

**Proceeding of the meeting on POPs monitoring capabilities in
Bangladesh held at Conference Room Poribesh Bhaban (Annex
Building), DOE, on 10 January, 2005**

A meeting on POPs Monitoring capabilities in Bangladesh was held on 10 January 2005 at Conference Room Poribesh Bhaban (Annex Building), Department of Environment, Agargaon, Dhaka. The meeting was presided over by the National Project Director, POPs NIP Project. Representatives from different laboratories, research institutes and Regional offices of DOE having full flagged laboratories facility were present in the meeting (List of participants in **Annexure- I**). The main objectives of the meeting were:

- To assess the capacity and capabilities of the laboratories for monitoring POPs in Bangladesh.
- To find out a way for laboratory analysis of transformer oil, obsolete pesticides, soil, water and ash samples for POPs.
- To suggest a national monitoring system in order to enter into the Global Monitoring Programme for POPs.
- To suggest monitoring, research and development on POPs in Bangladesh.
- To develop national reference laboratory for POPs in Bangladesh.

Participants attended the meeting were welcomed by the chair and a brief on the project and its activities and the reason for convening this meeting was explained. The meeting was organized after receiving filled up questionnaire submitted by the respective research institutes and departments. On the basis of the information gathered, a assessment report along with the laboratory analyses requirement for POPs was presented by Dr. M. A. Malek, Project Manager, POPs NIP Project (**Annexure- II**). He explained the necessity for developing national capacity for POPs monitoring in Bangladesh. The UNEP chemicals has developed a Global Monitoring Programme (GMP) for POPs and initiated an activity aiming to link together the existing national, regional and global POPs monitoring facilities he added. It has made a data base inventory of POPs monitoring laboratories through out the world. On the basis of the information supplied by each laboratory as regards to the capabilities to perform analysis of POPs chemicals identified by Stockholm Convention, the laboratories are categories into Tier 1, Tier 2, Tier 3 and Tier 4. Bangladesh at present is legging behind on capacity and capabilities to participate fully in such a programme. So the capacity building in this regard is of prime importance for the country. Dr. Malek put forward some vital questions to carry out monitoring activities of POPs in Bangladesh which were as follows:

- What do we need to monitor?
- What we need to analyze?
- What are the methods for analysis?
- What are the processes for analysis?
- What are the requirements?
- What do we have in the laboratory?
- What more we need?
- How could we make it sustainable?

In his presentation, he explained all the aforesaid questionnaires including analytical procedures such as sampling and sample preparation methodology, matrix selection, extraction of analytcs, clean up, detection of analytcs and limit of detection, quality control, accreditation of laboratory etc.

After this presentation Ms Irena Wosk an International Consultant for POPs Project, also presented a questionnaire on capabilities for monitoring of POPs-chemicals in different matrices of the environment such as air, water, soil, sediment etc (**Annexure III**). She mentioned the necessity for a policy for management of the laboratories for monitoring POPs-chemicals within the country. She emphasized for coordination among laboratories for quality control (QC) and quality assurance (QA) in order to generate quality results. She advised for the laboratory accreditation system, even if lacking nationally, international accreditation can be achieved by fulfilling the required criteria.

Open Discussion

Initiating discussion on the lab. capability Prof. Dr. Nilufar Nahar, Department of Chemistry, University of Dhaka mentioned that their laboratory has Gas Chromatograph (GC) and they analyze some of the pesticides in fish and water and PCBs in water samples. They have some standards of POPs chemicals but not the dioxins and furans. Dr. Malek inquired whether they are capable to render services by analyzing at least POPs pesticides and PCBs samples. She assured for a limited number of samples at this moment.

Mr. Mustafizur Rahman, Senior Chemist, Chittagong Division, Department of Environment, informed that they have GC and they analyze food items but not for POPs chemicals. If they are provided with required technical and financial supports they would be able to analyze POPs samples in future.

Dr. Md. Mazibur Rahman, Senior Scientific Officer (SSO), Agrochemical and Environmental Research Laboratory from the Institute of Food and Radiation Biology (IFRB) of Atomic Energy Research Establishment Ganakabari, Savar, Dhaka said that they have been working on DDT, Heptachlor and Dieldrin for a long time. They found the presence of DDT and its metabolites in dry fish, water, soil and fresh fishes too. They can analyze some POPs-pesticide samples if they are provided with technical and financial supports from the project.

Dr. Md. Nazrul Islam, SSO, Poultry Feed Analysis Laboratory, Bangladesh Livestock Research Institute (BLRI), Savar, Dhaka, informed that they have GC/HPLC/AAS and they analyse poultry feed on regular basis. If they are provided with technical and financial supports then they would be able to analyze some POPs-chemicals.

Prof. Dr. M. Mahbubar Rahman, Professor, BSMR Agricultural University participated in the discussion and said that laboratory peoples are interested to work, even many have developed expertise from out side the country but could not achieve the goal as because there is lacking harmony between expertise, facilities and requirements. He informed that many laboratories have purchased GC but could not brought into operation. At this point Prof. Nilufar informed the house that they have developed a programme for providing technical services for repairing, installation etc. of instrument in the laboratories. If some one is interested, can avail this opportunity.

Dr. Mainuddin, PSO, Entomology Division, Bangladesh Tea Research Institute (BTRI), Sri-mangal informed that they have developed a pesticide residue laboratory. Their work is exclusively on tea. They have installed Electron Capture Detector (ECD) with their Gas Chromatograph (GC). They could try to detect heptachlor in samples if needed by this project.

Dr. Raisuddin Miah, Director, Water Quality Fuel Testing Environmental Research (WQFTER), Khulna Power Station Chemical Laboratory under Bangladesh Power Development Board said that they have capacity to analyze water including various parameters of waste water. They have Atomic Absorption Spectrophotometer (AAS) equipped with hydride generation. If equipments and other technical and financial supports are provided they would be able to test for some POPs-chemicals, in particular PCBs in transformer oil. They have skilled manpower too. Since they are dealing with transformer oils, they need to have the facilities for detecting PCBs in transformer oil.

SK. Md. Abdullah, Chemist, Pesticide Administration and Quality Control Laboratory of Plant Protection Wing, Department of Agricultural Extension (DAE), Khamarbari, Dhaka informed the house that they have capacity to test pesticide formulated products. If they are provide with technical and financial supports they would be able to analyze POPs pesticides too. They have trained skilled manpower, he added.

Prof. Dr. Nilufar Nahar advised that problems relating to POPs chemicals analysis could be solved in two ways: (a) short-term and (b) long-term basis. According to the requirement of the project limited samples needs to be analysed immediately (short-term basis). She expressed her willingness to participate in that programme. They have standards for some pesticides and PCBs. They will offer their service for those only. For long-term basis Prof. Nilufar proposed that some laboratories could be identified and be provided with necessary equipments and other facilities.

Prof. Dr. Mahabubar Rahman, supporting the proposal of Prof. Nilufar Nahar proposed for central coordinating authority for making national network for POPs monitoring in Bangladesh. This coordinating authority will work as an umbrella to facilitate cooperation among the laboratories, monitor the QC/QA of the laboratories, introduce interlaboratory calibration programme, and provide technical know-how and services. He also emphasized that this authority will be independent from the participating laboratories activities. It could be established under the Department of Environment, Ministry of Environment & Forests.

Dr. M. A. Malek mentioned that for PCB analysis a laboratory of Bangladesh Power Development Board (BPDB) needs to be equipped and for POPs pesticides laboratory of the Department of Agricultural Extension needs to be strengthen. Development of laboratory for dioxin and furans detections is important. The existing laboratory facility under the Department of Environment could be utilized and strengthened. Besides, research and development on POPs are also required for the country. All the work on POPs monitoring and research activities will come under the same coordinating umbrella.

Dr. H. K. Das, Sub-Task Leader (Unintentional by product) of the project expressed his opinion that some private sector may be encouraged for establishing private laboratory for analyzing POPs-chemicals. The meeting recommended his proposal and

feels that private sectors are capable to solve many problems in much shorter period and there will be competitiveness in the work.

Recommendation

The followings were the recommendations from the meeting:

1. A national monitoring network for POPs be developed incorporating a number of laboratories in the country. The laboratories will work under a coordinating authority under the Department of Environment. This coordinating authority will work independently and formation of this authority could be finalized through appropriate procedure.
2. In order to meet immediate requirement for analyzing samples for POPs be done at the Organic Research Laboratory of the Department of Chemistry at DU, Agrochemical and Environmental Research Laboratory of Institute of Food Radiation Biology at BAEC, Analytical Research laboratory of BCSIR, Dhaka, DOE laboratory and DAE laboratory.
3. Pesticide Laboratory of DAE be strengthen for POPs pesticide analysis.
4. A laboratory for PCB detection in transformer oil be developed under the Bangladesh Power Development Board.
5. For the analysis of Dioxin and Furan the existing laboratories under the Department of Environment will be strengthen with equipment and trained manpower.
6. Private Laboratories be encouraged to develop facilities for POPs analysis.
7. Reference Laboratory for POPs be established under appropriate authority.
8. National accreditation system for the laboratories be introduced in Bangladesh.

Chairperson thanks all the participants of the meeting for their valuable contribution and showing their keen interest to participate in POPs Monitoring Programme.

(Quazi Sarwar Imtiaz Hashmi)
National Project Director
Bangladesh: Preparation of Persistent
Organic Pollutants (POPs) National Implementation
Plan under the Stockholm Convention
&
Deputy Director (Dev & Plan)
Phone: 9113328

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List of Participants
Meeting on POPs Monitoring Program
Room # 214, Paribesh Bhaban
January 10, 2005

SL#	Name & Designation	Contact Address	Signature
1.	Dr. Md. Jahangir Alam Senior Scientific Officer	Entomology Laboratory Bangladesh Institute of Nuclear Agriculture(BINA) Mymensingh, Post Code: 2202	
2.	Dr. Md. Mazibur Rahman Senior Scientific Officer	Agrochemical and Environmental Research Laboratory Institute of Food and Radiation Biology Atomic Energy Research Establishment Ganakabari, P.O.: DEPZ, Savar Dhaka-1339	
3.	Dr. Md. Nazrul Islam Senior Scientific Officer	Poultry Feed Analysis Laboratory Bangladesh Livestock Research Institute Savar, Dhaka-1341	
4.	Dr. Nilufar Nahar Professor	Organic Research Laboratory (Pesticide Project) Department of Chemistry University of Dhaka Dhaka-1000	
5.	Dr. Raisuddin Miah Director Water Quality, Fuel, Testing & Environmental Research	Khulna Power Station Chemical Laboratory Khulna Power Station Bangladesh Power Development Board Khalishpur, Khulna-9000	
6.	Dr. Md. Abdullah, Associate Cane Entomologist (Grade-I)	Bangladesh Sugarcane Research Institute Bangladesh Sugarcane Research Institute Ishurdi, Pabna-6620	
7.	Sk. Md. Abdullah Chemist	Pesticide Administration and Quality Control Lab. Plant Protection Wing Department of Agriculture Extension (DAE) Khamarbari, Firmgate Dhaka-1215	
8.	Dr. Nasim Sultana Senior Scientific Officer	Analytical Research Division, BCSIR Laboratories Qudrat-i-Khuda Road Dhanmondi, Dhaka-1205	
9.	Md. Matiur Rahman Principal Scientific Officer	BCSIR Laboratories, Rajshahi Binodpur Bazar Rajshahi-6206	
10.	Matiur Rahim Senior Scientific Officer	Institute of Food Science & Technology (IFST) IFST, Qudrat-i-Khuda Road Dhanmondi, Dhaka-1205	
11.	Dr. Mainuddin Ahmed Principal Scientific Officer Entomology Division	Pesticide Residue Analytical Laboratory Bangladesh Tea Research Institute (BTRI) Moulvibazar, Srimangol-3210	
12.	Dr. Yahia Mahmood Senior Scientific Officer	Central Freshwater Laboratory Bangladesh Fisheries Research Institute Mymensingh-2201	

13.	Md. Shahjahan Khan Senior Chemist Dhaka Division	Department of Environment Poribesh Bhaban 16/E, Sher-e-Bangla Nagar, Agargaon, Dhaka	
14.	Md. Makbul Hossain Senior Chemist	Department of Environment Poribesh Bhaban Boyra, Khulna	
15.	Md. Mostafizur Rahman Akhand Senior Chemist	Department of Environment Chittagong Divisional Office 237 Nowab Sirajudoula Road Chokbazar, Chittagong	
16.	Md. Abdul Aziz Sarkar Research Officer	Department of Environment Poribesh Bhaban Nishindara, Bogra	
17.	Begum Ummey Hasna Mst. Akhtaruzzahan DD (Technical)	Department of Environment Head Office Agargaon, Dhaka	
18.	Dr. Md. Mahbubar Rahman Professor	Insecticide Toxicology Laboratory Entomology Department BSMRAU, Gazipur.	
19.	Irena Wosk International Consultant	POPs NIP Project, DOE	
20.	Quazi Sarwar Imtiaz Hashmi National Project Director	POPs NIP Project, DOE	
21.	Dr. M. A. Malek Project Manager	POPs NIP Project, DOE	
22.	Dr. Khairul Bashar Consultant	POPs NIP Project, DOE	
23.	Dr. H. K. Das Consultant	POPs NIP Project, DOE	
24.	Md. Abdul Mannan Consultant-PCBs	POPs NIP Project, DOE	
25.	Quazi Tafazzal Hossain Consultant-Pesticide	POPs NIP Project, DOE	

Report on POPs Monitoring Capabilities in Bangladesh

1. Background and needs for National POPs Monitoring capabilities:

On 22 May 2001, 127 Governments adopted the Stockholm Convention on Persistent Organic Pollutants (POPs). POPs are chemicals those are persistent, bio-accumulates in fatty tissues, biomagnifies through the food chain and adversely affect human health and the environment.

Bangladesh is the signatory of the Stockholm Convention on Persistent Organic Pollutants (POPs). The main objective of the convention is to protect human health and the environment from the adverse effects of Persistent Organic Pollutants. To achieve this objective requires significant monitoring capacity worldwide that are effectively integrated and co-ordinate within countries that also between countries with a given region. In this regard the convention includes two activities: Article 11- research, development and monitoring, Article 16 - Effectiveness evaluation. UNEP Chemicals, which is the centre for all chemicals related activities of the United Nations Environment Programme, has established the "Global Network for monitoring of Chemicals in the environment". This network focuses on the twelve POPs chemical identified by the Stockholm Convention. The Stockholm convention on POPs entered in to force on 17 May 2004. Parties of the Conference shall undertake appropriate research, development and monitoring of POPs at national and international levels within their capabilities. Bangladesh also do have some obligations in this regards.

2. Substances and analytes :

Stockholm convention has identified 12 POPs substances initially. The substances or groups of substances listed in the convention are:

- Aldrin
- Chlordane*
- Dieldrin
- Endrin
- Heptachlor
- Hexachlorobenzene (HCB)
- Mirex
- Toxaphene*
- Polychlorinated biphenyls (PCBs)*
- Dichloro diphenyl trichloroethane (DDT)*
- Poly chlorinated dibenzo-*para*-dioxins (PCDD)*
- Polychlorinated dibenzofurans (PCDF)*

* Mixtures of several congeners, for some of them several hundreds. If is not necessary or even possible to analyze all these congeners.

The essential analytics for the determination of POPs recommended by Global Monitoring Programme (GMP) of UNEP Chemicals are as follows:

Chemicals	Analytes
HCB	HCB
Chlordane	<i>cis</i> - and <i>trans</i> -chlordane <i>cis</i> - and <i>trans</i> -nonachlor oxychlordane
Heptachlor	Heptachlor, heptachlorepoxide
DDT	4,4' – DDE, 4,4' – DDD, 4,4' – DDT
Mirex	Mirex
Toxaphene	Congeners P26, P50, P62
Dieldrin	Dieldrin
Endrin	Endrin
Aldrin	Aldrin
PCBs	Σ PCB ₇ (Congeners 28, 52, 101, 118, 138, 153 and 180) PCB with TEFs*: 12 congeners.
PCDD/PCDF	2, 3, 7, 8 substituted tetra- to octachlorodibenzo- <i>p</i> -dioxins and dibenzofurans (17 congeners)

* PCB with TEFs (Toxic Equivalency Factors) are those congeners that have found to have dioxin-like effects.

3. Sampling and Sample preparing methodology:

In March 2003 POPs Global Monitoring Programme (GMP) Workshop at Geneva, Switzerland recommended air, bivalves, biota and humans are to be considered first in a POPs monitoring Programme, that there may be cases when countries or regions may choose water, soil sediments etc. to identify levels of POPs in hot spots.

Sampling for monitoring POPs should follow established methodological guidelines. Samples in all programmes should be numbered in the same way and it will always include field or trip blanks and in duplicate. Frequency and timing should be harmonized between matrices as much as possible. As a rural samples should be taken at least annually and during the same period every year. Sample banking should be considered for all samples, though banking is an expensive and resource intensive activity.

4. Matrix Selection:

In a national POPs monitoring Programme selection of matrix will be based on probable contamination level, availability of the matrix to a wider range of population, that content in the matrix as POPs are mainly accumulate in that substances, homogeneity of the matrix, rate of sampling and as indicator of source and exposure. Air, Water, Sediments, Soil, human tissues, human milk, blood, adipose tissue, fishes etc. should be of priority for a POPs monitoring programme

5. Extraction of Analytics:

Extraction of the analytics depends on the specific analytics and the matrices. The main points to consider are to allow adequate time of exposure of the solvent system in the sample matrix and to limit sample handling steps, i.e. avoid filtration steps by using soxhlet or semi automated systems. Extractions can also be accelerated by the use of ultrasonication. Cross contamination from reduces left behind by high levels of

POPs in other samples is a concern. The requirement must be thoroughly cleaned and checked from batch to batch. In order to avoid contamination, equipments glassware used for formulation analytics just not be used for residue or true level of determination. The laboratory specific should be completely separated from each other. Priority of extraction solvents is also a major consideration. Internal standards should be added to the sample as early as possible in the process. A part of the sample can be frozen and stored for future control analysis. For storing preferably in glass ampoules, at - 20°C for short period while at -70°C.

6. Clean up:

During the process of extraction, co-extracts like pigments, lipids and other macro molecules come out with the analytics. Generally Silica gel or Florisil columns chromatography is used for the purpose. Separation of non-polar PCB from polar POPs (HCH, chlordanes, dieldrin, endrin) is done by eluting by non-polar solvents.

Separation of high lipid contents from the extract can be achieved by using size exclusion or gel permeation chromatography (GPC). It may be automatized by using HPLC or normally by gravity flow columns.

7. Detection of analytics and limit of detection:

Various analytical approaches are available for quantifying organochlorine pesticides, PCBs and PCDD/PCDFs. Gas chromatography with electron capture detector (ECD) and mass spectrometry detection are most valuable instrumental arrangement for these compounds. General guidance given by GMP is presented below:

General guidance on GC analysis and data reporting for POPs

GC detector	Analytes	Configuration	Advantages/disadvantages	Detection limit*
Capillary with ECD	All ortho-substituted PCB and all OCPs on the POPs list except toxaphene	30 or 60 m x 0.25mm i.d. column with H ₂ carrier gas. Dual column, non-polar (DB-1) and intermediate polarity columns ((DB-5)	Similar response factors for most OCs. Good sensitivity for all POPs. Adequate for routine tasks. High potential for misidentification of some POPs due to co-eluting peaks	Examples: DDT/DDE~ 1pg HCB~0.5pg
Quadrupole mass spectrometry in Electron Ionization (EI) mode.	All PCB and all OCPs on the POPs list except toxaphene	30m x 0.25mm i.d. low bleed columns with He carrier gs. Selected ion mode for target POPs	Newer instruments (post 1997) have adequate sensitivity for routine POPs monitoring at low pg/μL concentrations. Much less potential for mis-identification than with ECD	Example: DDT/DDE~1-10pg HCB~1-10pg Dieldrin~25pg Toxaphene~500pg (as technical mixture)
Quadrupole Mass spectrometry in Electron Capture Negative Ionization (ECNIMS) mode.	Toxaphene and other highly chlorinated OCPs and PCB with > 4 chlorine atoms	30m x 0.25mm i.d. low bleed columns with He carrier gas. Selected ion mode for target POPs	Comparable sensitivity to ECD in SIM mode for some POPs, in ECNIMS mode. Much less potential for misidentification than with ECD.	Example: DDT/DDE~0.1pg HCB~0.1pg Dieldrin~1pg Toxaphene~10pg (as technical mixture)

Ion trap mass spectrometry using MS/MS mode	All PCB, All OCPs on the POPs list	30m x 0.25mm i.d. low bleed columns with He carrier gas. Same columns as quadrupole MS	Comparable sensitivity to ECD in MS/MS mode for some POPs. Much less potential for mis-identification than with ECD	Example: DDT/DDE~1pg HCB~1pg Dieldrin~5pg Toxaphene~100pg (as technical mixture)
High resolution magnetic sector mass spectrometry in Electron Ionization (EI) mode	PCDD/PCDF, all PCB, all OCPs on the POPs list except toxaphene	30m x 0.25mm i.d. low bleed columns with He carrier gas. Selected ion mode for target POPs at 10,000 resolution	Comparable sensitivity to ECD in SIM mode. Highly reliable identification at low pg/uL	Example: DDT/DDE~0.05pg HCB~0.05pg Dieldrin~0.1-0.5pg Toxaphene~10pg (as technical mixture)

* The smallest amount introduced in the instrument that can be detected at S/N of ~10.

The lowest concentration that can be quantitatively be determined is termed as limit of quantitation (LOQ) and it is normally three times higher than LOD.

Analytical methods for determination of POPs in various samples depends on the matrix and required limit of detection (LOD). Analytical procedure includes the following steps:

1. Sample collection and preservation
2. Extraction of the analytcs
3. Clean-up of the co-extracts
4. Separation of the analytcs of Gas chromatography
5. Detection the analytcs

UNEP Guidance for a Global Monitoring Programme for POPs has categorized three types of laboratories based on the availability of commonly used instruments for the determination of POPs. Laboratory types with requirements for the instrumental analysis of POPs is presented in the table below:

Requirements for the instrumental analysis of POPs

Laboratory tire	Equipments	Infrastructure needs	Cost (USD)	Chemicals
3	Basic sample extraction and clean-up equipment, capillary GC/ECD*	Nitrogen/air conditioning/power/personnel specifically trained to operate and trouble-shoot equipment problems	Instruments: \$50K Lab equip: \$30K Operation: \$10K/year Personnel: 2PY	Most PCB and all OCPs except toxaphene
2	Sample extraction and clean-up equipment, capillary GC/LRMS*	Helium/air conditioning/consistent power/personnel specifically trained to operate and trouble-shoot equipment problems	Instruments: \$150K Lab equip: \$50K Operation: \$20K/year Personnel: 3PY	Most PCB and all OCPs; toxaphene if negative chemical ionization is available

1	Sample extraction and clean-up equipment, capillary GC/HRMS*	Helium/air conditioning consistent power/high operational costs/personnel specifically trained to operate and trouble-shoot complicated instrumentation	Instruments: \$400K Lab equip: \$50K Operation: \$50K/year Personnel: 5PY	PCDD/PCDF, all PCB, all OCPs except toxaphene
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* GC-ECD- gas chromatography/electron capture detection

* GC/LRMS- gas chromatography/low resolution mass spectrometry

* GC/HRMS- gas chromatography/high resolution mass spectrometry

According to the GMP a good network within a region would contain at least one Tier 1 laboratory and several tier 2 and 3 laboratories. A Tier 1 lab could be responsible for the training and quality assurance work within the region if it is well trained for the analysis of POPs. If such a lab is not available in the region collaboration with labs in other region(s) is necessary.

Besides, a number of OCPs in particular DDT, Dieldrine, Heptachlore etc may be determined by TLC and ELISA method too. The ELISA procedure has been found to be relatively simple rapid and inexpensive as an analytical technique to detect dieldrine residues in water and soil matrix. But both these method have the limitation over the limit of detection (LOD) and the isomers of the compounds.

Laboratory standard operating procedures (SOPs) for analysis of POPs are available. Numerous widely acceptable methods are published during the last 40 years. Methods endorsed by **US EPA, Japan Environment Agency, Association of Official analytical chemist (AOAC) International Gos Standard of the Russian Federation, DFG (Germany)** method are mentionable in this regard. General guidance for various preparation, extraction and isolation steps in analysis of PCB and OCPs suggested by GMP is presented below:

Guidance for various preparations, QA extraction and isolation steps in the analysis of PCB and OCPs

Matrix	Analytical steps	General procedures
Fish and shell fish	Preparation	Select muscle or liver depending on species. For mussels and crustaceans use soft tissue. Select tissue that has not been in contact with the sample container. Homogenize using food chopper or blender. Cryo blending is useful. Mix with drying agent. Separate determination of lipid.
	QA	One blank and fish or mussel CRM every 10 samples; spike all samples with recovery surrogate standards. Bake glassware by overnight heating at 200°C or higher
	Extraction	Soxhlet, Accelerated Solvent Extraction or column extraction use acetone: hexane or dichloromethane (DCM)
	Isolation/cleanup	Remove lipid using gel permeation chromatography is possible or by repeated washing of the extract with sulphuric acid (the latter will partly destroy dieldrin). Follow with fractionation on silica or Florisil columns.
Marine mammal blubber	Preparation	Select blubber that has not been in contact with the sample container. Blend or hand mix with drying agent. Separate determination of lipid content.
	QA	Same as fish. Use fish oil or marine mammal SRMs and LRMs.
	Isolation/cleanup	Same as for fish extracts

Birds eggs	Preparation	Homogenize the egg content.
	QA	One blank and fish CRM every 10 samples; spike all samples with recovery surrogate standards. Bake glassware by overnight heating at 200°C or higher
	Extraction	Soxhlet. Accelerated Solvent Extraction, or column extraction. Use acetone: hexane or DCM
	Isolation/cleanup	Same for the fish extracts
Air (high volume)	Extraction. QA and cleanup	Assuming that air is collected on PUF or XAD resin these would be extracted in a Soxhlet or Pressurized fluid extractor
Semi-permeable membrane devices (SPMD)	Preparation	SPMDs would be removed from their transport cases and rinsed with pre-cleaned water to remove accumulated dust (air bone samplers) or periphyton (water samplers).
	Extraction. QA and cleanup	Assuming that the SPMD is lipid based, extraction of POPs by "dialysis" into hexane would be achieved in a large glass cylinder.
Human milk	Extraction and cleanup	Follow the new WHO guideline when available
Human blood (AMAP method E-347-G)	Sampling	Vacutainers, anticoagulation, centrifuge, freeze plasma
	Extraction and cleanup	Ammonium sulphate/ethanol/hexane (1/1/3). Florisil columns, dichloromethane/hexane (1/3) acetone.
	Determination	GC-NCIMS
	Lipid determination	Sum of free cholesterol, triglycerides and phospholipids determine by enzymatic methods.

8. Quality Control:

Quality assurance/quality control (QA/QC) is a system to ensure that the data generated by a laboratory are of the highest quality possible and there by acceptable to all parties.

In order to achieve comparable data some inter laboratory activities are needed. These are standard of analytes, reference material and inter-laboratory collaboration. Other important QA components include: sampling protocols (e.g. method, number, size etc), limit of detection/limit of quantitation, recoveries, duplicates, calibration, confirmatory tests etc.

9. Accreditation of laboratory:

In many countries there are the provisions for national accreditation of laboratories. Besides, International Standard Organization (ISO) has a system of accreditation of laboratories (ISO-25). EU countries have their own system of accreditation. In Bangladesh, still now we are for from this system of accreditation. National laboratories under the initiatives of BSTI may start a programme for national accreditation system.

GMP for POPs laboratories has introduced system of laboratories accreditation for the analysis of POPs.

UNEP chemicals has made a data base inventory of POPs laboratories through out the world. On the basis of the information supplied by each laboratory as regards to the capacities to perform analysis of Stockholm convention POPs the laboratories one categorized in to Tier 1, 2, 3, and 4. The tire level is assigned according to the following criteria:

Tire-1: Performs congener specific PCB and PCDD/F analysis using HRGC/HRMS in at least one of he GMP metrics. Has participated is least one

international inter-calibration including at least one of the GMP matrices and Stockholm Conventions POPs, during the last three years.

- Tire-2: Performs congener specific PCB analysis (SPCB₇) using HRGC/LRMS in at least one of the GMP matrices.
- Tire-3: Performs congener specific PCB analysis (SPCB₇) using HRGC/ECD in at least one of the GMP matrices.
- Tire-4: Laboratories that analyze POPs in other matrices than the GMP matrices or laboratories that do not do congener specific PCB analysis (SPCB₇)

10. National POPs Monitoring Laboratory Capacity Assessment:

“Bangladesh: Preparation of POPs National Implementation Plan under the Stockholm Convention” Project has been undertaken with an overall objective to prepare the National Implementation Plan for phase-out of the Persistent Organic Pollutants (POPs) and development of POPs management options as an effective response measures to achieve Stockholm Convention objectives. The target of this project is to create sustainable capacity and ownership in Bangladesh to meet its obligation under the Stockholm convention.

With a view to assess the capacity and capability to participate in such a programme from Bangladesh and based on the accommodation of the inception workshop held on 26 June 2004 regarding the sustainable development of POPs national monitoring laboratories in Bangladesh a questionnaire was placed to potential and interested organizations. The questionnaire comprises with the information on general and manpower information of the laboratory, equipment and facilities available POPs chemical analysis performed by the laboratories etc.

A total of 34 organization/ laboratories were requested to fill up the questionnaire while only 19 have feed back with information until now.

An initial inventory of the laboratories has been made recording their capabilities and resources available. It can be noted that based on technical analytical capability the real situation on the POPs monitoring capacity in Bangladesh is not even up to Tire -3 category of UNEP. Unfortunately, the fact is that there is no national accreditation system of laboratories in Bangladesh.

As a first step there is a need to get an overview of the laboratory capacity and capability. Based on which recommendation and proposal could be incorporated in NIP. For assessing and making a comprehensive recommendation for the NIP a discussion meeting of the laboratories is arranged. The summary of the information supplied by each of the laboratories are enclosed in the following pages.

References:

Web references: Guidance for a Global Monitoring Programme for POPs , Ist edition, June 2004, Prepared by UNEP Chemicals, Geneva, Switzerland, (<http://www.chem.unep.ch/>)

: UNDP-GEF POPs Resource Kit (<http://www.undp.org/gef>)

M.R. amin, J. Khatoon, M. A. Malek and M. Rehman, Evaluation of immunoassay procedures for dieldrine analysis Nuc Sci. & appli vol. 5, No 1;2 Page 31-36) 1996

Organization: Bangladesh Institute of Nuclear Agriculture

Name of the Laboratory :	Entomology Laboratory
Address :	Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh, Bangladesh, Post Code – 2202
Head of the Laboratory :	Dr. Jahangir Alam,
Contact Person :	Mr. Rattan Kumar Dutta, Director (Research).
E-Mail :	direcres@bttb.net.bd
Tel :	091-54046
Fax :	091-54046
Professional Manpower :	> 10, M.Sc – nil, M.S.- nil, Ph.D- 1
Equipment Available : (POPs analytical)	Nil
POPs analysed with Matrix:	Nil
Pesticides :	Nil
PCBs :	Nil
Dioxin, Furan :	Nil
QA/ QC System :	No
Participation in inter-calibrations:	No
Interest to participate in National POPs Monitoring Programme:	
Assessment :	

Organization: Bangladesh Atomic Energy Commission

Name of the Laboratory :	Agrochemical and Environmental Research Laboratory
Address :	Institute of Food and Radiation Biology, Atomic Energy Research Establishment, Ganakbiri, P.O. DEPZ, Savar , Dhaka, Postal Code- 1339
Head of the Laboratory :	Md. Saifur Rahman
Contact Person :	Md. Saifur Rahman
E-Mail :	aere@bangla.net
Tel :	7701830, 7701340 (on request)
Fax :	8613051
Professional Manpower :	10-25, Professional -8 M.Sc – 4, M.S.- 1, Ph.D- 3
Equipment Available : (POPs analytical)	GC with ECD(HP), GC with FID and ECD (Pye Un.), GC with NPD (Varian) under servicing Cond. HPLC (waters) UV detector, HPTLC (DESAGA), TLC ELISA Reader (Anthos) GC-MS (Thermo Electronic Corp)
POPs analysed with Matrix:	
Pesticides :	Aldrin, Dieldrin, DDT, Endrin, Heptachlor, Mirex, HCB,
PCBs :	Nil
Dioxin, Furan :	Nil
QA/ QC System :	No
Participation in inter-calibrations:	yes, IAEA Inter laboratory Calibration practices
Interest to participate in National POPs Monitoring Programme:	
Assessment :	

Organization: Bangladesh Livestock Research Institute

Name of the Laboratory :	Animal Health Research Laboratory
Address :	Bangladesh Livestock Research Institute, Savar, Dhaka, Postal Code - 1341
Head of the Laboratory :	Dr. Kazi M. Kamaruddin
Contact Person :	
E-Mail :	dgbli@bangla.net
Tel :	7708631
Fax :	7708325
Professional Manpower :	not furnished
Equipment Available : (POPs analytical)	Nil
POPs analysed with Matrix:	Nil
Pesticides :	Nil
PCBs :	Nil
Dioxin, Furan :	Nil
QA/ QC System :	No
Participation in inter-calibrations:	No
Interest to participate in National POPs Monitoring Programme:	
Assessment :	

Organization: Bangladesh Livestock Research Institute

Name of the Laboratory :	Poultry Feed Analysis Laboratory
Address :	Bangladesh Livestock Research Institute, Savar, Dhaka, Postal Code - 1341
Head of the Laboratory :	Dr. Md. Nazrul Islam
Contact Person :	Dr. Md. Nazrul Islam
E-Mail :	dglbri@bangla.net
Tel :	7708320-23
Fax :	7708325
Professional Manpower :	<10 , Professional - 4, M.S.-1, Ph.D. 3
Equipment Available : (POPs analytical)	Nil
POPs analysed with Matrix:	Nil
Pesticides :	Nil
PCBs :	Nil
Dioxin, Furan :	Nil
QA/ QC System :	No
Participation in inter-calibrations:	No
Interest to participate in National POPs Monitoring Programme:	
Assessment :	

Organization: Bangladesh Livestock Research Institute

Name of the Laboratory :	Animal Nutrition Laboratory
Address :	Bangladesh Livestock Research Institute, Savar, Dhaka, Postal Code - 1341
Head of the Laboratory :	Dr. Md. Rafiqul Islam
Contact Person :	Dr. Khan Shahidul Islam
E-Mail :	aprblri@accesstel.net
Tel :	7708320-27
Fax :	7708325
Professional Manpower :	<10, Professional - 3, M.S. 2, Ph.D.-1
Equipment Available : (POPs analytical)	GC (BUCK) under commissioning.
POPs analysed with Matrix:	Nil
Pesticides :	Nil
PCBs :	Nil
Dioxin, Furan :	Nil
QA/ QC System :	No
Participation in inter-calibrations:	No
Interest to participate in National POPs Monitoring Programme:	
Assessment :	

Organization: University of Dhaka

Name of the Laboratory :	Organic Research Laboratory, (Pesticide Project)
Address :	Department of Chemistry, University of Dhaka, Dhaka, Postal Code 1000
Head of the Laboratory :	Prof. Nilufar Nahar
Contact Person :	Chairman, Depart. of Chemistry, Attention : Prof. Dr. Nilufar Nahar
E-Mail :	<nilufarnahar@yahoo.com> , <banoi@bangla.net>
Tel :	9661900-59 Ext. 4871
Fax :	8615583
Professional Manpower :	<10, Professional -7, M.Sc - 1, M.S. - 3., Ph.D. – 3
Equipment Available : (POPs analytical)	GC-MS to be installed, GC with ECD (Shimadzu) GC with FTD and FID (Pye Uni) HPLC with UV - VIS and RI TLC normal and reverse phase
POPs analysed with Matrix:	
Pesticides :	Aldrin, Chlordene, Dieldrin, DDT, Endrin, Heptachlor, Toxaphane, HCB,
PCBs :	PCBs
Dioxin, Furan :	Nil
QA/ QC System :	No
Participation in inter-calibrations:	No
Interest to participate in National POPs Monitoring Programme:	
Assessment :	

Organization: Bangladesh Power Development Board

Name of the Laboratory :	Khulna Power Station Chemical Laboratory
Address :	Khulna Power Station, BPDB, Khalishpur, Khulna, Postal code-9000
Head of the Laboratory :	Chief Chemist
Contact Person :	Dr. Raisuddin Miah, Director, WQFTEC
E-Mail :	
Tel :	041-760027
Fax :	041-763573
Professional Manpower :	<10, Professional - 3, M.Sc. -2, Ph.D.-1
Equipment Available : (POPs analytical)	GC (BUCK) under commissioning.
POPs analysed with Matrix:	Nil
Pesticides :	Nil
PCBs :	Nil
Dioxin, Furan :	Nil
QA/ QC System :	No
Participation in inter-calibrations:	No
Interest to participate in National POPs Monitoring Programme:	
Assessment :	

Organization: Bangladesh Sugarcane Research Institute

Name of the Laboratory :	Bangladesh Sugarcane Research Institute
Address :	Bangladesh Sugarcane Research Institute , Ishurdi, Pabna, Postal code-6620
Head of the Laboratory :	Director General
Contact Person :	Dr. A.B.M. Mafizur Rahman, DG, BSRI
E-Mail :	bsri@bdonline.com
Tel :	07326-63414, 63999
Fax :	07326-63888
Professional Manpower :	Professional - , M.Sc-11, M.S. 26, Ph.D.-16
Equipment Available : (POPs analytical)	GC (Chemito, India), out of order. ELISA Reader (Sunrise EC),
POPs analysed with Matrix:	Nil
Pesticides :	Nil
PCBs :	Nil
Dioxin, Furan :	Nil
QA/ QC System :	No
Participation in inter-calibrations:	No
Interest to participate in National POPs Monitoring Programme:	
Assessment :	

Organization: Department of Agriculture Extension

Name of the Laboratory :	Pesticide Administration and Quality Control Lab
Address :	Plant protection Wing, DAE, Khamarbari, Farmgate, Dhaka-1215
Head of the Laboratory :	Director, Plant Protection Wing
Contact Person :	Deputy Director (PA & QC)
E-Mail :	
Tel :	8121242
Fax :	
Professional Manpower :	< 10, Professional -3, M.Sc-1, B.Sc Ag.(Hons) -2
Equipment Available : (POPs analytical)	GC (Shiardzu) with FID and TCD. HPLC (Shimardzu), UV-VIS
POPs analysed with Matrix:	Dieldrin, Heptachlor, other formulated products.
Pesticides :	Dieldrin, Heptachlor, other formulated products.
PCBs :	Nil
Dioxin, Furan :	Nil
QA/ QC System :	No
Participation in inter-calibrations:	No
Interest to participate in National POPs Monitoring Programme:	
Assessment :	

Organization: Bangladesh Council of Scientific and Industrial Research

Name of the Laboratory :	Analytical Research Division, BCSIR Laboratories, Dhaka
Address :	Quadrat-i-Khuda Road, Dhanmondi, Dhaka, Postal Code – 1205
Head of the Laboratory :	Director, BCSIR Laboratories, Dhaka.
Contact Person :	Mr. Azizul Islam Kazi,
E-Mail :	directordl@bcsir.org
Tel :	8611679, 8621741
Fax :	8613022
Professional Manpower :	< 10, Professional -7, M.Sc-4, Ph.D – 2
Equipment Available : (POPs analytical)	GC-MS (Shiardzu) , GC (Shimadzu)with FID and TCD, GC (Shimadzu) with ECD. HPLC (Shimadzu), SPD RI and Fluorescence Detector, TLC,
POPs analysed with Matrix:	Dieldrin, Heptachlor, other formulated products.
Pesticides :	Dieldrin, Heptachlor, other formulated products.
PCBs :	Nil
Dioxin, Furan :	Nil
QA/ QC System :	No
Participation in inter-calibrations:	No
Interest to participate in National POPs Monitoring Programme:	
Assessment :	

Organization: Bangladesh Council of Scientific and Industrial Research

Name of the Laboratory :	BCSIR Laboratories, Rajshahi
Address :	Binodpur Bazar, Rajshahi, Postal Code – 6206
Head of the Laboratory :	Director, BCSIR Laboratories, Rajshaahi.
Contact Person :	Director, BCSIR Laboratories
E-Mail :	bcsir@librabd.net
Tel :	750851, 750757
Fax :	750851
Professional Manpower :	> 25, Professional -35, M.Sc-21, Ph.D – 14
Equipment Available : (POPs analytical)	GC (Chemoto)with -----
POPs analysed with Matrix:	nil
Pesticides :	nil
PCBs :	Nil
Dioxin, Furan :	Nil
QA/ QC System :	No
Participation in inter-calibrations:	No
Interest to participate in National POPs Monitoring Programme:	
Assessment :	

Organization: Bangladesh Council of Scientific and Industrial Research

Name of the Laboratory :	Institute of Food Science & Technology
Address :	IFST, Quadrat-i-Khuda Road, Dhanmondi, Dhaka, Postal Code - 1205
Head of the Laboratory :	Dr. Md. Zahirul Hoque.
Contact Person :	Director, IFST
E-Mail :	bcsir@bangla.net
Tel :	8621148,
Fax :	8613022
Professional Manpower :	> 25, Professional -58, M.Sc-47, M.S. – 1, Ph.D – 10
Equipment Available : (POPs analytical)	GC (Chemito) with FID, GC (14B-2)with FID and FTD. HPLC (Cecil) UV Detector, HPTLC (CAMAG) TLC,
POPs analysed with Matrix:	All.
Pesticides :	All POPs Pesticides.
PCBs :	PCBs
Dioxin, Furan :	Dioxin, Furan
QA/ QC System :	No
Participation in inter-calibrations:	No
Interest to participate in National POPs Monitoring Programme:	
Assessment :	

Organization: Bangladesh Council of Scientific and Industrial Research

Name of the Laboratory :	INSTITUTE OF GLSS & CERAMIC RESEARCH and TESTING
Address :	Qudrat-i-Khuda Road, Dhanmondi, Dhaka, Postal Code – 1205
Head of the Laboratory :	Dr. Sanowar Hossain Mandal.
Contact Person :	Prof. DR. Amjad Hossain
E-Mail :	bcsir@bangla.net
Tel :	8621148,
Fax :	8613022
Professional Manpower :	> 25, Professional -26, M.Sc-23, M.S. – 0, Ph.D – 3
Equipment Available : (POPs analytical)	nil
POPs analysed with Matrix:	All.
Pesticides :	All POPs Pesticides.
PCBs :	PCBs
Dioxin, Furan :	Dioxin, Furan
QA/ QC System :	No
Participation in inter-calibrations:	No
Interest to participate in National POPs Monitoring Programme:	
Assessment :	

Organization: Bangladesh University of Engineering and Technology

Name of the Laboratory :	Environmental Laboratory, Chemical Engineering Dept.
Address :	Chemical Engineering Department , BUET, Dhaka – 1000
Head of the Laboratory :	Dr. M. Sabder Ali. Professor and Head
Contact Person :	Dr. M. Sabder Ali, Dr. A.K.M.A. Quader
E-Mail :	headche@che-buet.ac.bd
Tel :	9665609,
Fax :	8613046
Professional Manpower :	< 10, Professional -9, M.Sc-2, M.S. – 0, Ph.D – 7
Equipment Available : (POPs analytical)	GC () with TCD and FID.
POPs analysed with Matrix:	All.
Pesticides :	nil.
PCBs :	nil
Dioxin, Furan :	nil
QA/ QC System :	No
Participation in inter-calibrations:	No
Interest to participate in National POPs Monitoring Programme:	
Assessment :	

Organization: Bangladesh Tea Research Institute

Name of the Laboratory :	Pesticide Residue Analytical Laboratory
Address :	BTRI, Srimangol -3210, Moulvibazar
Head of the Laboratory :	PSO, Entomology.
Contact Person :	Director, BTRI
E-Mail :	btrisrg@yahoo.com
Tel :	08626-225 (office), Mobile 0171-867485
Fax :	
Professional Manpower :	< 10, Professional -5, M.Sc-2, M.S. – 2, Ph.D – 1
Equipment Available : (POPs analytical)	GC (Shimadzu) with ECD, GC (Shimadzu)with other detector.
POPs analysed with Matrix:	
Pesticides :	Hepatchlor.
PCBs :	nil
Dioxin, Furan :	nil
QA/ QC System :	No
Participation in inter-calibrations:	No
Interest to participate in National POPs Monitoring Programme:	
Assessment :	

Organization: Bangladesh Fisheries Research Institute

Name of the Laboratory :	Central Freshwater Laboratory
Address :	Bangladesh Fisheries Research Institute, Mymensingh Postal Code - 2201
Head of the Laboratory :	Chief Scientific Officer, Freshwater Station
Contact Person :	Dr. G.M. Hussain,
E-Mail :	fsbfri@bdonline.com
Tel :	091-54221,
Fax :	091-54221
Professional Manpower :	< 10, Professional -6, M.Sc-0, M.S. – 0, Ph.D – 6
Equipment Available : (POPs analytical)	HPLC (Buck Scientific),
POPs analysed with Matrix:	Nil
Pesticides :	nil.
PCBs :	nil
Dioxin, Furan :	nil
QA/ QC System :	No
Participation in inter-calibrations:	No
Interest to participate in National POPs Monitoring Programme:	
Assessment :	

Organization: Bangladesh Rice Research Institute

Name of the Laboratory :	Entomology Laboratory
Address :	Entomology Division, BRRI, Gazipur, Postal Code – 1701
Head of the Laboratory :	Chief Scientific officer.
Contact Person :	Dr. N.Q. Kamal, C.S.O. and Head
E-Mail :	brihq@bdonline.com
Tel :	9257401-5,
Fax :	9262734
Professional Manpower :	10-25, Professional -12, M.Sc-1, M.S. – 7, Ph.D – 4
Equipment Available : (POPs analytical)	nil
POPs analysed with Matrix:	nil.
Pesticides :	nil.
PCBs :	nil
Dioxin, Furan :	nil
QA/ QC System :	No
Participation in inter-calibrations:	No
Interest to participate in National POPs Monitoring Programme:	
Assessment :	

Organization: BSMR Agricultural University

Name of the Laboratory :	Insecticide Toxicology Laboratory
Address :	BSMR Agricultural University, Salna, Gazipur, Postal Code - 1706
Head of the Laboratory :	Prof. Dr. Mahbubar Rahman
Contact Person :	Prof. Dr. Mahbubar Rahman, Head of Laboratory
E-Mail :	dmr@bangla.net
Tel :	9252850-52 and 9252020, extn. 2086 (office), 8122012 (Res.)
Fax :	
Professional Manpower :	>10, Professional >10, M.Sc-1, Ph.D – 1
Equipment Available : (POPs analytical)	GC with ECD under process for procurement, TLC available
POPs analysed with Matrix:	nil.
Pesticides :	nil.
PCBs :	nil
Dioxin, Furan :	nil
QA/ QC System :	No
Participation in inter-calibrations:	No
Interest to participate in National POPs Monitoring Programme:	
Assessment :	