Figure 5.3.3. Layout of Tarkom Ekoservis Rotary Kiln Incineration System in Odessa, Ukraine

Emission

The incineration must meet the 99.9999 DRE requirements and must with permissible PCDDs/PCDFs, PCBs, and other air pollutants. Observed emissions include carbon monoxide, carbon dioxide, HCB, hydrogen chloride, particulates, PCDDs, PCDFs and PCBs and water vapor. Incinerators applying BAT, i.e., inter alia, designed for high temperature and equipped with prevention of reformation of PCDD/F and dedicated PCDD and PCDF removal (e.g., activated carbon filters), have led to very low PCDD and PCDF emissions to air.

Process gases may require treatment to remove hydrogen chloride and particulate matter and to prevent the formation of and remove unintentionally produced POPs. This can be achieved through a combination of types of post-treatments, including cyclones and multi-cyclones, electrostatic filters, static bed filters, scrubbers, selective catalytic reduction, rapid quenching systems and carbon adsorption. Depending upon their characteristics, bottom and fly ashes may require disposal within a specially engineered landfill.

Energy and Materials

Because of the high Chlorine content of PCBs, liquid PCBs wastes must be blended with other organic materials or solvents to reduce the Chlorine content in the feedstock to 2 to 3% maximum. Waste streams vary depending on waste being destroyed.

NaOH (50%) solution = 40 kg per ton of waste
CO_2 = 820 kg per ton of waste
Active Carbon/Calcium Hydroxide = 1.4 kg per ton of waste
Cooling/Scrubber water = 1.7 m^3 per ton of waste

Capacity

Fixed hazardous waste incinerators up to 100,000 of waste per year are commercially operational in Europe. Smaller units as fixed or portable units with capacity of as low as 300 kg/hr of waste with calorific value of 24 MJ/Kg are also commercially available.

Efficiency

The standard requirement for destruction efficiency for PCB incinerators is that they have to comply with the 99.9999% DRE. In addition, they have to comply with any relevant regulatory requirements existing in the jurisdiction where the incinerators are built and operated.

Case Studies

Rotary kiln incinerators for the destruction of hazardous wastes are in operation in several countries including: Germany, Finland and France,

Portability

The large size and significant capital cost required to install a rotary kiln similar to the operating units in Europe make the transferring of this technology quite difficult. Rather than offering transferring this technology, the owners/operators of these incinerators offer disposal services that include packaging, transportation and disposal of the PCB wastes from owners around the world.
Nevertheless, smaller rotary kiln incineration systems that can also be used for the disposal of hazardous wastes have been commercialized. Thus, Tarkom Ekoservis has acquired a 500 kg/hr rotary kiln incinerator that has been approved by the government of Ukraine to process hazardous wastes, including PCBs. In addition, Poland with a capacity of 300 kg/h for a calorific value of waste 24 MJ/kg and at present in Latvia a container-based Incineration system (CIS) with a capacity of 2000-4000 t/y depending on calorific value of waste. Waste can contain to 2.5 % Sulphur and to 10% halogen.