Bangladesh National Implementation Plan (NIP)

For Management of Persistent Organic Pollutants (POPs)

Prepared under UNDP Project BGD/02/G31/1G/99

Bangladesh: Preparation of the POPs National Implementation Plan
under the Stockholm Convention

Department of Environment (DoE)
Ministry of Environment and Forests
Government of the People's Republic of Bangladesh

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1. Introduction

The Stockholm Convention on Persistent Organic Pollutants (POPs) was adopted in on 23 May 2001 at the Conference of Plenipotentiaries in Stockholm, Sweden. Bangladesh is a signatory to the Convention and currently in the process of ratification. The Convention will enter into force in Bangladesh 90 days after it deposits the instrument of ratification.

The objective of the Convention is to protect human health and the environment from persistent organic pollutants. To meet this objective, the Convention sets forth measures intended to lead to the elimination of releases of the listed POPs to the environment, as achieved through reduction and phase-out of their production and use, and environmentally sound disposal of wastes. The Convention is structured to address:

- intentionally produced POPs, which include pesticides (insecticides, rodenticides and fungicides) and other manufactured POPs (e.g., polychlorinated biphenyls or PCBs);
- intentionally produced POPs for which the only exempted use is restricted to acceptable purposes (e.g., disease vector control); and
- unintentionally generated POPs that are produced and released as a result of human activity (e.g., as by-products through combustion or chemical processes).

There are 12 POPs listed in the Convention (PCBs and hexachlorobenzene appear within annexes A and C, based on the means by which they are generated):

- Annex A: The eight pesticide POPs—aldrin, chlordane, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex, and toxaphene—and one industrial chemical- PCB
- Annex B: DDT
- Annex C: Dioxins, furans, hexachlorobenzene (HCB), PCBs

As manufactured POPs have been/are phased out, they are typically replaced with alternatives that break down much more quickly in the environment and therefore pose less risk to the environment and humans and animals, as regards long-term or chronic adverse health effects. However, some of the POPs alternatives can cause acute adverse health effects, for example in people who apply them without regard to proper handling and/or application procedures and the effects/effectiveness of some are not well known. Therefore, the Stockholm Convention also includes provisions for research on POPs alternatives in the interests of protecting the population.

This National Implementation Plan (NIP) has been prepared consistent with the country's obligation under Article 7 of the Convention. The NIP will be submitted to the Stockholm Conference of the Parties (CoP) within two years of the Convention's entry into force for Bangladesh.

This NIP, which will form the basis for fulfillment of Bangladesh's obligation under the Stockholm Convention, is developed under the project BGD/02/G31/1G/99 "Bangladesh: Preparation of the POPs National Implementation Plan under the Stockholm Convention". The project is financed by the Global Environment Facility (GEF), in co-operation with the United Nations Development Programme (UNDP). The Department of Environment (DoE) under the Ministry of Environment and Forests (MoEF) is the lead implementing agency, while the Department of Agricultural Extension (DAE) under the Ministry of Agriculture (MOA) and the Bangladesh Power Development Board (BPDB) under the Ministry of Power, Energy and Mineral Resources (MOPEMR) are the co-implementing agencies.

The five phases under which the NIP was developed were as follows:

1. Establishment of a coordinating mechanism and organizational process for NIP development and inter-ministerial and stakeholder consultation;
2. Assessment of the national infrastructure and capacity for life-cycle management of POPs;
3. Development of POPs national inventories for Annex A and B pesticides POPs; Annex A PCBs (those that have been and are currently used in Bangladesh); and the by-product Annex C POPs;
4. Priority setting and determination of objectives;
5. Formulation (drafting) of the Bangladesh NIP on POPs; and
6. Endorsement of the NIP by stakeholders.

The NIP presentation is consistent with the UNEP-World Bank's *Interim Guidance for Developing a National Implementation Plan for the Stockholm Convention*. It consists of a country profile providing the geographic, demographic, political and economic profile, the institutional and legislative framework relevant to the POPs issue; an assessment of the status of Annex A, B and C POPs (production, use, imports-exports, stockpiles and releases to the environment). The state of knowledge of exposure of humans and environment to POPs is addressed, as is the status of institutional and physical infrastructure capacity of Bangladesh for management of POPs. The final section of the NIP (Section 3) provides a strategy and action plan for management of POPs, inclusive of their reduction and elimination from production and use, and destruction of stockpiles and wastes.

2. What are POPs?

Persistent Organic Pollutants (POPs) are produced and released into the environment as a result of human activity. They can persist for many years in the environment because they do not dissolve in water or break down easily in the environment. They concentrate in fat tissues of animals, reaching their highest concentrations in predatory fish, birds, marine and aquatic mammals, and humans. POPs are semi-volatile. Through repeated evaporation and deposition, they can be transported many 1000s of miles from their initial sources of release. Consequently, they are now found in humans living on all continents, including in locations where no POPs have ever been produced or used.

Adverse health effects can be either acute (severe and with a sudden onset) or chronic. Health effects associated with POPs include allergies, damage to the nervous and respiratory systems and to organs, reproductive and immune system dysfunction, sex-linked disorders, birth defects, neurobehavioral[1] and developmental disorders, endocrine disruption, cancer, shortened lactation periods for nursing mothers, and, in extreme cases, death (including abortion of the foetus). The foetus and children are at higher risk than adults because of the hormone-mediated changes they are undergoing, which govern several aspects of both development and growth, their physiology (weight, height, respiration rate, etc.) and, in the case of young children, their habits, such as hand-to-mouth ingestion.

The main exposure pathway among the general adult populations in countries where POPs are most studied (industrialized nations) is through consumption of contaminated food. Food sources of greatest concern relative to PCBs, dioxins and furans exposure are contaminated dairy products, meat and fish. While extremely high contamination of food by dioxins and furans can lead to acute affects,

[1] For example, a May, 1998, WHO meeting recognized that subtle effects associated with exposure to dioxins may be occurring in the general population in developed countries at the then current estimated background levels of 2 to 6 pg/kg body weight. Various studies have also found that infants in industrialized nations are exposed to many times the WHO tolerable daily intake level.

the main concern with dioxins and furans food contamination is one of chronic exposure over time as POPs accumulate in human body fat until they may reach concentrations in adulthood at which adverse effects can occur. The main exposure route within the general population for most pesticide POPs is also contamination of food (e.g., meat and dairy), although a main exposure route chlordane is through inhalation of contaminated indoor air). Occupational and accidental exposures to POPs are also a concern (e.g., direct contact with pesticide POPs via inhalation, through the skin and by ingestion).

3. Country profile

General Information: Bangladesh emerged as an independent and sovereign state on 26 March 1971. The country was liberated from the occupation of Pakistani army by a war of liberation that ended on 16 December 1971. The area of the country is 56,977 sq. miles or 1,47,570 sq. km. The capital is Dhaka.

Geographical Position: Bangladesh is situated in between 20° 34' and 26° 38' north latitude and 88° 01' and 92° 41' east longitude. The country is bounded by India on the west, the north, and the northeast, by Myanmar on the southeast, and by the Bay of Bengal on the south. The limits of territorial waters of Bangladesh are 12 nautical miles and the area of the high seas extending to 200 nautical miles constitutes the economic zone of the country.

Climate Characteristics: Bangladesh enjoys generally a subtropical monsoon climate. There are six seasons in a year. In winter minimum temperatures range from 7°C - 13 °C (45°F - 55°F) to a maximum of 24°C - 31°C (75 - 85°F). The maximum temperature in summer months is typically 37°C (98°F), although in some places temperatures can reach 40°C (105°F). Monsoon season, which occurs from July through October, accounts for 80% of the total yearly rainfall. The average rainfall varies from 1,429 millimetres (mm) to 4,338 mm. Humidity varies from 55% to 96%.

Population: The present population of the country is 140 million, up from 123 million in the 2001 census. The annual growth rate is 1.48%. There are 60.3 million people in the workforce, of which 60% are employed in agriculture, 7.8% in manufacturing and mining, and 28.5% in other occupations. *Bangla* is the official language. The literacy rate is 43%. With respect to religion, 88.3% of the people are Muslim (mostly Sunni), 10.5% Hindu, 0.3% Christian, 0.6% Buddhist and 0.3% belong to other religions.

Political Structure: The government of Bangladesh is based on Parliamentary democracy. The president is the chief of state. The prime minister is the nation's Chief Executive Officer, heading the government. Legislative power resides with the 300-member unicameral National Parliament, which decides on enactment and amendment of the constitution, passes laws, and adopts the state budget.

Constitution: The Bangladesh Constitution came into force 4 November 1972 and has undergone subsequent amendments. Under the Constitution, the State is obligated to secure for its citizens the provision of the basic necessities of life, including food, clothing, shelter, education, and medical care; the right to reasonable rest, recreation, and leisure; and the right to social security in the event of unemployment, disablement, and illness. The Constitution also contains provisions for rights pertaining to public health, rural and agriculture development, public health, and equality before law. Although there is no provision specific to protection or conservation of the environment in the Constitution, the concept can be considered integral to its provisions for protection of right to life and health security. Recent court cases interpret provisions pertaining to the right to life as including the right to a healthy environment.

Economy: Bangladesh has achieved self-sufficiency in rice, its main cereal, while production of other grains (e.g., wheat) has also increased and the economy generally has become more diversified (e.g.,

fisheries, livestock and poultry subsectors have shown substantial gains). Nevertheless, Bangladesh remains heavily reliant on foreign aid, which provides it with an estimated 40% of government revenues and 50% of foreign exchange. Economic indicators for Bangladesh are shown in the table below.

Economic indicators of Bangladesh

Indicator	Year	Data
GDP, million US$	2003	3005.8 (billion taka[a])
GDP per capita, 000US$	2003	389
Population, million	2004	140
Industrial production (% of GDP)	2003-04	25
Agricultural (% GDP)	2003-04	26
Inflation rate (%)	2004 (April)	5.75
Exports, bln. US$ (f.o.b.)	2003	6.492
Imports, bln. US$ (c.i.f.)	2003	8.707
Foreign exchange reserves bln. US$	2003	2.471

[a] 2003 Taka per US dollar - 58.15

Sources: Bangladesh Bureau of Statistics, BBS, 2003; 2004; Planning Commission, Unlocking the Potential, *National Strategy for Accelerated Priority Reduction, Planning Commission*, GoB, 2004; U.S. Department of State, Bureau of South Asian Affairs, 2004.

Agriculture: Agriculture is the economic backbone of Bangladesh, with production accounting for about one third of the gross domestic product (GDP). Major crops of the country are rice, wheat, pulses, jute, oilseed crops, vegetables, potatoes, fruits, sugarcane and cotton, of which rice accounts for 82% of the total cultivated area or about 10.66 million hectares (BBS 2002).

Livestock subsector: The livestock subsector (including poultry, cattle, buffalo, goat, sheep and dairy) is just developing within in Bangladesh. The number of livestock totals 32,557,551 head, with 3.55 heads per holding (BBS 2002).

Fisheries subsector: Fish are an important source of protein in the Bangladesh diet, contributing from 61% to 71% of the daily per capita protein supply for the Bangladesh population, although this is down from 95% in the 1940-50s and 80% before 1980 (FAO 1999, UNEP, 2001). In 2003, the fisheries sector contributed 5.9% to the country's total agricultural output (Bangladesh Bank, 2004). Additionally, growth in some segments of this sector is contributing to export earning and diversification of the Bangladesh economy. However, the total fish production in the country in 2001 was just 1.781 million metric tons (MT), comprising 1.402 million MT from inland fisheries (78.2%) and 0.379 million MT from marine fisheries (21.28%) (BBS, 2002). The sector supports more than million people full-time (e.g., fishermen, traders, transporters, packers) (UNEP, 2001) and provides more than 12 million people with part-time employment. Almost all of the population living in coastal communities make their livelihood from fishing. (FAO, 1999).

Power Generation: The total installed capacity of power generation in 2005 is 4,861 megawatts (MW), as comprised of the following:

- Hydro - 230 MW (6.47%);
- Steam turbine - 2448 MW (62.1%);
- Gas turbine - 724 MW (17.3%);
- Combined cycle - 180 MW (5.0%);
- Diesel - 29 MW (0.8%);
- Independent Power Producers (IPP) - 1250 MW (8.4%).

Of the total installed capacity, about two-thirds is considered to be available. Problems in the Bangladeshi electric power sector include high system losses (up to 40%), delays in completion of new plants, low plant efficiencies, natural gas availability problems, erratic power supply, electricity theft, blackouts, shortages of funds for needed maintenance at the country's power plants and other power infrastructure, and unwillingness of customers to pay bills. Currently 20% of the population (25% in urban areas and 10% in rural areas) have access to electricity. The main organizations involved in the power sector are the following six entities: Bangladesh Power Development Board (BPDB), Rural Electrification Board (REB), Dhaka Electric Supply Authority (DESA), Dhaka Electric Supply Company (DESCO) and Power Grid Company of Bangladesh (PGCB) and the Independent Power Producers (IPP).

Industries: Industry constitutes a small but growing sector within the Bangladesh economy. The industrial sector contributed 27.2% of the GDP in 2003, of which manufacturing accounted for 16% (11.3% large and medium-scale and small-scale 4.7%), followed by construction (8.6%), power, water supply (1.5%) and mining (1.1%) (Bangladesh Bank, 2004). Industrial production growth averaged more than 6% from 1995-2000. Industrial output for Fiscal Year (FY) 2003 was estimated at 7.79%, while manufacturing expanded by 7.4%, from 6.8% the previous year (Bangladesh Bank, 2004). The manufacturing sector employed 4 million and mining .4 million in 2000 (ADB, 2004).

Large-scale industries based on both indigenous and imported raw materials include jute and cotton textile production, paper and newsprint production; sugar refining, cement, chemicals, fertilizer and tanneries. Other notable industries are engineering and shipbuilding, iron and steel, including re-rolling mills, oil refining, paints, dyes and varnishes, electronic cables and wires, electric lamps, fluorescent tube lights, other electrical goods and accessories, matches and cigarettes. Cottage industries include handlooms, carpet-making, shoe-making, coir, bamboo and cane products, earthenware, brass and bell metal products, *bidi* and cheroots, small tools and implements, etc. Natural gas production is the primary mining activity in Bangladesh.

Education: The education sector consists of five sub-sectors. These sub-sectors are: i) Early Childhood Development, Pre-school and Primary Education, ii) Secondary and Higher Secondary Education, iii) Technical and Vocational Education and Training, iv) Tertiary Education and v) Literacy and Non-formal Adult Education. Additionally, a number of universities provide courses/degrees in chemistry, and medical and biological sciences. Primary education enrolment in 2002 was 97%, with a gender ratio of 51 boys to 49 girls. About 11 million students are enrolled in secondary schools.

Transport: The transport sector, in general, has expanded rapidly, in terms of passenger and freight infrastructure. The road network has grown from only 4,000 kilometres (km) of roads in 1971 to 182,000 km in 2004, inclusive of six categories: national highway, regional highway, district road, *upazila* road, union road and village road. The Bangladesh Railway (BR) is comprised of 459 stations and 2,768 kilometres (kms) of track (BBS, 2001). There are an estimated 577,623 registered vehicles, (BBS, 2001), of which more than 50% are more than 15 years old.

Environmental Overview: The *Bangladesh State of the Environment 2001* report observes that major environmental issues in Bangladesh are land degradation, water pollution and water scarcity, air pollution, loss of biodiversity and susceptibility to natural disasters.

4. Institutional, policy and regulatory framework

Managerial capacity: Managerial capacity within the Ministry of Environment and Forests relative to the environment generally has been strengthened considerably in recent years with international support. With regard to ministerial staffing, the Department of Environment is seeking financing to fully implement its restructuring plan. This will enable it to fully implement legislative provisions, including as applicable to persistent organic pollutants.

Policy: The Environmental Policy, 1992, addresses sustainability, predominantly conceived as conservation, although it includes provision for pollution prevention and corrective measures (as part of protection of the environment and environmentally sound development), and enables framing of new laws in all sectors, as necessary to control activities concerning environmental degradation (MoEF, 2005).

Legislation reform to address gaps in POPs management is a near-term priority for Bangladesh. Currently, there is no national policy specific to POPs, or to the sound management of chemicals generally, including for toxics and hazardous chemicals and wastes. National plans typically lack specific reference to toxic and hazardous chemicals (and POPs as a subset of these), although pollution prevention is now incorporated in some plans.

Bangladesh has enabling environmental legislation, as well as legislation and regulations that govern some facets of chemicals management.

With regard to agricultural uses of POPs, all Annex A POPs pesticide (aldrin, dieldrin, chlordane, endrin, heptachlor, hexachlorobenzene, mirex, and toxaphene) registrations had either been cancelled or withdrawn by 1997. Hence, in accordance with Article 4 of the Pesticides Ordinance 1971, they cannot be imported, manufactured, formulated, repacked, sold, held in stock for sale or advertised in any manner. Toxaphene and mirex are reported never to have been imported or used, hence were never registered. DDT is no longer used in agriculture, but was used up through 2000 for disease vector control. It has never been registered; hence, its legislative status requires clarification. With respect to pesticide legislation (Pesticide Rules, 1985), some amendments are required regarding handling and disposition of Pesticide POPs wastes and to add bioaccumulation to screening criteria for pesticide registrations.

The Environment Conservation Act, 1995, and Environment Conservation Rules, 1997, provide the basis for management of releases from new facilities of Annex C by-product POPs, and also for promulgating standards, etc., for PCBs (currently not legislated in Bangladesh). On 15 March 2005, the Director General of DoE issued a letter to the Chairman of Bangladesh Power Development Board (BPDB) and other relevant organizations requesting that they buy PCB-free transformers, transformer oil, and capacitors, store all unserviceable oil in safe and secure locations, and ensure that out-of-service equipment and oils are not sold in the market for other uses. This letter could serve as the initial step prior to official *notification* for PCBs under existing legislation.

Bangladesh has completed its evaluation of laws relative to POPs. The following table indicates changes required for amendment or development of the Bangladesh legislative framework as specific to POPs.

Convention obligation and Bangladesh's position

Applicable Article and State Obligation	Bangladesh's law	Comment
Preamble, Parties encouraged to develop regulatory and assessment schemes for pesticides and industrial chemicals if they do not already have them. **Art. 1** and **Art. 2**, No obligation.		No obligation.
Article 3. 1) Elimination and restriction of production, use, import and export of Annex A & B POPs. 2) Take measures to ensure that POPs are imported complying the provisions only, 3) Take regulatory measures to prevent the introduction of new chemicals with POPs characteristics **Annex A, Part II (PCBs)** 1) Take action by 2025 to identify and remove from use PCBs in equipment above thresholds 2) Use only intact, non-leaking equipment and not use around food or feed areas 3) Take other measures to ensure sound management of disposal as detailed 4) Provide reports every five years on efforts to eliminate PCB use to CoP **Annex B, Part II (DDT)** 1) Each Party that produces or uses DDT shall restrict such activities only to disease vector control in accordance WHO guidelines 2) Each Party that produces or uses DDT shall provide the Secretariat and WHO with information on amounts used and conditions of use every three years	The Pesticides Act, 1971 Pesticide Rules, 1985 Import Policy Order, 2003-2006 Bangladesh Environment Conservation Act, 1995 (ECA'95)	The pesticides laws need to be amended for life cycle management of POPs pesticides (e.g., relative to their handling, packaging, collection, transport, labelling, temporary, storage, disposal and destruction). There is no law that addresses PCBs specifically. However, the ECA'95 may be effectively used to address PCB issues. Bangladesh ceased agricultural use of DDT in 1997. DDT was never registered, hence its legal status requires official clarification, i.e., registration and subsequent deregistration. All existing stockpiles of DDT are obsolete but will need to be officially declared waste under law and will need to be destroyed.
Art. 4. Register of specific exemptions. Parties wishing to continue use of specific exemption beyond five year period need to submit report to the Secretariat for justification		Bangladesh has never produced POPs pesticides other than DDT. Bangladesh will likely apply for an exemption for DDT until a final determination of effectiveness of alternatives for control of disease vectors, in particular, kala-azar, is made. A registration for an exemption will enable Bangladesh to make a rational determination before its official phase out of DDT.
Art. 5. Measures to reduce/eliminate releases from	The	There is no law that directly

Applicable Article and State Obligation	Bangladesh's law	Comment
unintentional production **Annex C (Unintentional Production)** Develop and implement an action plan to identify sources and reduce releases of POPS listed in Annex C (dioxins and furans). Promote measures, including best available techniques (BAT) and best environmental practices (BEP), to achieve release reduction and implement an action plan to identify sources and reduce releases through: 1) Evaluation of current and projected releases, 2) Source inventories and release estimates, 3) Evaluation of efficacy of relevant laws and policies, 4) Strategies to implement Article 5) Education, training and awareness raising, 6) Review of strategies every five years Schedule for implementation, 7) Identifying BAT and BEP for particular industry, and 8) Awareness raising in industry and community on appropriate procedures, practices and alternatives	Bangladesh Environment Conservation Act, 1995 (ECA'95)	addresses unintentional by-products; However, the ECA'95, may be effectively used to address these issues, incorporating the BAT and BEP and all other requirements stipulated in this Article. Action Plan for this Article is integral within the NIP. Implementation of specific actions will help to inform amendments required/drafting of standards, etc.
Article6 Measures to reduce/eliminate, releases from stockpiles and wastes: 1) Develop strategies and for identifying stockpiles of POPS listed in Annexes A and B, and products containing POPs listed in Annexes A, B and C and manage in an environmentally sound manner. 2) Take measures to ensure that POPs wastes is managed and disposed of in an environmentally sound manner according to international standards and guidelines.3) Not allow recovery, recycling, reclamation, direct use of alternative uses of POPs. 4) Ensure that transport of POPs wastes is consistent with Basel Convention. 5) Endeavour to identify POPs contaminated sites, and if remediation is necessary that it is done in an environmentally sound manner. 6) Preliminary inventory of stockpiles of POPs, or products and wastes containing POPs.	The Pesticides Act, 1971 Pesticide Rules, 1985, Bangladesh Environment Conservation Act, 1995 (ECA'95)	Law will require amendment to ensure compliance with the requirements of this Article. (Wastes include stockpiles of DDT; PCB wastes, including contaminated equipment).
Article7 (Implementation Plans) Develop and endeavour to implement a plan to meet its obligations under the Convention to be submitted to the CoP within two years of entry into force for the Party.		This NIP is the product of inter-agency and stakeholder consultation. DoE, as the national focal point for Convention, will submit the final NIP on behalf of the Government of Bangladesh (GoB).
Article 8 (Listing of chemicals in Annexes A, B &	No Law	It is a Party's prerogative.

Applicable Article and State Obligation	**Bangladesh's law**	**Comment**
C)		Bangladesh can list POPs subsequent to its ratification of the Convention.
Art 9 (Information Exchange) Facilitate/undertake exchange of information on POPs and their alternatives, and designate a national Focal Point for the exchange of such information.		National focal point (DoE) has been designated.
Art10 (Public information, awareness & education) Facilitate/promote awareness and understanding of POPS information to the public, particularly decision makers and effected groups.	No Law	Some public awareness materials have been produced and distributed and others are under development.
Art11 (Research, development & monitoring)	No Law	A law will need to be developed relative to research, development and monitoring for POPS and POPs alternatives so as to support national and international efforts for protection of health and the environment and as consistent with the Convention.
Art12 (Technical assistance)		National capacity for POPs identification or analysis requires upgrading to meet international standards.
Art13 (Financial resources and mechanisms)		It is the obligation of developed country Parties. Identification of needs for financial assistance at national level is in process.
Art14 (Interim financial arrangements)		The NIP project in Bangladesh is made possible by assistance of GEF, which serves as the principal financial mechanism for the Convention. DoE has initiated discussions with donors. NIA will continue to explore financial arrangements for implementation of specific actions.
Art15 (Reporting)		Bangladesh is in the process of ratifying the Convention, hence is not yet obligated to report.
Art16 (Effectiveness evaluation)		Implement arrangements to be determined by the CoP at its first meeting.

Applicable Article and State Obligation	Bangladesh's law	Comment
Art 17 Non-compliance **Art 19** Conference of the Parties **Art 20** Secretariat **Art 21** Amendment to the Convention, **Art 22** Adoption and amendment of annexes, **Art 23** Right to vote		No Obligation
Art 24 Signature		Bangladesh signed the Convention on 23rd May 2001
Art 25 Ratification		In process.

Source: MoEF, 2005a.

Laboratory capacity: Building laboratory capacity for POPs analysis is a near-term priority for Bangladesh. Such capacity will enable Bangladesh to the analyze samples taken for monitoring purposes to determine the presence of POPs in humans and the environment, and POPs content in equipment and wastes so as to identify wastes with POPs content and determine whether such wastes require destruction or disposal as consistent with the Stockholm Convention. Improved analytical capacity is also needed to enable Bangladesh to monitor progress on and the effectiveness of NIP implementation. At this time, Bangladesh does not have a national accreditation system for laboratories, nor does it have a reference laboratory for POPs. Taking into consideration both government and academic laboratories, there are at this time facilities to test just nine of the different pesticides of the 300 marketed in Bangladesh. With respect to POPs pesticides, DAE laboratories are not currently capable of analyzing for POPs impurities in active ingredients at a sufficiently low level of concentration (GoB, DoE, 2005). None of the existing laboratories has as yet achieved Tier 1 capacity (the lowest of three tiers for POPs analysis[2] recommended by UNEP guidance for global monitoring for any of the POPs (GoB, DoE, 2005). Therefore, strategies for monitoring will need to bear in mind that until Bangladesh has adequate laboratory infrastructure in place, near-term monitoring strategies will need to be adjusted accordingly (e.g., use of rapid immuno-assays; sending samples to outside laboratories for analysis).

Research: Bangladesh has capacity for research generally, but would require technical and financial assistance to undertake some types of specialized research on POPs. The need for research on POPs alternatives is particularly acute, including as linked to biomonitoring and environmental monitoring. Research on DDT alternatives is needed to ensure that disease vectors such as those that cause kala-azar can be adequately controlled.

Assessment: Bangladesh has limited assessment capacity and therefore relies primarily on information available via international sources in making determinations regarding chemicals, for example with respect to those registered under its pesticide legislation. With respect to pesticides, the Pesticide Technical Advisory Committees created to implement provisions of the Pesticide Act and Rules screen and evaluate pesticides.

5. Assessment of Annex-A Part I POPs pesticides:

The Annex A POPs are aldrin, endrin, dieldrin, chlordane, heptachlor, hexachlorobenzene, mirex and toxaphene.

Use of Annex A POPs

[2] The DoE has a laboratory that supports its basic monitoring activities for chemicals generally. The DoE has a project to strengthen is regional laboratories and establishing a library and documentation center in Dhaka. However, the DoE laboratory would require upgrading of analytical equipment and training of analysts to enable POPs analysis.

The use of Annex A POPs pesticides in Bangladesh dates back to the mid 1950s with the application of endrin in modern rice cultivation. Pesticide POPs were used primarily on rice crops, with some usage also reported for sugarcane, cotton, jute, etc. (GoB, MoEF, 2005c). For example, chlordane, dieldrin and heptachlor are reported to have been used historically for soil-borne insect control (sugarcane and jute) (UNEP, 1998). Heptachlor may also have been used as a termiticide.

Following cancellation of registration in 1977 of the Annex A POPs, marketing and consumption of existing stocks of these POPs appears to have continued up through 2000, based on the findings of a 2005 case study survey of wholesalers and retailers of pesticides conducted by EADS for the Government of Bangladesh. According to the survey, chlordane, dieldrin, endrin and heptachlor (and also DDT, an Annex B pesticide) were sold through 1980, and thereafter Heptachlor 40WP and Dieldrin 20EC were sold through 2000. After 2000, all POPs stocks held by wholesalers and retailers in the sample study had been depleted. The survey indicates that before 1980, the most common use of POPs was of endrin (86%), followed by heptachlor (23%), DDT (20%) and dieldrin (8%). Farmers reported using these POPs at their maximum recommended dose on rice, sugarcane, and potato crops, respectively. After 1980, the majority of the sample farmers used heptachlor (57%), followed by dieldrin (29%), DDT (21%) and chlordane (7%). Heptachlor, dieldrin, DDT and chlordane were used at their maximum does on sugarcane, rice and vegetables, respectively. From 1980 through 2000, they reported using chlordane, dieldrin and heptachlor. These farmers indicated in follow-up interviews that they obtained the POPs pesticides they used through cross-boundary sources. However, from 2000 onward, when sale of these pesticides by the wholesalers or retailers ceased within Bangladesh, farmers surveyed reported that they did not use any POPs.

Manufacture, imports and distribution of Annex A pesticides

Annex A POPs were never manufactured in Bangladesh.

Based on estimates of imports for the years 1955-1974 (prior to official record keeping), and import records for subsequent years up through 1997 when imports were banned, there were an estimated 1469 metric tonnes (MT) to 1533 MT of Annex A POPs pesticides imported to Bangladesh, of which 713.63 MT were active ingredient.

Up through 1973, POPs pesticides were imported through supply credit, grant, loan, barter etc., provided by United Nations and donor agencies. The Pakistan Central Plant Protection Department procured all pesticides used for agriculture purposes up through 1965, which it distributed to the Provincial Directorate of Agriculture (Plant Protection; DOA of the former East Pakistan). After 1965, the Bangladesh Agricultural Development Corporation (BADC), a semi-autonomous body of the Ministry of Agriculture (MOA), purchased pesticides based on its estimates of need, as provided by the Deputy Director, Plant Protection (PP) branch of the Department of Agricultural Extension (DAE). The pesticides thus procured were centrally housed in Central Stores at Shyambazar and distributed from there to the districts, where they were housed in District Stores and then distributed to *thanas*, and subsequently to *Thana* Stores. From *Thana Stores,* the pesticides were distributed to farmers free of cost (Rahman, Inception Report, 2004).

From 1974 to 1979, imported POP pesticides were similarly distributed via the DAE's network to districts and subsequently to *thanas*, which continued to sell these at the subsidized price as per government policy.
From 1973-1980, private agencies, including foreign manufacturers, became involved in the pesticide import and local formulation business, consistent with the government's withdrawal in April 1975 of its 50% subsidy for pesticides (Rahman, inception report, citing PAB, 1979), and ultimately, its complete privatization of the industry in 1980, when local agencies took over procurement, marketing

and promotion. Pesticides were then sold at non-subsidized prices. Additionally, the DAE during the 1974–1985 period sold POPs pesticides directly to 15 Sugar Mills. POPs pesticides imported from 1986 to 1997 were marketed and sold directly by companies through their wholesalers and retailers (GoB, MoEF, 2005c).

Information on quantity of procurement of POPs pesticide was not formally maintained until 1974 when the Bangladesh Agricultural Development Corporation (BADC) was the importing authority. The BADC *Official Stock Book* indicated a total of 276.03 MT of Heptachlor 40WP and Dieldrin 20EC were imported from 1974 to 1985.[3] While the BADC stock book did not include records of importation of chlordane, PAB records, maintained for the years 1976-1985, show importation of chlordane and higher amounts of imports of Heptachlor 40WP and Dieldrin 20EC for a total of 357.105 MT. Based on case study consultation of the Stock Books of 4 sample Divisions as reported via the District/*Upazila* Agriculture office, a total of 6545 pounds of Chlordane 40WP had been received; hence it is likely that the chlordane imported (as supported by PAB records) was Chlordane 40WP (GoB, MoEF, 2005c).

Imports of POPs pesticides for agricultural use 1950-1974

POP Pesticides	**Import Period**	**Extrapolated Quantity** (Metric Tonnes of active ingredient (a.i.)	**Import Period** (BADC Stock Book 1974-1985; PAB 1976-1985)	**Total imports (MT)**	**Import Period**	**Total imports (MT)** (PPW and PAB Official Registers)	**TOTAL IMPORTS (MT of active ingredient, plus MT formulation)**
Aldrin	1960-1965	70.00 a.i.	1974-1985	–	1986-May 1997	–	70.ai.
Chlordane	1960-1974	30.80 a.i.	1974-1985	2.2 PAB	1986-May 1997	No Data	30.80 a.i. 2.2. PAB
Dieldrin (+Dieldrin 20 EC)	1960-1974	227.33 a.i.	1974-1985	156.78+ BADC 194.851+PAB	1986-May 1997	56.52+ MT 11.30 +(a.i)	238.63 a.i. 213.3-251.371
Endrin	1955-1960**	25.00 a.i.	1974-1985	–	1986-May 1997	–	25 a.i.
Heptachlor (+Heptachl	1960-1974	186.73 a.i.	1974-1985	119.25+ BADC 160.054+	1986-May 1997	406.18 MT+ 162.472+	349.202 a.i. 525.43-

[3] After 1985, the BADC no longer imported or regulated pesticides. From 1985 onward, in accordance with the Pesticide rules, 1985, the PPW maintained the official pesticides import records.

or 40 WP)				PAB		(a.i)	566.225
Total (a.i)	1960-1974	**539.86 a.i.**	1974-1985	276.03 BADC **357.105 PAB**	1986-May 1997	**462.70 MT 173.77 a.i.**	**713.632 a.i. 738.728-794.803**

Source: Md. Mahbubar Rahman. Personal communication, extrapolation. (Inception report, 2004; and GoB, MoEF, 2005c)
* PPW, 2004 and BCPA
**Rahman indicates Endrin was imported until 1963 and gives extrapolation figure of 50.00 MT.

Annex A stocks and wastes

While there were 3.650 MT of dieldrin 20EC reported as remaining in Plant Protection stores at the district and *thana* level, physical verification found no existing stocks of dieldrin or other Annex A POPs pesticides.

6. Assessment of Annex B pesticides (DDT)

DDT use

DDT was never formally registered for manufacture or use in Bangladesh. Nevertheless, it was has a history of use in agriculture and disease vector control as described below. DDT's use in agriculture may have begun as early as 1955 when it may have been imported along with other POPs) (Badruddin, Rahman, Inception report, 2004) and its use was reportedly widespread, including on banana, potato, and cotton fields at least through the mid-sixties when is reported that its use for agricultural was discontinued. In 1960, when Bangladesh initiated its Malaria Eradication Programme under the direction of then health minister Habibullah Bahar (GoB, MoEF, 2005c) through 1993, DDT was used for disease vector control, in particular of *visceral leishmaniasis* or kala-azar, a disease spread by the bite of the infected *Phlebotomus argentipes* sand fly (WHO, 2002), and also for various mosquito vectors of malaria (UNEP Chemicals, 2001). The initial Malaria Eradication Programme (1960-1971) lowered the incidence of kala-azar to the extent that it almost disappeared from Bangladesh. However, with the cessation of the widespread use of DDT in 1971, kala-azar, beginning in the mid-seventies, made resurgence and was recently reported to be at epidemic proportions with the number of reported cases increasing from 2,397 in 1993 to 7,032 in 1998 (Bangali 2000). From 1999-2000, 45,338 kg and 39,990 kg of DDT 75% water dispersible powder (wdp), respectively, were reported to be used for kala-azar control[4] (USAID, 2004).

DDT Import and manufacture

DDT was supplied by the FAO for use in agriculture through 1965 (as there was no local agent).
After that date, imports for agricultural use were discontinued. DDT used for vector control in Bangladesh was similarly supplied by donors (WHO) up through 1965, when the government, as part of its formal launch of its Malaria Eradication Programme, constructed a DDT production facility at Barakubndu in Sitakundu, Chittagong, known as the Chittagong Chemical Complex (CCC). The Chittagong Chemical Complex had a production capacity of 2000 metric tons of DDT powder/year, which it began producing in 1966. Another chemical complex with the annual production capacity of 4,500 metric tons of DDT was subsequently established by the private sector near the CCC facility.

[4] The World Health Organization has reported that residual spraying of DDT is very effective in controlling sandfly vectors in Bangladesh (WHO 1990). WHO recommends that spraying for this purpose be preceded and followed by an assessment of susceptibility of *P. argentipes* to DDT and other insecticides (USAID, 2004).

Both plants were nationalized immediately after the Bangladesh independence. In 1982, the two units were assimilated as Chittagong Chemical Complex and placed under the control of the Bangladesh Chemical Industries Corporation (BCIC). Production of DDT by CCC ceased officially on 1 December 1991, but, in practice, was not discontinued until 1993. From 1966–1992, the DDT plant/CCC produced a total of 7,706 MT of DDT Technical, of which 7,604.49 MT was formulated into 12,003.17 MT of 75% DDT. Out of its total 75% DDT formulations, 11,793.27 MT was sold to the Bangladesh Health Directorate for its malaria eradication programme.

DDT stocks and wastes

The physical verification of the *godowns* or warehouses, including Department of Health stocks and those stored on the Chittagong facility site, together with information on actual condition, reveals that **there remain a total of 524.752 MT of DDT stocks.** Of this stock, 3.889 MT of DDT 75WP stored in Department of Health district reserve stores and *Upazila* Project offices were found to be in good condition. However, based on local studies that indicate the half-life of DDT in Bangladesh' tropical climate is just 24 months, there was concurrence by representatives of the government ministries present at the 6-7 July 2005 workshop that **all of the 524.752 DDT stocks, which have a minimum age of 13 years (based on last year of production) are obsolete**. These waste stocks will require disposal in an environmentally sound manner, as consistent with provisions of the Stockholm Convention.

Unlabelled pesticide stocks

During the physical verification of POPs pesticide stocks, it was found that 13.688 MT of unlabelled and unidentified pesticides are in storage at the division level (all divisions except Sylhet). These stocks will need to be analysed to determine if they are POPs pesticides or contaminated by POPs (GOB, MoEF, 2005c).

7. Potential illegal trade in Annex A and Annex B POPs

Every border crossing is subject to inspection, including inspection for plant protection based on the permit of the competent authority and the registry of permitted products approved for import. While such inspection, and the affordability of POPs alternatives has diminished the incentive for and likelihood of smuggling, reports of the continued use of banned pesticides need to be authenticated through proper investigation, including analysis by a qualified laboratory (not currently available within Bangladesh).

The Deputy Director of the Department of Agricultural Extension, Plant Protection wing, during a 2001 workshop organized by the DoE, scientists and researchers, reported that some of the POPs pesticides might be imported illegally. For example, there are a number of anecdotal sources reporting illegal transboundary entry into Bangladesh of chlordane, heptachlor, dieldrin and also unconfirmed reports suggesting that some local companies may have illegally formulated POPs pesticides subsequently sold via local distributors for control of soil-borne insects (Hossain 2000; UNEP 2001, Toxics Link 2004). The Indian ENGO *Toxics Link* reports that India exported 8.3 metric tonnes of aldrin and 16 tones of chlordane to Bangladesh during the April 1998-December 1999 period, subsequent to the 1997 ban on POPs in Bangladesh (Toxics Link, 2004, citing its Trojan Horses 2000 report) and provides the table below of purported quantities of POPs introduced to Bangladesh in its report on POPs use in South Asia. Several studies and newspaper reports have reported that sprinkling dried fish sold commercially with DDT as a preservative to ward off flies has been and perhaps continues to be a fairly common practice.

8. Assessment with respect to Annex- A, Part II chemicals (PCBs)

PCB use

PCB compounds are still in use in Bangladesh, mostly in closed systems as dielectrics in transformers and capacitors used in the electrical generating sector. At this time, the facilities for identification of PCB content in electrical equipment are not available within the power sector or government laboratories within Bangladesh; hence as discussed below, PCB content is estimated base on typical practice in Bangladesh and internationally with regard to suspected PCB content. The present inventory of the electrical sector does not include PCB-containing hydraulic fluids, which will be estimated as part of future activities.

Six entities comprise the Bangladesh generating sector: the Bangladesh Power Development Board (BPDB), the Dhaka Electric Supply Authority (DESA), the Dhaka Electric Supply Company (DESCO), the Power Grid Company of Bangladesh (PGCB), the Rural Electrification Board (REB) and the Independent Power Producers (IPP). Collectively, they have in service 2,353 power transformers, 374,260 distribution transformers, and 84 oil circuit breakers (OCB), which are utilized in 425 locations throughout the country.

The total volume of transformer oil in use within in-service transformers (power and distribution), capacitors and oil circuit breaks is estimated at 107,370 metric tones. The another 65 MT transformer oil are estimated to be held in reservoirs and 424 MT of transformer waste oils to be stored in drums that are held in different locations within Bangladesh, primarily in maintenance shops where electrical equipment is serviced and oil removed.

As there are no reliable facilities for analysis and identification of PCB content in this oil within the power sector in Bangladesh or via government laboratories, there is no capacity within Bangladesh at this time to determine the PCB content (volume, concentration, etc.) in this oil. However, trade names of transformer oil recorded from field observations, and the common practice within in the electrical industry (as was common practice in this sector globally) of "topping up" oil levels in transformers (i.e., to replace oil lost over time due to evaporation, leaking, spills, etc.) suggests that irregardless of labels on transformers that may indicate no PCB content, **most of the surveyed electrical equipment could have been, and indeed is likely to be, contaminated with PCB oils**.

In addition to transformer oil, lubricating oil used in Bangladesh power stations are estimated at 3,818 MT, of which 3,336 MT are estimated to be in use and 492 MT in stock.

PCB content of in-service electrical equipment is estimated at 51.6 MT, of which 48.9 MT is thought to be in distribution transformers and 2.7 MT in other types of equipment.

Another 519 MT of waste transformer oils are estimated to be stored in reservoirs, of which 95 MT are stored in reservoirs and 424 MT in drums that are held in different locations within Bangladesh, primarily in maintenance shops where electrical equipment is serviced and oil removed. **Of the 519 MT of waste transformer oils, 259.45 kilograms are estimated to be contaminated with PCBs. Additionally, of 8,403 MT of waste oils contained in waste equipment, 4.193 MT are estimated to be contaminated with PCBs**. **Hence, the total electrical sector PCBs requiring destruction is estimated at 55.8 MT.**

PCB manufacture and import

PCBs (or PCB mixtures) were never manufactured in Bangladesh.

Electrical power transformers, capacitors, lubricating oils etc., have been imported to Bangladesh for an indeterminate period, as records were not maintained. As manufacture of PCBs in other nations began in 1929, it is possible their import dates back to this period although most equipment in use in Bangladesh today was fabricated after the 1970s. Most transformers were imported from 29 different nations, with the greatest number imported Korea (241), Japan (200), China (130), Germany (83), England (74), India (55), Belgium (53), Poland (32) and France (29). The main nations manufacturing transformers that were imported include the United States, Canada, USSR and Russia, Germany, Italy, West Germany, the Czech Republic, Czechoslovakia, and Sweden. Additionally, Energy Pac and General Electric Company manufactured transformers in Bangladesh. A number of the importing nations were known to use PCBs in their electrical equipment.

The widespread prohibition on manufacture, distribution and processing of PCBs from the1980s onward means that older equipment in general is likely to have higher PCB content. However, some equipment imported as recently as 2000 was found during the survey labelled with PCB content. Additionally, as discussed above, the practice of "topping up" the level of transformer oil in electrical equipment with unlabelled or PCB transformer oils means that age of equipment is not, in itself, a reliable indication of PCB content. Therefore, all equipment will need to be sampled and analyzed to verify if PCB content or contamination has occurred.

PCBs in the ship-breaking industry

The Bangladesh ship recycling industry, initiated in 1972, consists of 70 ship-breaking or recycling yards located on the Bay of Bengal beaches, of which from 20 to 25 yards operate on a regular basis, collectively recycling from 50 to 90 ships annually. The main ship-breaking yards are located in the beach of the Bay of Bengal below the Sitakundu Police Station of Chittagong and 8 to 10 kilometres from the City of Chittagong.

The typical merchant ship dismantled for scrap contains between 250 kg to 800 kg of PCBs, found principally in the paint, as well as in the machinery, of the vessel (Agarwal, 2004). Some studies have made the assumption that ships from the WWII era (1940s) would have the greatest amounts of PCBs in materials, such as paint, cable sheathing and hydraulic fluids. However, until PCBs were banned in various nations, they continued to be used in ships, i.e., up through the mid 1970s and 1980s. For purposes of its preliminary PCB national inventory, Bangladesh estimated that each old ship contained 250 kg of PCBs, inclusive of transformer oil. Based on this estimate, **the total quantity of PCBs estimated to be contained within the ships dismantled each year in Bangladesh is 22,500 kg or 22.5 metric tonnes of PCBs.** Presumably, with appropriate protocols, most or all of these PCBs would be recoverable for destruction or disposal.

9. Assessment of POPs from unintentional production (dioxins and furans)

Dioxins and furans are by-products of combustion of chlorine-based chemical compounds, chlorine-based pulp and paper bleaching, certain types of manufacturing and processing (including manufacture of some pesticides), and some industrial processes. They have never been produced commercially except in small quantities for laboratory purposes.

In Bangladesh, a preliminary national assessment of releases from unintentional production of Annex-C chemicals (Dioxins/Furans) was performed in 2004-2005. While the assessment did not address by-products of HCB and PCBs, control measures applicable to dioxins and furans (for example, via processes changes and application of pollution control devices) typically controls these POPs as well.

Leading sources of dioxins and furans emissions: Based on consolidated results from the preliminary national inventory of dioxins and furans conducted for each main category and sub-category, there are an estimated 485.81 g TEQ/a are released in 2005 to all environment compartments (air, water, products and residues) as shown in Table 33 below. The top six emitters include the following:

(1) chemicals and consumer goods manufacturing sector which released an estimated 144.34 TEQ/a;
(2) disposal/landfilling activities, which released an estimated 116.17 g TEQ/a;
(3) electrical power generation and heating, which released an estimated 79.49 g TEQ/a;
(4) uncontrolled combustion processes, which accounted for an estimated 71.678 g TEQ/a**;**
(5) ferrous and Non-Ferrous Metal Production, with an estimated 31.98 g TEQ/a; and
(6) waste incineration, with an estimated 31.13 g TEQ/a.

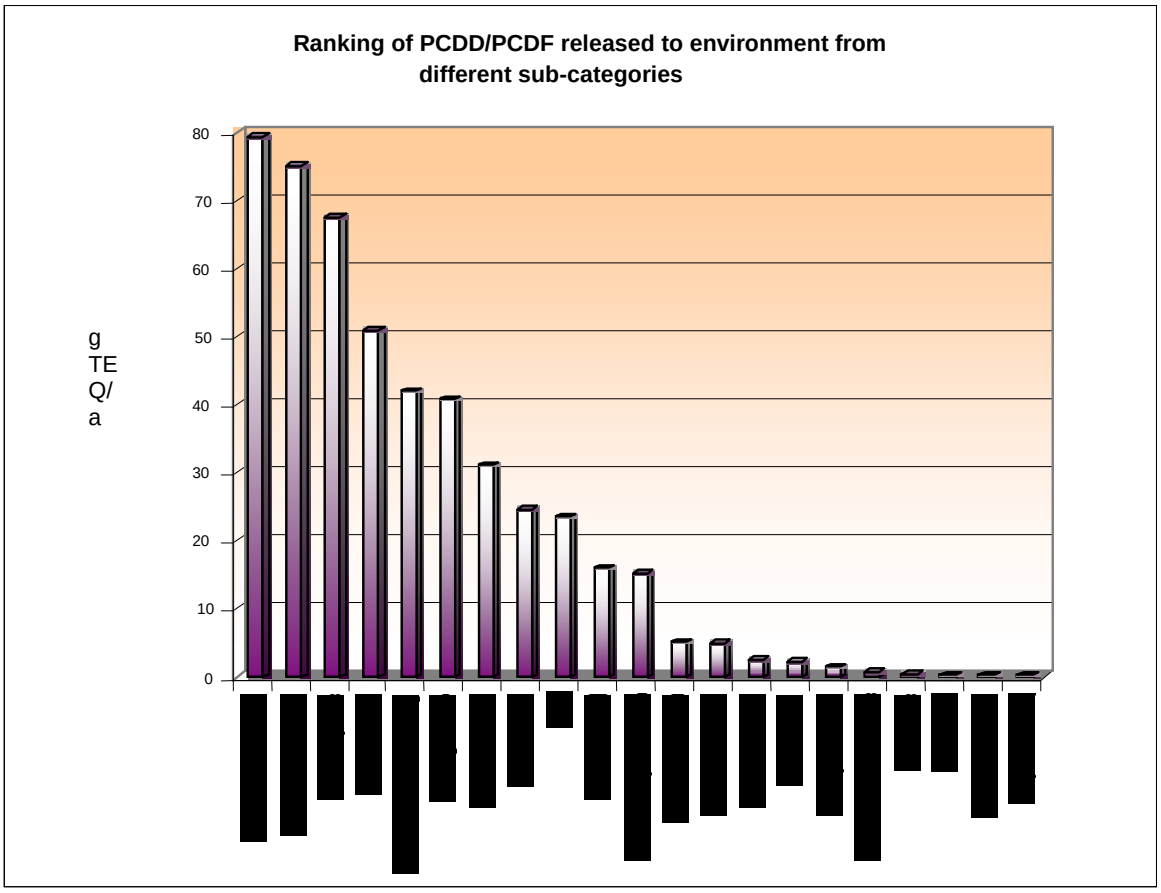
The table below provides a summary of releases.

Dioxins and furans releases, 2005

Category	Air		Water		Product		Residue		Total	
	g TEQ/a	%	g TEQ/a	%	g TEQ/a	%	g TEQ/a	%	g TEQ/a	%
Production of Chemicals and Consumer Goods	0	0.00	21.31	34.3	123.02	62	0.001	0.00	**144.34**	29.71
Disposal/Landfill	0	0.00	40.8	65.7	75	38	0.36	0.97	**116.17**	23.91
Power Generation and Heating	79.18	42.03	0	0	0	0	0.316	0.85	**79.49**	16.36
Uncontrolled Combustion Processes	57.16	30.34	0	0	0	0	14.51	38.9	**71.67**	14.75
Ferrous and Non-Ferrous Metal Production	10.09	5.36	0	0	0	0	21.89	58.7	**31.98**	6.58
Waste Incineration	31.11	16.51	0	0	0	0	0.015	0.02	**31.13**	6.4
Production of Mineral Products	9.05	4.80	0	0	0	0	0.045	0.12	**9.09**	1.87
Transport	1.51	0.80	0	0	0	0	0	0.00	**1.51**	0.31
Miscellaneous	0.31	0.16	0	0	0	0	0.131	0.35	**0.44**	0.09
Total =	**188.41**		**62.111**		**198.02**		**37.268**		**485.809**	

Source: GoB, MoEF, 2005d

Releases from different subcategories are shown below.



10. Monitoring

Environmental monitoring of chemical pollutants generally is very recent and has focused on common air pollutants and lead generated by vehicular traffic. There is no monitoring programme for POPs in Bangladesh, whether in environmental media (inland waters and sediment; groundwater; marine water and sediment; soil; and air); animals (fish, birds, mammals and other animals including domestic and imported livestock and poultry); animal feeds, or of people. Nor has there been such a programme historically or capacity for such a program. There is currently no systematic surveillance programme in place to determine and track resistance in disease vectors to DDT or pesticide alternatives to DDT, such as deltamethrine (USAID, 2004 a-c). Bangladesh does not require reporting of pesticide poisonings, nor does it have an established poison control and information centre (i.e., a clinical toxicology facility dedicated to management of poisoning cases).

There are only a very few studies undertaken by either international entities, the Bangladesh government, academia or others of POPs exposure in humans, bird, animals or fish, or of the environment. Consequently, there is a noteworthy paucity of data on POPs exposure, including as contrasted to other countries in the South Asia region. Similarly, there are very few studies of POPs pesticides alternatives, for which use has increased since POPs were banned (e.g., carbamates and organophosphates). Those studies that have been performed on sporadic basis indicate that POPs are present in the environment, including in water, and as residues in fish and some foods (with a few of the samples taken exceeding international guidelines). While these studies are sufficient to indicate the presence of POPs, they are not adequate for determining the extent to which the environment, fish, etc. are contaminated in Bangladesh.

Given the past use of POPs in Bangladesh, in some instances for as long as four decades, it is suspected that both rural and urban populations would have been exposed to POPs. The single article found with any reference to pesticide (or other) POPs exposure in the Bangladesh population was in an article by the Pesticide Action Network (PAN) — United Kingdom posted by PAN's Asia Pacific office. The PAN-UP article references a study "Organochlorine Pesticides residues in the beast milk, especially in the coastal region of Chittagong" carried out under joint collaboration with Institute of Marine Science, Chittagong University, Atomic Energy Centre, Savar, Dhaka and Institute of Food and Radiation Biology. Researcher Mohammad Selim Uddin was the lead report author. The PAN article reports that the researchers detected nine POPs pesticides in 20 milk samples collected from mothers living in the coastal area of Chittagong. The samples were collected during one week of the post-natal period during 1998-99. The study found that the maximum and minimum concentrations of total DDT in the milk of each woman (age below 25) were 0.02031 mg per litre (mg/1) and 0.00073 mg/1, respectively. In the age group above 25, maximum and minimum total DDT concentrations in the human milk were 0.055765 mg/1 and 0.00071 mg/1, respectively. The highest and lowest concentrations of total DDT and total organochlorine POPs measured were 0.02031-0.00073 mg/1 and 0.00144 mg/1 respectively. The concentration of total DDT was lower than the maximum permissible limit (1.25mg/1). The PAN article also refers to a study of breast milk in the Rajbari agricultural region where POPs concentrations were found to be higher but provides no further details. The study found that the people of Chittagong consume most of the POPs residues from agricultural food products and dried fish (PANAP, 2001).

Systematic quantitative information on human exposure would be useful to identify potentially effected sub-populations as informed by results of first order inventories. For example, repairpersons in utility companies who are in contact with transformer fluids may have been exposed to PCBs much more frequently and at higher concentrations than the general public. Similarly, wholesalers, retailers and farmers who handle pesticides on a regular, and their families (given that pesticide residues remain on clothing, in hair, etc., and can be transferred to other members of the family within the home) should be considered for monitoring. Fishers and their wives and children are another potentially vulnerable subpopulation. If they are known to consume more fish due to occupational circumstances of the household, it is possible that they are at greater risk of exposure. Similarly, populations who regularly consume fish that swim in waters that are found to be polluted at high concentrations, e.g., offshore of a warehouse that is known to have leaked or based on sampling, may also be at elevated risk of exposure (although benefits of consuming such fish typically outweigh the risks of exposure).

It is unclear whether there are suitable alternatives to DDT for controlling outbreaks of kala-azar, and also malaria and dengue fever in endemic areas for these diseases, and whether the affected populations are themselves systematically monitored to enable rapid diagnosis and response to disease outbreaks as part of a national population surveillance programme that could help to prevent the spread of disease to other populations and thereby reduce the need for use of pesticides as part of a holistic control programme.

11. Current level of awareness, information and outreach

Bangladesh is committed to provision of POPs information that is broadly accessible and transparent. As part of its initial efforts with respect to NIP development, its consultation efforts included awareness raising components.

Workshops held to date on the NIP project, including preliminary inventories and drafts of the NIP, both for purposes of raising awareness and consultation, include the following:

1. Inception workshop – 26 June 2004
2. Awareness raising meeting on PCBs – 29 September 2004

3. Awareness raising meeting on POPs pesticides – 7 October 2004
4. Awareness raising meeting on unintentional POPs – 19 December 2004
5. Meeting on POPs monitoring capabilities –10 January 2005
6. Workshop on national inventory of POPs in Bangladesh and phase-out –24-25 April 2005
7. Multi-stakeholder NIP consultation workshop – 6-7 July 2005
8. Brainstorming downstream projects' concepts, workshop – 14 July 2005

Additionally, a government POPs website has also been developed by the MoEF, available at www.doe-bd.org/POPS.pdf. This site includes draft and final versions of inventories, as well as overview documents on POPs and links to international sites.

It is evident from various qualitative assessments, such as group discussion with potential target audiences, consultation meetings with stakeholders, and pre-testing of some communications materials with vulnerable groups that most of the Bangladeshi are not aware of POPs issues. Only a few professionals have some knowledge about POPs, including within academia and among industry sectors that use POPs.

With respect to existing systems, Bangladesh, along with its various non-governmental partners and organizations, has considerable experience with developing and implementing national awareness-raising programmes, for example, pertaining to health and family planning, literacy, HIV/AIDS, agriculture, livestock, fisheries, malaria control, and micro-credit. Many of these efforts have been recognized internationally for their success.

While POPs are a concern to the general population, it will be particularly important to develop strategies to raise awareness among potentially vulnerable populations. As monitoring is undertaken, specific subgroups may be identified relative to outreach needs. Initially, outreach can be of a broad awareness-raising nature, so as to prepare key "actors" within government, the private sector and local communities who can assist with disseminating awareness-raising strategies once they themselves have been made aware of the issues pertaining to POPs and government commitments and implementation strategies.

12. Policy statement

Sustainable growth of the Bangladesh economy and health of Bangladesh people depends on the natural resource base, together with the biological and physical environment. Additionally, Bangladesh recognizes that the measures it takes nationally to protect its people and environment will contribute to protection of the global environment from POPs compounds.

The Government of Bangladesh is therefore committed to support sustainable development that includes development and implementation of a national policy for management of POPs chemicals and POPs alternatives with the aim of protecting the health of its people and environment. To this end, Bangladesh will work to reduce the exposure of humans and the environment to POPs, including by:

1. phasing out the remaining POPs in use within Bangladesh (PCBs in electrical equipment and DDT);
2. continuously reducing and, to the extent feasible, eliminating of releases of by-product POPs (dioxins and furans, HCB and PCBs) resulting from human activity;
3. eliminating POPs wastes in an environmentally sound manner, as consistent with its obligations under the Stockholm Convention; and
4. improving its capacity to determine the nature and extent of exposure of the Bangladesh ecosystems, fish and wildlife, and especially humans, to POPs and POPs alternatives so as to be able to target actions as appropriate to protection of exposed populations.

13. Implementation strategy

Implementation mechanism

The Government of Bangladesh (GoB) will establish an inter-ministerial National Implementation Authority (NIA) to provide oversight for implementation of the NIP as a near-term priority. The NIA will be comprised of representatives of key ministries and their agencies involved with POPs management (e.g., DoE, Ministry of Agriculture-DAE, Ministry of Health-DGHS; Ministry of Power, Energy and Mineral Resources), with a broadened constituency, inclusive of stakeholders, as needed to implement specific actions. Representatives from donor agencies will also be invited and encouraged to sit on the NIA. The National Focal Point of the Stockholm Convention (the Director General, DoE) will be the coordinator of the NIA. The NIA's responsibilities will include the following tasks:

a. Arranging for availability of funds and resources for implementing the NIP.
b. Supervision of NIP activities, coordinate among different departments
c. Review and authorization of work plans submitted by implementation mechanisms (ministries responsible for actions)
d. Upgrading POPs inventories and the NIP on regular basis as prescribed by the Convention.
e. Evaluating progress of NIP implementation every three years.
f. Collection and dissemination of information about POPs domestically and internationally.
g. Provision of oversight for development and implementation of a programme to promote application of the BAT and BEP principles in various social and economical activities.
h. Arrangement for training of appropriate specialists (e.g., customs officer, border control officers, engineers, technicians) responsible for management of POPs.

Actions

Priority actions to be pursued for NIP implementation are as follows:

1. **Establish a monitoring program,** inclusive of specific strategies, for determining the presence, levels and trends of POPs in humans and the environment (*near to long term*). The program will identify and take into consideration actions for:
    a. the general population
    b. vulnerable populations, e.g., repair persons in utility companies who come into contact with PCBs; wholesalers, retailers and farmers who regularly handle pesticides; people living in homes that were formerly known to be pesticide storehouses; fisherman and their families; shipyard workers and their families; people living adjacent to facilities that formerly manufactured/formulated or imported POPs, etc.

3.3.13 Activity: Technical and financial assistance (articles 12 and 13)

3.3.13.1 PROBLEM DEFINITION

The Government of Bangladesh will seek technical and financial assistance to implement actions that it cannot fully implement without such support.

3.3.13.2 IMPLEMENTATION MECHANISM

NIA; DoE

3.3.13.3 ACTIONS FOR TECHNICAL AND FINANCIAL ASSISTANCE

1. The Government of Bangladesh will seek international technical and financial assistance for the following priority actions:

    Near term (1-5 years)

    a. National POPs management capacity building project
    b. Improvement of existing legal framework and legislative provisions for POPs
    c. Awareness raising, outreach and education
    d. Creation of national SMOC laboratory network and laboratory capacity for analysis of POPs compounds.
    e. Safe packaging, labelling and storage of Annex B (DDT) obsolete stockpiles
    f. Shipment of Annex B (DDT) obsolete stockpiles for destruction
    g. DDT sampling in dried fish
    h. Detailed PCB management plan, PCB legislation and rapid-assay pilot project
    i. Full-scale PCB rapid assay and follow-up sampling to determine presence of PCBs and verify PCB content; packing and safe storage of PCB wastes. Feasibility study for PCB destruction and decontamination technology options (building on results of sampling and analysis)
    j. Determination of final PCB destruction and decontamination options as informed by feasibility study
    k. Identification and remediation of PCB contamination within the ship-breaking sector
    l. Procurement of BAT for application in different social and economic activities
    m. Identification of POPs contaminated sites

Mid term (6-10 years)

n. Determination of final PCB destruction and decontamination options as informed by feasibility study (*started in near term and completed in mid term*)
o. PCB waste equipment decontamination/destruction infrastructure created
p. PCB contaminated waste destruction/disposal initiated
q. Training (industrial sectors; inspectors; customs officials)
r. Outreach and procurement of BAT for application in different social and economic activities
s. Monitoring
t. Awareness raising, outreach and education on POPs (ongoing)

Long term (11-20 years)

u. Decontamination and/or destruction of PCB equipment as removed from service and destruction of PCB wastes (ongoing as PCBs and contaminated equipment removed from service)
v. Monitoring
w. Procurement of BAT for application in different social and economic activities Contaminated site remediation as warranted (1 or 2 priority sites)\

Institutions involved in POPs implementation

Institutions	Responsibilities
Lead Ministry &Agency: Ministry of Environment and Forests (MoEF), DoE, Other Ministries: DAE, DGHS	• Strengthening legislative framework to address POPs and enforcement • Coordinator for the National Implementation Agency interagency for POPs NIP implementation • Arranging for funding and resources for implementing NIP actions. • Oversight for NIP actions for environmentally sound disposal of POPs wastes. • Oversight for development and responsibility for identification and remediation of POPs contaminated sites. • Joint oversight with DGHS for development of national monitoring plan (health) • Oversight for national environmental monitoring • Upgrading NIP and reporting its progress of implementation to the Convention. • Application of BAT and BAP in different social and economical activities. • Arrangement of training for POPs management. • Oversight for awareness-raising activities.
Lead: DAE, Ministry of Agriculture Other ministries: DGHS	• Identification of Annex A POPs pesticide contaminated sites and remediation in association with DoE. • Provide information to support monitoring of POPs pesticides.
Joint lead: DGHS, Ministry of Health and Family Planning; DoE	• Responsibility for health monitoring actions within NIP (DGHS) • Handle, collect and store of Annex B POPs pesticide (DDT) in environmentally sound manner. • Arrangement of environmentally sound disposal of DDT wastes. • Identification and remediation of DDT contaminated sites in

Institutions	Responsibilities
	association with DoE. • Rationalization of medical wastes disposal practice. •
Lead: Ministry of Power, Energy and Mineral Resources (NPMN) Other ministries: DoE Stakeholders: (i.e., BPDB, PGCB, REB, DESA, DESCO, IPP)	• PCB Work Plan for PCB management, inclusive of o Upgrading and modernizing existing PCB laboratories (coordinated with Laboratory Upgrading below). o Inventory efforts (sampling for PCB presence in equipment and follow up sampling to determine concentrations and volumes) o Based on results, determination of destruction requirements and selection of technology option (domestic or overseas) o Destruction of PCB wastes consistent with Stockholm Convention o Decontamination of electrical equipment from PCBs in given timeframe o Provide information to support monitoring of POPs PCBs o Identification and remediation of PCB contaminated sites in association with DoE
Lead: DoE **Other key institutions:** DAE; Bangladesh Atomic Energy Commission (BAEC) **Stakeholders:** Environmental Research Laboratory of the Institute of Food Radiation the Agrochemical and Biology; Analytical Research Laboratory of BCSIR; DoE and DAE pesticides laboratory, and the PDB, BCSIR, BPDB; the Organic Research Laboratory of the Chemistry Department of Dhaka University	• POPs Pesticides: Laboratory Upgrade Work Plan • By-product POPs laboratory upgrade • PCB laboratory upgrade (as coordinated with NPMN-led PCB Work Plan implementation above)
Joint Lead: DoE and DGHS Stakeholders: Ship-breaking industries; Labour organizations;	• Ship-breaking Sectoral POPs Plan • POPs wastes guidance/protocols • Annex C releases monitoring • Worker safety guidance/protocols

Institutions	Responsibilities
ILO; WHO	
Joint Lead: DoE, DGHS Other ministries: Ministry of Science & Technology Stakeholders: Academia	• Monitoring & Research Work Plan (environment; people) o Environment (baseline; contaminated sites identification, etc.) - DoE o Research on resistance of disease vectors to DDT and POPs alternatives – DGHS o Research on effects of POPs and POPs alternatives on human health
Lead: DoE	• Public awareness, outreach, education & risk communication

13. International donor support

At a 14 July 2005, the Department of Environment, MoEF sponsored a workshop in Dhaka on *Brainstorming Downstream Project Concepts on POPs for the Bangladesh National Implementation Plan.* The workshop sought to create linkages with the international donor community with regard to priority actions proposed by the GoB for management and phase out of POPs. The workshop was chaired by the Director General of the DoE and attended by representatives from government ministries and the donor community, including, among others, the World Bank, the UNDP, and the Canadian International Development Agency. Ten priority projects were identified for NIP implementation (see above were presented for donor consideration). As an outcome of the workshop, the UNDP committed to seeking funding from the Global Environment Facility (GEF) for four projects:

1. Development of a national laboratory network for chemicals sampling, inclusive of certification, and building capacity within one leading laboratory DoE for POPs sampling and analysis;
2. A DDT project for management of obsolete stocks, for which GEF would be a co-funder and partnering with an EU country with the appropriate environmentally sound destruction facilities. The Netherlands expressed interest in such a partnership. The project would address packaging, labelling, collection, and secure storage of DDT obsolete stocks, followed by their shipment for destruction to the Netherlands' facility in Rotterdam. The project could also address research on alternatives to DDT for use in control of disease vectors.
3. PCB management, inclusive of development of a detailed overall management plan, draft legislation and near-term sampling of PCBs in waste oils, waste equipment and in-service equipment and oil reserves, initially using rapid assay kits, with more detailed follow up analysis as indicated by assay results. Management would include repacking and secure storage in suitable facilities, determination of destruction technology options and selection and implementation of an option. The GoB will initiate this project by developing a detailed overall management plan. The plan will include a pilot project to sample electrical equipment oils using rapid assay kits to determine presence of PCBs, followed by more sophisticated analysis where PCB content is indicated. The GoB will seek funding for the management plan, draft legislation and pilot rapid assay sampling from the CIDA Canada POPs Trust Fund administered by the World Bank, and funding from the GEF for the portion of the project focused on full-scale sampling, inclusive of improved laboratory capacity for PCB analysis, storage infrastructure and determination of destruction and decontamination technologies.
4. Outreach and communication. UNDP will seek funding via the GEF for this project.

The FAO expressed interest in expanding an existing fisheries project to include research on use of DDT as a preservative in dried fish.

WHO expressed an interest to work with GoB in the areas related to human health.

The Government of Bangladesh will work with these partners to develop full project proposals and will continue to seek additional international partners and funding for priority projects.

Acronyms and abbreviations

2,4-D	Dichlorophenoxy acetic acid
a.i.	Active ingredient
ADB	Asian Development Bank
ADI	Acceptable Daily Intake
ATSDR	Agency for Toxic Substances and Disease Registry (United States)
APCS	Air Pollution Control System
BADC	Bangladesh Agricultural Development Corporation
BARI	Bangladesh Agriculture Research Institute
BAT	Best Available Techniques
Bbl/d	Barrels per day
BBS	Bangladesh Bureau of Statistics
BCIC	Bangladesh Chemical Industries Corporation
BCPA	Bangladesh Crop Protection Association
BEP	Best Environmental Practices
BHC	Benzene hexachloride
BPDB	Bangladesh Power Development Board
BPMC	Butylphenylmethylcarbamate
BRRI	Bangladesh Rice Research Institute
BSs	Block Supervisors
BSTI	Bangladesh Standards and Testing Institution
BTI	*Bacillus thurungensis israelensis*
CCC	Chittagong Chemical Complex
CBD	Convention on Biological Diversity
CEO	Chief Executive Officer
CIDA	Canadian International Development Agency
CoP	Conference of the Parties
DAE	Department of Agricultural Extension (Ministry of Agriculture)
DANIDA	Danish International Development Agency
DBCP	Dibromochloropropane
DC	Deputy Commissioner / Divisional Commissioner
DCC	Dhaka City Corporation
DD	Deputy Director
DDT	Dichlorodiphenyltrichloroethane (1,1,1-trichloro-2,2-bis(4-chlorophenyl)ethane)
DESA	Dhaka Electric Supply Authority
DESCO	Dhaka Electric Supply Company
DFID	Department of International Development (United Kingdom)
DGHS	Director General of Health Services
DOA	Director of Agriculture

DOHS	Directorate of Health Services
DPHE	Department of Public Health Engineering
DPP	Directorate of Plant Protection
ECA	Environment Conservation Act
ECR	Environment Conservation Rules
EIA	Environmental Impact Assessment
E.I.F.	Entry Into Force (Convention)
EPIDC	East Pakistan Industrial Development Corporation (DDT production)
ESM	Environmentally Sound Management
EU	European Union
FAO	Food and Agriculture Organization
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FRG	Federal Republic of Germany
FY	Fiscal Year
GDP	Gross Domestic Product
g TEQ/a	Grams/Toxic Equivalent/Annum (year)
GEF	Global Environment Facility
GoB	Government of the People's Republic of Bangladesh
Ha	Hectares
HCB	Hexachlorobenzene
IA	Implementing Agency (for GEF)
IARC	International Agency for Research on Carcinogens
ICDDR,B	International Centre for Diarrhoeal Disease Research, Bangladesh
IFCS	Intergovernmental Forum on Chemical Safety
IGO	International Governmental Organization
INC	Intergovernmental Negotiating Committee (Stockholm Convention)
IPM	Integrated Pest Management
IPP	Independent Power Producers
ISO	International Standards Organization
IUCN	The World Conservation Union
JICA	Japanese International Cooperation Agency
Km	Kilometres
Mg/L	Milligram per litre. (1 Mg/L = 1 ppm; 1Microgram/L= 1 part per billion or ppb)
Mm	Millimetres
MM	Molecular Weight
MOA	Ministry of Agriculture
MOHFW	Ministry of Health and Family Welfare
MoEF	Ministry of Environment and Forests

MOPEMR	Ministry of Power, Energy and Mineral Resources
MRL	Maximum Residue Limit
MSD	Medical Sub Depot
MT	Metric Tonne
MW	Mega Watts
NAEP	New Agricultural Extension Policy
NBR	National Board of Revenue
NCC	National Coordination Committee (for Bangladesh NIP)
N.d.	No date (bibliographic entries)
NFP	National Fisheries Policy
NGO	Non-Governmental Organization
NIA	National Implementation Authority (for Bangladesh NIP)
NIP	National Implementation Plan
NLA	National Lead Agency (for Bangladesh NIP)
OCB	Oil Circuit Breaker
ODA	Official Development Assistance
OECD	Organisation for Economic Co-operation and Development
PAB	*Pesticide Association of Bangladesh*
PCBs	Polychlorinated biphenyls
PCDD	Polychlorinated dibenzo-p-dioxin (dioxins)
PCDF	Polychlorinated dibenzo furans (furans)
PGCB	Power Grid Company of Bangladesh
POPs	Persistent Organic Pollutants
PP	Plant Protection
PPM	Parts per million
PPT	Parts per trillion
PPW	Plant Protection Wing (DAE, Ministry of Agriculture)
PRODOC	Project Document
PRTR	Pollutant Release and Transfer Register
PSC	Project Steering Committee
PVC	Polyvinyl chloride
R&D	Research and Development
REB	Rural Electrification Board
SEARO	South East Asian Regional Office (WHO)
Sq. km.	Square kilometres
SRTI	Sugar Cane Research Institute
TAPP	Technical Assistance Project Proposal
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TEF	Toxic Equivalency Factor

TEQ	Toxic Equivalent (dioxin)
TRI	Tea Research Institute
TSCA	*Toxic Substance Control Act*
µ	*Micro as in µg/l or microgram per litre*
UNCED	*United Nations Conference on Environment and Development*
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
USEPA	United States Environment Protection Agency
WARPO	Water Resource Planning Organization
WHO	World Health Organization
WWF	World Wildlife Fund

1.0 Introduction

The People's Republic of Bangladesh signed the Stockholm Convention on Persistent Organic Pollutants (POPs) on 23 May 2001 as a gesture of its commitment to contribute to global environmental protection and sustainable development. Bangladesh is currently in the process of ratifying the Convention.

As part of its preparations pertaining to ratification, Bangladesh determined to develop a National Implementation Plan for Persistent Organic Pollutants as an effective response measure to achieve Stockholm Convention objectives. Accordingly, with support from a follow-up mission wgkb and in consultation with stakeholders, the Government of Bangladesh (GoB) subsequently prepared an *Enabling Activity Proposal*, which was forwarded, along with the endorsement of the Ministry of Environment and Forests (MoEF), through the United Nations Development Programme (UNDP) to the Global Environment Facility (GEF) for GEF approval. The proposal was accepted and a Project Document signed between UNDP (an Implementing Agency of the GEF) and MoEF, for preparation of this National Implementation Plan (NIP) under Technical Assistance Project Proposal (TAPP) *BDG/02/G31/1G/99 — Bangladesh: Preparation of the Persistent Organic Pollutants (POPs) National Implementation Plan under the Stockholm Convention*. The project is financed by the GEF (US$495,075), working in cooperation with UNDP. The Government of Bangladesh contributed in-kind support equivalent to US$147,200)

The Ministry of Environment and Forests is the Operational Focal Point for the GEF. The Department of Environment (DoE) of the MoEF serves as the lead implementing agency. The MoEF works with two co-implementing agencies, the Department of Agricultural Extension (DAE) of the Ministry of Agriculture, and the Bangladesh Power Board (BPDB) of the Ministry of Power, Energy and Mineral Resources (MOPEMR).

Implementation of the project involves six phases:

1. Establishment of a coordinating mechanism and organizational process;
2. Assessment of national infrastructure;
3. Development of three national inventories for the Stockholm Convention POPs (Annex A pesticide POPs; Annex B DDT, and Annex C by-product POPs);
4. Priority setting and determination of objectives;
5. Formulation of a draft National Implementation Plan on POPs; and
6. Stakeholder consultation on the draft NIP prior to production of subsequent drafts and final draft of the NIP.

In accordance with phase 1, the Director General for the MoEF Department of the Environment established a National Coordination Committee (NCC) with representation from the MoEF, co-implementing agencies, the Directorate General of Health Services (DGHS), academia, non-governmental organizations (NGOs). A representative from UNDP also sits on the NCC for project monitoring purposes.

The MoEF also established an inter-ministerial Project Steering Committee (PSC) to provide oversight for development of the NIP. The committee is headed by the MoEF national project director for POPs. Membership includes relevant ministries, academicians, NGOs and representation from UNDP.

Following an Inception Meeting on the project held 26 June 2004, and production of the *Inception Report* in July 2004, the Project Director formed a national Project Team of domestic and international experts to undertake the necessary inventories, assessments and studies as per phases 2 and 3. These studies helped to inform a preliminary priority-setting exercise that contributed to actions proposed within the first draft of the NIP. Following consultation, these priorities were again reviewed in light of comments received.

A country becomes a Party to the Convention 90 days after depositing its instrument of ratification with the UN Treaty Section in New York City, at which time the Convention enters into force for that country. According to this process, Bangladesh will have at least 27 months from the date that it deposits its instrument of ratification to prepare and transmits its NIP to be in compliance with its Party obligations for development of its NIP. Bangladesh is currently in the process of ratifying the Stockholm Convention.

The NIP's central objective is phase out of POPs as achieved through strategic activities, strategies and action plans incorporated in the NIP, and priorities and attendant timetables developed for their implementation.
The NIP is structured in accordance with the recommended NIP elements outline as proposed in the 2004 UNEP Chemicals-World Bank NIP Guidance Document, which was approved by the Convention Conference of the Parties at its first session (CoP1) held 2-5 May 2005 in Punta del Este, Uruguay.

Once the NIP is approved, authority for its implementation will reside with a National Implementation Authority (NIA), to be formed by the MoEF as the lead agency. The Director General of DoE, as the National Focal Point for Bangladesh to the Convention, will serve as the NIA coordinator. The NIA will itself be comprised of representatives from the DoE, DAE, PDB, DGHS, researchers, academicians, and donor agencies. The NIA will also involve stakeholders in NIP implementation activities.

The NIA will be responsible for overall coordination of NIP implementation, inclusive of interagency collaboration, and will arrange availability of funds and resources required to implement the NIP.

1.1 The Stockholm Convention

The Stockholm Convention was adopted in on 23 May 2001 at the Conference of Plenipotentiaries on the Stockholm Convention on Persistent Organic Pollutants in Stockholm. The Convention entered into force on 17 May 2004, following deposit of the 50th instrument of ratification.[1, 2]

[1] Article 26, Paragraph 1 states that the Convention "shall enter into force on the ninetieth day after the date of deposit of the fiftieth instrument of ratification, acceptance, approval or accession." Art. 26, Paragraph 2, further observes that "For each State or regional economic integration organization that ratifies, accepts or approves this Convention or accedes thereto after the deposit of the fiftieth instrument of ratification, acceptance, approval or accession, the Convention shall enter into force on the ninetieth day after the date of deposit by such State or regional economic integration organization of its instrument of ratification, acceptance, approval or accession."

[2] Text of *The Final Act of the Conference of Plenipotentiaries on the Stockholm Convention on Persistent Organic Pollutants* (UNEP/POPS/CONF/4, 5 June 2001) can be downloaded from UNEP Chemicals, the Convention Secretariat, at http://www.pops.int/.

The objective of the Stockholm Convention is stated in Article 1:"Mindful of the precautionary approach as set forth in Principle 15 of the Rio Declaration on Environment and Development, the objective of this Convention is to protect human health and the environment from persistent organic pollutants."

To meet this objective, the Convention sets forth measures intended to lead to the elimination of releases of the listed POPs to the environment, as achieved through reduction and phase out of their production and use, and environmentally sound disposal of wastes.

The Convention is structured to address POPs as follows:

(1) intentionally produced POPs —pesticides (inclusive of insecticides, rodenticides and fungicides) and manufactured PCBs. These POPs are slated for eliminationexcept where interim exemptions apply, as per discussion below);

(2) intentionally produced POPs for which the use is restricted to acceptable purposes (e.g., disease vector control); and

(3) unintentionally generated POPs that are produced and released as the result of human activity (e.g., as by-products of combustion or chemical processes).

Specific POPs substances to be addressed via these categories are listed in annexes A-C, which are integral to the Convention. There are 12 POPs listed in the Convention (PCBs and hexachlorobenzene appear within annexes A and C, based on the means by which they are generated):

Annex A: The eight pesticide POPs—aldrin, chlordane, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex, and toxaphene—and PCBs
Annex B: DDT (only for disease vector control)
Annex C: Dioxins, furans, HCB, PCBs

1.1.1 Intentionally produced (Annex A and B) POPs

Article 3 "*Measures to reduce or eliminate releases from intentional production and use*" sets out provisions for the elimination of production and use, and for the import and export of the nine Annex A substances.[3]

All of the Annex A and B POPs are to be eliminated immediately for production and use, except where a Party has registered for specific exemptions for a substance, as per Article 4, and within the relevant annexes. Control strategies for reducing releases of Annex A POPs include prohibition and/or administrative measures necessary to eliminate production and use.

[3] Quantities of an Annex A or B listed chemical occurring as constituents of articles manufactured or already in use before the date of entry into force of the relevant Convention obligation with respect to that chemical shall not be considered as listed in these Annexes, provided that a Party has notified the Secretariat that a particular type of article remains in use within that Party's state, with such notification to be made publicly available by the Secretariat. For PCBs, there are additional qualifications regarding exemptions for articles in use, as per provisions of Part II, Annex A. Once an article consisting of, containing or contaminated by an Annex A or B POP becomes a waste, it is subject to Article 6 provisions for wastes.

Exemptions for Annex A and B chemicals: Countries are required to notify the Convention Secretariat of their intent to seek specific exemptions for Annex A or B chemicals before May 21, 2001 or, upon becoming a Party, to register for one or more specific exemptions. The Convention Secretariat (which resides with UNEP Chemicals) maintains a publicly available Register of such exemptions.

Exemptions remain in place for five years after the Convention enters into force for a particular chemical, unless a Party specifies an earlier date (Article.4, Para. 4) or withdraws from the Register, which it may do at any time (Article 4, para. 8). A Party may request that a *specific exemption* be extended for five years. This request would be subject to a review by the CoP based on information submitted by the requesting Party to justify continued need for exemption (Article 4, paras 6 and 7).

There are no exemptions for production or use of *endrin* or *toxaphene*, or for production of *aldrin*, *dieldrin*, or *heptachlor*.

Exemptions for production and use of *chlordane*, *hexachlorobenzene* and *mirex* are limited to the narrowly prescribed purposes shown in the table below.

The only exempted acceptable purpose for production or use of *DDT* is for disease vector control. As per Annex B Part II, para. 2, exempted production and use is to occur only when "locally safe, effective and affordable alternatives are not available to the Party" and in accordance with WHO recommendations and guidelines.[4] A Party may at any time withdraw its name from the DDT Registry upon written notification to the Secretariat. The Conference of the Parties will review at its first meeting and every three years thereafter whether DDT continues to be needed for disease vector control (Annex B, Part II, para. 6).

PCBs used in/recovered from equipment: Parties have until 2025 to phase out the use of equipment containing PCBs (e.g., transformers, capacitors or other receptacles containing liquid PCBs). PCBs recovered from equipment must be treated and eliminated by 2028.

In the interim period, as specified in Part II of Annex A, each Party shall, subject to review by the CoP, take action on in-use PCBs in accordance with the following priorities:

- Make determined efforts to identify, label and remove from use equipment containing greater than 10% polychlorinated biphenyls and volumes greater than 5 litres
- Make determined efforts to identify, label and remove from use equipment containing greater than 0.05% polychlorinated biphenyls and volumes greater than 5 litres
- Endeavour to identify and remove from use equipment containing greater than 0.005% polychlorinated biphenyls and volumes greater than 0.05 litres

Consistent with these priorities the Parties are to promote the following measures to reduce exposures and risk to control the use of PCBs:

[4] See the *WHO Action Plan for the Reduction of Reliance on DDT in Disease Vector Control*, 2001, WHO/SDE/WSH/01.5 (WHO, 2001), http://www.who.int.

restrict) use to intact and non-leaking equipment, with such use limited to areas where the risk from environmental release can be minimized and quickly remedied

- prohibit use in equipment involved in production or processing of food or feed
- when used in populated areas, including schools and hospitals, take all reasonable measures to protect from electrical failure, which could result in a fire, and regularly inspect equipment for leaks.

Imports and exports: Imports of Annex A or B substances by Parties are permitted only for environmentally sound disposal and where a use or purpose is permitted (i.e., where the importing country has obtained a *specific exemption* or *acceptable purpose* exemption for the POPs pesticides and as per provisions for PCB interim use). Similarly, exports by Parties of Annex A or B substances are permitted to other Parties to the Convention only for environmentally sound disposal or to a Party which is permitted use of the chemical under the terms of the relevant annex.[5] Where exports are destined to non-Parties of the Convention, the State is to provide an annual certification regarding its commitment to protection human health and the environment by taking the necessary measures to minimize or prevent release and its compliance with the Convention (i.e., Article 6, paragraph 1 and Annex B, Part II, paragraph 2).

1.1.2 By-product (Annex C) POPs

As per Article 5, the Convention requires that each Party shall, at a minimum, take specified measures to reduce the total releases derived from human generated sources of each of the chemicals listed in Annex C, with the goal of their continuing minimization and, where feasible, ultimate elimination. To this end, the Parties are to:

- develop an action plan or, where appropriate, a regional or sub regional action plan, within two years of the date of entry into force of the Convention for that Party and subsequently implement the plan
- promote application of available, feasible and practical measures to achieve realistic and meaningful levels of release reduction or source elimination
-
- promote development, and, where appropriate, require use of substitute or modified materials, products and processes to prevent formation and release of Annex C POPs
-
- promote and, in accordance with the implementation schedule of the Party's action plan, require the use of Best Available Techniques (BAT) for new sources within source categories that a Party has identified as warranting such action in its action plan, with a particular initial focus on sources that have the potential for comparatively high formation and release to the environment, listed in Annex C, Part II;

[5] The second note respectively of Annexes A and B observes that notification by Parties of articles having POPs as constituents and which were manufactured or already in use before on the date of entry into force of the relevant Convention obligation with respect to that chemical does not constitute a production and use specific exemption with respect to importation of these articles.

- Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge;
- Cement kilns firing hazardous waste;
- Production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching;
- The following thermal processes in the metallurgical industry:
  Secondary copper production;
  Sinter plants in the iron and steel industry;
  Secondary aluminium production;
  Secondary zinc production.

Requirements for BAT shall be phased in as soon as practicable but no later than four years after the entry into force of the Convention for that Party.

Promote, in accordance with its action plan, the use of BAT and Best Environmental Practices (BEP) for existing sources within the source categories listed in Annex C, Parts II and III, and for new sources within source categories such as those listed in Part III. The Annex C, Part III list of other potential sources of formation of dioxins, furans and unintentionally produced PCBs includes:

- open burning of waste, including burning of landfill sites;
- thermal processes in the metallurgical industry not mentioned in Part II;
- residential combustion sources;
- fossil fuel-fired utility and industrial boilers;
- firing installations for wood and other biomass fuels;
- specific chemical production processes releasing unintentionally formed persistent organic pollutants, especially production of chlorophenols and chloranil;
- crematoria;
- motor vehicles, particularly those burning leaded gasoline;
- destruction of animal carcasses;
- textile and leather dyeing (with chloranil) and finishing (with alkaline extraction);
- shredder plants for the treatment of end of life vehicles;
- smouldering of copper cables; and
- waste oil refineries.

1.1.3 POPs stockpiles and wastes

Article 6, "*Measures to reduce or eliminate releases from stockpiles and wastes*," establishes measures that each Party shall take to ensure that wastes are managed to be protective of human health and the environment. These measures apply to (1) stockpiles consisting of or containing chemicals listed either in Annex A or Annex B that are deemed to be waste, and (2) products and articles upon becoming wastes consisting of, containing or contaminated with an Annex A, B or C chemical.

As per Article 6.1(c), Parties shall deem stockpiles to be waste after the stockpiles are no longer allowed to be used by the Party according to any specific exemption specified in Annex A or any specific exemption or acceptable purpose specified in Annex B, with the exception of stockpiles which are allowed to be exported to a Party that is permitted use of that chemical as per Article 3.2.

Examples of waste products and waste articles include POPs pesticide mixtures or formulations that have been prohibited, deregistered, or, for which the use exemption has been deregistered by the Party or expired; PCB liquids no longer exempted for use in electrical equipment; and the electrical equipment that contained PCBs (e.g., transformers and capacitors), unless such equipment has been decontaminated. (Quantities of a chemical occurring as unintentional trace contaminants in products and articles, unless specified in the Convention, are not subject to the Convention provisions.)

Stockpiles are to be managed, as appropriate, in a safe, efficient and environmentally sound manner. For wastes, each Party is to take appropriate measures so that they are handled, collected, transported and stored in an environmentally sound manner.

Article 6.1(d) requires that all Annex A, B and C POPs wastes be "disposed of in such a way that the persistent organic pollutant content is destroyed or irreversibly transformed…or otherwise disposed of in an environmentally sound manner when destruction or irreversible transformation does not represent the environmentally preferable option or the persistent organic pollutant content is low, taking into account international rules, standards and guidelines…

The Stockholm CoP, as per provisions of Article 6.2, shall cooperate closely with the appropriate bodies of the Basel Convention to establish appropriate levels of destruction and irreversible transformation necessary to ensure that characteristics of POPs. Additionally, the CoP is tasked with establishing the concentration levels of chemicals listed in Annexes A, B and C in order to define the low persistent organic pollutant content.

Article 6.1(iii) requires that each Party shall take appropriate measures so that wastes, *including*, including products and articles upon becoming wastes are "Not permitted to be subjected to disposal operations that may lead to recovery, recycling, reclamation, direct reuse or alternative uses of persistent organic pollutants." Thus, for example, waste capacitors and waste transformers that may have formerly contained PCBs would either have to be de-contaminated prior to reuse or meet provisions for destruction/irreversible transformation. Similarly, POPs pesticides that are above the low POPs content to be established by the Convention CoP are to be destroyed/irreversibly transformed unless such action is not the environmentally sound option.

Provisions of 6.1(iv) stipulate that POPs wastes shall not be transported across international boundaries without taking into account relevant international rules, standards and guidelines.

Each Party is also to endeavour to develop appropriate strategies for identifying contaminated sites and, where it undertakes remediation, to do so in an environmentally sound manner.

1.1.4 Research and monitoring (*-monitoring means any of various persons or devices for checking or warning about a situation, operation, etc.*)

The Convention, via Article 11 "*Research, development and monitoring*" provides general direction with regard to research and development activities by encouraging cooperative efforts at regional and international levels to gain economies of effort by avoiding duplication and to allow all Parties to tap into information for which it may lack the requisite resources or expertise to gather on its own.
Inventory information and monitoring to track environmental impact is required to provide information that can be used to gauge progress or regression in reducing the priority chemicals.

The Convention lists the following inventory and monitoring needs:

- sources and releases into the environment;
- presence, levels and trends in humans and the environment;
- environmental transport, fate and transformation;
- effects on human health and the environment;
- socio-economic and cultural impacts;
- release reduction and/or elimination; and
- harmonized methodologies for making inventories of generating sources and analytical techniques for the measurement of releases.

With respect to *DDT***,** each Party that has an exemption for production shall promote, within its capabilities, research and development of safe alternative chemical and non–chemical products, methods and strategies for DDT, relevant to the conditions of the country and with the goal of decreasing the human and economic burden of the disease. Human health risks and environmental implications of alternatives shall be taken into account. Viable alternatives shall pose less risk to human health and the environment, be suitable for disease control and be supported with monitoring data.

1.1.5 Education, outreach (an organization involvement with or influence in the community esp. in the context of social welfare) **and training**

Article 10 "Public *information, awareness and education*" requires that each Party, within its capabilities, promote and facilitate public participation, consultation and education, including with respect to raising awareness and education regarding both POPs and their alternatives.
Parties must, within their capabilities, address the following obligations in preparing to implement actions to address public information, awareness and education measures on POPs:

1. Promote and facilitate (para. 1):

- awareness among policy and decision makers concerning POPs;
- provision of available POPs information to the public;
- development and implementation of educational and public awareness programmes on POPs, on their health effects and on their alternatives;
- public participation in developing and implementing adequate measures to address POPs, including providing input regarding implementation of the Convention;
- training of stakeholders;
- development and exchange of education and public awareness materials at national and international levels; and
- development and implementation of education and training programmes at national and international levels.

Pesticide

3. Encourage industry and professional users to promote and facilitate provision of information at national and, as appropriate, subregional, regional and global levels (para. 3).

4. Use a range of approaches to provide information on POPs and their alternatives, and may establish information centres at national and regional levels (para. 4).

5. Consider developing mechanisms (such as pollutant release and transfer registers) to collect and disseminate information on annual amounts of POPs in Annex A, B or C that are released or disposed of (para. 5).

1.1.6 General, administrative and reporting requirements

Parties must address the following obligations in preparing to implement actions to address reporting requirements:

1. Parties must report to the Conference of the Parties on measures taken to implement the Convention and the effectiveness of those measures in meeting the Convention objectives (para.1). The frequency and format of reporting will be decided by the Conference of the Parties. In addition, Parties must report every five years:

    - if they make use of the PCB *specific exemption*, on their progress in eliminating in-use PCB equipment and disposing of PCB wastes [Annex A, Part II, paragraph (g)]; and
    - on the success of strategies in reducing releases of unintentionally produced POPs [Article 5, subparagraph (a) (v)];

2. Parties must report to the Secretariat (para. 2):

    - data on or reasonable estimates of the total quantities of production, import and export of each intentionally produced POP; and
    - a list of the States that it has imported from or exported to each intentionally produced POP;

3. Parties that are included in the DDT Register must report to the Secretariat and WHO every three years on the quantities of DDT used, conditions of its use, and the relevance of DDT to the Party's disease management strategy (Annex B, Part II, para. 4).

1.1.7 Adding POPs to Convention lists

Parties may submit to the Secretariat proposals for the addition of new POPs in accordance with Article 8. Candidate substances are to be subjected to a rigorous screening process as per the Convention's provisions.

1.1.8 National plans

(1) Pursuant to Article 7, each Party is to develop and endeavour to implement a *National Implementation Plan* (referred to in this report as a *NIP*), which describes how it will meet its Convention obligations. The NIP is to be submitted to the Stockholm CoP within two years of the Convention's entry into force for that Party. Parties are to review and update the NIP, as appropriate, on a periodic basis and in a manner to be specified by a decision of the Cop. Additionally, each Party shall endeavour to utilize and, where necessary, establish the means to integrate the NIP into its sustainable development strategies, as appropriate.

(2) Each Party is encouraged, as per Part II of Annex B, to develop a *DDT action plan* as part of its NIP that shall include the following:

- development of regulatory and other mechanisms to ensure that DDT use is restricted to disease vector control;
- implementation of suitable alternative products, methods and strategies, including resistance management strategies to ensure the continuing effectiveness of these alternatives; and
- measures to strengthen health care and to reduce the incidence of the disease.

(3) Additionally, as per Article 5(a), each Party is to develop *an action plan for unintentionally generated POPs (Annex C POPs)*[6] that is to be implemented as part of its NIP. This plan is to include the following:

- an evaluation of the efficacy of laws and policies of the Party relating to the management of releases of Annex C chemicals;
- an evaluation of current and projected Annex C POPs releases, including the development and maintenance of source inventories and release estimates, taking into consideration the Convention's prescribed source categories identified in Annex C;
- strategies to meet the obligations required of the action plan;
- steps to promote education and training with regard to, and awareness of, those strategies;
- a review every five years of these strategies and their success in meeting Convention obligations for Annex C substances;
- a schedule for implementation of the action plan, including for the strategies and measures identified therein.

(4) The NIP, inclusive of its action plan for Annex C POPs, and potentially a DDT action plan, will:

- identify, characterize and address the releases of POPs in Annex C;
- evaluate current and projected releases, including development and maintenance of source inventories and release estimates, noting the source categories in Annex C;
- evaluate the efficacy of the Party's laws and policies to manage such releases;
- develop strategies to reduce releases;
- promote education and training on the strategies;
- review success of the strategies every 5 years and include this information in reports to the CoP (Article 15);
- include a schedule for implementation of the action plan; and
- be implemented.

1.2 Persistent Organic Pollutants

1.2.1 What are POPs?

The term "Persistent Organic Pollutants" or POPs is used to describe a class of toxic and environmentally persistent substances that can harm human health and the environment.

[6] Alternatively, a Party may prepare, where appropriate, a regional or sub-regional action plan.

POPs are:

1 Produced and mobilized into the environment as a result of human activity, i.e., they are anthropogenic;
2 Long-lived in the environment (years to decades) because they do not dissolve in water or break down easily in soil, sediments, air or biota
3 Concentrate in fat tissues of animals, reaching ever-higher concentrations as they progress up the food chain (e.g., species accumulate POPs by eating smaller POPs-contaminated plants and animals). POPs reach their highest concentrations in predatory fish, birds, marine and aquatic mammals, and humans. For this reason, measurements of POPs in the environment (such as the water column) are not in themselves indicative of concentrations that may be found in animals.
4 Semi-volatile (evaporate to a gaseous state). POPs travel great distances in the environment (through air, water, or migratory species) and can be deposited and accumulate at locations that are distant (1000s of miles) from the sources of release. Consequently, they are now found in humans living on all continents, including in locations where no POPs have ever been produced or used.

In polar climates, very low temperatures prevent or slow volatilization of POPs. As a result, concentrations of POPs in the environment and living organisms in the Arctic where POPs have been manufactured and/or used are similar to levels in highly industrialized areas. People from Arctic regions who regularly eat marine animals contaminated with high concentrations of POPs (for example, whales and seals, which have thick layers of body fat for insulation against the cold) have some of the highest concentrations in their bodies among humans globally. The rate of volatilization and subsequent circulation within tropical climates is more rapid than in colder climates although less well studied.

1.2.2 Health effects

Adverse health effects, both acute (severe and with a sudden onset) or chronic, associated with POPs include allergies, damage to the nervous and respiratory systems and to organs, reproductive and immune system dysfunction, sex-linked disorders, birth defects, neurobehavioral[7] and developmental disorders, endocrine disruption, cancer, shortened lactation periods for nursing mothers, and, in extreme cases, death (including abortion of the foetus). The foetus and children are at higher risk than adults because of the hormone-mediated changes they are undergoing, which govern several aspects of both development and growth, their physiology (size, weight, respiration rate, etc.) and, in, in the case of young children, their habits, such as hand-to-mouth ingestion.

Table 1 below describes the known global uses of each POP, including historically, and health effects associated with each POP. (Bangladesh uses may have been different or more circumscribed as discussed in the assessment Section 2.3)

[7] For example, a May 1998, WHO meeting recognized that subtle effects associated with exposure to dioxins may be occurring in the general population in developed countries at the then current estimated background levels of 2 to 6 pg/kg body weight. Various studies have also found that infants in industrialized nations are exposed to many times the WHO tolerable daily intake level.

Table 1. POPs known uses globally and health effects

POP CHEMICAL	KNOWN GLOBAL USES (includes historical uses)	HEALTH EFFECTS
Aldrin	Insecticide used to control soil and crop insects, such as corn rootworm, wireworm, rice water weevils and grasshoppers, and also to protect wooden structures from termites. Most commonly used on corn, potato and cotton crops. Aldrin readily converts to dieldrin in plants and animals and, therefore, residues of this chemical are usually found in small amounts.	• Low toxicity to plants but has adverse effects on aquatic invertebrates, particularly insects. Acute exposure to aldrin has caused death in waterfowl, shorebirds, fish and humans. The International Programme on Chemical Safety (IPCS) estimates the fatal dose for humans at five grams. • International Agency for Research on Cancer (IARC)— Group 3 (not classifiable as a carcinogen in humans) • World Health Organization (WHO)— Class 1b) (highly hazardous on the basis of acute toxicity to experimental animals)
Chlordane	Broad-spectrum agricultural insecticide used on crops, including vegetables, grains, maize, oilseeds, potatoes, sugarcane, sugar beets, fruits, nuts, cotton and jute and to control termites.	Chlordane can kill aquatic invertebrates, fish and birds IARC—Group 2B (possibly carcinogenic to humans)
Dieldrin	Insecticide used to control soil insects, termites, textile pests, and insect vectors of disease. The main crops treated with dieldrin include corn, cotton and potato.	Low toxicity to plants; high toxicity to insects, fish and aquatic animals. Toxic effects on birds and mammals vary. Dieldrin is suspected of negatively affecting the immune response in humans. IARC—Group 3 (not classifiable as a carcinogen in humans)
Endrin	Insecticide to control pests in crops, e.g., cotton, rice, corn, jute; rodenticide to control mice.	Highly toxic to fish and other aquatic organisms. Suspected of suppressing the human immune system IARC—Group 3 (not classifiable as a carcinogen in humans)

POP CHEMICAL	KNOWN GLOBAL USES (includes historical uses)	HEALTH EFFECTS
Heptachlor	Insecticide used in control of soil and crop pests (particularly cotton), termites, and for disease vector control	Toxic to wildlife even at low concentrations. In birds, exposure to the chemical has induced behavioural changes, reduced reproductive success, and mortality. IARC—Group 2B (possibly carcinogenic to humans)
Hexachlorobenzene[a]	Pesticide and fungicide for seed treatment. By-product of manufacturing processes, combustion and can occur as impurity in other chlorinated pesticides	HCB, including at low levels, has produced a variety of adverse affects in aquatic animals, fish, birds and small mammals, e.g., fatigue, skin irritation, reproductive disorders, kidney and liver damage, cancer and death. Acute exposure in humans has caused photosensitive skin lesions, unusual hair growth, colic, severe weakness, kidney and liver damage, central nervous effects (including seizures), circulatory collapse and respiratory depression, debilitation, urinary, arthritic, neurological and metabolic disorders, and death. HCB has been linked to spontaneous abortions in humans IARC—Group 2B (possibly carcinogenic to humans)
Mirex	Insecticide to control ants, leaf cutters, mealy but, harvester termites, etc. Also used as a fire retardant in plastics, rubber, paint paper and electrical goods.	Toxic to plants, aquatic organisms and birds. IARC—Group 2B (possibly carcinogenic to humans)
Toxaphene	Insecticide used primarily on cotton, cereal grains, fruits, nuts and vegetables. Also used to control ticks and mites in livestock.	Non-toxic to plants, highly toxic to fish and has noted to cause reproductive disorders in birds. IARC—Group 2B (possibly carcinogenic to humans)
Polychlorinated biphenyls (PCBs)[b]	Class of chlorinated hydrocarbons widely used as industrial chemicals since 1930. Thee were 209 varieties (congeners) of PCBs manufactured. Most common use has been as a cooling and dielectric fluid in electrical transformers and	Immune system suppression and reproductive failure in various wildlife. • Acute (severe) human exposure can produce swelling of the eyelids, pigmentation of the nails and mucous membranes, fatigue, nausea

POP CHEMICAL	KNOWN GLOBAL USES (includes historical uses)	HEALTH EFFECTS
	capacitors. Also widely used as hydraulic fluids and heat exchange fluids. PCBs have been used as additives to sealant, paints, plastics, carbonless copy papers, etc. Also a by-product of combustion and some chemical processes.	and vomiting. • Chronic exposure in humans, including at low levels, can cause alteration to liver enzymes, rashes, acne, developmental, mental and behavioural problems, immune suppression, and possibly cancer. • Children in the United States (Michigan State) followed subsequent to their exposure to PCBs while in the womb (via placental transfer) and from breast milk had deficits in intellectual function, short-term memory loss, and hyperactivity and behavioral problems.[8] IARC—Group 2B (possibly carcinogenic to humans)
Dioxins and Furans (PCDD and PCDF)	Class of chlorinated hydrocarbons for which 75 different dioxin and 135 furan congeners exist. Of the dioxin congeners, seven are of serious concern as regards toxicity and adverse health effects. The World Health Organization has assigned to each of these congeners a toxic equivalency factor (TEF) based on each congener's potency relative to that of the most potent of the dioxin congener (2,3,7,8-TCDD). Dioxins and furans are by-products of combustion of chlorine-based chemical compounds, chlorine-based pulp and paper bleaching, certain types of manufacturing and processing (including manufacture of some pesticides), and some industrial processes They have never been produced commercially except in small quantities for	Toxic to fish, causing behavioural changes and death; Implicated in developmental and digestive disorders in birds and other wildlife; a multi-site carcinogen in experimental animals In humans, chloracne is the most consistent health effect observed. Other effects include fatigue, depression, personality changes, and altered cellular and hormone levels (which can include immune, enzyme, reproductive and developmental disorders). Elevated prenatal exposure may affect the gender ratio among newborns. Possible link to glucose intolerance and diabetes. IARC—2,3,7,8-TCDD congener [CAS 1746-01-6] is classified as a known human carcinogen. One report (Becher, 1998) suggests that exposure to dioxins and furans may be responsible for 12% of all cancers.

[8] Animal Studies associate low-concentration exposure to dioxins in rat foetuses with altered development of reproductive functions, including reduced sperm production in males upon maturation, abnormalities in anogenital distance, time to testis decent, and feminized sexual behaviour associated also with increased aggressively in male rats. Monkey foetuses exposed to dioxin at levels similar to human breast milk contamination (5 ppt -25 ppt or parts per trillion) showed evidence of learning disabilities.

POP CHEMICAL	KNOWN GLOBAL USES (includes historical uses)	HEALTH EFFECTS
	laboratory purposes.	

[a] Used historically as a pesticide. Also occurs as a contaminant in pesticides and more commonly, as a by-product of combustion. Hence, it is listed in both Annexes A (intentional use) and Annex C of the Convention.

[b] PCBs are both manufactured POPs and generated as a by-product of combustion, hence are also listed in both Annexes A and C.

1.2.3 Exposure pathways

Some portions of maternal exposures are passed on to the foetus through the placenta (from circulating contaminants in the mother's blood) and in breast milk,[9] although most of the exposure may already have occurred via the placenta. (Breast milk remains an important source of nutrients and antibodies for newborns and infants; hence, the benefits of breast milk outweigh the risks posed by POPs.)

The main exposure pathway among the general adult populations in countries where POPs are most studied (industrialized nations) is through consumption of contaminated food. Food sources of greatest concern relative to PCB, dioxin and furan exposure are contaminated dairy products, meat and fish. Pesticide residues can occur in a variety of foods (fruits, vegetables, fish, etc.). While extremely high contamination of food can lead to acute affects, the main concern with food contamination is one of chronic exposure over time as POPs accumulate in human body fat until they may reach concentrations at which adverse effects can occur.

Food becomes contaminated via uptake from a contaminated environment (through food chain biomagnification) or occurs as the result of accidental or criminal negligence (as in a Belgium dioxin contamination episode, which cost the EU food industry an estimated $3 billion in sales owing to import restrictions on EU products).

The pathways of exposure in developing countries are less well studied than in developing nations. In developing countries, there is typically less fat (the portion of tissue in which POPs concentrate) in the diet. Food distribution is typically more localized than in industrialized countries, such that a food contamination incident resulting from accident or neglect could be expected to be similarly localized. However, many developing nations lack adequate monitoring capacity to determine if the environment or biota, including major food sources, are contaminated with POPs, and, if so, at concentrations that exceed acceptable or tolerable daily intake standards, such as those set by the World Health Organization.

Populations in developing nations are more likely to be exposed directly to pesticide POPs than their developed nation counterparts because of lower awareness and use of safety measures. Exposure can occur via inhalation and dermal contact, for example during manufacture or formulation, application, and through accidental contact. The poor (e.g., migrant field workers, rag pickers; and people burning garbage for heating and/or cooking fuel) are at heightened risk of exposure to toxic and hazardous chemicals generally, owing to occupation and life-style practices. Dietary deficiency, more prevalent in developing nations, is associated with weakened immune

[9] Judy Stober, Executive Secretary of IFCS, Switzerland. Proceedings of the subregional Awareness Raising workshop on Persistent Organic Pollutants (POPs), Kranjska Gora, Slovenia, 11-14 May 1998.

systems; hence, exposed populations in poor nutritional condition may also be at greater risk of the adverse effects of POPs and other toxic and hazardous chemicals.

1.2.4 POPs "life-cycle" management in the context of the sound management of chemicals

Life-cycle management of toxic and hazardous chemicals (including POPs) in the interests of protecting health and environment refers to both prevention and control measures undertaken from a chemical's development to its ultimate destruction. Management is therefore comprehensive ("cradle-to-grave"). It entails governmental co-ordination among ministries; enabling legislation and regulatory provisions and practices that address screening and assessment of chemicals, labelling of products at all stages of the life-cycle; governance relative to chemical import, transport, storage, sale, use and disposal, mandatory safety provisions, e.g., with respect to workers, facility siting and design; emergency contingency (in event of spills, accidents); source reporting of POPs in stock, wastes generated and releases; monitoring (i.e., of humans, animals, fish and birds, including aquatic life and of food and feed stocks); laboratory analysis; identification and remediation of contaminated sites; research; training; risk communications and public outreach, education and awareness-raising; governmental co-ordination among ministries; obligatory corrective actions, and audit and compliance procedures. Expertise, including legal and technical expertise is a key factor in ability to management chemicals safely.

The modern environmental protection process, and in particular the sound management of chemicals, is information driven process with two major components: risk assessment and risk management.

To carry out all the requirements of Stockholm Convention requires a comprehensive environmental protection regime, inclusive of risk assessment and risk management, that is supported by the necessary domestic legal instruments and a fully functioning organizational infrastructure with properly equipped facilities and trained personnel. Table 2 provides an overview of components of a basic sound management of chemicals process.

The Stockholm Convention offers some flexibility to a ratifying Party in structuring its National Implementation Plan (NIP). Moreover, where serious shortfalls that exist at the national in the operational capacity to manage POPs in accordance with the basic requirements of the Convention are identified and adequately explained in the NIP, Parties have the potential to obtain funding (e.g., via the Global Environment Facility) that will assist them in addressing shortfalls, consistent with proposed actions and priorities for their implementation.

Table 2. Basic components of a generic environmental protection process for the Sound Management of Chemicals

Required Information	Authorizing Legislation	Operational Requirement	Required Information
Risk Assessment	Environmental & Human Health Effects Data	Research, analysis and assessment of chemicals	Accredited laboratory for analysis Expertise to undertake analysis in accordance with accepted standards
Risk Management	Exposure Data	Requirement for Monitoring	Develop, implement and maintain monitoring programmes
	Source Data	Requirement for Inventory	Develop, implement and maintain inventories

Required Information	Authorizing Legislation	Operational Requirement	Required Information
	Societal Impact Data	Requirement for socio-economic impact study	Ability to undertake socio-economic impact studies
	Abatement Technology Information	Development and certification of abatement technologies	Integrate technology requirements in permits and certificates
	Environmental Approvals and Compliance Reporting	Requirement for approvals through imposition of specific controls through establishment of rules, ordinances or regulations	Develop, implement and maintain a form of permitting or certificate system
	Enforcement	Establishment of legal process and specification of powers of inspectors, investigators Designation of penalties	Develop, implement and maintain an inspection and investigation programme

2.0 The People's Republic of Bangladesh—Country baseline

2.1 Country profile

2.1.1 Geography and population

GEOGRAPHICAL POSITION

Bangladesh is situated in South Asia between $20^{0}34^{I}$ and $26^{0}38^{I}$ north latitude and $88^{0}01^{I}$ and $92^{0}41^{I}$ east longitude. It is bounded by India to the west (West Bengal), the north (Asamand Magalaya), the northeast (Asam and Tripura), and by Myanmar to the southeast, and by the Bay of Bengal to the south. It has an area of 147,570 square kilometres (sq. km), of which 10,090 sq. km is water. Bangladesh territorial waters extend 12 nautical miles and the area of the high seas to 200 nautical miles. The coastline is 710 kilometres (440 miles).

Figure 1: Map of Bangladesh

NATURAL AND GEOGRAPHICAL CHARACTERISTICS

Bangladesh occupies the major part of the delta of the Jamuna (Brahmaputra in India), the Padma (Ganges in India), and the Meghna rivers, for which Bangladesh is the lower riparian area of a five-nation,[10] 1, 554,000 sq. mile catchment area of more than 1, 554,000 sq. miles (UNEP, 2001). A fifth, unconnected river system, the Karnaphul, flows into the Chittagong region in southeastern Bangladesh from Surma in India. Other large rivers in this region are the Feni, Karnaphuli, Sangu,

[10] Bhutan, Nepal, China, India and Bangladesh.

Matamuhari and the Knaaf. The port of Chittagong is situated on the banks of the Karnaphuli, which runs downhill to the west and southwest before entering the Bay of Bengal (UNEP, 2001). At Chittagong, the Karnaphuli is dammed for the generation of hydroelectric power (U.S. Library of Congress, 1988).

Altogether, there are 57 transboundary rivers entering Bangladesh, 54 from India, and three from Myanmar (UNEP, 2001). Additionally, there are about 250 large and small rivers (Parveen, 2000) and some 500 canals and streams that form a complex tracery of waterways (UNEP, 2001). All major rivers end at the confluence with the Bay of Bengal (Parveen, 2000).

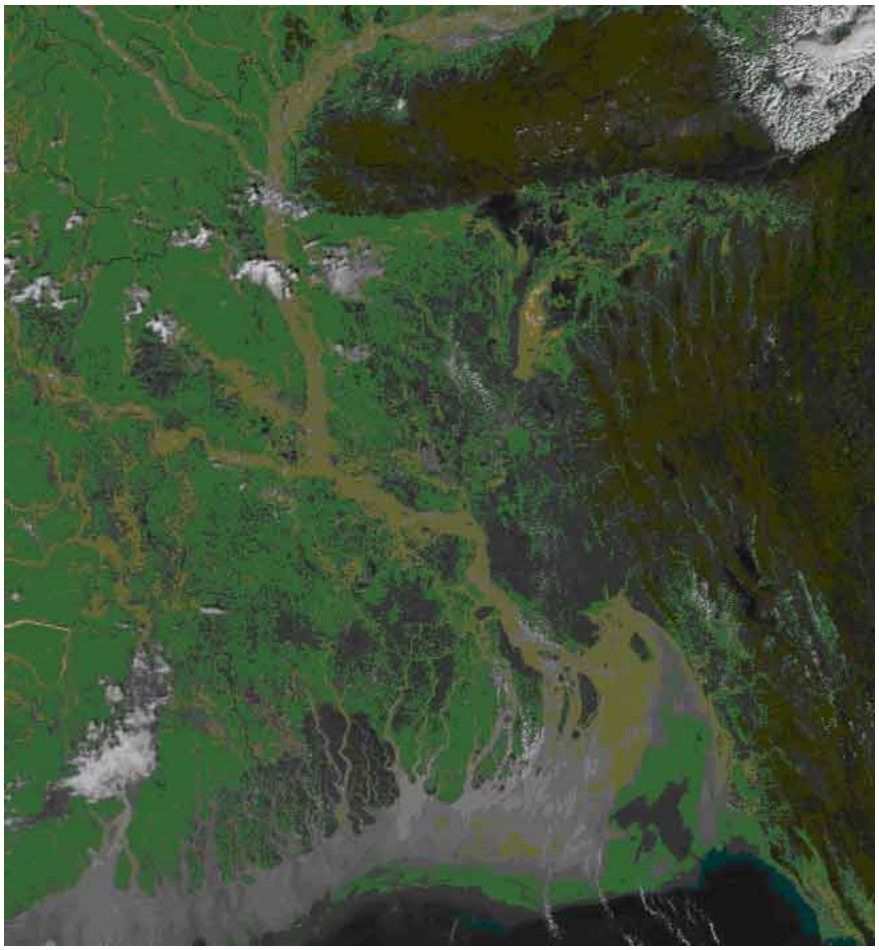


Figure 2: NASA satellite image of Bangladesh

About 90% of Bangladesh is covered by river alluvium (silt, clay, sand, etc.) deposited by its numerous rivers. These alluvial plans are less than 10 metres above sea level, including tidal plains with elevations of less than three meters above sea level that cover 20% of the country (UNEP, 2001). The alluvial soil is highly fertile but vulnerable to flood and drought.

More than 92% of the annual runoff from the Padma-Jamuna-Meghna river system flows through Bangladesh, although the country comprises only about seven percent of the total catchment area for the system (UNEP, 2001, citing Coleman, 1969). This system carries an estimated 1.2 to 2.0 billion tons of sediment each year, of which about five percent is deposited in the riverbeds and floodplain of Bangladesh, with the remaining 95% discharged to the Bay of Bengal (UNEP, 2001, citing Milliman and Meade, 1983, and Hossain, 1992).

The total area of wetlands in Bangladesh (inclusive of marsh, fen, peat land, permanent and temporary) is estimated at from seven to eight million hectares or about 50% of the total land surface (UNEP, 2001). Wetlands include permanent and seasonal water bodies known locally as *haors*, *beels, baors, khals*, *pukurs* and *dighies*. The *haors* are oxbow lakes from the old meandering bends of rivers that were cut off from the main stream and function as small internal drainage basins. Within the lowest points of the *haor*, there are one or more *beels* or lake-like deep depressions retaining water permanently or for a greater part of the year. The *beels* are usually connected to the adjacent rivers by one or more drainage channels, locally termed as *khals*. *Pukurs* and *dighies* refer to ponds of various sizes. Wetlands include the Sundarbans, in southwestern Bangladesh, the largest single expanse of mangrove forest in the world.

The country's highest topography is in the Chittagong Hills Tracts in the extreme southeast, where the hills rise steeply to narrow ridgelines (average 36 meters wide), with elevation ranges between 600 metres (m) and 900 m above sea level. Other hilly areas, although of low elevation, are located in the south-eastern region of Chittagong, and in the northeast Sylhet Division. There are also highlands in the north and northwest (Banglapedia, 1998-02).

The water table in Bangladesh is high, typically less than seven meters below ground level. There are now about four million tube-wells in Bangladesh, which supply an estimated 95% or more of the population's drinking water (Bridge, n.d.). The groundwater table is lowered seasonally during the dry season, and has undergone an overall decline over the past ten years (UNEP 2001, citing WARPO, 1999b).

CLIMATE CHARACTERISTICS

Bangladesh enjoys generally a subtropical monsoon climate. While there are six seasons, three of these—winter, summer and monsoon—are prominent. Winter, a mild, dry season, is quite pleasant. It begins in November and ends in February. Temperatures range from a minimum of $7^0 – 13^0$ Celsius (45^0F – 55^0F) to $24^0 – 31^0$ Celsius (75^0F – 85^0F). The maximum temperature recorded in summer months is 37^0 Celsius (98^0F), although in some places the temperature reaches 40^0 Celsius (105^0F) or more. The monsoon season, which starts in July and remains through October, accounts for 80% of total rainfall. The average annual rainfall varies from 1429 to 4338 millimetres (mm). The maximum rainfall is recorded is in the coastal areas of Chittagong and the northern part of the Sylhet district (north eastern Bangladesh), while minimum rainfall occurs in the western and northern parts of Bangladesh (UNEP, 2001 citing GoB, WARPO, 1999). Severe drought in the north occurred eight times between 1951 and 1991 (JICA, 1999). The contribution of local rainfall to annual surface runoff is about 25%, with substantial excess in the monsoon season.

POPULATION

The current estimated population of Bangladesh is 140 million, an increase from the 2002 census tally of 123 million. The annual growth rate is 1.48%, down from 2.9% in the mid-seventies, with family planning a factor in the slowdown.

Bangladesh has one of the world's highest population densities at 948 persons per square kilometre (1,495 per sq. km of cultivatable land) (Bangladesh Bank, 2004). An estimated 84% of the total population live in rural areas and are directly or indirectly engaged in a wide range of agricultural activities (GoB, MoEF, 2005c). Population within major cities is as follows: Dhaka, 10 million; Chittagong, 2.8 million; Khulna, 1.8 million and Rajshahi, 1 million (EIA, 2004). The population below the age of 15 is 39% (Permanent Mission of Bangladesh, citing 2000-2002 data.). The sex ratio is 106 males per 100 females (GoB, MoEF, 2005c).

Infant mortality in 1999 was 58 per 1000 live births, down from 145 in 1970 when the country experienced a famine. Life expectancy is 60.7 years (male) and 60.9 years (female) (Permanent Mission of Bangladesh, citing 2000-2002 data).

In 2000, 44.33 of the population lived below the poverty line (Finance Ministry).

Of the 60.3 million people employed in Bangladesh in 2000, 56.3% were male and 35.7% female (ADB, 2004). Of the total work force, 60% are employed in agriculture, 7.8% in manufacturing and mining and the 28.5% in other occupations.

Estimates of adult literacy (dependent on the definition adopted) for 2000 varied from 64% (estimated by the Primary and Mass education Division) to 45% (Household Income and Expenditure Survey). One 2003 study cites an adult literacy rate of 43.1% (age 15 and over), of which 53.9% is male and 31.8% female (CIA, The World Fact Book, 2004). This ratio is expected to improve as the government has achieved gender parity in primary education and nearly removed the gender gap in secondary education (GoB, MoEF, 2005c).

Ethnically, more than 98% of the population is Bengali, and the rest are tribal (Chakma, Marma, Khasia, Garo, Hajang, etc.). Approximately 88.3% of the population is Muslim, 10.5% Hindu, 0.3% Christian, 0.6% Buddhist and 0.3% are of other religions.

2.1.2 Political and economic profile

POLITICAL STRUCTURE

The government of Bangladesh is based on Parliamentary democracy. The president is the chief of state. The prime minister is the nation's Chief Executive Officer, heading the government. The prime minister must be a Member of Parliament and is appointed by the president from the majority party. The prime minister selects members of the cabinet (Council of Ministers), who are appointed by the president. Legislative power resides with the unicameral National Parliament, the *Jatiya Sangsad*. Its 300 members are elected by popular vote from 300 territorial constituencies. Members serve five-year terms. A Speaker, who is assisted by a Deputy Speaker, heads the Parliament. The Parliament decides on enactment and amendment of the constitution, passes laws, and adopts the state budget.

The Bangladesh Constitution came into force 4 November 1972 and has since undergone 13 Amendments (MoEF, 2005a). Under Article 15 (Provision of basic necessities) of Part II (Fundamental principles of State policy), it is the duty of the State to secure for its citizens the provision of the basic necessities of life, including food, clothing, shelter, education, and medical care; the right to reasonable rest, recreation, and leisure; and the right to social security in the event of unemployment, disablement, and illness. Other Articles in Part II contain provisions relating to health and citizens' rights including participation of women in national life; democracy and human rights; rural development and agricultural revolution; public health and morality; and equality of opportunity. Part III of the Constitution (Fundamental rights) guarantees the principles of equality before law; discrimination on grounds of religion, etc.; protection of right to life and personal liberty; and prohibition of forced labour (MoEF, 2005a).

Although there is no provision specific to protection or conservation of the environment in the Constitution, the concept can be considered integral to its provisions for protection of right to life and health security. In two recent cases, *Dr. Mohiuddin Farooque vs. Bangladesh* (17 Bangladesh legal digest, 1) the Supreme Court held that the "right to life" as enshrined in fundamental rights (articles 31 and 32) includes the "right to a healthy environment" (GOB, MoEF, 2005a).

JUDICIAL SYSTEM

The judicial system of Bangladesh is based primarily on common law, with the difference that the Supreme Court, which is independent of the Parliament and the Executive and the guardian of the Constitution, cannot only interpret laws made by Parliament (*Jatiya Sangsad*), but also declare the same null and void if found inconsistent with the basic sprit of the Constitution. Most of the laws are statutory laws enacted by Parliament and interpreted by the higher courts. The judiciary comprises all the courts and tribunals (Bari, 2004).

The Supreme Court, the highest judicial organ in the country, comprises the Appellate Division and the High Court Division. It consists of the Chief Justice and a number of other Judges. The Supreme Court enforces fundamental rights of the citizens. The Appellate Division hears and determines appeals from the High Court Division. At the district level, the District Court is headed by the District and Sessions Judge, who is assisted by Additional District Judges, Subordinate Judges, Assistant Judges and Magistrates. The lower courts consist of Magistrates Courts, which are part of the administrative branch of government, and Session and District Courts, comprised of judges who belong to the judicial branch. There are special and tribunal courts such as the Administrative Tribunal, Family Courts, Labour Tribunal, Land, Commercial, Municipal, Marine Courts and Environment Courts.

The laws declared by the appellate division are binding on the high court division and law declared by either division is binding on all subordinate courts. The High Court Division has been vested with the power to issue orders and directives in the nature of writs to enforce fundamental rights and to grant other relieves available under the writ jurisdiction.

There are four classes of subordinate *civil* courts: the courts of assistant judges, subordinate judges, additional judges and district judges. District judge is the head of the judiciary in each of the district.

Subject to the superintendence of the high court division, district judge has administrative control over all the civil courts of the district. There are five classes of subordinate *criminal* courts. These are courts of session, metropolitan magistrate, magistrate of the first class, magistrate of the second class and magistrate of the third class. At least one magistrate is placed in every *Upazila* to perform magisterial functions in respect of such area. The *Jatiya Sangsad* may, by law, establish one or more administrative *tribunals* to exercise jurisdiction in respect of matters relating to or arising out of terms and conditions of persons in the services of the republic, property vested in or managed by the government by or under any law etc (Hoque, K.E. 2000).

The head of the police administration in the country is the Inspector-General of Police (IGP). The Deputy Inspector General of Police heads the divisional police administration and the Superintendent of Police heads the district police-administration and there is an Inspector of Police in each *Upazila*. The Superintendents of Police and the Inspectors of Police work in close co-operation with the Deputy Commissioners and *Upazila Nirbahi* Officers for maintenance of law and order under their respective jurisdictions.

ADMINISTRATIVE DIVISIONS

Bangladesh is divided into six administrative divisions (Barisal, Chittagong, Dhaka, Khulna, Rajshahi; and Sylhet), each placed under a Divisional Commissioner (DC). The divisions are further sub-divided into 64 districts or *zilas*. A Deputy Commissioner heads the administration of each *zila*. Each *zila* is further divided into *upa-zilas* and then into unions. There are 4,484 unions, each union comprised of a number of villages. There are 87,319 villages in Bangladesh. In the towns and cities, the basic units are *mohallahs* and *words*. The towns are managed by municipal authority and the unions by the *Union Parisad*. The head of the *Union Parisad* and municipalities are designated as Chairman of the Union and Chairman of the musicality, respectively. Both the chairman and the members of the *Union Parisad* are elected by the people within their division. Every citizen of age 18 or over has the right to vote for their representatives.

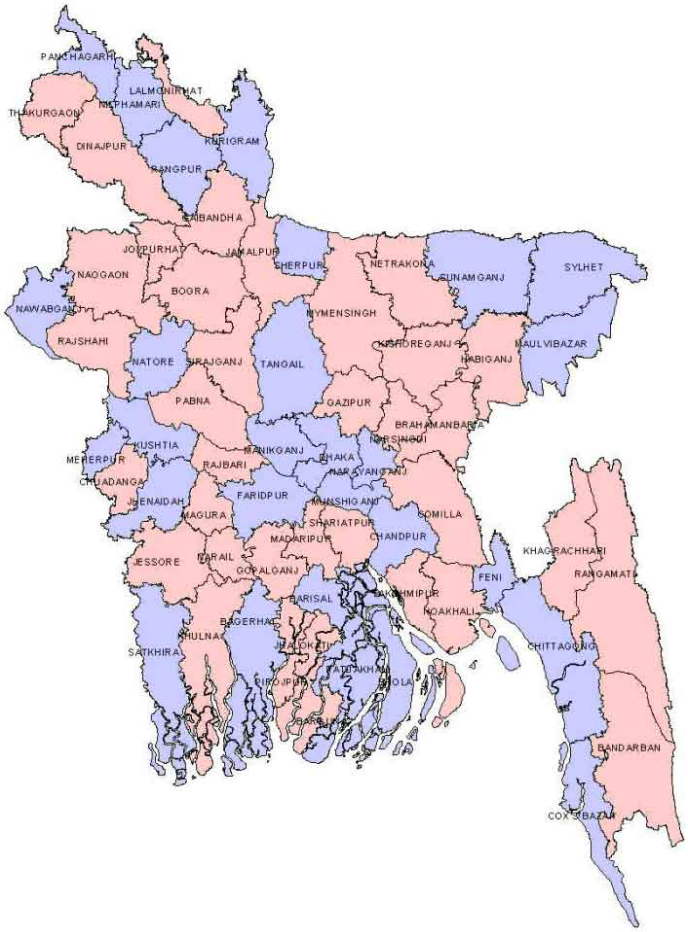


Figure 3: Bangladesh *zilas*.

LANGUAGE

The official language of Bangladesh is *Bangla*, although English is widely spoken and understood. Arabic is read and spoken for religious purposes.

EDUCATION

The education sector consists of five sub-sectors: i) Early Childhood Development, Pre-school and Primary Education, ii) Secondary and Higher Secondary Education, iii) Technical and Vocational Education and Training, iv) Tertiary Education and v) Literacy and Non-formal Adult Education. Each of these is described briefly below:

cÖ`Ë n‡jv t

(1)

i) Early Childhood Development, Pre-school and Primary Education

Early Childhood Development, Pre-school and Primary Education have not been a part of publicly provided education. The government, recognizing the value of and demand for pre-

schools, has encouraged NGOs and communities to set up and support pre-schools within the premises or near primary schools. Access to primary education has increased steadily over the past two decades. The overall enrolment rate in primary education reached 97% in 2002, with net enrolment estimated at 80%. However, the rate of completion of the five-year primary stage is about two-thirds of those enrolled. The gender ratio in the enrolment is at 51:49 boys to girls. There are about 17.6 million students in Primary Education.

ii.) Secondary and Higher Secondary Education

Secondary and Higher Secondary Education is provided from grade 6 to 12 through collaboration of government and non-government providers within a regulatory framework. Enrolment is about 11 million, of which girls constitute 51.3%.

iii) Technical and Vocational Education and Training

Technical and Vocational Education and Training programmes offer courses of one to four years duration after the junior secondary level (Class 8) and Secondary level (Class 10). Courses are offered by vocational training institutes, polytechnics, commercial institutes, technical training centres and specialized industries. In 2002, about 134,000 students were enrolled in these courses.

iv) Tertiary Education

The major components of the Tertiary Education network in 2003 were the 21 public general and specialized universities, 52 private universities and 1500 colleges of different kinds affiliated with the universities. The University Grants Commission (UGC) is the regulatory body for universities.

v) Literacy and Non-formal Adult Education

The government launched a major non-formal education programme in 1990s, focusing on basic literacy in achieving universal coverage of youth and young adults aged 11 to 45 years. The census data of Bangladesh Bureau of Statistics reports the rate of literacy for the population 15 years and above to be 47.4%, a significant improvement over a rate of around 35% in 1990.

A number of universities provide courses in chemistry and soil sciences, which could contribute to development of national expertise on POPs (see Table 3 below). In 1994, about 17 colleges provided Chemistry Honours and M.Sc. level of education and 215 colleges had facilities for B.Sc. courses. Also in 1994, there were 12 Medical Colleges, including one dental college, which provided education in chemistry of a limited scope. Examples (Ahmed, 1997) include:

The Bangladesh University of Engineering & Technology in Dhaka, the country's leading technical university, offers advanced degrees, including in environmental and chemical engineering and has a Centre for Environmental Research and Management (CERM).

- Dhaka University, the oldest and largest university in Bangladesh, has departments of chemistry, pharmacy and biochemistry.
- Jahangirnagar University in Dhaka has departments of chemistry and pharmacy.

As discussed in Section 2.3.10, Bangladesh universities (as well as government and private sector facilities) would need to upgrade their analytical capacity to perform POPs analysis consistent with international standards.

2.1.3 Profiles of economic sectors

Table 3. Bangladesh Institutions involved in Environmental Education, 1994

Primary Schools	Integrated elements of local environment
Secondary Schools	Integrated curriculum
Higher Secondary level	No specified curriculum
Undergraduate level	No curriculum at college level
B.Sc. Honours level	Both as major and minor subjects exist. Course contents vary from university to university.
Post-graduate levels	Compulsory and optional courses in Environmental Chemistry
Research	Research in the field of environmental chemistry at the departments of Chemistry and Applied Chemistry, Chemical Engineering, and at research institutions.

Source: Haider, S.J, 1994, updated 1998.

Universities specializing in agriculture include the BMSR Agricultural University, and the Bangladesh Agricultural University. The University of Chittagong has an Institute of Marine Science.

2.1.3 Profiles of economic sectors

Bangladesh, once plagued by famine and dubbed as “the test case of development”, has achieved a wide range of social and economic successes. While these gains are modest in relation to the magnitude of the overall problems that the country faces (poverty; size of population and growth rate relative to challenges of self-sufficiency; vulnerability to natural disasters, etc.), Bangladesh has defied the gloomy predictions that dominated global discourse about country’s long-term prospects until quite recently (Ministry of Finance, 2003). In particular, Bangladesh has achieved self-sufficiency in rice, its main cereal, while production of other grains (e.g., wheat) has also increased and the economy generally has become more diversified (e.g., livestock, poultry and fisheries sectors have shown substantial gains).

These gains have been manifested throughout the economy, including with respect per capita GNP growth (2% per year), and social gains (declines in poverty, infant mortality and rise in literacy as discussed above). Such successes are attributed to a mix of policy changes at both the macro and sector levels. These include government financing of rural infrastructure, an increase in rural

electrification (although still very small with just 10% of rural areas receiving electricity ((EIA, 2004)), an agricultural market that is the least subsidized in South Asia, and a public food distribution system that has moved from mass to localized distribution so as to target food to the poor via a "safety net" programme, with the result that 85% of public food reaches the poor, an increase of about 46% over 1992 (USAID, 2000).
Bangladesh is also heavily reliant on foreign aid, which provides it with an estimated 40% of government revenues and 50% of foreign exchange (EIA, 2004).

Economic indicators for Bangladesh are shown in Table 4 below. The fiscal year is July 1 to June 30. A more detailed portrait of the country's economy and sectors is provided below.

Table 4: Economic indicators of Bangladesh

Indicator	Year	Data
GDP per capita, 000US$	2003	389
Population, million	2004	140
Industrial production (% of GDP)	2003-04	25
Agricultural (% GDP)	2003-04	26
Inflation rate (%)	2004 (April)	5.75
Exports, bln. US$ (f.o.b.)	2003	6.492
Imports, bln. US$ (c.i.f.)	2003	8.707
Foreign exchange reserves bln. US$	2003	2.471

Sources: Bangladesh Bureau of Statistics, BBS, 2003, 2004; Planning Commission, *Unlocking the Potential*, *National Strategy for Accelerated Priority Reduction, Planning Commission*, GoB, 2004; U.S. Department of State, Bureau of South Asian Affairs, 2004.

Bangladesh is the largest exporter of jute and jute goods in the world, although this market is currently in decline. Readymade garments are among the most exportable items, accounting for 75% of exports in 2004 (ADB, 2004). Frozen foods (shrimp, fish) accounted for 4% of exports in 2004 (ADB, 2004), raw jute and jute goods for 4% and leather goods for 3% (ADB, 2004). Tea and handicrafts are also major exportable commodities. Export growth in FY2004 was 15.9%, compared with 9.5% in the previous year, with garments, knitwear, textiles, and frozen food accounting for the growth (ADB, 2004). Major export partners in 2002 were the United States (27.6%), Germany (10.4%), UK (9.8%), France (5.7%), and Italy (4%) (CIA World Fact Book, 2004).

Import growth declined slightly in FY2004 12.6% from 13.1% a year earlier. As the rise in imports offset that in exports, the trade deficit widened slightly to $2.3 billion in FY2004 from $2.2 billion (ADB, 2004). Major import partners in 2002 were India (14.6%), China (11.6%), Singapore (11.5%), Japan (7.6%), Hong Kong (5.4%), and South Korea (4.3%) (CIA World Fact Book, 2004).

AGRICULTURE

Agriculture is the backbone of the Bangladesh economy, with production accounting for about one third of the country's gross domestic product and 32% of its export earning. It is the single largest contributor to income and employment generation in Bangladesh, providing jobs in 2000 for 36 million of the 58 million people employed (ADB, 2004). The sector plays a vital role in the country's challenge to achieve self-sufficiency in food production, reduce rural poverty and foster sustainable economic development.

Crops: An estimated 3.4 million hectares or about 57.9% of Bangladesh's total land area is arable or under cultivation (World Resources Institute, 2003). Crops account for 13.4% of the agricultural output (Bangladesh Bank, 2004). Rice, the main crop, accounts for nearly 82% of all cultivated land. In 2003, 24,299 metric tonnes of rice were harvested from 13 million hectares (about 82% of the nation's total cropped hectares), placing Bangladesh among the world's leaders in rice production (BBS, 2003). Rice is grown in three overlapping seasons: *Boro* (November to April), Aus (B. Aus from March to August and T. Aus from April to September), and *Aman* (June to December) (BRRI, 2004).

After rice, the leading crops in 2003 were sugarcane, jute (the principal cash crop), pulses (an important contributor to the diet), oilseeds (mainly for cooking), condiments and spices, tobacco and tea (ADB, 2004). Also grown are wheat (1.8 million metric tons in 2000), cotton, potatoes, sweet potatoes, and the plantation crops bananas, coconuts, jackfruit, mangoes, papaya and pineapples and tea. Production of cereals increased 2.4% per year between the early 1980s and late 1990s, primarily because of use of high-yield varieties (HYV), coupled with dry-season irrigation and increased use of fertilizer.[11] Jute is grown principally in the flooded areas of the Jamuna-Padma-Meghna Delta. This crop is, however, in the midst of a decline, owing to global competition, including from synthetics. Tea is grown in the northeast around Sylhet.

Most farming is subsistence, carried out on small plots. There are 17.83 million farm holdings in the country. The farm holdings, even where described as median or large by Bangladesh standards, are very small by western standards. Small farm holdings (0.20 to 1.0 hectares size) predominate, covering 52.85% of cultivated land, followed by medium farm holdings (1.0 – 3.0 hectares) covering 11.65%, and large farm holdings (more than 3 hectares in size), covering 1.67% of tilled acreage (BBS, 2002). In general, landowners operate their own farms. Exceptions include some large and medium farmers, some of whom may lease some of their lands on a sharecropping basis or at a fixed rate on season or annual terms to small or marginal farmers or landless employees.

Livestock sub-sector: The livestock sub-sector, which contributed 2.9% to agricultural output in 2003 (Bangladesh Bank, 2004), includes poultry, beef and dairy farms. This sector is growing, although production is still constrained by factors such as disease, genetics, shortage of land for pasture, and inadequate feed supplies. Production is dominated by small farmers who are relatively unfamiliar with basic animal nutrition, feed value of different sources, disease control and breed selection. Total livestock and poultry are estimated at 32,557,551; individual holdings are small at just 3.55 head per holding (BBS 2002). The Government's recent strategy is to increase output of animal products by improving animal health and introducing modern methods of production, expanding technical skill of farmers, and building supportive policy framework and infrastructure. Commercial poultry, beef and dairy farms are promoted in areas around large cities, as well as in rural areas, to meet the demands of urban consumers and create links with export markets (Ministry of Finance, 2003).

[11] Fertilizer use is reported to have tripled over the last decade (West, 2000).

Fisheries sub-sector: Fish are an important source of protein in the Bangladesh diet, contributing from 61% to 71% of the daily per capita protein supply for the Bangladesh population, although this is down from 95% in the 1940-50s and 80% before 1980 (FAO 1999, UNEP, 2001). In 2003, the fisheries sector contributed 5.9% to the country's total agricultural output (Bangladesh Bank, 2004). Additionally, growth in some segments of this sector is contributing to export earning and diversification of the Bangladesh economy.

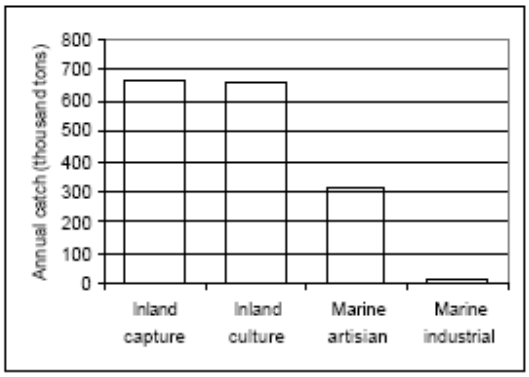
In 1996, the sector contributed 4.7% to the GDP, accounted for 6.9% of agricultural GDP and 11% of all export earnings (UNEP, 2001, citing Ahmed and Ali, 1996). In 1997, the fourth leading export item in Bangladesh was frozen shrimp and fish, which accounted for 7.3% share of the total export market. The major importers at the time were the European Union (EU), accounting for 34–50% of Bangladesh's exports, the United States at 23–38%, and Japan at 15%–26% (IFPRI, 2003).

The average annual growth rate of the fisheries sector in the recent past has been about 6.5%, which is likely to increase due to the growing demand for fish and fish products (Parveen, 2000). The sector supports more than two million people full-time (fishermen, traders, transporters, packers, etc.) (UNEP, 2001) and provides more than 12 million people with part-time employment. Almost all of the population living in coastal communities make their livelihood from fishing. (FAO, 1999).

Despite the gains and importance of this sector to the country's GDP, total fish production in the country in 2002 was estimated at just 2.3 million metric tons (t), of which 850,000 t (37%) was from inland freshwater aquaculture, 750,000 t (33%) from inland capture fisheries, 590,000 t (26%) from marine capture fisheries, and 95,000 t (4%) from coastal aquaculture (ADB, 2004, citing DOF, 2003).

The inland freshwater fishery has declined to about 50% in the past three decades, or a decline of about 1.24% per year (UNEP, 2001, citing Ahmed, 1995b). The decline is attributed to a variety of human stresses, including large-scale water abstraction for irrigation, construction of flood control dams, siltation of rivers and other open water bodies, pollution from agriculture runoff, industrial effluent, and municipal waste, capture of juvenile breeding stock, and ineffective conservation policies (FAO, 1999; UNEP 2001). The 2000 World Conservation Union Red List includes 54 threatened species of fish in Bangladesh (UNEP, 2001). In the past, farmers used to catch naturally-occurring fish in their rice fields, which retain water during the monsoon season (4four to six months of the year). As high-yield rice varieties requiring pesticides became popular, fish disappeared from rice fields. In the 1990s, farmers began stocking fields with fast-growing fish species, obtaining yields of 0.1t/hectare (FA0, 1994).

Figure 4. Fisheries sector catch 1998.



Source: Parveen 2000, citing Bangladesh Bureau of Statistics, 1998.

The decline in inland fisheries has been somewhat compensated for by an increase in production from marine fisheries, in particular coastal fisheries (FAO, 1999). Around 95% of marine fisheries production (based on a sector figure of 28%) is estimated to come from artisanal fishing practised on the extensive continental shelf. Industrial trawling, which began in 1971, accounts for the remaining 5% and is mostly concentrated on shrimp capture. However, marine fisheries are also under stress from overexploitation, environmental constraints and competing uses of coastal resources (FAO, 1999).

Over the past two decades, there has also been a dramatic increase in inland freshwater aquaculture production. There are about 147,000 hectares of aquaculture ponds in Bangladesh, of which some 60% are cultured (FAO, 1999). Inland fisheries shrimp production in 2001 was 0.109 million MT (7.77%), while *Hilsha* contributed 0.075 million MT (5.35%). The remainder or 1.218 million MT (86.86%) included, among others, the *Rui, Katla, Mrigal, Ghania, Kalbasu, Kali*, Silver, Common Mirror and Grass Carp, *Rita, Boal, Shol, Gazar, Koi, Singhi*, and *Magur* (ADB, 2004, citing DOF, 2003). Freshwater aquaculture production contributes an estimated $700 million/year to the rural economy (ADB, 2004, citing DOF, 2003).

International donor supported projects have played a major role in national projects aimed at development of the fisheries sector. For example, the World Bank estimates that more than two thirds of the total expenditure in the fisheries sector has been carried by sector development projects. The World Bank, therefore, acknowledges the role of donors in growth of fisheries, as well as the need for coordination between donors in fisheries-related activities to increase the relevance and the effectiveness of their programmes. Major players in the field are the World Bank, the United Kingdom Department of International Development (DFID), and the Danish International Development Agency (DANIDA). Non-governmental organizations (NGOs) are also active in popularizing a rice-fish culture.

Based on 1998 National Fisheries Policy, the Government has initiated measures to address several sectoral concerns. For example, three national projects – called the 1st, 2nd and 3rd fisheries projects – and a 4th fisheries project in progress (all funded with support from the World Bank) are aimed at rehabilitation of depleted inland water stocks and enhancement of the productivity of floodplains

through large-scale stocking programmes and aquaculture development (FAO, 1999). Under the 4th fisheries project, the Government is continuing to implement mitigation measures to minimize the negative impact of unplanned installation of water management structures on floodplain fisheries. To promote fish production in inland water bodies the government will promote good management, quality control, and adoption of improved technologies in farming and hatcheries. Efforts aimed at increasing shrimp production and export include enhanced enforcement of regulations on land and water use, adoption of sanitary and phytosanitary measures, strengthening infrastructure and information dissemination (GoB Ministry of Finance, 2003).

Chittagong is a main landing site for marine and inland fisheries, as well as aquaculture products. Barisal, Noakhali, Comilla and Mymensingh are major landing places for inland fisheries and aquaculture (FAO, 1999).

Power generation

In 1947, power generation and distribution of the then East Pakistan government was owned by private-sector firms, whose services were limited to 17 districts. Total power generation capacity was 21 Megawatts (MW). In 1948, an Electricity Directorate was created to develop power on a national basis. The directorate was subsequently merged in 1959 with the Water and Power Development Authority (WAPDA) created in that year. In 1959, three electrical generating plants were built at Siddhirganj, Chittagong and Khulna. In 1962, the Kaptai dam was constructed and the Karnafuli hydroelectric power station and 132 KV Dhaka-Chittagong transmission line installed. Subsequently, in the mid-sixties, natural gas was discovered at Titas and the Ashugon/Shahjibazar power stations, commissioned with capacities of 64 + 64 and 105 MW. Collectively, national power capacity as of 1971 was 224 MW. From the seventies until the present day, additional transmission and distribution lines of 827 km, 132 km, 167 km, 2,357 km, 33 KV, 6,653 Km and 11/4KVV were established. A privatization policy introduced in 1996 aims to achieve universal electrification by 2020 (EIA, 2004).

As of 2005, total installed power generation capacity is 4,861 MW, as contributed by the following sources:

- Steam turbine: 2,448 MW (62.1%)
- Gas turbine: 724 MW (17.3%)
- Hydro: 230 MW from 18 power stations (6.47% total capacity)
- Combined cycle: 180 MW (5.0%)
- Diesel (29 MW) (0.8%)

Of the total installed capacity, about two-thirds are available. Problems in the Bangladeshi electric power sector include high system losses (up to 40%), delays in completion of new plants, low plant efficiencies, natural gas availability problems, erratic power supply, electricity theft, blackouts, shortages of funds for needed maintenance at the country's power plants and other power infrastructure, and unwillingness of customers to pay bills. Currently 20% of the population (25% in urban areas and 10% in rural areas) have access to electricity. Per capita commercial energy consumption is among the lowest in the world. The World Bank has estimated that Bangladesh loses around $1 billion per year in economic output owing to power outages and unreliable energy supplies (EIA, 2004).

Natural gas accounts for an estimated 66% of commercial consumption, with the remainder mostly oil, as well as limited amounts of hydropower and coal (EIA, 2004). Extensive development of natural gas began in the 1990s after vast reserves both onshore (Chattack Field) and offshore in the Bay of Bengal were discovered. The country is thought to have sufficient additional reserves such that it could become a major gas producer.

Oil reserves are small (56.9 million barrels with production of 7,000 barrels per day (bbl/d), of which 6,000 bbl/d is crude oil). Bangladesh has one refinery; a 33,000-bbl/d unit at Chittagong Natural gas is Bangladesh's only significant source of commercial energy, with 2002 production of 384.9 billion cubic feet (Bcf) (EIA, 2004).

Bangladesh began its first significant coal production in April 2003 via its new Barapukuria Coal Mine in the Dinjapur area of northwest Bangladesh. The project, backed by Chinese investors, is anticipated to produce one million short tons of coal annually for electricity generation (EIA, 2004).

Non-commercial energy sources, such as wood, animal wastes, and crop residues provide more than half of the country's energy consumption. Consumption of wood for fuel has contributed to deforestation and other environmental problems in Bangladesh.

Under the nation’s new Power Policy, which aims “to provide access to affordable and reliable electricity to all by the year 2020” plans are in progress to increase generation capacity by five-fold to a benchmark estimate of about 15,000 MW and to expand the electrical grid and distribution network. The Bangladesh Power Sector has been restructured under the policy into the following organizations:

i) *Bangladesh Power Development Board (BPDB)* — responsible for generation and distribution of electricity. BPDB's distribution jurisdiction covers mainly urban areas, except the Dhaka. Retail sales account for about 40% of the total electricity retail sales.
ii) *Rural Electrification Board (REB)* — responsible for distribution of electricity in rural areas through a system of co-operatives known as Palli Biddyut Samities (PBS). It purchases power from BPDB. Its retail sales account for about 21% of total electricity retail sales.
iii) *Dhaka Electric Supply Authority (DESA)* — responsible for distribution of electricity in greater Dhaka City except Mirpur, Gulshan, Banani, Baridhara areas. Retail sale account for about 39% of total electricity sales.
iv) *Dhaka Electric Supply Company (DESCO)* — established under companies Act of 1994 is responsible for distribution of electricity, in particular areas of Mirpur, Gulshan, Banani, and Baridhara of Dhaka City.
v) *Power Grid Company of Bangladesh (PGCB)* — responsible for operation of grid network of transmission lines, including sub-stations.
vi) *Independent Power Producers (IPP)* — There are number of Independent Power Producers who generate and sell power to the Bangladesh Power Development Board.

INDUSTRY

The industrial sector contributed 27.2% of the GDP in 2003, of which manufacturing accounted for 16% (11.3% large and medium-scale and small-scale 4.7%), followed by construction (8.6%), power,

water supply (1.5%) and mining (1.1%) (Bangladesh Bank, 2004). Industrial production growth averaged more than 6% from 1995-2000. Industrial output for FY 2003 was estimated at 7.79%, while manufacturing expanded by 7.4%, from 6.8% the previous year (Bangladesh Bank, 2004). The manufacturing sector employed four million, and mining .4 million in 2000 (ADB, 2004).

Large-scale industries based on both indigenous and imported raw materials include jute and cotton textile production, paper and newsprint production; sugar refining, cement, chemicals, fertilizer and tanneries. Other notable industries are engineering and shipbuilding, iron and steel, including re-rolling ills, oil refining, paints, dyes and varnishes, electronic cables and wires, electric lamps, fluorescent tube lights, other electrical goods and accessories, matches and cigarettes. Cottage industries include handlooms, carpet-making, shoe-making, coir, bamboo and cane products, earthenware, brass and bell metal products, *bidi* and cheroots, small tools and implements, etc. Natural gas production is the primary mining activity in Bangladesh.

Production by selected industrial commodities for the years 1981-87 and 1993-2003 is shown below in Tables 5 and 6, respectively.

Table 5. Production of selected industrial commodities, selected fiscal years 1981-1987

(in millions of tons unless otherwise indicated)				
Commodity	**1981**	**1983**	**1985**	**1987[1]**
Textiles[2]				
Cotton cloth (1,000 meters)	78,612	59,741	62,590	59,410
Cotton yarn (1,000 kilograms)	46,235	45,237	48,139	45,141
Sacking	309,535	241,647	222,595	248,020
Carpet backing	71,276	93,966	80,922	80,308
Synthetic yarn (1,000 kilograms)	1,499	1,381	1,546	1,059
Paper products				
Newsprint	30,902	26,741	45,972	46,643
Particle board	1,228	543	2,308	2,502
Chemicals and fertilizers				
Urea	341,734	371,008	741,463	846,458
Ammonium sulfate	9,233	12,282	9,634	9,316
Caustic soda	5,984	5,685	6,811	8,331
D.D.T.* (metric tonnes)	1,016	412	1,252	911
Paints and varnish (gallons)	424,370	405,784	583,088	635,502
Cycle tires and tubes (dozens)	16,145	12,621	28,236	29,683
Cement	344,830	306,688	240,176	309,677
Steel ingots	139,343	47,401	101,149	82,081
Ceiling fans (units)	83,760	93,694	128,045	122,998
Television sets				

Black and white (units)	26,314	33,452	56,316	60,730
Colour (units)	0	174	706	14,341
Transportation equipment (units)				
Trucks	1,297	0	257	456
Buses	508	56	54	400
Automobiles	0	0	0	50
Jeeps	451	0	226	180
Motorcycles	6,122	3,167	17,334	10,469
Bicycles	28,214	13,338	14,712	16,917

[1] Projected.

[2] Includes ready-made garment production.

*MT correction for DDT output added by RFI.

Source: U.S. Library of Congress, based on information from Bangladesh, Ministry of Planning, Bureau of Statistics, Statistics Division, *Statistical Yearbook of Bangladesh, 1987*, Dhaka, July 1988, 246-49.

Table 6. Bangladesh production of major industrial commodities 1993-2003

(Other than jute goods)

PERIOD	Cotton Yarn[a]	Cotton Cloth[a]	Paper [b]	Newsprint [c]	Cigarettes[a]	Oil Products[a]	Food products[a]	Sugar[c]	Fertilizers[c]	Chemicals[c]	Glass sheets[c]	Iron and Steel[d]	Matches[a]	PERIOD
	'000' Bales	'000' Metres	Metric Tons	Metric Tons	Lakh Sticks	Metric Tons	Metric Tons	Metric Tons	Metric Tons	Metric Tons	'000' sq. Metres	Metric Tons	'000 Gross	
1993-94	3,21	3,15,50	44,391	47,423	1265,50	32,831	60,557	2,20,187	23,66,120	9,073	10,02	27,810	14,565	1993-94
1994-95	2,73	1,69,84	39,733	43,062	1737,90	29,704	69,234	2,69,566	2,142,301	8,852	8,08	69,914	11,817	1994-95
1995-96	2,77	1,02,79	41,889	40,479	1,622,20	30,569	60,591	1,84,108	2,248,042	9,327	18,65	47,658	12,461	1995-96
1996-97	2,79	10,904	38,018	27,675	1860,10	26,033	61,526	1,35,094	17,72,661	8,937	16,42	32,277	11,656	1996-97
1997-98	2,94	1,02,55	38,241	7,672	1988,90	26,955	63,068	1,63,792	20,30,672	12,433	13,35	33,178	11,917	1997-98
1998-99	3,04	1,11,55	38,289	21,573	1955,80	25,911	68,268	152,597	17,99,357	14,261	12,72	20,045	10,937	1998-99
1999-00	325	12,410	37,036	17,947	197,320	31,007	73,080	123,419	19,04,022	14,499	17,64	-	11,299	1999-00
2000-01	338	14731	39,950	11,157	201,200	31,193	76,633	96,300	2073,744	14,217	2,036	-	11,174	2000-01
2001-02	336	15,860	37,387	2,985	203,440	31,088	7,8891	204329	1,750,542	14083	2,000	-	12,049	2001-02
2002-03	358	17,834	30,262	-	204,180	31,833	80,005	177,397	2,263,518	5981	2,179	-	12,127	2002-03

[A] BBS - cotton yarn, cloth, cigarettes, oil products, food products and matches

[b] BCIC - paper

[c] BSFIC – sugar, newsprint, fertilizers, chemicals & glass sheet

[d] BSEC - iron and steel

Notes:

i) oil products = soybean + mustard oil up to July, 1991 & soybean + vegetable oil (dalda) from august, 1991

ii) fertilizer = urea + ammonium sulphate + tsp & ssp (ssp include from Nov. '90)

iii) Chemicals = Caustic Soda + Liquid Chlorine + HCl + Bleaching Powder + DDT* (*DDT in 1993-1994 only)

iv) Iron & Steel = Steel ingot + Billet 110/85 mm + Billet 50/85 mm + MS plate (thin & Heavy) + MS Rod & Flat Bar.

v) Food Products = Atta, Maida, Suji & Bread & Biscuit up to July 1991 and Bread & Biscuit exclude from August 1991.

'P' = Provisional, '-' = No production. '... ' = Not available

Source: Bangladesh Bank, 2005.

TRANSPORT

The road network has grown from only 4,000 km in 1971 to 182,000 in 2004. It covers six categories: National highway; regional highway; *zila* road, *upzila* road, union road and village road.

The transport sector, in general, has expanded rapidly, both in terms of passenger and freight movement. The movement of passengers increased from 35 billion passenger kilometers (km) in 1984-85 to 72 billion km. in 1996-97. Freight movement increased from 4.8 billion-tonne kms to 10 billion-tonne kms during the same period.

However, despite the increase in freight, railway transport, supplied by the Bangladesh Railway or BR, declined from 502 stations and 2,746 mm of route in 1990 to 459 stations and 2,768 km of route in 2001 (BBS, 2001; BRTA, 2001). Similarly, inland water transport has not expanded in the last three decades. Large volume freight is prevented from realizing its full potential on inland waterways owing to siltation, lack of *ghat* berthing facilities and obstructions caused by low narrow bridges and irrigation channel sluice gates.

2.1.4 Environmental overview

Land-use practices, water hydrology, climate, seasonal changes, and the vulnerability of Bangladesh to natural disasters, etc., need to be taken into account when managing chemicals, for example, with respect to design and siting of facilities, including storage facilities and disposal/destruction installations, and disease vector control. In addition to the discussion below, the reader is referred to the *Bangladesh State of the Environment 2001* report prepared in response to Agenda 21 recommendations at the Earth Summit.

LAND DEGRADATION

Poverty, combined with rapid population growth, absence of a proper land use policy, and other driving forces have compelled people in Bangladesh to over exploit natural resources, including land. The functional capacity of the soil has deteriorated. Additionally, approximately 2.1 million ha of wetland have been lost to flood control, drainage and irrigation development, while severe erosion in catchments has contributed to increased siltation. Shrimp culture and expansion of agricultural settlement within *haor* wetland reclaimed for rice production have also reduced wetlands (UNEP, 2001)

Forest covers about 2.56 million ha of Bangladesh, including natural forest (about 31%) and forest plantation (13%), which includes tea and rubber gardens. Forestry as an industry contributes 1.9% to agricultural output (Bangladesh Bank, 2004). Within natural forests half are estimated to be under non-forest use. There has been an estimated loss of 37,600 ha from 1980-1990, a three percent reduction annually. Causes of deforestation include rapid urbanization and industrialization, population pressure for settlement and shifting cultivation (UNEP, 2001). Additionally, designations can be misleading. For examples, although a significant part of existing forest area is designated as State Forest, most of the land is barren of trees (UNEP, citing FMP, 1995). Deforestation in the Modhupur forest has accelerated owing to its closeness to Dhaka and increased access afforded by new and improved roads, as well as urbanization and industrialization in the area.

The extent of degradation varies according to reason, season and year. Land degradation in the Chittagong Hill Tracts (CHT) is occurring rapidly due to rapid changes in demography, traditional shifting cultivation, and development of urban infrastructure. Land degradation in the Barind Tract occurs because of over exploitation of agricultural lands. Soil degradation in flood plains is largely a result of increased agricultural production and dispersed industrial growth. The Sundarbans mangrove is under threat from rapid deforestation, saline water intrusion, wildlife poaching and other stresses (UNEP, 2001). Land degradation in coastal areas generally is mainly due to cycles and storms, but also to poor land use planning. During the dry season, saline intrusion is a problem.

WATER POLLUTION AND SCARCITY

The economic growth and development of Bangladesh are greatly influenced by surface and groundwater quality and seasonal availability. Availability of surface and groundwater is highly responsive to the monsoon climate and physiographic characteristics of the country.

With respect to surface water quality, many transboundary rivers receive and carry pollutants, including those received from upstream catchment areas. Within Bangladesh, most surface waters are polluted to a greater or lesser extent by runoff pollution from pesticides, fertilizers, other chemicals, oil and lube spillage in coastal areas, untreated industrial effluent, and untreated human wastes (UNEP, 2001).

Pollutant concentrations are typically higher in estuaries than in the main watercourses, owing to the reduced volume and flow of water. For the same reason, in the dry season, pollution is more pronounced, particularly in the country's industrialized areas, (primarily around Dhaka and Chittagong). In recent decades, major river water levels in the dry season have shown a declining trend. There is practically no water flow during the dry season in small tributaries and distributaries (UNEP, 2001).

Surface water quality relates not just to the quality of the water itself, but also to the diffusion of pollutants within the water column and sediment (and during flooding, deposition of some portion of pollutants on the land). The aquatic environment, including for living organisms, is therefore affected, with some substances, such as POPs (as discussed above) accumulating in tissues of organisms and concentrating up the food chain.[12]

Except for the Dhaka area, inland surface water quality is in the monsoon season is within the standard set by the Bangladesh Department of the Environment (DoE) for those parameters it measures (which do not include chlorinated pesticides). However, at other times, surface water standards for coliform (fecal material), especially in rural areas, exceed national standards for any domestic use (UNEP, 2001). Waters in Dhaka and surrounding rivers and tributaries is not considered fit for human consumption at any time of the year, owing to pollution from human, industrial and agricultural wastes (UNEP, 2001).

[12] While Bangladesh uses fewer pesticides than developed nations, application practices and seasonal flooding contribute to pesticide runoff, as discussed in Section 2.3.1.

Systematic national monitoring for pesticides (POPs or other types),[13] or for industrial chemicals (which could in some instances include PCBs), in surface waters, sediment or in aquatic organisms, whether in freshwater or marine coastal systems, has not been undertaken in Bangladesh. Following a ban in 1977 on importation and use in agriculture of the six pesticide POPs used in Bangladesh (all but mirex and toxaphene) and of most other POPs (except endosulfan), one could anticipate that environmental concentrations resulting from their former use would decline. However, data is insufficient to draw conclusions regarding POPs contamination of Bangladesh freshwater or river systems, including the biota they support.

AIR POLLUTION

The ambient air quality of Bangladesh is clean overall. However, in urban areas, air quality has deteriorated due to human activities. The two major sources of air pollution in Bangladesh today are vehicular and industrial emissions, both concentrated mainly in cities. Urban air quality monitoring data indicates suspended particular matter in Dhaka and Chittagong exceeds the threshold limit set by the Department of Environment. Several important steps have already been taken to begin to address urban air pollution, with the initial focus on vehicular traffic.

Vehicular emissions: As of July 1999, the Government of Bangladesh executed a decision that only unleaded gas may be produced and used in Bangladesh. Additionally, after the DoE and other concerned agencies and organizations identified the two-stroke engines used in auto rickshaws, tempos and mini tracks as a significant source of hydrocarbons and particulate matter, these vehicles (representing 35,000 of Dhaka's 200,000 motor vehicles) were replaced in 2002 with CNG (Compressed Natural Gas) four-stroke-engines.

Industrial releases: Industry remains a small sector within the Bangladesh economy but is growing. Along with industrial growth have come environmental problems that increasingly the focus of government efforts to control and correct. However, at this time, comprehensive data on total pollution loadings from manufacturing and processing facilities to water or air, and pollution intensities from industry does not exist for Bangladesh (or for Asia generally) relative to many of the industrial pollutants they generate.

Estimates of the total number of industrial facilities vary. By one recent estimate, there are 6,000 large and medium industries and 24,000 small industries in Bangladesh, most of which discharge untreated effluent directly to rivers (IEDS, 2003). Most industrial plants are located in populous urban areas, with the majority of facilities clustered in Dhaka and Chittagong.

One report on industrial pollution generally suggests it will continue to increase concordant with growing industrialization, with the exception of toxic metal emissions owing to sector decline since the 1980s. The report estimates that by 2011, 81% of releases will be to air, 19% to land and 1% to water (Faisal, *et al*., n.d.). A number of industrial activities, particularly those that utilize chlorine in

[13] As much as 25% of annual pesticides used in Bangladesh may end up in water bodies eventually discharging into the Bay of Bengal (Praveen).

their processes, have the potential to generate dioxins and furans that can be released in effluent or to the air (with estimates of releases from such sources noted in Section 2.3.4).

Annual discharges to water by the industrial sector are estimated at 50,000 tons of BOD and 106,000 tons of total suspended solids. The most polluted rivers flowing around major urban or industrial areas are the Buriganga, the Sitalakhya, the Karnafuli and the Bhairabi/Rupsa rivers. In addition, ports, shipyards (20 of them in the Chittagong area) and a 70 registered ship recycling, scrap and scrap-handling enterprises in Mongla and Chittagong cause significant pollution (e.g., of oil) to local water bodies that eventually affect the coastal waters (Faisal, et. al, 2001; Rahman, 1999). A 2003 study by the Institute for Environment and Development Studies (IEDS, 2003), Dhaka, provides the following information on diffuse pollution from industrial sectors as correlated to specific rivers:

A 2000 report (Hossain, M.D.) sites the following environmental problems within industrial estates:

- Lack of indoor treatment plants
- Lack of Environment Management Systems
- Lack of proper technology for construction of treatment plants
- Inadequate drainage systems and congestion of drains
- Absence of control treatment plant at end of outlet
- Lack of understanding of ISO and its functions
- Air pollution
- Solid wastes disposed of without provision inside of estates
- Liquid wastes draining directly into pools and rivers
- Small entrepreneurs reluctant to invest in inside treatment
- Workers poorly trained and inadequate protective clothing

The incidence and range of vector-borne diseases (e.g., malaria, kala-azar, dengue fever and schistosomiasis) are expected to increase with global warming. Populations that are affected for the first time in tropical Asia by these diseases are expected to experience the highest case-fatality rates because of their lack of naturally acquired immunity. Seasonal malaria is expected to increase, with those nations that are unprepared or which have non-immune populations most at risk of epidemics. One study suggests that infected persons lose five working days per infection cycle with implications for the general economy as the range of malaria spreads (UN IPPC, 2000, citing Picard and Mills, 1992), while the cost of treatment would rise with the greater number of people requiring treatment. A 1992 study estimates a complete course of treatment in rural Bangladesh costs one month's wage for an agricultural worker (about US$40), or roughly one-fifth of overall per capita income (UN IPPC, 2000, citing ISPAN, 1992).

BIODIVERSITY

Biological resources and diversity form the basis of both the ecology and economy of Bangladesh. The country’s agriculture, including fisheries and livestock, along with a number of other sectors, are heavily dependent on biological resources.

Bangladesh possesses good terrestrial and aquatic resources that provide habitat for a large number of plants and animals. Rivers and other inland waters support 266 inland fish species and 150 species of

birds. Inland waters provide habitat for 56 species of prawns. Marine waters harbor 442 species of fish, more than 36 species of marine shrimp, and about 336 species of mollusks. However, this biological diversity is under threat from destruction of habitat (e.g., encroachment upon natural forests and loss of wetlands), including from changing land-use patterns and use conflicts that lead to over exploitation of flora and fauna, and also indiscriminate use of agrochemicals and industrial pollution. For example, several decades ago, there was an abundance of inland freshwater fish capture that contributed to meeting the protein needs of the populace. However, as noted in the previous discussion of fisheries, this resource has declined 50% in three decades (see also the discussion of agrochemicals' influence on this decline in Section 2.3.1).

Bangladesh places considerable emphasis on the linkages between biodiversity and sustainable development. It signed the Convention on Biological Diversity in 1992 and ratified it in 1994. Nationally, biodiversity is emphasized in the government's Forest and Environment Policy.

NATURAL DISASTERS

Bangladesh is a disaster prone nation owing to its geographical setting. Seasonal floods cover some 30%-35% of the total land surface (primarily the central region) each year during the wet monsoon. These normal floods are considered a blessing for providing vital moisture and fertility to the soil through deposition of alluvial silt. However, when the magnitude of floods is unusually high and they inundate large areas, they cause widespread damage to crops and property. For example, unusually high floods occurred in 1988, covering 100,000 square km, affecting three million people, and resulting in loss of life of 1,200 people, 27,000 cattle and 2.2 million tons of crops.

Cyclones, which occur mainly in May and November, and storm surges, cause significant destruction in coastal areas. Cyclones originating from the Bay of Bengal account for 75% of the damages by cyclones globally. For the period 1961 to 1991 there were 16,000 deaths annually caused by cyclones and induced high tides (JICA, 1999).

The northwestern part of Bangladesh is vulnerable to drought. Additionally, severe land erosion occurs along the banks of major river systems within the country.

While natural disasters cannot be prevented, the government and community-based organizations are working to mitigate the damage they cause through planning for disaster management and adaptation.

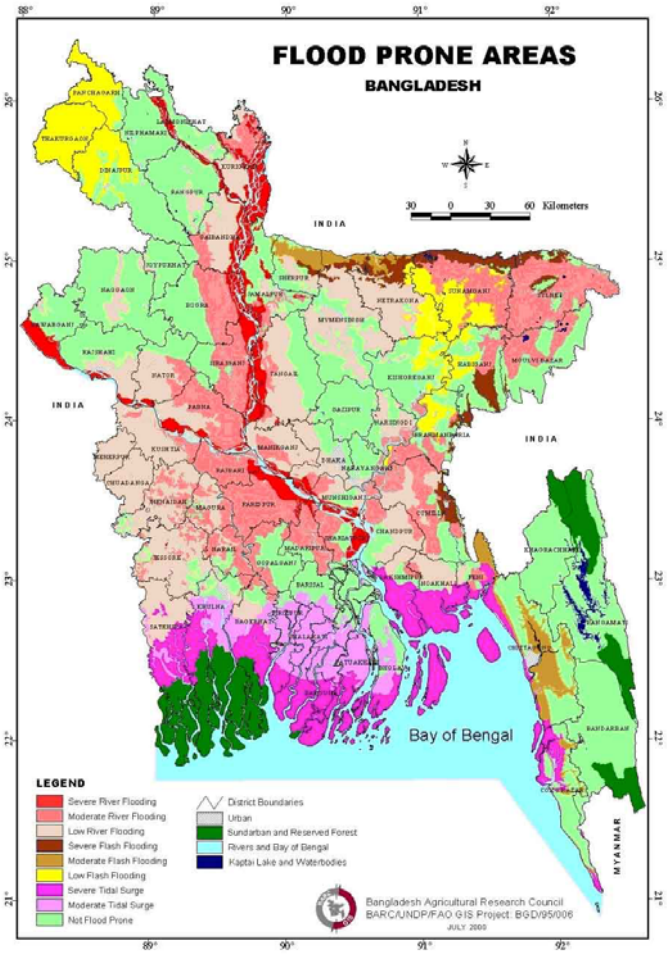


Figure 5: Flood Prone Areas of Bangladesh.

Source: Bangladesh Agricultural Research Council. GIS Project, BGD /95/006, BARC. Downloaded from FAO, Gateway to Land and Water Information. Bangladesh Country Report. Map 2.6.1. Map of Flood Prone Areas. Last updated 9 December 2004. http://www.fao.org/ag/agl/swlwpnr/reports/y_sa/z_bd/bd.htm#overview

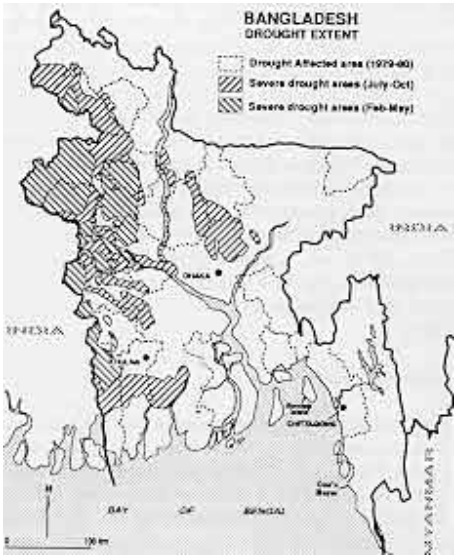


Figure 6. Drought prone areas of Bangladesh

Source: FAO, 2004.Climate change

CLIMATE

Bangladesh, as a delta nation, is expected to be one of the countries that will be hardest hit by the impacts of climate change. By 2050, the temperature in Bangladesh could rise by 1.5°-2.0°C. Were this scenario to occur, coupled with global changes, Bangladesh could experience 10% to 15% more rainfall by 2030. One report predicts that a one-metre rise in the sea level would result in loss of 22,889 sq km of land, or about 15.8% of the total area of Bangladesh. Coastal areas could experience erosion and flooding as tidal action becomes more intensified, with salinization reaching further inland to contaminate groundwater and render some areas of land infertile, while also contributing to a decline in freshwater fisheries. Weather cycles would be typified by more extreme draught and flood cycles and extreme weather events (cyclones, hurricanes, etc.) could become more severe and more frequent (Bangladpedia, 2002; UN IPCC, 2004).

The incidence and range of vector-borne diseases (e.g., malaria, kala-azar, dengue fever and schistosomiasis) are expected to increase with global warming. Populations that are affected for the first time in tropical Asia by these diseases are expected to experience the highest case-fatality rates because of their lack of naturally acquired immunity. Seasonal malaria is expected to increase, with those nations that are unprepared or which have non-immune populations most at risk of epidemics. One study suggests that infected persons lose five working days per infection cycle with implications for the general economy as the range of malaria spreads (UN IPPC, 2000, citing Picard and Mills, 1992), while the cost of treatment would rise with the greater number of people requiring treatment. A 1992 study estimates a complete course of treatment in rural Bangladesh costs one month's wage for an agricultural worker (about US$40), or roughly one-fifth of overall per capita income (UN IPPC, 2000, citing ISPAN, 1992).

2.2 Institutional, policy and regulatory framework.

2.2.1 Environmental policy, sustainable development policy and general legislative framework

This subsection gives an overview of the present institutional and legal framework of Bangladesh. It discusses legal initiatives necessary to effective implementation of a NIP, providing a short description of the environmental policies and legislative framework, roles of relevant agencies, international commitments and existing legislation related to POPs management.

At the national level, policy embraces general goals, acceptable procedures and actions to achieve goals. Policy provides a basis for formulation of strategies, plans, legislation and other framework documents. These are institutional documents of the concerned ministries of the government. They represent broad outlines of activities fulfilling goals of the ministries as per official mandates. Generally, the ministries initiate the policies with the assistance of their attached agencies, directorates, departments and other related organizations. Draft policies prepared by a ministry are circulated to other concerned ministries for comment. On receipt of the opinions of the other ministries, the sponsoring ministry arranges inter-ministerial meetings for consultations about the comments received and the views of the sponsoring ministry. The sponsoring ministry then sends the policy to the cabinet for approval. The cabinet, via the Council of Ministers, holds a detailed discussion considers all suggestions, and provides final approval of the policy. The approved policy is then published in the official gazette (Chowdhury, 2003). Thereafter, the implementation of the policy begins.

Currently, there is no national policy specific to POPs, or to the sound management of chemicals generally, including for toxics and hazardous chemicals and wastes. National plans typically lack specific reference to toxic and hazardous chemicals (and POPs as a subset of these), although pollution prevention is now incorporated in some plans.

A POPs-specific policy would need to be integrated within national sustainable development and environmental plans, and reflected in planning documents developed for use by International Funding Institutions (e.g., Country Assistance Strategies of the World Bank; Poverty Reduction Strategy Papers, etc.).

Key environmental policies are discussed below and summarized in Table 7.

The National Environment Policy, 1992
In recognition of the need for a comprehensive approach to address environmental issues as per Agenda 21, Bangladesh adopted The Environmental Policy, 1992. The main thrust of the policy is sustainability, predominantly conceived as conservation, although it includes provision for pollution prevention and corrective measures (as part of protection of the environment and environmentally sound development), and enables framing of new laws in all sectors necessary to control activities concerning environmental degradation (MoEF, 2005).

The policy provides for the following:

- Maintenance of the ecological balance and overall progress and development of the country through protection and improvement of the environment
- Protection of the country against natural disaster
- Identification and control/management of all types of activities related to pollution and degradation of the environment (Section 2.3) and for the identification and control/management of hazardous chemicals, among others, in agriculture, industry and fuel sectors, respectively (Sections 3.1, 3.2 and 3.4).
- Environmentally sound development in all sectors
- A sectoral approach to require specific actions to facilitate long-term sustainable use of all natural resources.
- Active involvement in all environmental fields with international initiatives, including ratification.
- Amendment of all laws and regulations related to protection of the environment and control of environmental pollution and degradation with a view to meeting the present day's need, and framing new laws in all sectors, as necessary to control activities relative to environmental degradation.

The Environment Policy 1992 provides a comprehensive foundation to the formulation of the Environment Conservation Act, 1995 and Environment Conservation Rules, 1997.

With respect to the industrial sector, the policy provides for environmental impact assessments (EIAs) for new industries, corrective measures for polluting industries, a ban on establishment of polluting industries, and development of environmentally sound and appropriate technology for sustainable and efficient utilisation of natural resources (MoEF, 2005). There is, however, no recognition of sound management of chemicals as a concept. A number of elements of the Environmental Policy have yet to be incorporated into law (MoEF, 2005).

Policy implementation strategy, inclusive of POPs: The National Environment Policy is the one national policy that incorporates programmes for its implementation. Hence, the policy serves as a guideline for all implementing agencies. To this end, it contains a National Environment Management Action Plan (NEMAP) that describes actions to be taken within Environmental Action Plans (EAPs) for each of 17 sectors as a means of implementing the Environmental Policy, 1992 (JICA, 1999).

Clause 4 of the agricultural sector Environmental Action Plan (EAP) provides instruction that all laws and regulations are to be amended to meet present needs as these relate to protection of the environment, including control of environmental pollution and degradation (MoEF, 2005). The EAP calls for:

- Control use of insecticides and pesticides with due consideration of the prevailing socio-economic condition of the country;
- Phase out production, import, and use of persistent organic pesticides;
- Use of easily biodegradable pesticides; and
- Encouragement of integrated pest management (IPM).

Both the policy and NEAP as per this sector plan therefore provided the impetus for the gradual phase out and ultimately banning of persistent and accumulative pesticides in agriculture, such as DDT, and other chlorinated hydrocarbons (i.e., POPs pesticides) (JICA, 1999).

New Agricultural Extension Policy (NAEP) 1996

Bangladesh updated its extension policy— known as the "New Agricultural Extension Policy (NAEP) in 1996—followed by "A Strategy for Implementing the NAEP- 1997. The NAEP has 11 key components of which "integrated environmental support" is of most relevance to POPs management. This component calls for integration of the environment into overall agricultural policy to ensure sustainable agricultural development natural environment. Additionally, the NAEP supports the following strategies:

- environmental impact assessment as an integral part of the development and testing of innovations by agricultural research institutes, universities, non-government organizations and the private sector;
- promotion of environmentally sound agricultural practices, such as Integrated Pest Management, and active discouragement of damaging and hazardous agricultural practices;
- monitoring the impact of agricultural practices by environmental agencies, and the use of findings to stimulate a continuous improvement of agricultural technologies and agricultural policies.(GoB, MoEF,2005c)

Integrated Pest Management Policy, 2002

The Government promulgated this policy in compliance with the provisions of the National Agricultural Extension Policy to promote environmental protection and 'environment-friendly sustainable agriculture' as achieved through Integrated Pest Management. The most relevant provision of the IPM Policy to POPs is Section 3.1, which directs that the FAO "International Code of Conduct on the Distribution and Use of Pesticides" will be observed in relation to IPM activities". Likewise, it directs that "The Convention on Persistent Organic Pollutants (POPs) be observed in reducing or eliminating the production and use of certain pesticides". Section 2.2.2 *Executing Appropriate Actions on Pesticides*, states that "GoB has banned all WHO Class 1a pesticide compounds, based on formulations, for agricultural purposes and will eliminate compounds in Class 1b. New proposals for registration of any pesticide falling under the above categories will be declined" and " GoB will review pesticide rules and regulations and amend the same as and where necessary." As an alternative to POPs and Class 1a and 1b pesticides, Section 2.2.1 Maintaining Ecological Balance states "Priorities will be given to the management of pests through the use of parasitoids, predators, insect pathogens, appropriate cultivation practices, pest tolerant varieties, mechanical control measures, crop diversification, botanical products and biopesticides." The GoB implements the policy and its related IPM strategies through the Department of Agricultural Extension (DAE), Ministry of Agriculture (MOA).

National Agricultural Policy 2004

The National Agricultural Policy 2004 was prepared in the context of the Millennium Goal, in recognition of the importance of agricultural development to economic growth and self-reliance of the country. The overall objective of the policy is nation self-sufficiency in food through increased production of all crops, including cereals, and ensuring a dependable food security system for all. Of particular relevance to POPs are policy objectives calling for taking the necessary steps to ensure

environmental protection, and for 'environment-friendly sustainable agriculture' through increased use of organic manure and strengthening of the Integrated Pest Management (IPM) programme (GoB, MoEF, 2005c).

National Policy for Safe Water Supply and Sanitation, 1998
The policy promotes increased service coverage, including via private sector organizations, as a means of lessening the burden on Government. With regard to rural water supply, user communities shall be responsible for operation and maintenance of water supply facilities and bear the total associated costs (Ahmad, 2003).

The Water Policy, 1999
The policy provides direction to all agencies and institutions working in the water sector for achievement of specified objectives, including as these relate to harnessing, development and management of all forms of surface and groundwater in an efficient and equitable manner. The policy seeks to bring about institutional changes that will help to decentralize management of water resources and develop the legal and regulatory environment required for this process, promote sound environmental management, enhance the role of women in water management, and improve the investment climate for the private sector in water development and management (Ahmad, 2003).

Draft National Water Management Plan (NWMP)
This plan, prepared by WARPO in 2001 and to be updated every five years, identifies 84 programmes, grouped into eight sub-sectoral clusters, and eight planning regions, relative to water management.

The Coastal Zone Policy, 2005
The goal of this policy is "to create conditions through integrated management, in which the reduction of poverty, development of sustainable livelihoods and the integration of the coastal zone into national processes can take place." To realize this goal, emphasis will be given, on a priority basis, to optimum utilization of natural resources, livelihood enhancement and area-based development. The government formulated the policy to provide general guidance for management and development of the coastal zone in a manner that will enable coastal populations to pursue their life and livelihoods in a secure and conducive environment.

This is a harmonized policy, which declares the Government's intent to integrate coastal zone management in a manner that transcends sectoral perspectives. To this end, the policy initiates a process that commits different ministries, their departments and agencies to harmonize and coordinate their activities in the coastal zone. The policy elaborates a basis for a firm co-ordination mechanism (Coastal News, 2004).

The National Health Policy, 1999

The goal of this policy is to ensure effective health service to the nation. However, it does not refer to chemical hazards or risks posed by chemicals. The objectives of the policy include development and provision of public health services to all classes of society, as envisaged in the Constitution, Article 15(A) and 18(1), and to determine the ways and means to ensure that health services are readily

available especially to people living in rural areas and poor people living in urban areas (Chowdhury, 2003).

Table 7. Bangladesh national policies and associated plans

Policy	Formulated	Purpose	Sponsoring Ministry	Source for information
National Environmental Policy	1992	1) *Maintenance of the ecological balance and overall progress and development of the country through protection and improvement of the environment* 2) Protection of the country against natural disaster *3) Identification and control of all types activities related to pollution and degradation of the environment* 4) *Environmentally sound development* in all sectors 5) Utilization of all natural resources with long-term environmental sustainability 6) *Active involvement in all environmental fields with international initiatives*	Ministry of Environment and Forests	JICA, 1999 MoEF, 2005
National Environment Management Action Plan (NEMAP)	1992	The Action Plan, integral to the Policy, presents actions to achieve the objective mentioned in the National Environmental Policy covering 17 fields of the environment, with emphasis on the people's participation in the process for formulating the plan. There is no reference in the plan to toxic and hazardous chemicals or wastes.	Ministry of Environment and Forests. Funded by UNDP.	JICA, 1999 Ahmed, 1997
Sustainable Environment Management Plan (SEMP)		Evolved from needs and actions identified in the NEMAP. Focuses on community based resource management in wetlands. Implemented by 22 organizations.	Ministry of Environment and Forests. Funded by UNDP and the World Bank.	UNEP, 2001
Bangladesh Environmental Management Project (BEMP)	1999-2004	The BEMP objective is to increase the capacity for sustainable environmental management in Bangladesh by strengthening the institutional capacity of the DoE to enable it to carry out its legislative powers and functions. Under BEMP, the DoE developed in 2002 a Strategic Plan[14] that sets out the mission, values and strategic direction of DoE in administrating its responsibilities under the laws of the country. Five priorities of the plan are to: • Enforce the Environmental Conservation Act and meet international obligations;	DoE and Government of Canada joint project. Funded by Canadian International Development Agency (CIDA)	http://www.doe-bd.org/bemp_index.html

[14] Strategic Plan for the Department of Environment produced by DoE through the Bangladesh Environmental Management Project. 2002.

Policy	Formulated	Purpose	Sponsoring Ministry	Source for information
		• Administer the Environmental Clearance process competently and transparently; • Address major air and water quality management problems; • Expand public awareness efforts; and Build DoE capacity		
Fourth Five Year Plan (1990-95) First plan to include measures to address industrial pollution	1990	1) *Control pollution and degradation related to soil, water and air* 2) *Promote environment friendly activities in the development process* 3) Preserve, protect and develop natural resources base 4) *Strengthen the capabilities of public and private sectors to manage environmental concerns as a basic requisite for sustainable development* 5) *Create people's awareness for participation in environment promotion activities*	Ministry of Environment and Forests	JICA 1999, citing Country Profile on Environment Bangladesh, 1999, AltafF Ali Faisal, n.d., WB website
Fifth Five Year Plan (1997-2002)	1997	To protect and preserve the environment by putting in place adequate regulatory regimes and effective institutions, keeping in view the need for regeneration, recycling and optimum exploitation of natural resources consistent with sustainable development	Ministry of Environment and Forests	MoEF, 2005
New Agricultural Extension Policy (NAEP)	1996	Integrated environmental support one of 11 components. Policy supports: • environmental impact assessment • promotion of environmentally sound agricultural practices, such as Integrated Pest Management, and active discouragement of damaging and hazardous agricultural practices; • monitoring the impact of agricultural practices by environmental agencies	Add	MoEF, 2005
National Agricultural Policy 2004	2004	• Developed in context of Millennium Goals, calls for nation self-sufficiency in food through increased production of all crops, including cereals, and ensuring a dependable food security system. • Objectives include environmental protection, and 'environment-friendly sustainable agriculture' through increased use of organic manure and strengthening of the Integrated Pest Management (IPM) programme	Add	MoEF, 2005
Integrated Pest Management Policy, 2002	2002	• Section 3.1 directs that the FAO "International Code of Conduct on the Distribution and Use of Pesticides" will be observed in relation to IPM	Add	MoEF, 2005

Policy	Formulated	Purpose	Sponsoring Ministry	Source for information
Reference to Stockholm Convention		activities", and "The Convention on Persistent Organic Pollutants (POPs) in reducing or eliminating the production and use of certain pesticides" will be observed and implemented. • Section 2.2.2 Executing Appropriate Actions on Pesticides, states that "GoB has banned all WHO Class 1a pesticide compounds, based on formulations, for agricultural purposes and will eliminate compounds in Class 1b. New proposals for registration of any pesticide falling under the above categories will be declined" and " GoB will review pesticide rules and regulations and amend the same as and where necessary". • As an alternative to POPs and Class 1a and 1b pesticides, Section 2.2.1 Maintaining Ecological Balance states "Priorities will be given to the management of pests through the use of parasitoids, predators, insect pathogens, appropriate cultivation practices, pest tolerant varieties, mechanical control measures, crop diversification, botanical products and biopesticides".		
National Health Policy	1999	• The goal is to ensure effective health service to the nation. • Chemical hazards and threats are not mentioned in the policy.	Department of Health Services (DOHS)	MoEF, 2005
The Coastal Zone Policy	2005	• creates conditions through integrated management, in which the reduction of poverty, development of sustainable livelihoods and the integration of the coastal zone into national processes can take place. • Emphasizes, on a priority basis, optimum utilization of natural resources, livelihood enhancement and area-based development	Harmonized policy across ministries	MoEF, 2005
National Fish Policy	1998	Applies to all water bodies used for fisheries. Goals are to: • Develop and increase the production of fish resources; • Promote poverty alleviation through creation of self-employment and improve their socio-economic condition; • Meet the demand of animal protein; • Promote economic growth and earn foreign currency through export of fish	Add	MoEF, 2005

Policy	Formulated	Purpose	Sponsoring Ministry	Source for information
		and fish products; and • *Preserve environmental balance, biodiversity and improve public heath.* • Open water*:* minimize damage on fish and fish habitat during development activities		
National Water Policy	1997	• Fisheries will receive due emphasis in water resources planning when the anticipated social impact is high; • *Keep the impact on natural aquatic environment to a minimum*; • State-owned swamps and marshes that are important for fish, waterfowl and other wild life will not be drained; • Water bodies such as *haor*, *boar*, *beel*, road-side ditch will be reserved for fish production and development to the extent possible; • Perennial links of these water bodies with rivers will be properly maintained; • Water resources projects will not interrupt fish movement and migration and breeding; • Brackish aquaculture will be confined to specific zones designated by the Government for this purpose	Add	Parveen, 2000
National Policy for Safe Water Supply and Sanitation	1998	• Promotes increased service coverage, including via private sector organizations, as a means of lessening the burden on Government. • In rural areas, communities shall be responsible for operation and maintenance of water supply facilities and bear the total associated costs (Ahmad, 2003).	Add	MoEF, 2005
Industrial Policy	1999	• Increase industrial sector contribution to GDP to 25% within next 10 years via 16 "thrust areas": agro-industry, leather, oil gas, textile, etc. • Maintain environmental qualities within set standards	Add	Faisal, et al., n.d. (WB website)

2.2.2 Roles and responsibilities of ministries, agencies and other governmental institutions involved in POPs life cycles

The roles and responsibilities of Bangladesh ministries and other national agencies and governmental institutions are summarized in Table 8 below. There are also local government institutions that could

potentially have a role in POPs management. These include the *paurashava* (municipalities), and *parishads* (councils, mainly the *upazila parishads* and union councils). However, this legislation does not apply to aspects of pesticides management such as requirements for inventories of obsolete stocks, conditions of storage, packaging, labelling, collection and disposal/destruction, or with respect to clean up of contaminated sites. Similarly, there are no provisions for monitoring of people, the environment or food. There may be gaps in regulation of pesticides used for health and domestic purposes. (See 5.3.1 for details on registration history of these POPs).

Table 8. Roles and responsibilities of Bangladesh ministries and other agencies

Organization	Implementing agency (ies)	Activities	Legal framework	Source
Ministry of Environment and Forests (MoEF)	• Department of Environment (DoE) • Department of Forests (DoF)	Responsible ministry for ECA 1995 Act. Director General has authority to: (a) coordination with the activities of any authority or agency having relevance to objectives of the Act; (b) prevent probable accidents which may cause environmental degradation and pollution, undertaking safety measures and determination of remedial measures for such accidents and issuance of directions relating thereto; (c) giving advice or issuing directions to the concerned person regarding the environmentally sound use, storage, transportation, import and export of a hazardous substance or its components. (d) conducting inquiries and undertaking research on conservation, improvement and pollution of the environment; (e) searching any place, examining any equipment, manufacturing or other processes, ingredients, or substance for the purpose of improvement of the environment, and control and mitigation of pollution; and issuance of direction or order to the appropriate authority or person for the prevention, control and mitigation of environmental pollution; (f) collection and publication of information about environmental pollution; (G) advising the government to avoid such manufacturing processes, commodities and substances as are likely to cause environmental pollution;	• Environment Conservation Act, 1995; • Environment Conservation Rules, 1997 • Brick Burning (Control) Act, 1989	MoEF, 2005; JICA, 1999

Organization	Implementing agency (ies)	Activities	Legal framework	Source
		(h) carrying out programmes for observation of the quality of drinking water and preparation of reports thereon, and rendering advice or, as the case may be, issuing direction to the concerned persons to follow standards for drinking water. **DoE programmes:** • Water quality monitoring at regional laboratories • Bangladesh Environment Management Project (BEMP) supported by the Canadian Government (inclusive of capacity building for environmental legislation and policy analysis and institutional strengthening of DoE) • Sustainable Environment Management Programme (SEMP) supported by UNDP and the World Bank • River water pollution control in Dhaka City • Establishment of wastewater treatment plants for handloom industries on cluster basis • Conversion of petrol and diesel operated vehicles into CNG • Promotion of self-monitoring system in export processing zone and other major industrial areas • Promotion of public awareness on environmental management • Industrial surveys and pollution control		
Ministry of Agriculture	Department of Agricultural Extension (DAE), Plant Protection Wing (PPW)	• Regulatory authority under the Pesticides Ordinance 1971 and oversight for registration, distribution and control of pesticides (Pesticides Rule 1985). PPW functions as a Secretariat, implementing Pesticide Technical Advisory Committee (PTAC) policy and registration/licensing decisions, which are published in GoB Gazette. • Screening and Assessment of chemicals used in agriculture (via Pesticide Ordinance 1971 and pesticide Rules 1985) as assisted	• Pesticides Ordinance, 1971; Pesticides Rules, 1985	MoEF, 2005. JICA, 1999

Organization	Implementing agency (ies)	Activities	Legal framework	Source
		by the PTAC and its Pesticides Technical Sub-Committee • Preparation of Crop Policy (1998) • Preparation of Irrigation Policy (1998) • Preparation of National Agriculture Extension Policy (1997) • Implementation at field level of Pesticide Rules is done by DAE, which maintains a network of agricultural extension workers in the field, including 466 Plant Protection Inspectors and about 12,000 Block Supervisors who make daily contacts with farmers and pesticide distributors.		
	Pesticide Technical Advisory Committee (PTAC)	PTAC makes *policy* decisions, and approves registration of pesticides, licenses, cancellation of registrations, bans of pesticides. Registration of pesticides is reviewed from time to time in context of the International Codes of Conduct.		
Bangladesh Agricultural Development Corporation		Fertilizer use		JICA, 1999
Ministry of Fisheries and Livestock (MOFL)		The major public sector institution for fisheries administration, management and development.* For the fisheries matters it includes: • The Department of Fisheries (DOF), • The Fisheries Research Institute (FRI) the Bangladesh Fisheries Development Corporation (BFDC). *Several other government ministries also work on fisheries administration, management and development with assistance from their affiliated institutions. These include the Ministry of Local Government, Rural Development and Cooperatives, Ministry of Lands and Ministry of Irrigation, and Water Development and Flood Control		Parveen, *et.al*., 2000
Ministry of	• Director		The International	MoEF,

Organization	Implementing agency (ies)	Activities	Legal framework	Source
Health and Family Planning	General of Health Services (DGHS) • International Centre for Diarrhoeal Disease Research (ICDDRB)		Centre for Diarrhoeal Disease Research Bangladesh Ordinance, 1978	2005
Ministry of Local Government Rural Development & Cooperatives	• Local Government Engineering Department (LGED) • Department of Public Health Engineering (DPHE) • City Corporations • Municipalities • UPs	• Routine monitoring of water quality at production wells in district centers since 1980. • Study and control of arsenic contamination in groundwater. • Sanitation facilities and the associated hygiene education programme	• City Corporations Laws • The Paurashava Ordinance, 1977 The Local Government (Union Parishads) Ordinance, 1983	JICA, 1999
Ministry of Water Resources		Preparation of Participatory Water Management Guidelines (drafted in 1999)		JICA, 1999
Bangladesh Water Development Board (BWDB)	A River Research Institute operates under BWDB authority at Faridpur	• Countrywide monitoring of tube wells. Monitoring of surface water salinity, suspended sediments • Flood forecasting and warning • Flood proofing, and disaster management • River management		JICA, 1999; Ahmed, 1997
Water Resources Planning Organization (WARPO)		• Sampling and analysis of pesticides residues • Cyclone warning and dissemination • Coastal protection • Urban protection • Water and Flood management • Ground water utilization • National Water Management Plan		JICA, 1999
Water and Sewerage Authority (Dhaka, Chittagong)		• Periodic check of production wells • Fecal pollution control • Sanitation facilities and the associated hygiene education programme		JICA, 1999
Bangladesh		Oversight for electrical generation.		

Organization	Implementing agency (ies)	Activities	Legal framework	Source
Power Development Board				
Ministry of Power, Energy and Mineral Resources	Bangladesh Power Development Board (BPDB)	Responsibility for the energy sector, with policy formulation and investment decisions under its control. Facilitates national electricity reform and restructuring, such as development of Independent Power Projects (IPPs).	Bangladesh Water and Power, Development Boards Order; 1972 Bangladesh Explosive Act, 1884	EIA, 2004
Ministry of Shipping		Authority over dredging and maintenance of river ports.	Inland Shipping Ordinance 1976 Merchant Shipping Ordinance 1983 Inland Water transport Authority Ordinance 1958	Ahmed, 1997
Ministry of Industry				MoEF, 2005
Ministry of Finance	National Board of Revenue, Customs Wing	Plans for and supervises implementation of the Government's macroeconomic, fiscal and economic reform policies. This is carried out by preparing legislation, planning state revenues and expenditures, managing and supervising the state budgetary spending process and preparing a framework for economic policy and development. The affairs of the Ministry of Finance are managed by three Divisions: Economic Relations Division (ERD), Finance Division, and Internal Resources Division (IRD).	• Customs Act, 1969 • Finance Act, 2004,	MoEF, 2005
Ministry of Law, Justice And Parliamentary Affairs				MoEF, 2005

INTER-MINISTERIAL BODIES AND CONSULTATION

Inter-agency consultation and decision-making on environmental policy and law involve the following ministries and their respective agencies: the MoEF, the Ministry of Commerce, the Ministry of Industry, the Ministry of Agriculture, the Ministry of Health, and the Ministry of Science and Technology. The Cabinet makes decisions when there is disagreement among the ministries and departments on a particular issue.

Stakeholders routinely consulted on environmental issues include the customs department, agricultural workers, health workers, industrial entrepreneurs; scavengers who recover articles from waste disposal sites, NGOs, Coast Guard, and Bangladesh Rifles are also involved in decision-making process to a certain extent.

POPs NIP Interministerial body and stakeholder consultation: With respect to NIP development, the MoEF, as the Executing Agency for its development and implementation, working with the DAE and Bangladesh Power Development Board, developed in 2004-2005 an inter-ministerial committee for inter-governmental consultation. Stakeholders were consulted on NIP development beginning with a 2004 inception meeting, and subsequently via various workshops (e.g., on laboratory analysis). A national meeting on the first full draft of the NIP was held in mid-July 2005.

2.2.3 Relevant international, regional and bilateral commitments and obligations

International agreements that Bangladesh has ratified or is in the process of ratifying are shown in Table 9 below.

Table 9. International Environmental Agreements: Bangladesh ratification status

Convention	Year Ratified
London Convention, 1972: Convention on the prevention of marine pollution by the dumping of Wastes	1981
Basel Convention 19989, on the Transboundary Movements of Hazardous Wastes and their Disposal	1.14.93 (Ac); has not ratified Ban amendment or Protocol on Liability
United Nations Framework Convention on Climate Change (UNFCCC), 1992	15.4.94 (R); 14.7.94 e.i.f. for Bangladesh
Kyoto protocol to the United Nations Framework Convention on Climate Change, 1997	22. 10. 01 (Ac)
Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (Rotterdam Convention)	In process of ratification
Stockholm Convention on Persistent Organic Pollutants	In process of ratification
Convention concerning the Protection of the World Cultural and Natural Heritage—World Heritage Convention	1983
London Dumping Convention or IMO Convention for the Prevention of Pollution from Ships 1973 (MARPOL 73/78) and Marpol Protocol 1997	4.11.02 (ac) to Convention, its protocols and annexes; Convention entered into force for Bangladesh 2 April 2003
International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Causalities, Brussels, 1969 (Intervention Convention)	1982 (R); 4.2.82 e.i.f. for Bangladesh
International Convention on Oil Pollution Preparedness Response and Cooperation (London)	In process of ratification
International Convention on the establishment of an international fund for compensation for oil pollution damage (as amended) Brussels, 1971.	1985

Convention	Year Ratified
Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxic Weapons, and on Their Destruction, London, Moscow, Washington, 1972.	
Vienna Convention for the Protection of Ozone Layer	2.8.90 (Ac)
• Montreal Protocol on Substances that Deplete the Ozone Layer, Copenhagen, 1987 • London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, London, 1990 • Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer adopted by the Ninth Meeting of the Parties, 1997	2.8.90 (Ac) 27.7.01 (At) 18.3.94 (R)
Ramsar Convention; Convention on Wetlands of International Importance Especially as Waterfowl Habitats	1992
Convention on International Trade In Endangered Species of Wild Fauna and Flora (CITES)	20.11.81 (R); 18.2.82 (e.i.f. for Bangladesh)
Convention on Biological Diversity (CBD), 1992	3.5.94 (R)
Cartagena Protocol on Biosafety to CBD, 2000	24.5.00 signed, not yet ratified
International Plan Protection Convention, 1951 (revised 1979, 1997)	1.9.78 (At) and Adherence); 11.1. 84 (At); 24.11.98 (At)
United Nations Convention to Combat Desertification (UNCCD), 1994	26.1. 96 (R); 26.12.96 e.i.f. for Bangladesh

ac: accession
at: accepted
R: ratified
e.i.f.: Entry into force
Source: MoEF

REGIONAL ENVIRONMENTAL AND HEALTH AGREEMENTS AND ORGANIZATIONS

Bangladesh:

- acceded to the Plant Protection Agreement for the South East Asia and Pacific Region (as amended), 1956 on 4 December 1974 and ratified the treaty on 12 November 2003.
- ratified in 1998 the Agreement on the Network of Aquaculture Centres in Asia and the Pacific, Bangkok. The agreement entered into force for Bangladesh on 15 May 1990. Bangladesh was also a participant of the conference.
- signed the Declaration and Article of Association on South Asian Environmental Programme, 1981 and is a member State of the Programme. The Declaration and Article establish a regional programme for conservation and protection of the environment among South Asian countries.

Bangladesh is a member of the South Asian Association for Regional Cooperation (SAARC), created in 1985 to promote regional economic cooperation and economic and social development in the South Asian region. Bangladesh also participates in the World Health Organization via its South East Asia Regional Office (SEARO).

2.2.4 Description of existing policies, legislation and regulations addressing POPs (manufactured chemicals and unintentionally produced POPs)

2.2.4.1 OVERVIEW OF BANGLADESH LEGISLATIVE FRAMEWORK

Bangladesh has enabling environmental legislation, as well as legislation and regulations that govern some facets of chemicals management (primarily pesticides), although there is no legislation specific to chemical management in compliance with international standard, which is quite a recent phenomenon.

The most important legislation with respect to management of the environment, including as these pertain to regulation of production, import, export, transportation, storage, handling, and use of toxic chemicals and generation and disposal of hazardous waste in Bangladesh, are the following:

- The Environment Conservation Act 1995 (framework legislation)
- The Environmental Court Act, 2000
- The Environmental Conservation Rules 1997 (applicable to industrial pollutants; standards)
- The Pesticide Ordinance 1971 and Pesticide Rules 1985 (governing registration; imports and use of pesticides in agriculture)
- The Imports and Export (Control) Act, 1950 and associated Import Policy Orders (i.e., The Import Policy Order, 2003-2006)

These and other legislation/regulations that are or could with amendment be applicable to POPs are described below.

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The Bangladesh Environment Conservation Act, 1995

The Bangladesh Environment Conservation Act, 1995, is the central framework legislation for the environment in Bangladesh [15] and is also the only legislation that specifically deals with environmental issues. The Act was passed to provide for conservation and improvement of environmental standards and for controlling and mitigating environmental pollution. The core strategies of the Act, in line with Agenda 21, include (a) declaration of ecologically critical areas and restriction of activities thereon, (b) regulation in respect of vehicles emitting smoke harmful for the environment, (c) regulation of the industrial and development activities, (d) promulgation of standards for quality of air, water, noise and soil for different areas for different purposes and
(e) promulgation of standard limits for discharge and releases of pollutants.

[15] Act No. 1 of 1995, the ECA was originally published in *Bangla* in 1995-02-16 and subsequently amended by Act Nos. 11 and 12 of 2000, No. 9 of 2002, and No. 10 of 2002. The Act's full title is " An Act to provide for conservation of the environment, improvement of environmental standards and control and mitigation of environmental pollution." The Act repeals the Environment Pollution Control Ordinance of 1977.

The Act establishes the Department of Environment (DoE),[16] which is overseen by a Director General (DG). The director general has discretionary authority to take such action as may be deemed necessary for the conservation of the environment, and mitigation of pollution of the environment, including through development of control measures (UNEP, 2001b). In particular, the Director General may:

- Co-ordinate with the activities of any authority or agency having relevance with the objectives of the ECA;
- Prevent probable accidents that may cause degradation and pollution of the environment, adopt safety measures, and determine remedial measures against such accidents;
- Advise or, in appropriate cases, direct the person concerned regarding the environment friendly handling, storage, transportation, import and export of a hazardous substance or its components;
- Examine any place, premises, plants, equipment's, manufacture or other processes, ingredients or substances for the purpose of improvement of environment and control and mitigation of pollution and may give orders or directions to appropriate authority or person for prevention, control and mitigation of environmental pollution;
- Request or force the operator to rectify environmental pollution that exceeds standards;
- Close down activities considered harmful to human life or the environment;
- Advise the Government to reject manufacturing processes, materials and substances that are likely to cause environmental pollution;
- Conduct investigations and research relative to environmental conservation, development and pollution prevention;
- Collect, publicize and disseminate information on environment pollution;
- Conduct drinking water quality surveillance (monitoring) programmes, and advise or direct, as appropriate, that every person follow the drinking water standard;
- Conduct surveillance of soil and air; and
- Declare an area affected by pollution as an ecologically critical area.

The Act provides the DoE with authority to regulate hazardous substances,[17] wastes,[18] and contaminated sites, which taken together provide for DoE's broad responsibility on chemical safety. *Conservation* as defined in the Act would require qualitative and quantitative improvement of different components of the environment and prevention of their degradation. *Environment* includes water, air, land and other physical properties and the interrelationships, which exist among them and between them, and human beings, other living beings, plants and micro-organisms. The Act's operational definitions of 'eco-systems', 'pollution', 'waste', and 'hazardous substance', which

[16] Under the ECA, the Department of Environment (DoE), which existed before the commencement of this Act, is deemed to have been established under Article 3 as the Act's implementing agency, endowed under Article 20 with regulatory authority (via notifications).

[17] Defined in the Act as "the chemical or biochemical properties of which are such that its manufacture, storage, discharge or unregulated transportation can be harmful to the environment."

[18] Defined in the Act as "any solid, liquid, gaseous, radioactive substance, the discharge, disposal and dumping of which may cause harmful change to the environment".

previously did not exist in the legal regime, have added a new dimension to environment management in Bangladesh by making a shift from 'pollution control' to 'environment conservation'. The recent amendment of the Act in 2002 give the provisions of the Act overriding effect over all other laws.

Section 2(1) of the Act on 'wastes' further authorizes the Government to determine the standard for discharge and emission of waste, including radioactive wastes. The Act further authorizes the Government to lay down rules for environmentally sound management of hazardous substances and toxic wastes. Section 12 of the ECA incorporates the precautionary principle by requiring industrial facilities or projects to obtain environmental clearance certificates from the DoE before commencing operation. Any violating unit may be shut down. It also empowers the government to ban products that are harmful to environment.

The Environmental Court Act, 2000

The Environmental Court Act, 2000 provides for the establishment of one or more Environmental Courts, primarily at each Division of the country, with specific terms of reference to deal with environmental offences. The Environment Court Act, 2000 ensures the establishment of environment courts for the trial of offences relating to environmental pollution and enforces any violation of environmental law.

Environment Conservation Rules (ECR) 1997

The Rule was promulgated in furtherance of the objectives of the ECA, 1995. Regarding management of toxic and hazardous substances, the Rules have broadly defined guidelines for disposal of waste from different categories of industries.

Among other provisions, the rules establish:

- environmental (ambient) standards for air, water, noise, odor and other environmental components within Ecologically Critical Areas;
- discharge and emission standards for air, water, noise and odor from industry (by sector);
- standards for wastes from industrial units and projects;
- standards for emissions from motor vehicles and mechanized vessels;
- procedures for Granting Environmental Clearance for new industrial enterprises and projects;
- requirements for EIAs, according to categories of industrial and other development interventions.

The Rules incorporate "inclusion lists" of projects requiring varying degrees of Environmental investigation, e.g., all new projects within a specified category generally will require a two-step assessment procedure consistent of (1) an Initial Environmental Examination (IEE) for site technical clearance (that is, approval of the design and the operating characteristics of the project) and (2) if warranted, a full EIA for technical clearance (that is, approval of the design and the operating characteristics of the project).

Standards for air developed thus far are for "common" pollutants, i.e., Suspended particular matter (10 parts per million or less); sulfur dioxide, carbon monoxide, and nitrogen oxides. Standards issued for inland surface waters (drinking water; use by fisheries; recreational use; and irrigation) similarly address pollution relative to general parameters for pollution caused by sewage and relative to turbidly, acidity, and dissolved oxygen content (i.e., pH, BOD mg/l, DO mg/l and coliform count). Standards issued for drinking water include some chemicals (e.g., chlorine and chlorinated alkanes, chlorinated phenols, phenolic compounds; arsenic; metals such as mercury and chromium; and oil and grease). Standards for industrial emissions are listed in Schedule 2 of the Act. Standards for waste from industrial units and projects include standards for some chemicals (e.g., some heavy metals, chloride, oil and grease).

For purposes of granting environmental clearance, industrial enterprises and projects are classified in Schedule 1 of the Act according to four colour-coded lists based on their respective environmental impact and location.

- Green (to be granted environmental clearance).
- Orange A
- Orange B, and
- Red (includes pesticides formulation, repacking; chemicals manufacturing, including pharmaceuticals).

Those industries on the *Orange B list* must submit an Initial Environmental Examination (IEE), Effluent Treatment Plan (ETP) and Environment Management Plan (EMP). Under the *Red* category, new industrial units, projects or products are generally required to undergo a two-step assessment procedure, involving an IEE for site technical clearance (that is, approval of the design and the operating characteristics of the project), and, if warranted, a full Environmental Impact Assessment (EIA) for technical clearance (approval of the design and the operating characteristics of the project) (Hossain, 2000).

The application for environmental clearance for a project classified in the *Red* category requires that the application be accompanied by the following documents:

- Feasibility Study Report of the industry (Project)
- IEE/EIA Report
- An NOC (Notice of Consent) from the local authorities concerned
- Pollution minimization plane including Emergency plane for mitigation of adverse environmental impacts
- Outline of relocation planes (where applicable)
- Other information as deemed necessary

Waste discharge (liquid) and emission (air) standards set under the Environmental Conservation Rules (with discharge and emission limits specified in the various schedules) encompass the following:

- Sewer discharge
- Water discharge for industrial units and projects
- Gaseous discharge for industrial unit or projects
- Waste emission or discharge for classified industries (e.g., nitrogenous fertilizer, phosphate fertilizer, integrated textile mills and large processing units, pulp and paper, cement, industrial boilers, nitric acid, distillery, sugar, tannery, food processing, fish canning, dairy, starch and jute, petroleum refinery).

At this time, the DoE is in the process of developing procedures and measurement methods to be used for determining the parameters listed in the standards as available in the U.S. Code of Federal Regulations, Title 40-Protection of Environment. The DoE also requires enhanced personnel and laboratory capacity to carry out analysis to determine if releases are in compliance with standards (Quadar, 2002).

Pesticide Ordinance, 1971

The Agricultural Pesticide Ordinance, 1971 (Ordinance No. 11 of 1971) as modified up to 30 June 1984 provides the legal framework to regulate the import, manufacture, formulation, licensing, repacking, sale, distribution and use of pesticides in Bangladesh. A 1983 amendment (No. XXV of 1983) deleted the word `Agriculture' where it existed to broaden its application to include pesticides used in public health, veterinary use, etc. The Pesticide Ordinance does not override provisions within any previous Acts (e.g., the Poison Act, 1919). The Ministry of Agriculture (MOA) is the implementing authority for the ordinance.

The ordinance provides for registration of pesticides, which are defined as "any substances or mixture of substances used or represented as a means for preventing, destroying, repelling, mitigating or controlling, directly or indirectly, any insect, fungus, bacterial organism, nematodes, virus, weeds, rodent, or other plant or animal pest" (Chapter 1, Section 3 and subsection (n) of the Ordinance). It therefore applies to pesticides, insecticides, herbicides, fungicides and rodenticides.

As per the Chapter II, Section 4 of the Ordinance, no person shall import, manufacture, formulate, repack, sell, offer for sale, hold in stock for sale, or in any manner advertise any brand of pesticide, which has not been registered in the manner provided in the Ordinance. The ordinance therefore gives the government power to ban importation of any pesticide found to be adulterated (formulated at a strength or purity which falls below the professed standard on the its label), or for which the sale contravenes the provisions of the ordinance.

In accordance with Section 4, registrations for the six Annex A pesticides *aldrin, chlordane, dieldrin, endrin, heptachlor, and hexachlorobenzene* had either been cancelled or withdrawn by 1997. *Toxaphene* and *mirex* are reported never to have been imported or used, hence were never registered. Therefore, these POPs cannot be imported, manufactured, formulated, repacked, sold, held in stock for sale or advertised in any manner.

Chapter II, Section 8A subsection (1) of the Ordinance, provides that "Any person may, after obtaining a license granted by the licensing authority (the Director, Plant Protection Wing, DAE), import, manufacture, formulate, repack, sell, offer for sale, hold in stock for sale, involve in pest

control operation on commercial basis or advertise in any manner any brand of registered pesticide". These provisions make registration and license mandatory for dealing with any pesticide.

Pesticides must satisfy a long list of eligibility (screening) criteria to be registered as per Chapter II, Section 5. The most relevant screening criterion with respect to POPs is that the pesticide "is not generally detrimental or injurious to vegetation, except weeds, or to human or animal health even when applied according to directions", as per Chapter II, Section 5, subsection (4) (d) of the Ordinance.

The Registration Authority is empowered to cancel the registration if it is of opinion that the registration has been secured in violation of any of the provisions of the Ordinance or the rules or that the pesticide is ineffective against pests or hazardous to vegetation, other than weeds, or to human or animal life, and after providing the registrant with a hearing prior to cancellation. Exercising this authority, the Government has already cancelled the registration of many hazardous pesticides, including POPs pesticides in as discussed below in subsection 2.2.5.

The Pesticide Ordinance makes provision for offences and penalty, power of court, and indemnity. These provisions provide tools for prosecuting legal actions against any person dealing with pesticides not registered or deregistered. However, the amount of financial penalty has been fixed-up by the Ordinance in the context of past time 1971, which now appears to be very low.

Powers of inspection (e.g., to collect samples) under the ordinance provide for entry into premises where pesticides are kept or stored, whether in containers or in bulk, by or on behalf of the owner, and premises belonging to a bailee, such as a shipping company or railway or other carrier. Samples are sent to the government analyst. Additionally, any person who has purchased a pesticide may apply to a Government Analyst to conduct a test or analysis of the pesticide. The analyst is then obliged to analyze the sample and provide a signed report of results to the applicant.

Section 29 of the ordinance empowers the government, via the Department of Agricultural Extension (DAE) of the MOA, to make regulations to implement the ordinance. The government may, in consultation with the Pesticide Technical Advisory Committee (PTAC) and after previous publication in the official Gazette make rules for carrying out the Ordinance. In particular, such rules may provide all or any of the following matters, namely:

- The pesticides that are generally detrimental or injurious to vegetation, domestic animals or public health even when used according to directions
- The pesticides that are labeled "Poison" and their antidotes
- The requirements for the safe storage of pesticides
- The quantities of different brands of pesticides which a person may hold in stock at any one time and the premises in which, and the conditions subject to which, he may hold them in stock
- The precautions for the protection of workers against risk of poisoning by pesticides arising from their working:
    - In connection with use of such pesticides; or
    - On land on which such pesticides are being or have been used

- The restrictions or conditions as to the purposes for which, the circumstances in which, or the methods or means by which, a pesticide m ay be used
- The restrictions or conditions involving a general prevention or limitation of the use of any pesticide
- The provision and keeping available and in good order, of facilities for washing and cleaning and of other things needed for protecting persons, clothing, equipment and appliances from contamination with pesticides or for removing sources of contamination
- The observance and precautions against poisoning by pesticides and abstention from eating, drinking and smoking in circumstances involving risk or poisoning by pesticides
- The observance of special precautions in the case of persons that are subject to particular risk of or injury from pesticides or imposing in the case of persons so subject prohibitions or restrictions on employment of workers
- The measures for detecting and investigating cases in which poisoning by pesticides has occurred
- The provisions of effective facilities for prevention of poisoning by pesticides and first aid treatment
- The provisions of instruction and training in the use of things provided in pursuance of the rules in and the observance of precautions against poisoning by pesticides

Pesticide Rules, 1985

The Pesticide Rules, 1985, published by the DAE of the Ministry of Agriculture (MOA) on 16 November 1985,[19] regulate the import, manufacture, formulation, repacking, sale, distribution, use, stock and disposal of pesticides.

The rules make provision for the following activities:

- Mandatory registration of pesticides. Pesticides are registered under two broad categories such as Public Health Pesticides and Agricultural Pesticides, with the abbreviated identifications “PHP” and “AP” respectively (GoB, MoEF, 2005c).
- Determination of the period for which registration shall be effective (typically two years), together with conditions as to its labeling, application and handling etc.
- Cancellation of registration.
- Renewal of registration.
- Licensing (different licenses are required for import, formulation; repacking; wholesale distribution; retail distribution, pesticide control on a commercial basis and advertisement of pesticides)
- Labeling of pesticides
- Storage and transportation of pesticides
- Banning of pesticides
- Disposition of pesticide packing/containers. As per existing law, “it shall be the duty of manufacturers, formulators, repackers of pesticides and operators to dispose of packages, condemned or surplus materials and washing in a safe manner so as to prevent air, soil, water

[19] The Rules were published under S.R.O No. 479-L/85 in the Bangladesh Extra-ordinary Gazette.

or other environmental pollution. ” Used packages shall not be left outside to prevent their reuse and “packages shall be broken, burnt, incinerated and buried away from habitation and water ways” (Sec. 56 of the Pesticides Rules, 1985).

The application with accompanying documentation as specified in the ordinance is reviewed for impact to the environment by the relevant ministries and research institutes. For new pesticide products a pure sample must be submitted for analysis by the DAE laboratory and by other ministries to determine its potential environmental or health impact.

Inspection of licensed products can occur at the point of entry if it is an imported product or at the point of use at the divisional or local level.

Administration of the Pesticide Ordinance and Pesticide Rules

The Plant Protection Wing (PPW) of the Department of Agricultural Extension (DAE) is the implementing authority for the Pesticide Ordinance and Pesticide Rules. The PPW is assisted by a policy body, the Pesticide Technical Advisory Committee (PTAC), and a technical subcommittee of the PTAC, the Pesticide Technical Sub-Committee.

The PPW exercises its authority as a Secretariat, processing applications and implementing decisions taken by the PTAC, which acts as a regulation policy board, i.e., both formulating policy and taking decisions including approval of registration, cancellation of registration and bans on imports. This committee also finalizes the regulations for the pesticide (Rahman, Inception Report). PTAC decisions on registration are published in the Government *Gazette* before their implementation.

The Director, PPW acts as the Member-Secretary of the PTAC, while the Secretary of the Ministry of Agriculture chairs the PTAC. Other government members include representatives from Department of Environment under the MoEF, the Ministry of Fishery, and the Ministry of Health. PTAC membership also includes representatives of institutions from scientific bodies and from the pesticide trade and industry (Ahmed 1997; JICA 1999; GoB, MoEF, 2005c). Hence, the private sector plays an active role not only in assisting with formulation of government policy but also with respect to registration and licensing decisions (JICA, 1999; Ahmed, 1997).

The PPW director is supported by a Deputy Director (DD), two Chemists in Pesticide Analytical Laboratory and a Pesticide Regulations Officer (PRO). The PRO maintains all the records and registers of pesticides (GoB, MoEF, 2005c).

The main function of the technical subcommittee is to assist the PTAC by screening/evaluating pesticides including through performance of field trials and laboratory test. This committee is headed by the Director, Department of Plant Protection, Ministry of Agriculture, and includes representation by DoE and scientists from nationalized institutions.

Registration of a pesticide entails the following procedural steps:

1. Application in form-1 (Prescribed), along with 3 types of samples (analytical, technical grade, & market sample) must be submitted to PPW.

2. Scrutiny of application and testing of active ingredient (a.i.) at the Plant Protection Wing (PPW) of the DAE.
3. Report obtainable by PPW from the DoE (for new pesticides)
4. Report on fish toxicity obtainable by PPW from the Fisheries Research Institute.
5. Decision of the technical sub-committee to the Pesticide Technical Advisory Committee (PTAC) regarding qualification of the pesticide for field testing.
6. Field efficacy test results are provided to the PPW by the entity performing the test, e.g., a research institute or the Institute of Epidemical Disease Control Research (IEDCR)
7. Discussion at the PTAC technical sub-committee on field efficacy test results and recommendation to PTAC.
8. Approved by PTAC.
9. Registration certificate issued by Director, Plant Protection (Registration Authority)

(Badruddin, Inception Report, 2004; RFI, 2005)

As a matter of practice, any reservations raised by reviewing agencies must be addressed before the application, along with recommendations for its registration, are forwarded by the PTAC to the DAE.

Registered pesticide companies conduct training of farmers at the village or field level if such training is stipulated as a condition of registration and licensing. In addition, at the divisional level, Pesticide Vigilance Committees have been established. These are chaired by the Deputy Director of the DAE, and include membership from various pesticides company representatives, as wholesalers and retailers. Their focus is on use of legally registered and licensed pesticides and the use of illegal pesticides (RFI, 2005). Quality control, monitoring and implementation of relevant decisions and actions are undertaken via the DAE network of administration under authority of an Additional Director (AD) at the Divisional/Regional level; a Deputy Director (DD) and Plant Protection Specialist (PPS) at the district level; an *Upazila* Agriculture Officer (UAO) and Plant Protection Inspector (PPI)/Plant Protection Assistant (PPA) at the *thana* Level and by block supervisors (BSs) at the village level (GoB, MoEF, 2005c).

The Import Policy Order, 2003-2006

The Import Policy Order was issued in exercise of the powers conferred by the sub-section (1) of Section 3 of the Imports and Export (Control) Act, 1950. In the 2003-2006 Import Policy Order, the government has withdrawn import restrictions for 37 goods, while imposing restrictions on 62 items harmful products in the domestic market. The Control List (i.e., items, whose import is controlled as per Sec. 2.1.8.) of insecticides banned for importation includes heptachlor, DDT, chlordane and dieldrin (four of the 12 POPs). A description of imported insecticides must be communicated to DAE, which then monitors the use of the imported insecticides as consistent with the level of use approved by the Pesticides Rules, 1985. In Section 26.6, the Order says that pesticides will be determined as per the Pesticides Ordinance, 1971. Pesticides and insecticides containers must be able to withstand handling by sea, indicate the chemical contents, and meet other specifications.

The Customs Act 1969

The Customs Authority follows the rules and regulation of The Board of Revenue, The Ministry of Commerce and The Ministry of Finance before issuing entry clearance for any imported chemicals. The Customs Authority when importing pesticides need to obtain a Clearance Certificate from the Department of Plant Protection (UNEP Chemicals, 2001a).

The Smoke Nuisance Act, 1905

The Act amends laws relating to the abatement of nuisance arising from the smoke of furnace or fireplaces in certain areas in Bangladesh. Under the Act, the government may prohibit within any specified area (a) the erection or use of any specified class of brick tile or lime kilns; (b) clamps for making bricks, or the erection or use of furnaces; (c) the smelting of ores or minerals, or the casting, puddling or rolling of iron or other metals, or the conversion of pig-iron into wrought-iron.

If smoke is emitted from any furnace in greater density, or at a lower altitude, or for a longer time than is permitted by the rules made under this Act, the owner of the furnace shall be liable to a fine. For the enforcement of this law, provision has been made for constituting a commission and appointing a chief inspector of smoke nuisance and assistant inspectors.

The Brick Burning (Control) Act, 1989 and the Brick Burning (Control) (Amendment) Act, 1992

Under this Act, a license is required for brick burning from the appropriate authority (Deputy Commissioner). The Act categorically mentions that no one will be allowed to use fuel-wood for brick burning. It has a provision of punitive measures of imprisonment or a fine. It also provides for inspection of the brickfields to check the use of fuel wood. The inspecting authority has the right to take possession of all the bricks and fuel wood found on the particular brickfield found in contravention of the Act. In the amendment, the definition of fuel has been broadened to include any floral based fuel, other than the dead root of bamboo.

The Smoking and Tobacco Usage (Control) Act, 2005

The Smoking and Tobacco Usage (Control) Act- 2005' officially came into effect 26 March 2005. It prohibits smoking in public places. Smoking is also restricted at public transports like motor vehicles, buses, trains, ships, launches and all mechanized vehicles and aeroplanes.

The Inland Shipping Ordinance, 1976

The ordinance was promulgated to ensure maritime safety in inland waterways. It has provisions regarding construction, registration, survey, inspection, route permit, staffing and safety equipment necessary to carry onboard, casualty investigation, accidents of inland vessels etc. The recent amendment of the Act has incorporated some provisions regarding protection of inland water from pollution. In the new chapter, pollution is defined in a very broad sense, which may cover all possible sources including chemical contamination although the word "chemical" is not mentioned. According to the Section 60B, every inland ship must carry a "pollution prevention certificate" which must be

renewed each year. The provision is a landmark of the pollution prevention issues in inland waterways of Bangladesh.

The Pure Food Ordinance, 1959

The Ordinance covers food and food related matters. Food means any article used as food or drink for human consumption, other than water or any drug, and includes ice and aerated water and (a) any substance which is intended for use in the composition or preparation of food, (b) any flavouring matter or any spice or condiment and (c) any colouring matter intended for use in food. The Ordinance recognises the people's right to question the standard of goods. Section 6 of the ordinance prohibits trade in adulterated food.

The Marine Fisheries Ordinance, 1983

The Marine Fisheries Ordinance of 1983 deals with matters relating to marine fisheries exploitation, including monitoring the operation of fishing vessels. The Marine Fisheries Rules, 1983, as amended in 1992, provides for licensing and monitoring of mechanized fishing boats under the Ordinance. The officers of the marine section of the Department of Fisheries have been empowered to control or take any further action required for surveillance and enforcement of the rules of the Ordinance. According to the section 26 of the Marine Fisheries Ordinance, 1983, it is an offence to use or attempt to use any explosive, poison or other noxious substances in water. Section 28 empowers government to declare any portion of Bangladesh fisheries water as a marine reserve to allow for special protection of aquatic flora and fauna therein.

The Penal Code, 1860 and the Criminal Procedure Code, 1898

The Penal Code, 1860 (as amended from time to time), while not environmental legislation, makes provision for punishments of environmental crimes. It applies to (1) whoever voluntarily vitiates the atmosphere in any place so as to make it noxious to the health of persons in general; (2) whoever voluntarily corrupts or fouls the water of any public spring or reservoir so as to render it less fit for the purpose for which it is ordinarily used; and (3) sale or offer for sale of any article of food or drink which has been rendered noxious and adulteration of articles of food or drink intended for sale.

The Code of Criminal Procedure, 1898 (as amended from time to time) also provides some arrangements applicable to environment conservation, such as (1) an order by the Magistrate for removal of nuisance; (2) an injunction to the person against whom the order was made, and (3) power to issue an order in urgent cases of nuisance or apprehended danger.

Other legislation

There is currently no public health legislation applicable to chemical contaminants, including POPs. Reporting of pesticide poisoning is not required. The Public Health (emergency provisions) Ordinance, 1944, is applicable to communicable diseases only. There are a few other laws that could potentially have application to POPs, namely the Juvenile Smoking Act, 1919, the Agricultural and Sanitary Improvement Act, 1920, the Forest Act, 1927, the Protection and Conservation of Fish Act, 1950, the Customs Act, 1969, the Bangladesh Wild Life (Preservation) Order, 1973, and the Motor Vehicle Ordinance, 1983.

2.2.5 Key approaches and procedures for POPs chemicals and pesticide management including enforcement and monitoring requirements

Provisions of the Environmental Conservation Act of 1995 and the Environmental Conservation Rule of 1997 provide the necessary the legislative authority for the Department of Environment to set out a basic environmental protection regime that addresses the key elements for the sound management of chemicals, as per Table 2 in Section 1.2.4. Key approaches and procedures for POPs chemicals and pesticide management are described below. The discussion of legislation includes application of existing legislation to POPs, as well as gaps in existing legislation that will need to be addressed relative to obligations under the Stockholm Convention.

2.2.5.1. STATUS OF EXISTING LEGISLATION ON POPS

Annex A and B pesticide POPs: The Import Policy Order 2003-2006 under its Sec. 2.1.8 lists *chlordane, DDT, dieldrin*, and heptachlor on its controlled list of insecticides for which importation is banned. Under Section 4 of the Pesticides Ordinance 1971, registrations for the six Annex A pesticides *aldrin, chlordane, dieldrin, endrin, heptachlor, hexachlorobenzene* had either been cancelled or withdrawn by 1997. *Toxaphene* and *mirex* are reported never to have been imported or used, hence were never registered. Therefore, these POPs cannot be imported, manufactured, formulated, repacked, sold, held in stock for sale or advertised in any manner. *DDT* was never registered, although it was used historically for agricultural and subsequently disease vector control, and continues to be held in stock and is reported to have been used for disease vector control as recently as 2000, primarily for the kala-azar vector (Rahman, Inception report, 2004; USAID, 2004).

Annex A, PCBs: There is currently no legislation specific to PCBs (e.g., their production, import, export or use, including use in equipment; or their recovery and disposal/destruction; inventories of PCBs, etc.). Specific names of PCB-containing substances and their threshold levels in equipment, etc., or applicability of non-destructive disposal techniques, penalties for illegal produce, sell, possess, export, hold etc. have therefore not been defined or addressed to date in Bangladesh legislation.

Annex C, by-product POPs: Bangladesh has no legislation specific to Annex C by-product POPs (dioxins and furans, PCBs, and hexachlorobenzene). The background and intent of existing laws geared to noxious substances and their emissions is such that amendment might be insufficient to address by-product POPs.

POPs wastes and contaminated sites: Transboundary movement of POPs wastes is not regulated by existing law. The only legislation addressing waste storage, handling and disposal is for pesticides, but this legislation as discussed below is not adequate for Annex A and B POPs pesticides wastes, hence existing legislation will require amendment. There is no legislation at present governing PCB or by-product wastes. There is no legislation at present pertaining to contaminated sites (e.g., their identification, provisions for containment, clean-up, etc.).

Toxic and hazardous substances generally: There is currently no public or other legislation that addresses health considerations relative to concentrations of toxic and hazardous chemicals (and POPs specifically) in food for human or animal consumption.

2.2.5.2 STRENGTHENING LEGISLATION

2.2.5.2.1 Legislative strengthening for Annex A and Annex B Pesticide POPs

The banning of production, use and import of POPs pesticides will have to be spelt out properly in law for all Annex A and Annex B pesticides.

For fulfilling the gaps remaining in existing law (the Pesticide Ordinance and Rules), the new law or amendment would need to address guidelines for safe handling, labelling, storage, transport, disposal, time frame for disposal, export provisions, trans-boundary movement of pesticides, routine reporting of releases, pollution prevention planning, emergency response planning, routine reporting of pesticide poisoning (POPs and POPs alternatives), financial supporting mechanism for enforcement of the legislation and safety reporting requirements.

The financial penalty, which has been fixed in the context of 1971 pesticide rules, will likely require a significant increase.

Section 56 of the Pesticide Rules would require amendment so as to address handling and destruction/disposal of pesticide POPs stockpiles and wastes, which cannot be treated as other pesticides, owing to their characteristics of toxicity at very low concentrations, persistence and bioaccumulation. For example, triple washing, although recommended by the Pesticide Rules, is not acceptable for POPs pesticides because even at very diluted concentrations these pesticides can pose a threat to the environment.

Similarly, incineration, a requirement for obsolete pesticides within the Pesticide Rules, unless carried out utilizing environmentally sound technology applicable to POPs pesticides (currently not available in Bangladesh), would result in emissions of dioxins and furans. Typically, the environmentally sound practice for destruction of pesticide POPs wastes by nations lacking adequate technology and having relatively small quantities of these POPs requiring destruction is shipment abroad to a country that has environmentally sound technology. Hence, the Pesticides Rule of 1985 would need to be examined to ensure they include adequate export provisions for POPs pesticide wastes.

There are currently no regulations that specify thresholds for destruction/disposal of POPs pesticides. The CoP of the Convention is mandated to establish threshold concentrations (as per provisions within Article 6). It would be expedient to consider finalized guidance when establishing low POPs content provisions within Bangladesh.[20] Capacity to accurately measure established concentrations is a related issue that would need to be addressed to enable such provisions to be implemented. Alternatively, the issue of threshold concentrations triggering destruction/irreversible transformation

[20] In decision (UNEP/POPS/CoP.1/CRP.5/ Rev.2) of CoP 1, the Parties are reminded to take into account the Basel Convention's technical guidelines for the environmentally sound management of POPs wastes, in particular the provisionally-defined "low POP content" levels of destruction and irreversible transformation, and methods considered to constitute environmentally sound disposal of wastes consisting of, or contaminated with POPs. The decision requests the Secretariat to further strengthen synergies with the Secretariat of the Basel Convention, and to keep Parties informed of the status of the technical guidelines, with a view to future consideration of a decision on the issue by the CoP. Currently, there is draft guidance for POPs low content concentrations that will be further developed and reviewed again at COP2.

of POPs pesticides could be avoided (in light of current national analytical capacity gaps) by mandating that all POPs pesticides be destroyed regardless of their concentration.

The Pesticides Ordinance, 1971, as environmental-specific legislation, does include health provisions to protect workers from poisoning associated with pesticides arising from their work. However, there are no health provisions relating to the general population or to vulnerable populations (including families of workers, children, those living near pesticide formulating facilities, etc.), including relative to poison detection and treatment (e.g., for POPs alternatives in use), or for monitoring and analysis of POPs exposure (e.g., chronic exposure over time) in humans and in food. Nor is there legislation for monitoring resistance of disease vector to pesticides used for their control to determine effectiveness of DDT or alternatives to POPs. Hence, legislation would also need to be strengthened relative to these shortcomings.

Also with respect to pesticide POPs, the following activities will be needed:

In the form of Application for Registration of Pesticides under the Pesticide Rules and relative to screening provisions, the rules should be amended to address all of the characteristics of POPs, particularly bioaccumulation.

Insert the names of the Annex A POPs pesticides in the above-mentioned laws that are not currently addressed (toxaphene and mirex) and impose a complete ban on them, such that no one can apply for registration and the registration authority is prohibited from registering them under any circumstances (with the exception of export for environmentally sound destruction).

The Import Policy Order 2003-2006 and the Custom Act 1969 should be amended with a ban imposed on the other Annex A POPs pesticides.

Register DDT for disease vector control only, and upon determining that suitable non-POPs alternatives are effective for disease vector control deregister DDT for all uses and impose a complete ban (both Pesticide Rules and via the Import Policy Order and Custom Act).

2.2.5.2.2 Legislation strengthening for PCBs

The Environment Conservation Act and Environment Conservation Rules, which provide a framework for conservation of the environment, improvement of environmental standards and control and mitigation of environmental pollution, could be utilized to effectively provide for PCB management consistent with Stockholm Convention provisions. The most relevant sections in regard to PCBs are Section 2 and Section 6A. Section 2 defines “environment”, “environment pollutant”, “hazardous substance”, “pollution”, “waste” etc., which can be applicable to PCBs because of their detrimental affect on environment and health. Section 6A *“Restrictions on manufacture, sale etc., of articles injurious to environment”* states that for any article injurious to the environment “… the Government may, by notification in the official Gazette, issue a direction imposing absolute ban on the manufacture, import, marketing, sale, demonstration for sale, stock, distribution, commercial carriage or commercial use, or allow the operation or management of such activities under conditions specified in the notification, and every person shall be bound to comply with such direction …”.

Thus, the law empowers the Director General of DoE to take necessary actions for imposing ban on use, import and dispose up of PCBs.

Accordingly, on 15 March 2005, the Director General of DoE issued a letter to the Chairman of BPDB and other relevant organisations requesting them to buy PCB free transformers, transformer oil, capacitors and to store all unserviceable oil in a safe place so that it is not sold in the market for other uses and it is kept away from humans. This letter could serve as the initial step prior to official *notification* as discussed above.

Existing legislation would also need to be strengthened relative to the timeline for retirement of PCB-containing in-service equipment and destruction of PCB wastes as consistent with the Stockholm Convention provisions. Legislation will also need to include provisions relative to spills/leak reporting for in-service equipment up through 2025 (when such in-service equipment must be retired), and appropriate responses for addressing spills and leaks. Similarly, legislation will need to address safe handling generally, labelling, storage, transport, and environmentally sound disposal of PCB wastes, including decommissioned equipment and also relative to recycling provisions as consistent with the Convention (i.e., recycling of PCB oils would be prohibited, as would re-use of PCB-containing equipment, unless it has first been decontaminated). Such legislation will also need to address safety provisions for workers. Legislation will also be required relative to removal and disposition of PCBs and worker safety within the ship-breaking industry, inspections, etc.

Regulations are required for PCBs in products, consistent with Stockholm Convention provisions, including timelines for phase out of PCB use in equipment, provisions for import and export of the PCBs in products and wastes, provisions prohibiting recycling of PCB contaminated oils, and life-cycle provisions (e.g., packaging, labeling, handling, storage, inspection, training and environmentally sound destruction/disposal of PCBs and contaminated equipment).

2.2.5.2.3 Legislative strengthening for by-product POPs

Under the Environmental Conservation Act of 1995 and Rule of 1997, the MoEF has the legal authority to manage by-product POPs as pertinent to operations of new facilities. Under Section 12, all *new facilities* must apply for and receive environmental clearances certificates from DoE in order to operate. In Section 7 of the Act, a procedure for the issuance for an Environmental Clearance Certificate is set out.[21] However, adjustments to the current procedures would be required to manage POPs in new facilities and with respect to operations of existing facilities. With respect to new facilities, these changes would include the following:

- Changes to schedules 9,10,11 and12 of the ECA Rule to specify elimination of POPs in wastewater effluents, wastes, air emissions and industrial discharges to the extent practicable.
- Some industries and operations listed in the Orange A and B categories of Schedule 1 should be reviewed as to their potential for the unintended production of POPs and, if warranted, moved into the Red category, namely:

[21] See also, EIA Guidelines for Industries, Department of Environment, Ministry of Environment and Forest, Government of the People's Republic of Bangladesh, June 1997.

- sawmills (if wood waste is burned as part of the operations)
- coal tar
- artificial fibres
- plastic materials
- adhesives
- box manufacturing
- production of utensils production of PVC items
- aluminium products
- bricks and tiles
- galvanizing
- carbon rod
- electric cable
- power loom
- ship breaking

Procedural changes to ensure consideration of by-product POPs in the environmental clearance process would require strengthening of expertise among departmental reviewers and certifiers. This will likely require technical sector specialists conversant with current processes and their current control technologies, pollution prevention-ESM approaches, and BAT and BET alternative technologies relevant to specific sectors and industries.

As existing industrial facilities are not addressed under this legislation, a new law or amendment to existing law would be required to address such sources. With respect to sources of by-product POPs that are small in and of themselves, but collectively significant, such as domestic burning for cooking or heating, brick burning, legislation might prove very difficult to enforce and an awareness raising campaign prove most effective.

2.2.5.2.4 Legislative strengthening common to all POPs

Environmentally sound disposal of all POPs wastes needs to be well described consistent with the spirit of modern environmental notions, such as the *Polluter Pays* principle, the *Precautionary Approach*, *assimilative capacity* approach, *risk assessment*, etc. Laws will be required to govern transboundary movement of POPs wastes, taking into account the potential that wastes may need to be transported elsewhere should Bangladesh determine that disposal in another country with appropriate technology is the preferred option for POPs waste destruction.

With respect to all Annex A and Annex B POPs, customs laws will need to be amended to prohibit illegal entry of DDT and PCBs at the entry point of the country. The reported incidence by the media and NGOs of the suspected use of illegal pesticides, i.e., non-licensed and non-registered pesticides in various areas of the country supports the need for well-trained inspectors and regularized, frequent inspections, as well as strengthened border inspections. The number of inspectors currently available to carry out inspections of POPs is insufficient and not required under law (although the shortage of

inspectors generally appears to be a government-wide problem and not restricted to DAE relative to POPs pesticides or MoEF relative to industrial emissions). Thus, for all POPs, legislation will need to address provisions requiring systematic training of customs officials and provision of proper equipment, machinery and facilities to enable detection of POPs and POPs wastes. For PCBs, inspections will need to ensure that PCB contaminated oils awaiting destruction/irreversible transformation or other environmentally sound disposal are properly stored and labeled and that inspections are adequate to prevent their use, with particular emphasis on food and feed processing industries.

Laws will need to be amended to require that the appropriate ministries and their agencies make an annual report to the government on the status of POPs legislative strengthening and implementation and enforcement of these provisions as applicable to all 12 of the Stockholm Convention POPs.

Table 10 below contrasts provisions within the Stockholm Convention to Bangladesh law to indicate where provisions apply and where gaps in legislation exist that will require amendment (Hossain, 2005).

Table 10. Convention obligation and Bangladesh's position

Applicable Article and State Obligation	Bangladesh's law	Comment
Preamble, Parties encouraged to develop regulatory and assessment schemes for pesticides and industrial chemicals if they do not already have them. **Article1** and **Art 2**, No obligation.		No obligation.
Article 3. 1) Elimination and restriction of production, use, import and export of Annex A & B POPs. 2) Take measures to ensure that POPs are imported complying the provisions only, 3) Take regulatory measures to prevent the introduction of new chemicals with POPs characteristics **Annex A, Part II (PCBs)** 1) Take action by 2025 to identify and remove from use PCBs in equipment above thresholds 2) Use only intact, non-leaking equipment and not use around food or feed areas 3) Take other measures to ensure sound management of disposal as detailed 4) Provide reports every five years on efforts to eliminate PCB use to CoP **Annex B, Part II (DDT)** 1) Each Party that produces or uses DDT shall restrict such activities only to disease vector control in accordance WHO guidelines 2) Each Party that produces or uses DDT shall provide the Secretariat and WHO with information on amounts used and conditions of use every three years	The Pesticides Act, 1971 Pesticide Rules, 1985 Import Policy Order, 2003-2006 Bangladesh Environment Conservation Act, 1995 (ECA'95)	The pesticides laws need to be amended for life cycle management of POPs pesticides (e.g., relative to their handling, packaging, collection, transport, labelling, temporary, storage, disposal and destruction). There is no law that addresses PCBs specifically. However, the ECA'95 may be effectively used to address PCB issues. Bangladesh ceased agricultural use of DDT in 1997. DDT was never registered, hence its legal status requires official clarification, i.e., registration and subsequent deregistration. All existing stockpiles of DDT are obsolete but will need to be officially declared waste under law and will need to be

Applicable Article and State Obligation	Bangladesh's law	Comment
		destroyed.
Article 4. Register of specific exemptions. Parties wishing to continue use of specific exemption beyond five year period need to submit report to the Secretariat for justification		Bangladesh has never produced POPs pesticides other than DDT. Bangladesh will likely apply for an exemption for DDT until a final determination of effectiveness of alternatives for control of disease vectors, in particular, kala-azar, is made. A registration for an exemption will enable Bangladesh to make a rational determination prior to its official phase out of DDT.
Article5. Measures to reduce/eliminate releases from unintentional production **Annex C (Unintentional Production)** Develop and implement an action plan to identify sources and reduce releases of POPS listed in Annex C (dioxins and furans). Promote measures, including best available techniques (BAT) and best environmental practices (BEP), to achieve release reduction and implement an action plan to identify sources and reduce releases through: 1) Evaluation of current and projected releases, 2) Source inventories and release estimates, 3) Evaluation of efficacy of relevant laws and policies, 4) Strategies to implement Article, 5) Education, training and awareness raising, 6) Review of strategies every 5 years Schedule for implementation, 7) Identifying BAT and BEP for particular industry, and 8) Awareness raising in industry and community on appropriate procedures, practices and alternatives.	The Bangladesh Environment Conservation Act, 1995 (ECA'95)	There is no law that directly addresses unintentional by-products; However, the ECA'95, may be effectively used to address these issues, incorporating the BAT and BEP and all other requirements stipulated in this Article. Action Plan for this Article is integral within the NIP. Implementation of specific actions will help to inform amendments required/drafting of standards, etc.
Article6 Measures to reduce/eliminate, releases from stockpiles and wastes: 1) Develop strategies and for identifying stockpiles of POPS listed in Annexes A and B, and products containing POPs listed in Annexes A, B and C and manage in an environmentally sound manner. 2) Take measures to ensure that POPs wastes is managed and disposed of in an environmentally sound manner according to international standards and guidelines.3) Not allow recovery, recycling, reclamation, direct use of alternative uses of POPs. 4) Ensure that transport of POPs wastes is consistent with Basel Convention. 5) Endeavour to identify POPs contaminated sites, and, if remediation is warranted, require that it be done in an environmentally	The Pesticides Act, 1971 Pesticide Rules, 1985, Bangladesh Environment Conservation Act, 1995 (ECA'95)	Law will require amendment to ensure compliance with the requirements of this Article. (Wastes include stockpiles of DDT; PCB wastes, including contaminated equipment).

Applicable Article and State Obligation	Bangladesh's law	Comment
sound manner. 6) Preliminary inventory of stockpiles of POPs, or products and wastes containing POPs.		
Article7 (Implementation Plans) Develop and endeavour to implement a plan to meet its obligations under the Convention to be submitted to the CoP within two years of entry into force for the Party.		This NIP is the product of inter-agency and stakeholder consultation. DoE, as the national focal point for Convention, will submit the final NIP on behalf of GoB.
Article 8 (Listing of chemicals in Annexes A, B & C)	No Law	It is a Party's prerogative. Bangladesh can list POPs subsequent to its ratification of the Convention.
Art 9 (Information Exchange) Facilitate/undertake exchange of information on POPs and their alternatives, and designate a national Focal Point for the exchange of such information.		National focal point (DoE) has been designated.
Art10 (Public information, awareness & education) Facilitate/promote awareness and understanding of POPS information to the public, particularly decision makers and effected groups.	No Law	Some public awareness materials have been produced and distributed.
Art11 (Research, development & monitoring)	No Law	A law will need to be developed relative to research, development and monitoring for POPS and POPs alternatives so as to support national and international efforts for protection of health and the environment and as consistent with the Convention.
Art12 (Technical assistance)		National capacity for POPs identification or analysis requires upgrading to meet international standards.
Art13 (Financial resources and mechanisms)		It is the obligation of developed country Parties. Identification of needs for financial assistance at national level is in process.
Art14 (Interim financial arrangements)		The NIP project in Bangladesh is made possible by assistance of GEF, which serves as the principal financial mechanism for the Convention. DoE has initiated discussions with donors. NIA will continue to explore financial arrangements for implementation of specific

Applicable Article and State Obligation	Bangladesh's law	Comment
		actions.
Art15 (Reporting)		Bangladesh will be obligated to report once it has ratified the Convention.
Art16 (Effectiveness evaluation)		Implement arrangements to be determined by the CoP at its first meeting.
Art 17 Non-compliance **Art 19** Conference of the Parties **Art 20** Secretariat **Art 21** Amendment to the Convention, **Art 22** Adoption and amendment of annexes, **Art 23** Right to vote		No Obligation
Art 24 Signature		Bangladesh signed the Convention on 23rd May 2001
Art 25 Ratification		In process.

Source: MoEF, 2005.

2.2.5.3 MINISTERIAL CAPACITY

2.2.5.3.1 Staffing and budget

In 2003, the DoE completed a restructuring plan for the department based on the strategic plan.[22] The restructuring plan outlines a gradual growth of the department from its base of 173 persons to 490 positions over a five-year period. The plan is specifically designed to enable the DoE to carry out the essential functions of a basic environmental protection process. The proposed plan includes development of a system of six laboratories to support essential enforcement activities and monitoring requirements, as well as a sufficient number of trained technical specialists to support environmental clearance and other key functions, such as inventories, assessments, and provision of technical advice on policy formulation. To date, the department has been allocated 244 positions; hence, more than half of the projected total remains to be filled. It is not clear when and if these other positions will be granted and filled. However, *a fully staffed operational organization will be required if the DoE is to successfully fulfill all the functions assigned to it by the Environmental Conservation Act and EC Rule, and if its capacity to manage pollutants, including POPs, is to be achieved.*

To provide just one example of the implications of inadequate staff, there is currently a shortage of trained personnel within MoEF to administer a full-fledged operational environmental clearance process as authorized under the ECA and Rule.[23] For example, in Dhaka division, a region with the second highest degree of industrial development, there is only an operational staff of two person years

[22] See the final report "Restructuring the DoE Organization" dated March 2003, produced by the Bangladesh Environmental Management Project (BEMP) a DoE project funded by CIDA.

[23] See the final report "Restructuring the DoE Organization" dated March 2003, produced by the Bangladesh Environmental Management Project (BEMP) a DoE project funded by CIDA.

devoted to the environmental clearance activity with support of three person years in the headquarters unit. Similarly, in the Chittagong Region there are only two person years for this purpose.

The limited amount of personnel reviews of applications for clearance will need to be addressed so that the environmental clearance process can be completed within a reasonable period. An adequate number of trained professionals will also be required to ensure the completeness of compliance reporting by facilities against stipulations in their certificates and a sufficient number of site inspections to ensure compliance with certificate conditions.

2.2.5.3.2 Inter-ministerial linkages

The linkages established via existing mechanisms (National Coordination Committee for POPs, Steering Committee, stakeholder consultation processes, etc.) will need to be maintained and strengthened in support of systematic information exchanges and active participation in NIP planning and implementation. Many ministries have an essential role to play in POPs management (e.g., those involved with health, power generation, agriculture (including fisheries and livestock), water, industry, commerce, transport, justice, and science and technology).

Strengthening linkages between the Ministry of Health and the DoE of the MoEF will be particularly important, as these are key ministries with respect to the scope of their involvement in NIP priority setting and implementation over the near and long term, including relative to other ministries. The DoE and the Department of Health already participate on a systematic basis with the MOA, DAE, and other ministry representatives on the PTAC relative to pesticide POPs registration. However, with respect to other areas of POPs management, communications and information sharing and planning relative to POPs will need to be substantially strengthened, including relative to disease-vector control, monitoring, and enhancement of analytical laboratory for chemicals/POPs.

Those ministries and agencies involved in waste management, and in ship breaking activities (as these pertain to PCB wastes and generation of unintentional POPs) will also need to be more actively involved through systematic efforts with the DoE, DGHS, etc., with considerable initial emphasis placed on awareness-raising of POPs life-cycle capacity needs relative to activities under their jurisdiction.

2.3 Assessment of the POPs issue in Bangladesh

2.3.1 Assessment with respect to Annex A, part 1 chemicals (POPs pesticides)

2.3.1.1 REGISTRATION HISTORY: ANNEX A POPS PESTICIDES

All Annex A POPs pesticide (aldrin, dieldrin, chlordane, endrin, heptachlor, hexachlorobenzene, mirex, and toxaphene) registrations had either been cancelled or withdrawn by 1997. Hence, in accordance with Article 4 of the Pesticides Ordinance 1971, they cannot be imported, manufactured,

formulated, repacked, sold, held in stock for sale or advertised in any manner. Toxaphene and mirex are reported never to have been imported or used, hence were never registered.

Before 1977 (from the period 1955-73), the Deputy Director (DD), Plant Protection Wing (PPW), Directorate of Agriculture (DOA), within the Ministry of Agriculture (MOA), was the single authority for pesticide registration. The Deputy Director listed pesticides used in manufacture or agriculture based on literature, research results and manufacturers' information. However, there was no standardization committee, and, as such, no registration formalities (Rahman, Inception Report, 2004).

Some screening of pesticides based on trial reports was instituted in the period 1973-1980. From 1981-1985, a pesticide Standardization Committee approved a pesticides list for allocation purposes with each year's purchases and allocations based on the previous year's procurements by private company firms. Formal registration, with the Director of the PPW of DAE as the registration authority, was instituted in 1986, in exercise of Clauses 4 and 5 of the Pesticide Ordinance of 1971, and the Pesticide Rules 1986 (Rahman Inception Report, 2004; GoB 2005b). Initially, all the pesticides listed by the previous Standardization Committee and procured/imported/marketed were registered *post-facto* in the name of the respective previous private agency/company. Subsequently, these pesticides were reviewed using screening procedures required by the Pesticide Rules (GoB, MoEF, 2005c).

Below is information on the registration history and import/export notifications as specific to each Annex A pesticide POP:[24]

Aldrin: This POP was never formally registered for use. The GoB notified the Secretariat of the Rotterdam Convention of its final decision not to consent to import in 1995. In 1997, the *post-facto* registration was cancelled (Rahman, citing PPW, 2004 and BCPA 2004a).

Chlordane: Chlordane 40 WP was registered for agricultural use by Krishi Banijya Prothistanon on 14 December 1986 (GoB, MoEF, 2005c; Rahman, Inception Report, citing PPW, 2004 and BCPA, 2003). The GoB interim decision on import furnished to the Rotterdam Convention Secretariat and published January 1998 in the PIC Circular indicates that the Bangladesh manufacturer had withdrawn the registration but the government consented to import chlordane under conditions. The single condition is listed as restricted use on sugar cane (PIC Circular, 2004). However, the 1997 ban is effective for imports as well as manufacture/formulation, resale or use of any kind and chlordane is included in the Import Policy Order (IPO) 1995-1997 list of items that cannot be imported (Ahmed, 1997).

Dieldrin: Dieldrin was registered as Areodreial 20 EC on 14 December 1986 by Liza Enterprise Ltd., and cancelled 14 July 1997. Dieldrin 20 EC, Dieldrin 50 WP and Dieldrin 40 WP were registered on

[24] The Government of Bangladesh as noted above, while in the process of ratifying the Rotterdam Convention, is not currently a Party, hence is under no obligation to furnish information to the Rotterdam Secretariat. Nevertheless, the GoB in the past has furnished information on some POPs to the Convention Secretariat, including with regard to registration status, and this information is reported here. Note that pesticides, for which registrations have been cancelled can no longer be imported; hence, consent to import notices for such pesticides would not longer be effective.

21 June 1987 by Shell Company of Bangladesh Ltd., and these registrations cancelled on 4 June 1997 (EADS 2005, citing PPW, 2005, BCPA). The GoB reported to the Rotterdam Convention Secretariat that the registration had been withdrawn by the manufacturer although it provided no formal notice requesting a ban on import. Hence, the PIC circular still indicates, "consent to import" for dieldrin (PIC Circular XIX, 2004) although cancellation of the registration prohibits such importation. UNEP Chemicals, in its 2002 *Regionally Based Assessment of Persistent Toxic Substances: Indian Ocean Regional Report*, indicates restricted use for dieldrin, but provides no details on the type of use or the source for this information.

Endrin: Endrin was never registered for use in Bangladesh and is reported to have been banned for all purposes under the Pesticides Rules 1985 (Rahman, Inception). The PIC circular of 2004 indicates "consent to import".

Heptachlor: Heptachlor 40 WP was registered by Krishni Banijya Prothistan on 14 December 1986 and the registration cancelled 4 June 1997 (GoB, MoEF, 2005c, citing PPW, 2005 and BCPA). The PIC Circular indicates registration for limited use as a termiticide based on information it published January 1998 (PIC, 2004). Heptachlor is on the banned list for the Import Policy Order for 1995-1997 (Ahmed, 1997).

Hexachlorobenzene: HCB was never registered for use in Bangladesh.

2.3.1.2 ANNEX A PESTICIDES PRODUCTION AND CONSUMPTION (USE)

Use of Annex A POPs pesticides was phased out by 1997 with cancellation or withdrawal of registrations (although as discussed below, there has been some use of some pesticide POPs for agricultural purposes from small remaining stocks through 2000). Annex A pesticide POPs were never manufactured in Bangladesh.

History of POPs pesticide use

POPs pesticides were first reported used in Bangladesh in 1955 when three metric tonnes (MT) of endrin were imported for controlling agricultural pests (Badruddin, Rahman, Inception report, 2004). Endrin is reported to have been used in agriculture through 1960. Aldrin, chlordane, dieldrin, heptachlor and lindane (BHC) were first imported for agriculture use in 1965, with aldrin and lindane discontinued for this purpose in 1965 (GoB, MoEF, 2005c).

Table 11. Previous known uses of Annex A POPs pesticides in Bangladesh

POP Chemical	**Use**
Chlordane	Soil-borne insect control (sugar cane; jute)
Aldrin	Crop pests
Dieldrin	Soil-borne insect control (sugar cane; jute; rice[a])
Endrin	No information
Heptachlor	Soil-borne insect control (sugar cane; jute); rice[a]; termiticide[b]
Mirex	Never imported or used
Toxaphene	Never imported or used
Hexachlorobenzene	No information

[a] FAO, 1994 (Source notes application at 4.5 kg/hectare)

[b] PIC Circular, 2004

Pesticide POPs were used primarily on rice crops, with some usage also reported for sugarcane, cotton, jute, etc. (GoB, MoEF, 2005c). For example, chlordane, dieldrin and heptachlor are reported to have been used for soil-borne insect control (sugarcane and jute) (UNEP, 1998). Heptachlor may also have been used as a termiticide, which is indicated as a restricted use in information furnished by the GoB to the Rotterdam Convention (PIC Circular, 2004).

Following cancellation of registration in 1997 of the Annex A POPs, marketing and consumption of existing stocks of these POPs appears to have continued up through 2000, based on the findings of a 2005 case study survey of wholesalers and retailers of pesticides conducted by the EADS for the Government of Bangladesh. According to the survey, chlordane, dieldrin, endrin and heptachlor (and also DDT, an Annex B pesticide) were sold through 1980, and thereafter Heptachlor 40WP and Dieldrin 20EC were sold through 2000. After 2000, all POPs stocks held by wholesalers and retailers in the sample study had been depleted (see Table 12 below). The uses of these POPs would likely have been agricultural. Results of a survey of farmers' POPs pesticide use, conducted by EADS for the GoB in 2005 via questionnaires and personal interviews, are largely in conformity with the wholesalers/retailers survey.

Before 1980, use of POPs pesticides by farmers (based on the survey group) was common. The most common use of POPs before 1980 was of endrin (86%), followed by heptachlor (23%), DDT (20%) and dieldrin (8%). Farmers reported using these POPs at their maximum recommended dose on rice, sugarcane, and potato crops, respectively. After 1980, the majority of the sample farmers used heptachlor (57%), followed by dieldrin (29%), DDT (21%) and chlordane (7%). Heptachlor, dieldrin, DDT and chlordane were used at their maximum does on sugarcane, rice and vegetables, respectively. From 1980 through 2000, they reported using chlordane, dieldrin and heptachlor. These farmers indicated in follow-up interviews that they obtained the POPs pesticides they used through cross-boundary sources. However, from 2000 onward, when sale of these pesticides by the wholesalers or retailers ceased within Bangladesh, farmers surveyed reported that they did not use any POPs (see Table 13).

Table 12: From 1970-2000, whaleshaller/Retaillers stocks and sale.

Whole-seller/Retailers	Year	Pesticides													
		Endrin		Chlordane 40 WP		Dieldrin/ Arodril 20 EC		Heptachlor 40 WP		DDT		Others	Total	
		Total Sale (kg)	Stock (kg)	Total Sale (kg)	Stock (kg)	Total Sale (kg)	Stock (kg)	Total Sale (kg)	Stock (kg)	Total Sale (kg)	Stock (kg)	Stock (kg)	Total Sale (kg)	Stock (kg)
Wholesaler	Up to 1979	1150	0	3150	0	11945	0	42920	0	1115	0	0	60280	0
	From 1980-Onward													
	1980-1990	0	0	500	0	14290	0	18850	0	0	0	0	33640	0
	1991-2000	0	0	0	0	480	0	2760	0	0	0	0	3240	0

		2000 - Onward	0	0	0	0	0	0	0	0	0	0	0	0	0
		Sub-total	0	0	500	0	14770	0	21610	0	0	0	0	36880	0
	Total		**1150**	**0**	**3650**	**0**	**26715**	**0**	**64530**	**0**	**1115**	**0**	**0**	**97160**	**0**
Retailer	Up to 1979		580	0	2100	0	6050	0	13670	0	100	0	0	22500	0
	From 1980-Onward														
		1980-1990	0	0	1000	0	2110	0	12275	0	0	0	0	15385	0
		1991-2000	0	0	0	0	10	0	2640	0	0	0	0	2650	0
		2000 - Onward	0	0	0	0	0	0	0	0	0	0	0	0	0
		Sub-total	0	0	1000	0	2120	0	14915	0	0	0	0	18035	0
	Total		**580**	**0**	**3100**	**0**	**8170**	**0**	**28585**	**0**	**100**	**0**	**0**	**40535**	**0**

Source: EADS, Pesticide Assessment, 2005.

Table 13. Use of POP pesticides before and after 1980 by sample farmers

Pesticides	**Farmers (No. & %) by Year**									
	Before 1980		**After 1980**							
			1980-1990		**1991-2000**		**2000-Onward**		**All**	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Heptachlor 40 WP	23	23	12	43	4	14	0	0	16	57
DDT	20	20	4	14	2	7	0	0	6	21
Endrin	42	42	0	0	0	0	0	0	0	0
Chlordane 40 WP	1	1	2	7	0	0	0	0	2	7
Dieldrin/Aerodril 20 EC	8	8	8	29	0	0	0	0	8	29
Total Sample	**99**	**100**							**28**	**100**

Source: EADS pesticide assessment, 2005

2.3.1.3 IMPORTS OF ANNEX A POPS PESTICIDES

All Annex A POPs pesticides used in Bangladesh were imported. Such imports of POPs pesticides date back to 1955, when the country was still part of East Pakistan, and continued up through 1997, when their importation was banned (Badruddin, Rahman, Inception Report, 2004). Records of imports are not available before 1974, although they have been extrapolated (Rahman, inception report, 2004; GoB, MoEF, 2005c) (see Table 14 below). Imports included product and/or active ingredient (a.i.) used in formulating pesticides by Bangladesh facilities.

Altogether, **there were an estimated 1452.36 metric tonnes-1533.435 MT of Annex A Stockholm Convention POPs pesticide imported from 1955-1997, of which 713.63 MT were active ingredients** that could be used in formulation of different brand name products.

- Chlordane was imported from 1960-1985, with records noting importation of Chlordane 40 WP. Chlordane was reportedly imported from May 1987 through May 1997. However, there is insufficient or no data available to determine quantities of chlordane imported during those years.
- Dieldrin was imported from the mid-1950s through 1993. From 1986-1997 Dieldrin 20 EC was imported.
- Endrin was imported from 1955 (when 3 MT were reported to have been received through donor agencies) until around 1963, when imports ceased as a result of concerns regarding its hazardous effects.
- Heptachlor was imported starting in the period 1960-1974, with the last import occurring in May 1997.
- Lindane: From 1960-1965, an estimated 94.72 metric tonnes of active ingredient were imported for agricultural use. Its registration in Bangladesh was cancelled in 1997. (Lindane is not a Stockholm Convention POP.)

Import history: Up through 1973, POPs pesticides were imported through supply credit, grant, loan, barter etc., provided by United Nations and donor agencies (e.g., FAO, USAID, the Danish bilateral aid agency, FRG, ADB, etc). The Pakistan Central Plant Protection Department procured all pesticides used for agriculture purposes up through 1965, which it distributed to the Provincial Directorate of Agriculture (Plant Protection; DOA of the former East Pakistan). After 1965, the Bangladesh Agricultural Development Corporation (BADC), a semi-autonomous body of the MOA, purchased pesticides based on its estimates of need as provided by the DD, Plant Protection branch of the DAE. The pesticides thus procured were centrally housed in Central Stores at Shyambazar and distributed from there to the districts, where they were housed in District Stores and then distributed to *thanas*, and subsequently in *Thana* Stores. From *thana Stores,* the pesticides were distributed to farmers free of cost (Rahman, Inception Report, 2004).

From 1974 to 1979, imported POP pesticides were similarly distributed via the DAE's network to districts and subsequently to *thanas*, which continued to sell them at the subsidized price as per government policy.

From 1973-1980, private agencies, including foreign manufacturers, became involved in the pesticide import and local formulation business, consistent with the government's withdrawal in April 1975 of its 50% subsidy for pesticides (Rahman, inception report, citing PAB, 1979), and ultimately, its complete privatization of the industry in 1980, when local agencies took over procurement, marketing and promotion. Pesticides were then sold at non-subsidized prices. Additionally, the DAE during the 1974–1985 period sold POPs pesticides directly to 15 Sugar Mills (108.00 MT Heptachlor 40WP procured in 1978 as per Annex IV of the GoB 2005 pesticides assessment). POPs pesticides imported from 1986 to 1997 were marketed and sold directly by companies through their wholesalers and retailers (GoB, MoEF, 2005c).

For the import period from 1955 to 1974 quantities of imported POPs are extrapolated from procurement records, based on the government's practice at the time of calculating procurement needs based on a previous year's use. In total, from 1955 through the 1974, an estimated total of 539.86 metric tonnes of active ingredients of aldrin, chlordane, dieldrin, endrin, and heptachlor are estimated to have been imported for use in agriculture (Rahman, Inception Report, 2004; EADS 2005).

Table 14. Imports of Stockholm Convention POPs pesticides for agricultural use 1950-1974

POP Pesticides	**Import Period**	**Extrapolated Quantity (Metric Tonnes of active ingredient (a.i.)**	**Import Period (BADC Stock Book 1974-1985; PAB 1976-1985)**	**Total imports (MT)**	**Import Period**	**Total imports (MT) (PPW and PAB Official Registers)**	**TOTAL IMPORTS (MT of** active ingredient, plus MT formulation)
Aldrin	1960-1965	70.00 a.i.	1974-1985	–	1986-May 1997	–	**70.ai.**
Chlordane	1960-1974	30.80 a.i.	1974-1985	2.2 PAB	1986-May 1997	No Data	**30.80 a.i. 2.2. PAB**
Dieldrin (+Dieldrin 20 EC)	1960-1974	227.33 a.i.	1974-1985	156.78+ BADC 194.851+PAB	1986-May 1997	56.52+ MT 11.30 +(a.i)	**238.63 a.i. 213.3-251.371**
Endrin	1955-1960**	25.00 a.i.	1974-1985	–	1986-May 1997	–	**25 a.i.**
Heptachlor (+Heptachlor 40 WP)	1960-1974	186.73 a.i.	1974-1985	119.25+ BADC 160.054+ PAB	1986-May 1997	406.18 MT+ 162.472+ (a.i)	**349.202 a.i. 525.43-566.225**
Total (a.i)	1960-1974	539.86 a.i.	1974-1985	276.03 BADC 357.105 PAB	1986-May 1997	462.70 MT 173.77 a.i.	**713.632 a.i. 738.728-794.803**

Source: Md. Mahbubar Rahman. Personal communication, extrapolation. (Inception report, 2004; and GoB, MoEF, 2005c)
* PPW, 2004 and BCPA
**Rahman indicates Endrin was imported until 1963 and gives extrapolation figure of 50.00 MT.

Information on quantity of procurement of pesticide POPs was not formally maintained until 1974 when the Bangladesh Agricultural Development Corporation (BADC) was the importing authority. The BADC *Official Stock Book* indicated a total of 276.03 MT of Heptachlor 40WP and Dieldrin 20EC were imported from 1974 to 1985.[25] While the BADC stock book did not include records of importation of chlordane, PAB records, maintained for the years 1976-1985, show importation of chlordane and higher amounts of imports of Heptachlor 40WP and Dieldrin 20EC for a total of 357.105 MT. Based on case study consultation of the Stock Books of 4 sample Divisions as reported via the District/*Upazila* Agriculture office, a total of 6545 pounds of Chlordane 40WP had been

[25] After 1985, the BADC no longer imported or regulated pesticides. From 1985 onward, in accordance with the Pesticide rules, 1985, the PPW maintained the official pesticides import records.

received; hence it is likely that the chlordane imported (as supported by PAB records) was Chlordane 40WP (GoB, MoEF, 2005c).

2.3.1.4 POTENTIAL ILLEGAL TRADE IN POPS

Every border crossing is subject to inspection, including inspection for plant protection based on the permit of the competent authority and the registry of permitted products approved for import. While such inspection, and the affordability of POPs alternatives has diminished the incentive for and likelihood of smuggling, reports of the continued use of banned pesticides[26] need to be authenticated through proper investigation, including analysis by a qualified laboratory.

The Deputy Director of the Department of Agricultural Extension, Plant Protection wing, during a 2001 workshop organized by the DoE, scientists and researchers, reported that some of the POPs pesticides might be imported illegally. For example, there are a number of anecdotal sources reporting cross-boundary entry into Bangladesh of some of the prohibited pesticides (chlordane, heptachlor, dieldrin), while other reports suggest that local companies may illegally formulate POPs pesticides that are sold via local distributors for control of soil-borne insects (Hossain 2000; UNEP 2001, Toxics Link 2004). The Indian ENGO *Toxics Link* reports that India exported 8.3 metric tonnes of aldrin and 16 tones of chlordane to Bangladesh during the April 1998-December 1999 period, subsequent to the 1997 ban on POPs in Bangladesh (Toxics Link, 2004, citing its Trojan Horses 2000 report) and provides the table below of purported quantities of POPs introduced to Bangladesh in its report on POPs use in South Asia. The Bangladesh government needs to verify this information before taking any action.

Table 15. Estimates of pesticides smuggled into Bangladesh

Trade name	Common name	Pkt size	Smuggled price (tk)	Estimated quantity smuggled
Eldrin 20 EC	Endrin	1 litre	235	25 KL
Dieldrin 20 EC	Dieldrin	1 litre	235	25 KL
Chlordane 20 EC	Chlordane	1 litre	235	35 KL
DDT	DDT	1 Kg	30	100 MT
Heptachlor 40 WP	Heptachlor	1 Kg	30	60 MT

Source: Pesticide Association of Bangladesh Report. Communication from Dr Hayat

Source: POPs in South Asia, Toxics Link, July 2004. Citing information provided by Dr. Hayat (a contributing author to the UNEP 2002 PTS report).

2.3.1.5 POPS ALTERNATIVES AND PESTICIDE CONSUMPTION

2.3.1.5.1 POPs alternatives used in agriculture

The majority of pesticides used in agriculture since POPs use for this purpose was prohibited, fall mainly into three chemical groups: *carbamates* (64%), *organophosphates* (34%) and *synthetic*

[26] It is not uncommon for products claiming to be a POP to be another type of product.

pyrithroate (2%) (Badruddin, Inception Report 2004). As reported consumption of chlorinated hydrocarbon pesticides (which includes POPs) declined, use of carbamates and organophosphates increased, as shown in Table 16 below. For example, soil pests that infest sugarcane and tea, including termites and white ants, were previously controlled by dieldrin, heptachlor and chlordane, which have since been replaced by insecticides such as chlorpyrifos (Dursban), an organophosphate, and Marshal, a carbosulfan. These pesticides, while less persistent than POPs, are nevertheless acutely toxic, hence can pose a health risk in the near term to applicators and others who come into contact with them without taking appropriate precautions (e.g. protective gear; and with regard to access to stored pesticides to prevent accidental contact).

Table 16. Bangladesh annual use of chlorinated pesticides, organophosphates from 1990-1998 (Metric tonnes)

Year	Chlorinated Hydrocarbons	Organophosphates	Carbamate insecticides
1990	30	720	170
1991	24	751	182
1992	32	821	202
1993	28	855	210
1994	0	0	0
1995	35	810	250
1996	15	950	270
1997	6	970	372
1998	8	920	390
1999	8		515
2000	11	1290	520

Source: FAO Agricultural Database.

2.3.1.5.2 Rationale for pesticide use in Bangladesh today and overall trends in use

The following discussion provides an overview of the context in which both POPs pesticides and currently, non-POPs pesticides are used and trends in overall types and volumes of non-POPs pesticides utilized since the bank on POPs became effective.

Rationale for pesticide use

Chemical control has been the primary method of pest control in Bangladesh since 1955 when the first use of pesticides reported was for POPs (see Section below for details on POPs consumption). The GoB observes that pesticides continue to serve as the most effective method for protecting crops that are vulnerable to partial or total loss in the country's tropical climate. For example, studies of crop loss due to insect pests and diseases (based on experimental plots or studies utilizing farmers' fields) reported average potential loss in rice in 1992 of 15.8% from pests, 9.9% from disease, and 1.5% from rodents (Shahjahan, 1993). Under farmers' field conditions, in certain years and places, crop losses ranging from 35% to 80% – 100% have been recorded for a single insect or disease, especially in the case of rice (Shahjahan, 1993). Similar estimates apply to wheat, jute, sugarcane,

pulses, oilseeds, vegetables and fruits. For examples, estimates of annual loss due to insect pests are 16% for rice, 11% for wheat, 20% for sugarcane, 25% for vegetables, 15% for jute and 25% for pulses (Alam et al., 1981; Khan 1991, Rahman, 2000). Increased use of pesticides in Bangladesh is correlated with increased crop production. The major use of pesticides is for cultivation of high-yield rice varieties and also other rice varieties. Cultivation of rice of all types has increased to meet Bangladesh food self-sufficiency needs, with crop acreage increasing from 7.89 million hectares in 1956 to 10.24 million hectares in 1998 (Islam, 2002), an increase of 77%. However, some predictions suggest that, assuming the present level of population growth is maintained, rice production will have to increased by at least another 60% to maintain the present level of rice requirements by the year 2020 (Sattar, citing Bhuiyan and Karim, 1999).

Trends in pesticide use 1995 to the present

Up until 1974, the government provided a 100% subsidy of pesticides, i.e., they were supplied free of cost to farmers (Badruddin, 2004). Initially, international donors provided POPs pesticides. Subsequently, the Department of Agricultural Extension (DAE) sold pesticides of various types at a 50% subsidy from April 1974 to April 1975, when the subsidy was withdrawn. In 1975, the Pesticide Association of Bangladesh (PAB), now the Bangladesh Corp Protection Association (BCPA), was formed to represent private sector interests. In 1979, the pesticides industry was privatized (GoB, MoEF, 2005c). Consistent with the introduction of privatization and the government's desire to promote import and use of pesticides, the government implemented a policy of gradual removal of obstacles to import and trade of pesticides. By 1989-90, most quantitative restrictions on pesticide import had been removed. Importers have since been permitted to import unlimited quantities of registered pesticides with minimum or no taxes and duties.

While the withdrawal of subsidy initially caused a slight decrease in pesticide consumption, after a short time, consumption again gained momentum, and is again increasing, having reached 18,080 metric tonnes in 2003 (GoB, MoEF, 2005c, citing BCPA, 2004a). Additionally, the government maintains a buffer stock of pesticides (variously reported as from 15 tonnes-20 tonnes (Bangladpedia) to 100 tonnes (Islam, 2002), to deal with emergency situations.

As of 2000, there were 100 companies registered to market pesticides, including three multi-national companies, Syngenta, Bayer Crop Science and FMC (GoB, MoEF, 2005c). However, of these firms, in 2003, only 18 companies were actively marketing pesticides, which totalled 3,866.24 MT/Kl of Active Ingredients (a.i.) and 18,080.44 MT/Kl of Formulated Products (FP) of pesticides (GoB, MoEF, 2005c, citing BCPA, 2004a). Those firms marketing the largest quantities of active ingredients and/or formulated products in 2003 included Syngenta Bangladesh Ltd., ACI Ltd., Auto Equipment Ltd., Bayer Crop Science Ltd., Shetu Corporation Ltd., Alpha Agro Ltd., BASF Bangladesh Ltd., and McDonnald Bangladesh Ltd. (GoB, MoEF, 2005c).

Only a few firms have formulation facilities and can formulate the respective registered brand out of the imported technical grade materials. Only those companies that have approved formulation plants and hold licenses can import both the technical grade materials and formulated products, while those having no formulation facilities can import formulated products only. Since decommissioning of the country's one pesticide manufacturing plant, which operated from 1966-1992/93 to manufacture DDT

(see subsection 2.3.3 for details), neither the government nor any firms have manufactured pesticides in Bangladesh (GoB, MoEF, 2005c).

Pesticides are registered with the Plant Protection Wing (PPW) as Public Health Pesticides (PHP) and Agricultural Pesticides (AP), respectively. From 1985, when registration was formalized, onward there were a total of 132 active ingredients represented by 813 brands for AP use, of which the registration of 32 active ingredients and 86 brands were cancelled, and 5 active ingredients and 17 brands banned. Those pesticides that were cancelled or banned were mostly WHO Class 1a (extremely hazardous) and 1b (highly hazardous) pesticides, or ozone depleting substances (GoB, MoEF, 2005c).

Currently, there are a total of 141 active ingredients (a.i.) (48 a.i. registered as PHP represented by 122 products (trade names) and 93 a.i. registered as AP, represented by 303 products (trade names) (GoB, MoEF, 2005c).

Despite the increase in overall pesticide consumption (see Table 17 and Figure 7 below), the 0.3 kg average per hectare use of pesticides in Bangladesh remains low in comparison to both developed nations and other developing countries of the Asia Pacific Region (e.g., 1 kg in India, 0.8 kg in Indonesia, 20 kg in Japan (Badruddin, Inception, 2004). A Ministry of Agriculture study estimates that 1.8 million hectares of the total 8.4 million hectares that are farmed were treated with pesticides in 1992.

Table 17. Chronological increase of pesticides use in Bangladesh

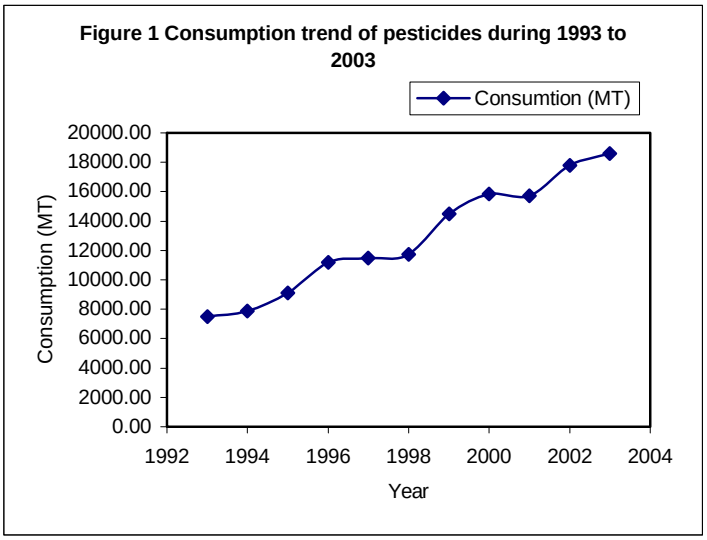
Year	Tons	Year	Tons
1987 - 1988	4 264	1993 - 1994	7 270
1988 - 1989	6 319	1994 - 1995	7 850
1989 - 1990	6 280	1995 - 1996	9 220
1990 - 1991	6 901	1996 - 1997	11 220
1991 - 1992	7 181	1997 - 1998	11 611
1992 - 1993	7 033	1998 - 1999	12 909

Source: Hossain, 2000

The pesticide market in Bangladesh shows a continued upward trend as shown in Figure 4**.**

The majority of pesticide use is a for pest control, which historically has accounted for approximately 90% of total consumed pesticide (Islam, 2002). Between 1982 and 1992 the total amount of active ingredient used in the country increased by 66% (for insecticides), 260% (for herbicides), and 1467% (for fungicides) (Hossain 2000, citing GoB/MOA 1995). Today, insecticides account for 70% of the market, fungicides for 15% and herbicides just 5% (Badruddin, Inception report, 2004). Types of pesticides used in Bangladesh in the past five years are presented in the Table 18.

Figure 7. Consumption trend of pesticide 1993-2003



Source: GoB, 2005c.

Table 18. Procurement and sales of POPs pesticides and non-POP pesticides by pesticide companies in Bangladesh 1998–2003

Farming practices involving pesticides

Farmers normally buy pesticides from local retailers, who purchase from pesticide dealers. The dealers, in turn, are connected to a network of wholesalers or distributors and these to the pesticide company at the national level. The retailers typically remove the pesticides from their original packaging, offering them for sale in smaller packets or bottles that no longer have the original labels. The farmers can buy the pesticides over the counter as for any other household commodity.

The pesticide retailers/dealers guide the farmers in buying and using the pesticides. Farmers also obtain advice from the Block Supervisors (BSs) and agricultural officials at *Upazila* Agriculture Office for selecting pesticides for their crops (GoB, MoEF, 2005c).

Many farmers cannot afford sprayers or other appropriate methods/equipment, although they are advised to apply the pesticides by sprayer. For this reason, pesticides are typically applied in granular form by hand by farmers or employed labour (GoB, MoEF, 2005c). Of the total 18,080 tonnes of pesticide consumed in 2003, about 14,500 tons are estimated to be in granular formation, 2000 tons in liquid form, and nearly 1500 tons in powder form. The appropriate dose is based on advice from the Block Supervisors or pesticide dealers. No aerial applications are reported to have been carried out since 1996 (Hossain 2000).

Despite the system in place for promotion of safe use of pesticides, farming practices with regard to pesticide use, as typical of many developing nations, are far from ideal. For example, a Bangladesh-Canada Agriculture Sector Team study on pesticide handling and use reported the following:

- 80% of farmers surveyed were unaware of non-chemical methods of pest control
- Public sources of water such as ponds, rivers/canals etc. are indiscriminately used by the farmers for washing their bodies, contaminated clothing and equipment after applying pesticides
- Few farmers have training on pesticide use and safety
- Protective clothing and equipment are usually not used by farmers when applying pesticides; and
- Safe storage of pesticides at the farm level is virtually non-existent; only 9% of farmers have well protected storage arrangements
- Farmers typically fail to discriminate between beneficial insects and crop pests (Islam, 2002).

Additionally, some studies have noted that, due to lack of knowledge, some farmers may be using the wrong pesticides, or use the correct pesticides at either sub-optimal doses because they cannot afford to buy the required quantity required, or conversely, apply excessive amounts (Hossain 2000, citing Ramaswamy 1992; Jackson 1991; EADS 2005). One study reports that indiscriminate, excessive and non-judicial use of pesticides and fertilizers is common everywhere and that some farmers are using pesticides up to 60 times for a single crop (Islam, 2002).

Iindiscriminate pesticide use has been associated with poisoning and also in one publicized incident (1999) a massive bird die-off (5000 or more sparrows) in Dakatia, a village of 40,000 people in Jessore, a district in the western border region of Bangladesh. Among the pesticides commonly promoted by pesticide companies that were reported to be used on village crops in Dakatia were Marshal 6G and 20EC (Carbosulfan), Suntap 50SP (Cartap), Ripcord 10EC (Cypermethrin), Sumithion (Fenitrothion), KAP 50EC (Phenthoate), Sevin 10% Dust (Carbaryl), Ustad 10EC (Cypermethrin, a pyrythroid), Sumibus 75EC (Fenitrothion + BPMCS) and Thiovit 80WP (sulfur). Most of these are categorised as moderately hazardous. Several Indian pesticides (Ustad, Thidrin and Methodrin) were also found in the village with Ustad implicated in the bird die-off as it was sprayed in eggplant and pointed gourd fields where the sparrows died the next day (Ubinig, 1999).

Integrated pest management (IPM)

Application of pesticides beyond a particular amount per hectare for specific crops show a leveling off or even decline in productivity for some crops. In some instances, pesticide application has resulted in increases in secondary pests. For example, resurgence of the Brown Plant Hopper (BPH) in 1991 in Nilphamari and Rangpur districts of Bangladesh was attributed, in part, to the excessive use of pesticides (Hossain, 2000).

Bangladesh first initiated work on IPM via the FAO inter-country rice (ICP) IPM programme in 1981, expanding the programme in 1987 as part of the project's second phase. From 1989 to 1995, ICP provided IPM training to build the training capacity of Department of Agricultural Extension (DAE) staff, and introduced Farmer Field Schools for training farmers. A number of persons from NGOs were also given training in IPM (Hossain, 2000). Reductions of pesticide of as much as 80% were achieved within one season following training in IPM in Bangladesh, while achieving yields comparable to or 10% higher than those achieved through agrochemical farming (Hossain, 2000). As

of 2000, close to 100,000 farmers received season-long practical in depth training in IPM. However, this figure represents just 0.27% of the estimated 36 million farmers employed in agriculture in Bangladesh. As a result of successes of the ICP and other IPM pilot training (with DAE-UNDP/FAO DAE-DANIDA, etc.) promotion of IPM is now official government policy.

Public health use of pesticides

The Dhaka City Corporation (DCC) is the largest user of *Public Health Pesticides*. The DCC did not use any POPs pesticides during the period 1999 to 2004. The 13 pesticides used during this four-year period are shown in Table 19 below.

Table 19. Pesticides used by the Dhaka City Corporation (DCC) 1999- 2004

POP Pesticides	Non- POP pesticides								
Quantity	Sl. No	Name	Purpose of Use	Quantity, Year Wise (Litre)					
				1999-00	2000-01	2001-02	2002-03	2003-04	Total
Nil	1	Abet	Larvicide	1440	11640	11660	0	10	24750
	2	Ciko-Flying	Adulticide	154800	215540	70590	450	25000	466380
	3	Malaria Oil-B	Larvicide	50200	58000	29345	5400	188400	331345
	4	Cidial	Larvicide	4000	10000		0	0	14000
	5	Newcidol	Larvicide	8990	10		0	0	9000
	6	Icon	Adulticide	5000	23400	200	0	0	28600
	7	Aktelic	Larvicide	0	0	0	7890	110	8000
	8	Quick Kill Fogging Fluid	Adulticide	0	0	0	17593	0	17593
	9	Malathion	Adulticide	0	0	0	0	2000	2000
	10	Anvil 10+10	Adulticide	0	0	0	0	5684	5684
	11	Fenitox	Larvicide	0	0	0	0	10000	10000
	12	Tepsy Liquid	Adulticide	0	0	0	0	44800	44800
	13	ACI Liquid	Adulticide	0	0	0	0	75000	75000
Nil	**Total**			**224430**	**318590**	**111795**	**31333**	**351004**	**1037152**

2.3.2 Assessment with respect to Annex A, part II chemicals (PCBs)

Annex A, Part II Chemicals are Polychlorinated biphenyls (PCBs). Most PCBs were used in closed systems, primarily in equipment used by the electrical sector, which is typically the major source of PCBs in a country and likely in Bangladesh. PCB-contaminated oils and equipment containing or contaminated with these oils (electrical transformers, capacitors, etc.) are of concern owing to past or potential leaks and evaporation of PCBs during use, and improper storage or disposal of PCB-contaminated oils and equipment. Another concern would be sale and use of contaminated oils, particularly with respect to the food-processing sector including for use in heat-exchange equipment or as a fuel, or for domestic cooking,

PCBs (or PCB mixtures) were never manufactured in Bangladesh. However, PCB compounds are still in use in Bangladesh, mostly in closed systems as dielectrics in transformers and capacitors used in the electrical generating sector. At this time, the facilities for identification of PCB content in electrical equipment are not available within the power sector or government laboratories within Bangladesh; hence as discussed below, PCB content is estimated base on typical practice in Bangladesh and internationally with regard to suspected PCB content. The present inventory of the electrical sector does not include PCB-containing hydraulic fluids, which will be estimated as part of future activities.

The ship-breaking sector is another potential source of PCBs for which PCB content was estimated for the first time as part of this inventory.

With respect to open systems, PCBs were used in the past as plasticizers in dyes, adhesives, plastics, lubricating oil formulations, etc. During PCBs inventory process and collection of data about PCBs use, no PCBs in the open systems were identified, hence such use is not reflected in the inventory.

The results of the preliminary national inventory of PCBs conducted in 2005 for the electrical and ship-breaking sectors are summarized below.

2.3.2.1 ELECTRICAL GENERATING SECTOR

Six entities comprise the Bangladesh generating sector: the Bangladesh Power Development Board (BPDB), the Dhaka Electric Supply Authority (DESA), the Dhaka Electric Supply Company (DESCO), the Power Grid Company of Bangladesh (PGCB), the Rural Electrification Board (REB) and the Independent Power Producers (IPP). (See also the description of the power generating sector in Section 2.1.3). Collectively, they have in service 2,353 power transformers, 374,260 distribution transformers, and 84 oil circuit breakers (OCB). These are utilized in 425 locations throughout the country. The type and location of in-service equipment is shown below in Table 20.

The total volume of transformer oil within in-service transformers (power and distribution), capacitors and oil circuit breaks is estimated at 107,370 metric tones (Table 21). As there are no reliable facilities for analysis and identification of PCB content in this oil within the power sector in Bangladesh or via government laboratories, there is no capacity within Bangladesh at this time to determine the concentration of PCBs in this oil. However, trade names of transformer oil recorded

from field observations,[27] and the common practice within in the electrical industry (as was common practice in this sector globally) of "topping up" oil levels in transformers (i.e., to replace oil lost over time due to evaporation, leaking, spills, etc.) suggests that irregardless of labels on transformers that may indicate no PCB content, most of the surveyed electrical equipment could have been, and indeed is likely to be, contaminated with PCB oils.

Electrical power transformers, capacitors, lubricating oils, etc. have been imported to Bangladesh for an indeterminate period as records were not maintained. As manufacture of PCBs in other nations began in 1929, it is possible their import dates back to this period although most equipment in use in Bangladesh today was fabricated after the 1970s.[28] The widespread prohibition on manufacture, distribution and processing of PCBs from the1980s onward means that older equipment, in general, is likely to have higher PCB content. However, some equipment imported as recently as 2000 was found during the survey labelled with PCB content. Additionally, the practice of "topping up" the level of transformer oil in electrical equipment with unlabelled or PCB transformer oils means that age of equipment is not, in itself, a reliable indication of PCB content. Therefore, all equipment will need to be sampled and analyzed to verify if PCB content or contamination has occurred.

Table 20. Number of in-service transformers and other equipment by sector and location

Sl. No.	Sector and Sub-sector	Category	No. of Companies	No. of Locations	Equipment (No.)						
					Transformer					OCB	Total
					Power Transformer			*Distribution Transformer	Total		
					Main	Auxiliary	Total				
1. BPDB											
		Power Station	1	19	156	2	158	128	286	0	286
		Distribution Sub-station	1	59	318	88	406	14682	15088	49	15137
		Subtotal	2	66	474	90	564	14810	15374	49	15423
2. DESA		Distribution Sub-station	2	3	31	0	31	6556	6587	0	6587
3.	DESCO	Distribution Sub-station	1	1	27	11	38	2894	2932	4	2936
4.	PGCB	Grid sub-station	9	39	257	29	286		286	31	317
5.	IPP	Power Station	5	6	32		32	0	32		32
6.	*REB	PBS	67	308			1402	350000	351402		351402
	Grand Total		**86**	**425**	**821**	**130**	**2,353**	**374,260**	**376,613**	**84**	**376,697**

Source: *Field Survey*

* Data were collected from official sources

[27] A survey of 1,163 transformers, found that 451 contained 30 different brands of transformer oil with unknown PCB content.

[28] For example, out of the 1,163 electrical power units surveyed, 741 were fabricated before 1990, 267 were fabricated from 1991 to 2000, and the remaining 155 were fabricated after 2000 (See Table 23).

Table 21. Quantity of transformer oil within the Bangladesh power sector

Sl. No.	Owners/companies	Quantity of Oil (kg)						
		Transformer					OCB	Total
		Power Transformer			*Distribution Transformer	Total		
		Main	Auxiliary	Total				
1.	BPDB (Power Station & Distribution sub-station)	3326052	47546	3373598	6370759	9744357	18335	9762692
2.	DESA (Grid sub-station & Distribution sub-station)	247949	0	247949	1639000	1886949	0	1886949
3.	DESCO	204834	4208	209042	607740	816782	1000	817782
4.	PGCB	4915772	29978	4945750		4945750	83604	5029354
5.	IPP	509373	0	509373		509373		509373
6.	REB*			1967025	87500000	89467025		89467025
Grand total		**9,203,980**	**81732**	**11,252,737**	**96,117,499**	**107,370,236**	**102,939**	**107,473,175**

Source: MoEF, Final PCB inventory, April 2005.
** Data collected from official sources.*

Information on transformer oil brand names found in transformers, the number of power transformers by country of origin and year of fabrication and the quantity of transformer oil as correlated to the year of fabrication and number of transformer units is shown in Tables 22 – 23 below. Most transformers were imported from 29 different nations, with the greatest number imported from Korea (241), Japan (200), China (130), Germany (83), England (74), India (55), Belgium (53), Poland (32) and France (29). A number of the **importing nations** were known to use PCBs in their electrical equipment. The main nations manufacturing transformers that were **imported** include the United States, Canada, USSR and Russia, Germany, Italy, West Germany, the Czech Republic, Czechoslovakia, and Sweden. Additionally, Energy Pac and General Electric Company manufactured transformers in Bangladesh.

Lubricating oil in Bangladesh power stations is estimated at 3,818 MT, of which 3,336 MT are estimated to be in use and 492 MT in stock (Table 24).

Table 22. Brand name of transformer oils used in transformers in Bangladesh

Sl. No.	Liquid	Power Transformers			OCB	Total	Quantity of Oil (kg)	Distribution Transformer		Total Oil (kg)	PCB Content
		Main	Auxiliary	Total				No.	Oil (kg)		
A. Survey Data											
01.	ASKAREL	2	2	4	0	4	15690	0	0	15690	Not Known
02.	ASTMD3487	3	0	3	0	3	73800	0	0	73800	Not Known
03.	BP, ENERGOL, Singapore	46	0	46	0	46	622907	0	0	622907	Not Known
04.	BP, TRANSFO-2	4	0	4	0	4	27520	0	0	27520	Not Known
05.	BP-ENERGIL, USA	12	0	12	0	12	168187	0	0	168187	Not Known
06.	DONG NAM LTD, Korea	21	11	32	0	32	296190	0	0	296190	Not Known
07.	DONG NAM PETRO. LTD	5	3	8	0	8	51010	0	0	51010	Not Known
08.	EDISOL	1	0	1	0	1	6000	0	0	6000	Not Known
09.	ELECTROL, INDIA	0	2	2	0	2	576	0	0	576	Not Known
10.	EMCO, India	14	7	21	0	21	107272	0	0	107272	Not Known
11.	Hyrex, Malaysia	4	0	4	0	4	96450	0	0	96450	Not Known
12.	IEC-296	27	0	27	0	27	446095	0	0	446095	Not Known
13.	IEC-976	6	0	6	0	6	20614	0	0	20614	Not Known
14.	IKR -982-68	1	0	1	0	1	6400	0	0	6400	Not Known
15.	JIS-C-2320	6	0	6	0	6	99000	0	0	99000	Not Known
16.	Mineral Oil	15	0	15	0	15	55823	0	0	55823	Not Known
17.	Mobilect 35	2	0	2	0	2	17250	0	0	17250	Not Known
18.	NF-C-27-0	3	0	3	0	3	28700	0	0	28700	Not Known
22.	Nynas Nitro Lox	1	0	1	0	1	6070	0	0	6070	Not Known
23.	SHELL 4610	16	0	16	0	16	248150	0	0	248150	Not Known
24.	Shell, Diola-B	22	2	24	2	26	270629	0	0	270629	Not Known
25.	Sovtol-10	0	0	0	0	0	0	22	31982	31982	Not Known
26.	TKN-982-56	15	0	15	0	15	240280	0	0	240280	Not Known
27.	Transformer oil	111	0	111	0	111	853416	0	0	853416	Not Known
28.	TRANSOL	5	0	5	0	5	39572	0	0	39572	Not Known
29.	X- Former oil	5	0	5	0	5	27300	0	0	27300	Not Known
30.	YILONG, CHINA	23	12	35	0	35	504207	0	0	504207	Not Known
	Total	*370*	*39*	*409*	*2*	*433*	*4329108*	*22*	*31982*	*4361090*	Not Known
31.	Not known	451	91	542	82	730	5059543	106	231064	5290607	Not Known
Sub-total		*821*	*130*	*951*	*84*	*1163*	*9388651*	*128*	*263046*	*9651697*	*Not Known*
B*. Not known (Distribution Transformer)											
01.	BPDB, DESA & DESCO							24132	8354453	8354453	Not Known
02.	REB			1402		1402	1967025	350000	87500000	89467025	Not Known
Sub-total				*1402*		*1402*	*1967025*	*374132*	*9.6E+07*	*97821478*	*Not Known*
Grand Total		**821**	**130**	**2,353**	**84**	**2,565**	**11,355,676**	**374,260**	**96,117,499**	**107,473,175**	

Source: MoEF, Final PCB inventory, April 2005.

Table 23. Oil in electrical equipment by year of equipment fabrication, country of origin and trade name of oils

Year of Fabrication		No. of Equipment	Quantity of Oils by									
			Country of Origin			Manufacturer			Trade Name of Oils			
			Origin known by reference: (USA, Germany, USSR & Russia	Others (No reference)	* Not known (Distribution Transformer)	Having ref. (General Electric Company, General Electric Ltd. GEC, GEC Subcidiaries, Westing House & AEG)	Others (No reference)	* Not known (Distribution Transformer)	Having ref. (Askaral, Sovtol-10)	Others (No reference)	Not known	* Not known (Distribution Transformer)
A. Survey Data (BPDB, DESA, DESCO, PGCB and IPP)												
Old	**Upto 1970**	179	322569	937099		644538	615130		120	353890	905658	
	1971-1980	84	95820	683966		50575	721096		2640	273770	495261	
	1981-1990	478	784332	2260471		73180	2971623		8682	1559221	1476900	
	Sub-total	741	1202721	3881536		768293	4307849		11442	2186881	2877819	
New	**1991-2000**	267	164660	2611253		1480	2782548		20660	1121308	1570351	
	Above 2000	155	2300	1789460		492	1791268		15570	825352	1022547	
	Sub-total	422	166960	4400713		1972	4573816		36230	1946660	2592898	
	Total	1,163	**1,369,681**	**8,282,249**		**770,265**	**8,881,665**		**47,672**	**4,133,541**	**5,470,717**	
B. Distribution Transformer												
	BPDB	14682			6107480			6107480				6107480
	DESA	6556			1639000			1639000				1639000
	DESCO	2894			607740			607740				607740
	REB	351402			89467025			89467025				89467025
		375534			97821245			97821245				97821245
Grand Total		**376,697**	**1,369,681**	**8,282,249**	**97,821,245**	**770,265**	**8,881,665**	**97,821,245**	**47,672**	**4,133,541**	**5,470,717**	**97,821,245**

Source: MoEF, Final PCB inventory, April 2005

Table 24. Quantity of lubricating oil used in Bangladesh power stations

Sl. No.	Name of Power Station	Oil (kg)		
		In use	Stock	Total
01.	Sylhet Gas Turbine	7728	1800	9528
02.	Shahjibazar Power Station	103192	28701	131893
03.	Fenchuganj Power Station	25600	7235	32835
04.	Bheramara Power Station	19350	21622	40972
05.	Khulna Power Station	40000	2255	42255
06.	Bagabari Power Station	31500	7953	39453
07.	Ashuganj Power Station	113600	13200	126800
08.	Ghorasal Power Station	273000	123623	396623
09.	Chittagong Power Station	74120	26200	100320
10.	Karnafuli Hydro Station	76400	8400	84800
11.	Shikalbaha Power Station	14000	6240	20240
12.	Barisal Gas Turbine Power Station	12000	1872	13872
13.	Barisal Diesel Power Station	5500	1100	6600
14.	Bhola Diesel	9000	0	9000
15.	Rangpur Gas Turbine Power Station	5240	956	6196
16.	Saidpur Gas Turbine Power Station	6540	3665	10205
17.	Khulna Power Company Limited (IPP)	2357734	140168	2497902
18.	Westmont Power (Bangladesh) Limited, Bagabari- IPP	25420	536	25956
19.	110 MW Barge Mounted Power Plant, Haripur - IPP	97080	62516	159596
20.	Rural Power Company (IPP) Limited,Shambhuganj, Mymensingh	6800	3500	10300
21.	Siddirganj Power Station	2060	6360	8420
22.	Haripur 360 mw Power Station, IPP	5256	8046	13302
23.	Meghnaghat 450 MW Power Station, IPP	14540	16420	30960
Total		**3,325,660**	**492,368**	**3,818,028**

Source: MoEF, Final PCB inventory, April 2005

Table 25. Estimated PCB content in in-service electrical equipment

Type of Oils		Oil Contents (kg)			PCB Content (kg)		
		Old Equipment (before 1990)	New Equipment (after 1990)	Total	Old Equipment	New Equipment	Total
A. Survey Data (BPDB, DESA, DESCO, PGCB and IPP)							
Ref. (Askarel, Sovtol-10)	@ 490 ppm in old Equipment and @ 50 ppm in new Equipment	11442	36230	47672	5.61	1.81	7.42
Others	@ 490 ppm in old Equipment and @ 50 ppm in new Equipment	2186881	1946660	4133541	1071.57	97.33	1168.90
Unknown	@ 500 ppm in old Equipment and @ 50 ppm in new Equipment	2877819	2592898	5470717	1438.91	129.64	1568.55
Total		5,076,142	4,575,788	9,651,930	2,516.088	228.7894	2,744.877
B. Distribution Transformer							
BPDB	@ 500 ppm in old Equipment			6107480			3053.74
DESA	@ 500 ppm in old Equipment			1639000			819.50
DESCO	@ 500 ppm in old Equipment			607740			303.87
PGCB	@ 500 ppm in old Equipment						
REB	@ 500 ppm in old Equipment			89467025			44733.51
Total		0	0	97821245	0	0	48910.62
Grand Total		**5,076,142**	**4,575,788**	**195,542,490**	**2,516.088**	**228.7894**	**51,655.5**

Source: MoEF, Final PCB inventory, April 2005

- Data were collected from official sources

Table 26. Quantity of reserve and waste oil, and waste transformer equipment oils

Name of Liquid	Quantity of Oil (kg)			Contaminated Waste Equipment					
	In Drums	In Reservoirs	Total	Power Transformer			OCB	Total	Quantity of Oil (kg)
				Main	Auxiliary	Total			
ASKAREL	0	0	0	2	2	4	0	4	15690
BP, ENERGOL, Singapore	20	0	20	51	0	51	0	51	665907
BP, TRANSFO-2	0	0	0	3	0	3	0	3	26650
BP-ENERGIL, USA	63520	0	63520	6	0	6	0	6	90816
DONG NAM LTD, Korea	0	14000	14000	21	11	32	0	32	296190
DONG NAM PETRO. LTD	0	2800	2800	5	3	8	0	8	51010
EDISOL	500	0	500	1	0	1	0	1	6000
ELECTROL, INDIA	0	0	0	0	2	2	0	2	576
EMCO, India	0	0	0	14	7	21	0	21	107272
Hyrex, Malaysia	0	0	0	1	0	1	0	1	7350
IEC-296	0	0	0	20	0	20	0	20	223775
IKR -982-68	0	0	0	1	0	1	0	1	6400
JIS-C-2320	0	0	0	3	0	3	0	3	49500
NF-C-27-0	0	0	0	9	0	9	0	9	106700
Nynas Nitro Lox	0	0	0	1	0	1	0	1	6070
SHELL 4610	0	19600	19600	13	0	13	0	13	200150
Shell, Diola-B	20400	0	20400	21	2	23	2	25	268729
Sovtol-10	0	0	0	0	22	22	0	22	31982
TKN-982-56	0	0	0	15	0	15	0	15	270280
Transformer oil	0	0	0	53	0	53	0	53	513378
TRANSOL	6000	0	6000	5	0	5	0	5	39572
YILONG, CHINA	24600	0	24600	23	12	35	0	35	495207
Total	115040	36400	151440	268	61	329	0	331	3479204
Not known	309640	58850	368490	509	89	598	82	680	4924188
Grand Total	**424680**	**95,250**	**519,930**	**777**	**150**	**927**	**84**	**1,011**	**8,403,392**

Source: MoEF, Final PCB inventory, April 2005

Table 27. Estimated quantity of PCBs in waste oils and in oils in PCB-contaminated electrical waste equipment

Oil Type	In Drums or Reservoirs		In Contaminated Equipment		Total	
	Quantity of Oils (kg)	Quantity of PCBs (kg)	Quantity of Oil (kg)	Quantity of PCBs (kg)	Oils (kg)	PCBs (kg)[a]
Ref. Known Oils (ASKAREL & Sovtol-10) PCB Content @ 499 pmm	0	0.00	47672	23.79	47672	24
Other known oils: PCB Content (@ 499 pmm)	151440	75.57	3431532	1712.33	3582972	1788
Unknown PCB Content (@ 500 ppm)	368490	183.88	4924188	2457.17	5292678	2641
Total	**519,930**	**259.45**	**8,403,392**	**4,193.29**	**8,923,322**	**4,453**

Source: MoEF, Final PCB inventory, April 2005
[a] Data collected from official sources.

Stockholm Convention provisions for PCBs with which Bangladesh will comply are summarized below in Table 28.

Table 28. Provisions of Stockholm Convention and its relation to the PCB management plan of Bangladesh

Priorities	Type of PCB	Convention's Provision
First Priority: Concentration >100000 mg/kg (10%) & volume >5 litres	**Concentrated PCBs**	• Make determined efforts to identify, label and remove from use equipment in order to eliminate the use of PCBs by 2025. • Environmentally sound disposal of all PCB stockpile and wastes by 2028.
Second Priority: Concentration >500 mg/kg (0.05%) & volume >5 litres		
Third Priority: Concentration >50 mg/kg (0.005%) & volume > 0.05 litres	**Scheduled PCB**	• Make determined efforts to identify, label and remove from use equipment in order to eliminate the use of PCBs by 2025. • Environmentally sound disposal of all PCB stockpile and wastes by 2028. • Except for maintenance and servicing operations, recovery for the purpose of reuse in other equipment of liquids with PCB content >50 mg/kg (0.005%) is not allowed.
Threshold levels 50 mg/kg (0.005%) & volume ≤ 0.05 litres	**Non-Scheduled PCB**	• Non-scheduled PCBs are not presently controlled by the Stockholm Convention. Non-scheduled PCB stockpile and wastes in landfill or permanent subsurface storage in Maddhapara Hardrock Mine will be examined as options for these wastes.
2 mg/kg	**PCB-free**	• Many countries recognize materials or wastes containing PCBs at 2 mg/kg or less as PCB free.

2.3.2.2 PCB CONTENT IN THE SHIP-BREAKING INDUSTRY

Currently, 92% of the world's ship-breaking facilities are located in four nations, of which Bangladesh is one (the others being India, Pakistan and China). Ship breaking meets about 80% of the nation's need for iron. With the global decommissioning of single-hulled merchant vessels globally, this industry can be expected to have a considerable life span, including in Bangladesh, where it is a growth industry. Globally, it is estimated that 500 to 700 merchant vessels will be dismantled every year for the next 15 years (Tibbetts, 2001).

The Bangladesh ship-breaking industry was initiated in 1972. In 2005, the industry consists of 70 ship-breaking or recycling yards located on the Bay of Bengal beaches, of which from 20 to 25 yards operate on a regular basis, collectively recycling from 50 to 90 ships annually. The main ship-breaking yards are located on the beach of the Bay of Bengal below the Sitakundu Police Station of Chittagong and eight to 10 kilometres from the City of Chittagong.

There is no available inventory of PCBs in old ships that are slated for demolition. One study estimates that the typical merchant ship dismantled for scrap contains between 250 kg to 800 kg of PCBs, found principally in the paint, as well as in the machinery, of the vessel (Agarwal, 2004). Some studies have made the assumption that ships from the WWII era (1940s) would have the

greatest amounts of PCBs in materials, such as paint, cable sheathing and hydraulic fluids. However, until PCBs were banned in various nations, they continued to be used in ships, i.e., up through the mid-1970s and 1980s.

Table 29. Bangladesh vessels imported for ship breaking by number and type, 1999-2004

Year of Import	Total Number of Ships Imported	Nature of Ship		
		Cargo	Container/ Tanker	Other
1999	72	20	39	13
2000	22	04	15	02
2001	135	75	46	14
2002	84	39	33	12
2003	87	36	41	10
2004	145	55	84	06
Average	**90.8**			

Source: GoB, MoEF, 2005e, citing Custom House, Chittagong, Government of the People's Republic of Bangladesh, 2005

For purposes of its preliminary PCB national inventory, Bangladesh estimated that each old ship contained 250 kg of PCBs, inclusive of transformer oil. Based on this estimate, **the total quantity of PCBs estimated to be generated each year within the ship-breaking industry is 22,500 kg or 22.5 metric tonnes**. (This estimate does not include the PCB contents of the ships dismantled in the past that may have already entered the environment but only PCB content of the average mercantile ship. To date, none of the PCB contents of ships have been recovered; hence there are no PCB waste stocks from such ships.) AQMP

Additionally, the heating system oils of older ships that were built to ply northern waters may contain much higher PCB content than the average ship although it is not known how many (if any) such ships may have been dismantled in Bangladesh. For example, the Canadian oil barge, the Irving Whale, constructed in 1966, was estimated by Environment Canada to have contained 7.2 imperial tons of Aroclor 1242 PCBs, with approximately 6,800 litres of PCBs in heating system fluids. Concentrations of PCBs found in sediment after the barge was raised were up to 890 parts per million (ppm) and detectable up to 2.5 kilometres from the ship's sunken position (GoC, Environment Canada, 1995). The example is significant, for while not representative of most merchant marine ships, just one such ship would have considerable potential to contaminate a marine (and potentially estuarine) environment were proper precautions to remove the oils not to be taken prior to ship abandonment in Bangladesh waters /dismantling the ship for recycling purposes. Contamination of sea-life from a potential discharge of such a burden of PCBs (or small quantities that add up over time) would bioaccumulate in marine life and could be re-introduced via evaporation to the atmosphere. The type of PCB mixture found in the Canadian is heavy and would likely sink to the ocean floor, where currents and shipping activity (dredging, etc.) could re-release the PCBs into the water column.

2.3.2.3 POTENTIAL PCB-CONTAMINATED SITES

Transformers and capacitors are repaired, overhauled, dismantled or retro-filled in different workshops throughout Bangladesh. These workshops are probable PCB-contaminated sites. They include one central, two regional and four sub-regional workshops managed by the power sector. As well, the 67 Rural Electrification Boards in different districts of Bangladesh where small transformers are repaired may constitute contaminated sites, as may ship-breaking yards located in the coastal area of Sitakund, Chittagong and, possibly, coastal waters adjacent to the ship yards.

2.3.2.4 INFRASTRUCTURE FOR MANAGING PCBS

Legislation will be required for PCBs and PCB wastes to address life-cycle management as consistent with Stockholm Convention obligations, inclusive of Convention timetables for phase-out of PCB-containing electrical equipment (as discussed in section 2.2.5.2.2 on strengthening legislation).

Bangladesh has the managerial capacity to utilize rapid-assay tests for PCBs to determine whether power sector equipment and wastes contains oils contaminated with PCBs. Plans are in progress, inclusive of locating international funding, that would enable the Bangladesh Power Development Board to lead a national pilot project and subsequent national-scale use of rapid-assays as part of the country's preliminary (first order) assessment of PCBs. Where results indicate PCBs are present, more sophisticated analysis will be required to determine the specific PCB congeners present in sampled oils (not currently available within Bangladesh). However, where PCBs are present, steps can then be taken to ensure that contaminated equipment and PCB oils and wastes are handled appropriately, consistent with Convention requirements, including withdrawal of all PCB-containing equipment from service by 2025 and segregation of PCB-containing wastes from other wastes.

Bangladesh as of 2002 had no environmentally sound destruction facilities for PCBs, nor did other nations within the Indian Ocean region (UNEP, 2002). A strategy will be needed for disposition of PCB waste oils and contaminated waste equipment, including (1) an examination of internationally acceptable waste destruction technologies (for PCBs and other POPs as well) to determine whether the best course for Bangladesh is to develop national destruction capabilities for POPs or destruction abroad within an environmentally acceptable facility(ies) and (2) an examination of internationally acceptable decontamination technologies for PCB-contaminated equipment.

The ship-breaking industry does not currently follow any protocols regarding protection of workers and the environment from exposure to PCBs, including relative to handling and disposal of PCBs and PCB-containing materials extracted from ships.

Inspectors at present are not trained to detect PCBs, as there is no legislation requiring this. Also, as previously noted, there currently is no laboratory analysis capacity for PCBs.

Knowledge of PCBs (e.g., sources, health effects, and pathways of exposure of people and the environment, including biota) is very low among public officials and the population. Therefore, knowledge of PCBs will need to be enhanced through development of awareness raising, outreach and potentially a risk communication planning. The infrastructure for development of such a campaign does exist, although expertise may need to be strengthened.

2.3.3 Assessment with respect to Annex B chemicals (DDT)

2.3.3.1 REGISTRATION HISTORY: DDT

DDT was never formally registered for manufacture or use in Bangladesh. Nevertheless, it has a history of use in agriculture and disease vector control, as described below.

2.3.3.2 DDT USE IN AGRICULTURE

DDT's use in agriculture may have begun as early as 1955 when it may have been imported, along with other POPs (Badruddin, Rahman, Inception report, 2004). Its use was reportedly widespread, including on banana, potato, and cotton fields at least through the mid-sixties when is reported that its use for agricultural was discontinued (GoB, MoEF, 2005c). However, as noted in Table 13 above, a survey of reported use by farmers of Convention pesticide POPs undertaken as part of the 2005 national pesticide assessment indicates that use of small amounts of stocks of DDT remaining in district and *thana* stores were purchased and used through 2000, when it appears these stocks were depleted. While the GoB notified the Rotterdam Convention Secretariat in 1998 via an interim decision that it permitted imports of DDT with use restricted to sugar cane (PIC Circular, 2004), the 1997 National Chemicals profile indicates that DDT was listed on the banned list if Import Policy Order (IPO) for 1995-1997 (Ahmed, 1997) and there is no indication of imports for use on sugar cane. However, the notification may be indicative of a past use of DDT for this crop.

2.3.3.3 DDT USE IN DISEASE VECTOR CONTROL

In 1960, Bangladesh initiated its Malaria Eradication Programme under the direction of then health minister Habibullah Bahar (GoB, MoEF, 2005c). DDT was used for disease vector control as part of this programme up through 1993 for various mosquito vectors of malaria (UNEP Chemicals, 2001) and also for control of *visceral leishmaniasis* or kala-azar, a disease spread by the bite of the infected *Phlebotomus argentipes* sand fly (WHO, 2002). For the first decade of the programme (1960s), DDT was sprayed twice a year on every house at 2 grams/sq. metre to control malaria (GoB, MoEF, 2005c). Widespread spraying of DDT for malaria and other disease vectors ceased in 1971 and was thereafter carried out on only in highly endemic malaria areas, a practice which continued up through 1991 (USAID, 2004). Limited use of DDT for control of the kala-azar vector was also reported up through 2000. Other chemicals used on a focal basis (endemic areas) in place of DDT include malathion and deltamethrin. There are only a few reports of insecticide resistance in malaria vectors from Bangladesh (USAID, 2004a-c).

The initial Malaria Eradication Programme (1960-1971) lowered the incidence of kala-azar to the extent that it almost disappeared from Bangladesh. However, with the cessation of the widespread use of DDT in 1971, kala-azar, beginning in the mid-seventies, made resurgence and was recently reported to be at epidemic proportions with the number of reported cases increasing from a total of 2,397 in 1993 to 7,032 in 1998 (Bangali 2000). From 1999-2000, 45,338 kg and 39,990 kg of DDT

75% water dispersible powder (wdp), respectively, were reported to be used for kala-azar control[29] (USAID, 2004). Tables 30 and 31 provide information on DDT use from 1990-2000.

As discussed below in 2.3.5, a reserve stock of 12.789 MT of DDT 75WP was held by the DGHS for disease vector control, although during the July 2005 consultation workshop on the first draft of the NIP, representatives of the various ministries, including the DGHS, concurred that the reserve stock, owing to its age, is obsolete. Hence, there remain no reserve stocks of DDT in Bangladesh.

Table 30. Insecticide usage in Malaria Control Programme (including KA and JE) in Bangladesh from 1990 – 1996

Country	Insecticide in metric ton	1990	1991	1992	1993	1994	1995	1996
Bangladesh	DDT (75% wdp)	644	222	644.7	223.9	109.6*	137.4*	50.6*
	Malathion (25% wdp)	0	0	0	0	4.2	2.1	N.A.
	Deltamethrin (25% EC)	0	0	0	0	1.0	0.6	0.4

Source: USAID, 2004, based on data from WHO/SEARO (1998) Insecticide resistance in mosquito vectors of disease SEA/VBC/59 used for KA

Table 31. Insecticides used in the control of malaria and KA in Bangladesh from 1997-2000

Country	Insecticide used	1997	1998	1999	2000
Bangladesh	DDT 75% wdp (IRS)	N.A.	N.A.	45,338 kg (34,004 kg ai)	39,990 (29,932.5 kg ai)
	Malathion 57% EC (IRS)	N.A.	N.A.	4,039 L (2,302.2 L ai)	2,581L (1,471. L ai)
	Deltamethrin 2.5% EC (ITMN)	N.A.	N.A.	3,000L (75 L ai)	3,000L (75 L ai)

Source: USAID, 2004, based on data from WHO/SEARO. Insecticide resistance in mosquito vectors of disease SEA/VBC/59 used for KA

Although not confirmed by the Government of Bangladesh, several studies have reported that sprinkling dried fish sold commercially with DDT as a preservative to ward off flies has been a fairly common and widespread practice. For example, such use was reported by Dutch farming and environmental organizations as part of a 1993 educational project organized by the Netherlands Organization for International Development Cooperation (Pesticide News, referencing NOVIB,

[29] The World Health Organization has reported that residual spraying of DDT is very effective in controlling sandfly vectors in Bangladesh (WHO 1990). WHO recommends that spraying for this purpose be preceded and followed by an assessment of susceptibility of *P. argentipes* to DDT and other insecticides (USAID, 2004).

1993). Anecdotal reports in Bangladesh newspapers of DDT as a dried fish preservative are fairly common (e.g., Chittagong, Cox's Bazar, Kishoreganj, Lalmonirhat, Mechhnua Bazar (The Independent, 2005; The Bangladesh Observer, 2005). Toxics Link, an Indian ENGO, reports that up to 100 MT of DDT may have been smuggled into Bangladesh in 1 kg packets sold for 30 *taka* (US$0.47) each, although a time period is not specified during which this is reported to have occurred (Toxics Link, 2004). The alleged importation, formulation and illegal use of DDT on foodstuffs needs to be further investigated and confirmed. [Insert court case conviction on DDT here; RFI does not have source]

2.3.3.5 DDT IMPORT AND MANUFACTURE

DDT was supplied by the FAO for use in agriculture through 1965 (as there was no local agent).
After that date, imports for agricultural use were discontinued. DDT used for vector control in Bangladesh was similarly supplied by donors (WHO) up through 1965, when, as part of its formal launch of its Malaria Eradication Programme, the government constructed a DDT production facility near the East Pakistan Industrial Development Corporation (EPIDC) on 40 hectares of land at Barakubndu in Sitakundu, Chittagong, known as the Chittagong Chemical Complex (CCC).

The Chittagong Chemical Complex had a production capacity of 2,000 metric tons of DDT powder/year, which it began producing in 1966. Another chemical complex with the annual production capacity of 4,500 metric tons of DDT was subsequently established by the private sector near the CCC facility. Both plants were nationalized immediately after the Bangladesh independence. In 1982, the two units were assimilated as Chittagong Chemical Complex and placed under the control of the Bangladesh Chemical Industries Corporation (BCIC). The CCC also manufactured caustic soda, chlorine, hydraulic acid, hypo, bleaching powder, calcium hydrochloric and other pesticides.

Production of DDT by CCC ceased officially on 1 December 1991, but, in practice, was only discontinued after 1993. **From 1966–1992, the DDT plant/CCC produced a total of 7706 MT of DDT Technical, of which 7604.49 MT was formulated into 12,003.17 MT of 75% DDT** (Table 32). Out of the total 75% DDT formulations, 11,793.27 MT was sold to the Bangladesh Health Directorate for its malaria eradication programme (GoB, MoEF, 2005c).

Table 32. Annual production, sale and stock of DDT at DDT Plant, BCIC, 1966-1992

Year	Production of DDT Technical (MT)	Formulation of DDT Technical into 75% DDT (MT)	Sale	
			Technical (MT)	75% DDT Formulation (MT)
1966-67	180.71	-	-	-
1967-68	454.05	200.16	-	160.06
1968-69	357.26	552.69	-	546.91
1969-70	389.08	726.60	-	500.50
1970-71	314.01	508.91	-	702.04
1971-72	10.78	142.20	0.01	200.86
1972-73	188.86	116.60	-	0.06

Year	Production of DDT Technical (MT)	Formulation of DDT Technical into 75% DDT (MT)	Sale	
			Technical (MT)	75% DDT Formulation (MT)
1973-74	80.93	260.61	6.38	347.05
1974-75	93.91	161.35	-	189.55
1975-76	110.13	31.81	2.58	33.82
1976-77	115.65	270.23	9.40	213.00
1977-78	452.58	445.38	45.45	490.00
1978-79	360.15	460.44	29.55	439.40
1979-80	113.94	222.35	0.52	230.36
1980-81	751.17	1017.37	0.34	678.81
1981-82	600.85	780.46	0.51	514.11
1982-83	455.00	367.00	-	667.00
1983-84	691.00	1030.00	-	1175.00
1984-85	-	1252.00	-	1204.00
1985-86	-	808.00	-	907.29
1986-87	665.88	912.03	-	998.74
1987-88	526.14	706.33	-	714.86
1988-89	325.30	400.70	6.85	375.50
1989-90	182.18	131.10	0.10	201.40
1990-91	214.45	279.85	-	210.00
1991-92	72.53	219.00	-	92.95
Total	**7706.49**	**12003.17**	**101.69**	**11793.27**

N.B.- (7706.49 – 101.69) = 7604.80 MT DDT Technical used for preparing DDT 75%; (12003.17- 11793.27+ = rest 209.90 MT DDT 75WP distributed to DGHS at the time of closing. Balance is nil.

Source: *BCIC DDT Plant Stock Book,* Appendix I: Case Studies.

A total of 500 MT of DDT was imported in 1983/84 under an Asian Development Bank (ADB) Loan. However, the DDT was found to be substandard and not accepted by the DGHS. [30] This DDT was subsequently stored in MSD *godowns* or warehouses in the Chittagong region. Upon later inspection during 2005 as part of the Bangladesh preliminary national pesticides inventory, a total of 482.904 MT were found in 18,2000 cartoons held in four MSD warehouses, all in poor or obsolete condition (GoB, MoEF, 2005c).

[30] Ref. A/T No.S-6/con/9/DDT/82-83/204 dt 29.12.83 under ADB Loan no. 504 BAN (S), Invoice no AL/249/84 dated 27th November 1984, Contract no: S-6/cont/9/DDT/82-83/204 dated 29-12-83.

2.3.4 Assessment of releases from unintentional production of Annex C chemicals (PCDD/PCDF, HCB and PCBs)[31]

The first national inventory of Annex C by-product POPs was finalized in March 2005 in preparation for development of this NIP. The inventory examined sources of dioxin and furan emissions (estimated in grams/Toxic Equivalent/year or g TEQ/annum) from the following 10 categories as prescribed by UNEP *Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases*:

1. Waste incineration,
2. Ferrous and non-ferrous metal production
3. Power generation and heating
4. Mineral products
5. Transport
6. Uncontrolled combustion processes
7. Production of chemicals and consumer goods
8. Miscellaneous
9. Disposal/Landfill
10. Identification of potential hot-spots

2.3.4.1 POTENTIAL PATHWAYS OF RELEASES

These categories and their subcategories are shown below in Table 33, along with potential routes of their release to the environment. The route of environmental exposure likely to be most significant is marked with an uppercase "X". A lowercase "x" indicates other potential release pathways.

Releases to air and water are typically of the greatest concern. Dioxins and furans in air return to earth as deposition (e.g., rain) that is then available for bio-uptake in the environment (e.g., grass) and, subsequently, by animals (e.g., livestock) and people. Dioxins and furans in water may be taken up by aquatic organisms, including fish, hence represent another source of particular concern to animals and people who consume contaminated fish. It is not known at this time, what portion of dioxin and furan releases to air or water remain in the Bangladesh environment, as they are also subject to long-term transport. As contamination of the environment is the main route of subsequent exposure, this will need to be determined through subsequent monitoring. The dioxin and furan content of products is a concern as it can be released to air, water or land during product use or, more likely, during disposal (e.g., when combusted). Product content therefore gives an indication of potential releases to the environment waiting to happen. Inventorying products highlights the potential for avoidance of dioxin and furan emissions through "green design", such that product content does not contain dioxins and furans. (Where products utilized are imported, option for reducing content may be limited, but include purchasing policies aimed at using suitable alternatives.) In the case of household waste, products such as food or grass clippings contain dioxins and furans owing to past releases to the environment and subsequent uptake via **x** atmospheric deposition (e.g., rain), and the subsequent consumption of

[31] Unless otherwise stated, information if from GoB, MoEF, 2005d.

contaminated food sources (e.g., grass) that can then lead to bioaccumulation through the food chain (e.g., from livestock to people). The concern regarding exposure from food is typically chronic exposure (accumulated during one's lifetime) as previously discussed.

Table 33. Potential routes of entry of dioxins (PCDD) and furans (PCDF) to the environment from the top 10 source categories.

No.		Main categories and sub-categories of PCDD/PCDF sources	Potential routes of PCDD/PCDF expansion in environment				
			air	water	ground	products	waste
1		**Waste incinerators**	**X**				**X**
	a	Municipal solid waste incineration		(x)			x
	b	Hazardous waste incineration	X	(x)			x
	c	Medical waste incineration	X	(x)			x
	d	Light-fraction shredder waste incineration	X				x
	e	Sewage sludge incineration	X	(x)			x
	f	Waste wood and waste biomass incineration	X				x
	g	Combustion of animal carcasses	X				x
2		**Ferrous and Non-Ferrous Metal Production**	**X**				**X**
	a	Iron ore sintering	x				x
	b	Coke production	x	X	x	x	x
	c	Iron and steel production	x				x
	d	Copper production	x				x
	e	Aluminium production	x				x
	f	Lead production	x				x
	g	Zinc production	x				x
	h	Brass production					
	i	Magnesium production		x			x
	j	Other non-ferrous metal production	x	x			x
	l	Shredders	x				x
	m	Thermal wire reclamation	x	(x)	x		x
3		**Power generation and heating**	**X**				**X**
	a	Fossil fuel power plants	X				X
	b	Biomass power plants	X				X
	c	Landfill, biogas combustion	X				X

No.		Main categories and sub-categories of PCDD/PCDF sources	Potential routes of PCDD/PCDF expansion in environment				
			air	water	ground	products	waste
	d	Household heating and cooking (biomass)	X				X
	e	Domestic heating (fossil fuels)	X				X
4		**Production of mineral products**	**X**				**X**
	a	Cement production	X				X
	b	Lime production	X				X
	c	Brick production	X				X
	d	Glass production	X				X
	e	Ceramics production	X				X
	f	Asphalt mixing	X				X
5		**Transport**	**X**				
	a	Four-stroke engines	X				
	b	Two-stroke engines	X				
	c	Diesel engines	X				(x)
	d	Heavy oil fired engines	X				(x)
6		**Uncontrolled combustion processes**	**X**				**X**
	a	Biomass burning	X	(x)	(x)		x
	b	Waste burning and accidental fires	X	(x)	(x)		X
7		**Production and use of chemicals and consumer goods**	**X**	**X**		**X**	**X**
	a	Pulp and paper mills	x	x		x	x
	b	Chemical industry	x	x	(x)	x	x
	c	Petroleum industry	x				x
	d	Textile plants		x		x	
	e	Leather plants		x		x	
8		**Miscellaneous**	**X**	**X**	**X**	**X**	**X**
	a	Drying of biomass	x				
	b	Crematoria	x				X
	c	Smoke houses	x			x	X

No.		Main categories and sub-categories of PCDD/PCDF sources	Potential routes of PCDD/PCDF expansion in environment				
			air	water	ground	products	waste
	d	Dry cleaning		x	x	x	
	e	Tobacco smoking	x				
9		**Waste disposal**		**X**	**X**		
	a	Landfills and waste dumps					
	b	Sewage and sewage treatment					
	c	Waste disposal into rivers, lakes and sea					
	d	Disposal of waste oil (non-thermal)					
10		**Identification of potential hot spots**	Recording possible upon expert assessment of the site				
	a	Production sites of chlorinated organics			X		
	b	Production sites of chlorine			X		
	c	Formulation sites of chlorinated phenols			X		
	d	Application sites of chlorinated phenols	x	X	x	x	
	e	Timber manufacture and treatment sites		X	X	x	x
	f	PCB-filled transformers and capacitors				x	x
	g	Dumps of wastes/residues from categories 1-9	x	X	X		x
	h	Sites of relevant accidents		X	x		x
	i	Dredging of sediments					x
	j	Kaolinitic or ball clay sites			x		

Source: GoB, MoEF, 2005d

2.3.4.1 QUANTIFICATION OF RELEASES: OVERVIEW[32]

The quantification of releases of dioxins (PCDD) and furans (PCDF) is based on calculations applied to activity data that was collected on a national basis from publicly available information sources for each emission source category. Dioxin and furan emission default factors presented in the *UNEP*

[32] Unless otherwise noted, all information in this section is from the first (preliminary) national inventory, reference GoB, MoEF, 2005d.

Toolkit,[33] which were judged suitable for Bangladesh conditions, were applied to each emission source category (including main and subcategories). Bangladesh does not at this time have the capacity to verify releases through field verification (i.e., application of sophisticated equipment to measure releases in facility stacks, etc.), although this would be a useful exercise to undertake in the future so that preliminary estimates can be further refined. Nevertheless, initial estimates, as based on UNEP Toolkit emission factors (predicated upon field-testing by other nations), provide a useful and relatively accurate indication of releases from each sector.

Leading sources of dioxin and furan emissions: Based on consolidated results of the dioxins and furans inventory conducted for each main category and subcategories throughout the country, an estimated 485.81 grams TEQ/annum were released in 2005 to all environment compartments (air, water, products and residues) as shown in Table 34 below. The top six ranked emitters include the following:

(1) Chemicals and consumer goods manufacturing sector, which released an estimated 144.34 g TEQ/a;
(2) Disposal/landfilling activities, which released an estimated 116.17 g TEQ/a;
(3) Electrical power generation and heating, which released an estimated 79.49 g TEQ/a;
(4) Uncontrolled combustion processes, which accounted for an estimated 71.678 g TEQ/a**;**
(5) Ferrous and Non-Ferrous Metal Production, with an estimated 31.98 g TEQ/a; and
(6) Waste incineration, with an estimated 31.13 g TEQ/a.

[33] The formula used to calculate annual emission of PCDD/PCDF into environmental is: ***Emission of (PCDD/PCDF)/year = emission factor x activity***. Activity is the annual consumption of the starting raw material or annual production of individual products (e.g. tonnes of paper/year). Emission factors are expressed as grams toxic equivalent per unit of the input raw material or the outgoing product, e.g. µg I-TEQ/ton. Annual emission of PCDD/PCDF is expressed in grams of the toxic equivalent I-TEQ per year. In some cases, annual emission of PCDD/PCDF were calculated from the equation: *Emission (PCDD /PCDF)/year = concentration x flow.* Flow is a mass flow of the released gas, liquid or solid material per year, e.g. m^3 per year or ton per year. Annual emissions for each sub-category are summarized to obtain the emission by potential expansion routes of PCDD/PCDF into environment for all ten of the main categories. In Bangladesh almost all solid wastes are disposed of at unsanitary landfills, and burned in the open; therefore the UNEP emission factors utilized for this inventory, e.g., 3500 µg TEQ/t for domestic waste, 35000 µg TEQ/t hazardous waste, 40000 µg TEQ/t for medical waste are very high for Bangladesh, which does not have any municipal solid waste or hazardous waste incinerators.

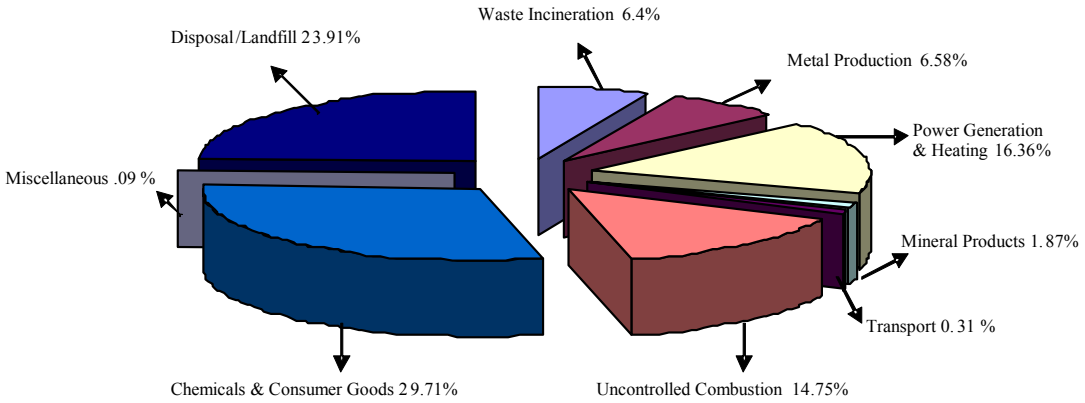
Table 34. Dioxins and furans releases, 2005 (grams TEQ/annum)

Category	Air		Water		Product		Residue		Total	
	g TEQ/a	%	g TEQ/a	%	g TEQ/a	%	g TEQ/a	%	g TEQ/a	%
Production of Chemicals and Consumer Goods	0	0.00	21.31	34.3	123.02	62	0.001	0.00	**144.34**	29.71
Disposal/Landfill	0	0.00	40.8	65.7	75	38	0.36	0.97	**116.17**	23.91
Power Generation and Heating	79.18	42.03	0	0	0	0	0.316	0.85	**79.49**	16.36
Uncontrolled Combustion Processes	57.16	30.34	0	0	0	0	14.51	38.9	**71.67**	14.75
Ferrous and Non-Ferrous Metal Production	10.09	5.36	0	0	0	0	21.89	58.7	**31.98**	6.58
Waste Incineration	31.11	16.51	0	0	0	0	0.015	0.02	**31.13**	6.4
Production of Mineral Products	9.05	4.80	0	0	0	0	0.045	0.12	**9.09**	1.87
Transport	1.51	0.80	0	0	0	0	0	0.00	**1.51**	0.31
Miscellaneous	0.31	0.16	0	0	0	0	0.131	0.35	**0.44**	0.09
Total =	**188.41**		**62.111**		**198.02**		**37.268**		**485.809**	

Source: GoB, MoEF, 2005d

The percentage of total emissions to the environment from the main sources is shown in the right-hand column and in graphic form in Figure 8 below.

Figure 8. Percentage of Dioxin and Furan (PCDD/PCDF) releases to the environment from main sources.



Source: GoB, MoEF, 2005d

Leading sources of releases to air: The most releases to any one environmental compartment were to the air, which accounted for 188.41 g/TEQ/a or 38.8% of country's total release of 485.81 gTEQ/a. The leading contribution of dioxins and furans to air (42%) was from power generation and heating, followed by uncontrolled combustion (30.3%), and production of mineral products (4.8%),

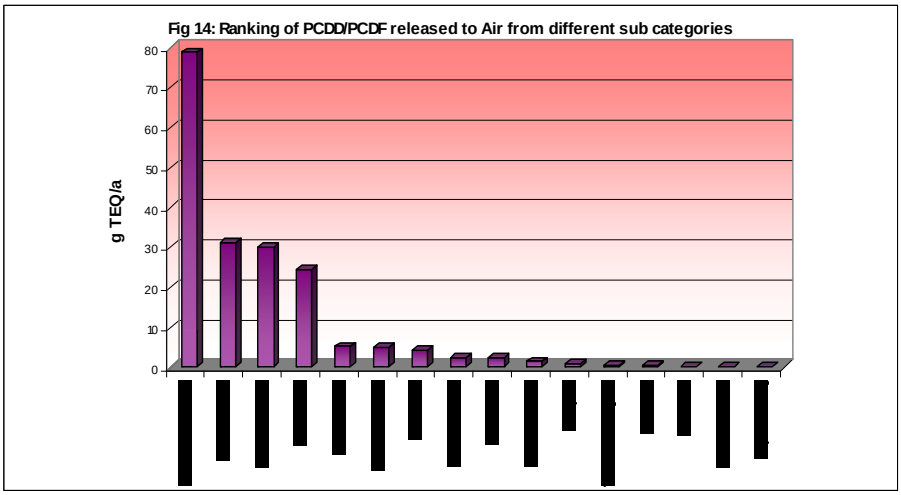
respectively (Table 33 above). Uncontrolled burning of biomass (coal, straw, etc.) in household cooking is the main source of releases to the air within the power generation and heating subsector at 78.93 g TEQ/a (41.89% of total air emissions), followed by medical waste incineration with 31.09 gTEQ/a (16.5%), uncontrolled domestic waste burning with 30.00 g TEQ/a (15.92%), and landfill with 24.64 g TEQ/a (13.07%) (Table 35). Ranking of dioxin and furan sources to air from subcategories is shown in Figure 9.

Table 35. Release estimates for the top 22 emitters by sub-category, 2005

Category	Air (g TEQ/a)	Water (g TEQ/a)	Products (g TEQ/a)	Residue (g TEQ/a)	Total (g TEQ/a)
Household cooking biomass	78.932	00	00	0.316	79.248
Household waste Composting	00	00	75.000	00	75.000
Leather plants	00	11.550	55.838	00	67.388
Textile plants	00	8.447	42.407	00	50.854
Uncontrolled domestic waste burning	30.000	00	00	12.000	42.000
Untreated liquid sewage waste	00	40.80	00	00	40.80
Medical waste incineration	31.09	00	00	0.0155	31.107
Landfill fires	24.637	00	00	00	24.637
Chemical products	00	00	23.58	.001	23.58
Iron and steel production	5.194	00	00	10.793	15.987
Aluminium production	4.162	00	00	11.10	15.262
Brick production	5.075	00	00	00	5.075
Accidental fires in house and factories	2.516	00	00	2.515	5.032
Cement kiln	2.25	00	00	00	2.25
Lime production	1.457	00	00	00	1.457
Pulp and paper	0.002	1.314	1.200	00	2.516
Heavy oil fired engines	0.806	00	00	00	0.806
Two-stroke engines	0.581	00	00	00	0.581
Foundries	0.390	00	00	00	0.390
Cremation	0.304	00	00	.008	0.312
Lead production	0.281	00	00	00	0.281
Asphalt mixing	0.241	00	00	00	0.241

Source: GoB, MoEF, 2005d

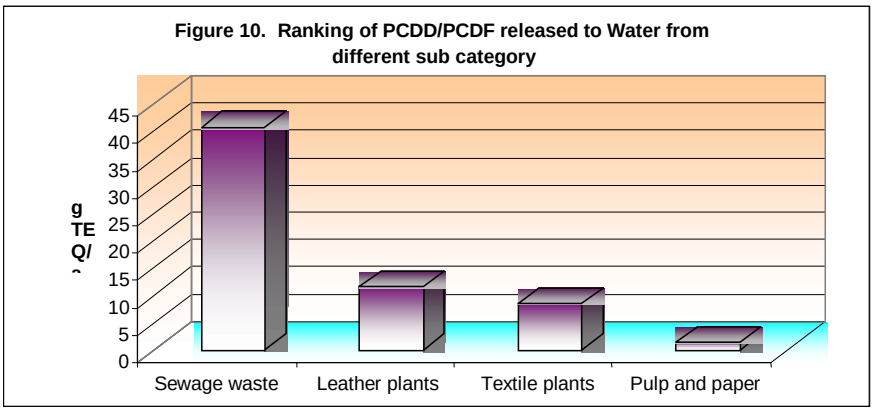
Figure 9. Dioxin and furan releases to the air from sub-categories, 2005



Source: GoB, MoEF, 2005d

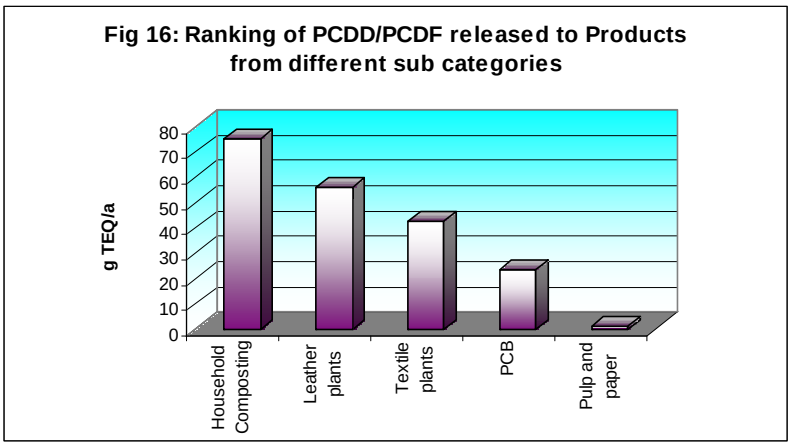
Leading sources of releases to water: Total releases to water are estimated at 62.11 g TEQ/a. The major source category is disposal/landfill at 40.8 g TEQ/a, which includes untreated sewage sludge (65.7% of total emissions to water). The next largest category of releases to water is consumer goods, which contributed an estimated 21.31 g TEQ/a (the remaining 34.3% of total emissions to water). Within the consumer goods category, major subsectors of releases were from the leather sector (11.55 g TEQ/a,), the textile sector (8.45 g TEQ/a), and the pulp and papers sector (1.31 g TEQ/a), respectively (Table 35 above and Figure 10).

Figure 10: Ranking of dioxins and furans released to water, 2005



Leading sources of releases to products: The major dioxin and furan contribution to products is from the chemical and consumer goods and disposal/land fill sectors, which contributed 61.54% and 38.46% of total emission, respectively in 2005 (Table 34). Household waste composting, a subcategory of disposal/landfill, contributed 75 g TEQ/a to products; and the leather, textile, PCB, and pulp and papers industry subsectors (from the main production category of chemicals and consumer goods) released 55.84 g TEQ/a, 42.40 g TEQ/a, 20.58 TEQ/a and 1.2 g TEQ/a to products, respectively (Table 35 and figures 11).

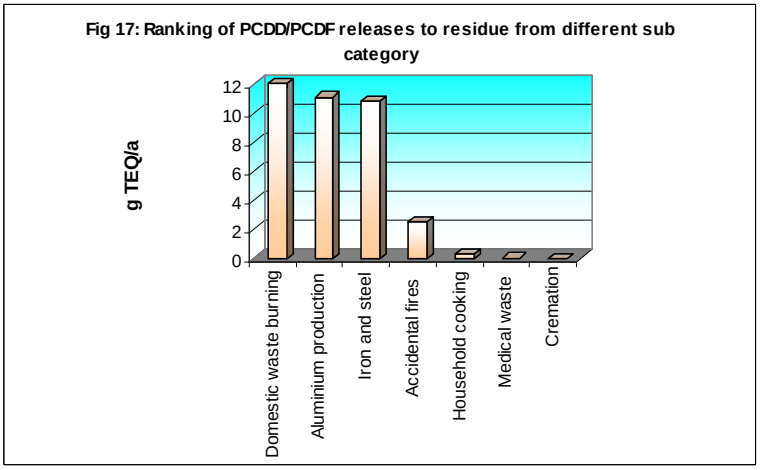
Figure 11: Ranking of Dioxins and Furans released to Products, 2005



Source: GoB, MoEF, 2005d

Leading sources of releases to residue: Residue is primary comprised of bottom ash left over after combustion. Leading sources of dioxins and furans to residue are the ferrous and non-ferrous metal production (mainly iron and steel, and aluminium) sector (58.7%), and uncontrolled combustion processes released (32.2%) (Table 34). The most significant releases to residues were from the ferrous and non-ferrous metal production sector were aluminium (11.11 g TEQ/a), iron (10.79 g TEQ/a); and uncontrolled domestic waste burning (12 g TEQ/a) (Table 35).

Figure 12: Ranking of dioxin and furan releases to residue, 2005



Source: GoB, MoEF, 2005d

The ranking of sources relative to their releases to the environment (air and water) of dioxins and furans is illustrated in Figure 13.

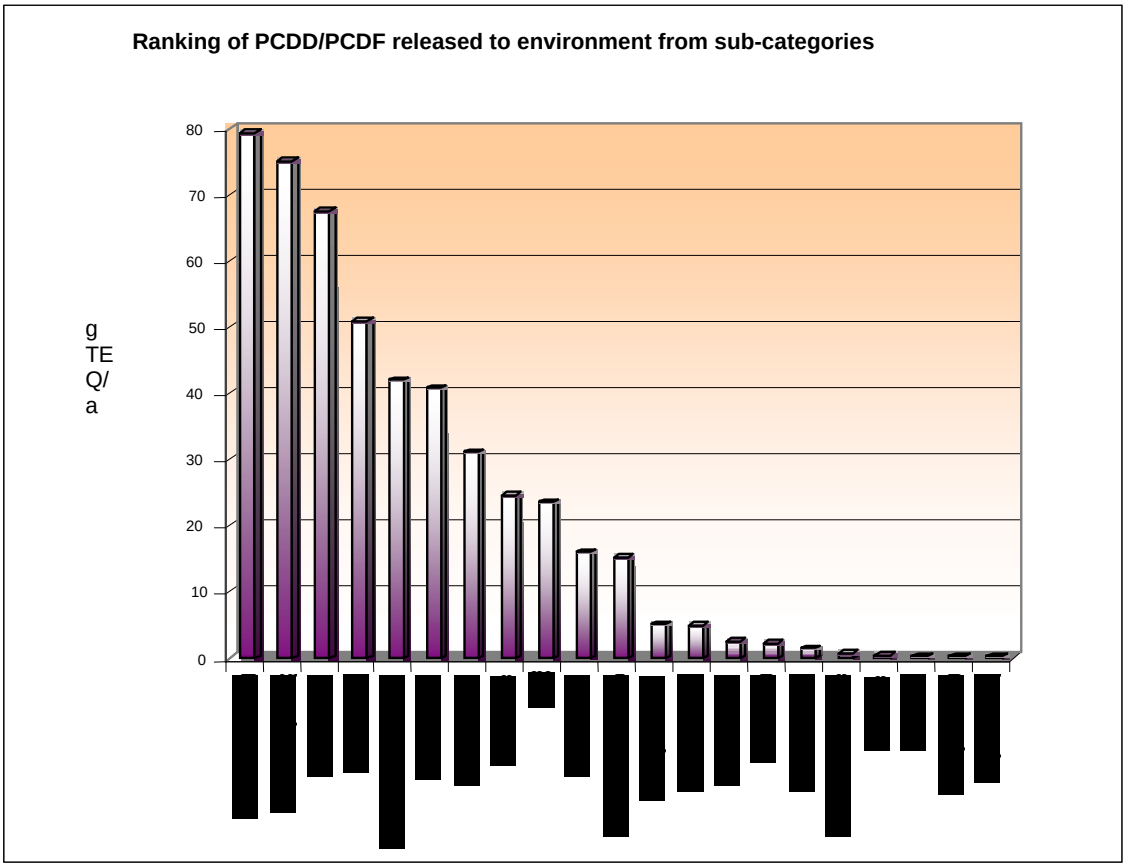


Figure 13. Ranking of dioxin and furan releases to the environment, 2005

Source: GoB, MoEF, 2005d

2.3.4.2 RELEASES FROM SUBSECTORS TO ENVIRONMENT, PRODUCTS AND RESIDUE

This section briefly summarizes the releases of dioxins and furans from subsectors, and provides information on the emission factors range used and information on the categories.

2.3.4.2.1 Waste incineration

The majority of releases from waste incineration are to the air. There are no commercial municipal solid waste or hazardous waste incinerators in Bangladesh. Instead, municipal and hazardous wastes

are burned in the open without use of technological incineration.[34] Burning fuel such as wood or other biomass for the generation of energy is also common in Bangladesh; hence, was addressed in the inventory.

The quantity and percentage of solid wastes in Bangladesh are estimated as follows: Municipal solid waste, 6.2 million metric tons; rural solid waste, 10.0 million MT; agricultural solid waste, 30 MT; and manure, 15 MT. Out of 6.2 million metric tons of municipal solid waste, 65% was domestic waste, 34% commercial and industrial waste, and about 1% hospital waste (Waste Concern, 2005). The average waste generated was 0.5 kg/capita/day in municipal areas in Bangladesh.

Hospital wastes: Only an estimated 5%-10% of hospital sector waste is incinerated and the rest is disposed of in landfills. Similarly, waste generated in clinics, laboratories, pharmaceutical industries, etc., have not been accounted for as this waste is also disposed of in landfills.

While most hospitals in Bangladesh that incinerate their wastes have systems for regulating temperature and are equipped with Air Pollution Control Systems, older incinerators lack both. Uncontrolled batch combustion in these incinerators accounts for the majority of releases. The major routes for emissions are to air, fly ash and bottom ash. Calculations were based on the total number of hospitals (1,300 in 2003) and total number of beds (43,143 in 2003), and estimated medical waste generated from each bed (0.5 kg/per person/day) and an occupancy rate of 90%.

Waste shredding: Waste shredding does not exist in Bangladesh.

Sewage sludge incineration: Sludge is dumped rather than incinerated in Bangladesh.

Emission factors:

- Emission factors range from 200 µg TEQ/t to 40,000 µg TEQ/t according to standardized Toolkit (UNEP Chemicals, 2003).
- Waste biomass incineration: old batch combustion furnaces, no APCS; emission factors range from 100 µg TEQ/t to 1,000 µg TEQ/t. The burn materials are waste biomass, paper, carton, plastic, waste wood etc.
- Animal carcasses burning: old furnaces, batch, no APCS; emission factor 500 µg-TEQ/t.
- Animal carcasses (e.g., cattle, goats, sheep, especially test animals in laboratories).

[34] Almost all incinerators are made up of single chamber into which wastes are introduced manually and burned using kerosene, diesel or natural gas as fuel. When all the wastes have burned for a particular time, the incinerator is turned off and residues removed from the bottom after they have cooled, to be disposed off at landfill sites.

Table 36. Dioxins and furans released from waste incineration

Sub-category	Air (g TEQ/a)	Water (g TEQ/a)	Products (g TEQ/a)	Residue (g TEQ/a)	Total (g TEQ/a)
Municipal solid waste incineration	00	00	00	00	00
Hazardous waste incineration	00	00	00	00	00
Medical/hospital waste incineration	31.09136	00	00	0.015545	31.106905
Light fraction shredder waste incineration	00	00	00	00	00
Sewage sludge incineration	00	00	00	00	00
Waste wood and waste biomass incineration	0.018	00	00	00	0.018
Animal carcasses burning	0.004548	00	00	00	0.004548
Total	31.113908	00	00	0.015545	31.13

Source: GoB, MoEF, 2005d

2.3.4.2.2 Production of ferrous and non-ferrous metals[35]

Coke production: Coke is not produced in Bangladesh. Total imported coke was 14,455.1 tons (GoB, 2005f, citing Foreign Trade Statistics of Bangladesh. Vol. II, February 2003). The major of imported coke is used in the iron and steel industry.

Iron and steel production: There is no iron ore sintering in Bangladesh. Iron is mainly produced for construction and reforming imported iron pellets. The major iron products are manufactured from metal scrap recycling. There are 195 iron and re-rolling mills of different capacities (BBS, 2000). The average production of each iron facility is 4,500t. The total production of iron is (4,500*195)t/a for a total of 877,500 t/a. About 50% of mills use dirty scrap and scrap-preheating systems, 30% use clean scrap/virgin iron, afterburner, and 20% use clean scrap and BOS (basic oxygen steel) furnaces.

Foundries: Recycling of metallic materials for use as raw materials for foundries is a growing business in Bangladesh. There are about 250 foundries in the country, the majority located in Dhaka. Most of the foundries use scrap metals, such as cast iron, mild steel, stainless steel, aluminium and aluminium composition ingots, bronze and brass. Cast iron and aluminium scrap are the predominant scrap metals used. Locally manufactured furnaces should be evaluated further to better refine emission factors as provided in the UNEP Toolkit. The total production of foundries was estimated through visits to five industries. Based on average production of 156 t/a at these foundries, the total production is (156*250) or 39,000 t/a.

Copper production: Scrap and imported copper pellets are the major sources of copper production in Bangladesh. A mix of copper is made that contains copper and copper alloy scrap, slag, flue dust,

[35] All information is from GoB, MoEF, 2005d, unless otherwise noted.

residues and sludge. An emission factor of 0.03 µg TEQ/t of copper was applied to installations that smelt and cast copper and its alloys, e.g., brass. Total production of copper is 19,050 t/a.

Aluminium production: Aluminium is mainly produced in Bangladesh by reforming imported aluminium pellets and from scrap recycling. In the aluminium production industry, dioxin and furan releases to air were mainly from the thermal processing of scrap aluminium that treated and removed contaminated oil and dust from the scrap material. Virgin and scrap aluminium are processed by re-melt furnace to cleanse and extract the target alloy before being cast into rolling ingots, milled and extruded to form aluminium billets or cans. Aluminium recycling classified as thermal processing of scrap, with minimal treatment of inputs and simple dust removal, as an emission factor of 150 and 400 µg TEQ/t for PCDD/PCDF released to air and residue, respectively (UNEP, 2001). Five facilities were visited for basic information on their production. Their average production was 555 ton/a. There are 50 aluminium facilities in Bangladesh. Hence, the estimated total production is (555*50) for a total of 27,750 ton/a.

Lead production: The main sources of lead production in Bangladesh are imported lead pellets and battery recycling. Battery recycling lead is composed of battery re-conditioners, cottage smelters, smaller battery recyclers and secondary lead smelters. Most recycled lead is recovered from lead-acid batteries from cars and uninterrupted power supply systems. The main importer and recycling industry is Rahim Afroze, which consumes about 80% of the total lead in Bangladesh. Scrap smelting processes and furnaces are mostly reverberating. Rahim Afroze extracts the lead from the batteries at a temperature of 150°C - 600°C and smelts it to manufacture finished products, including new car batteries and shields. The remaining 20% consumption is from other companies. The total imported lead was 6,216 tons (BBS, 2002). The total consumed lead is approximately 9,484 ton/a. About 30% of the lead is from scrap, and the remaining 70% is imported pellets and scrap.

Zinc production: Melting of zinc may occur with the addition of fluxes, including zinc and magnesium chlorides. Emissions to air may arise from smelting and melting of mix scrap with an emission factor 0.3 µg TEQ/t of zinc. Total production of zinc is 32,133.767 tons/a in Bangladesh.

Brass production: Brass is the 2:1 mixture of zinc and copper. It is produced by either re-melting scrap brass or melting some amounts of copper and zinc together. Brass is produced in simple, relatively small melting pots. Emissions to air may arise from smelting processes and melting of mixed scrap. Emission factor 1 µg TEQ/t of brass was considered in this calculation. Total production of brass was 342.5 t/a.

Magnesium production: No magnesium was produced in Bangladesh.

Other non-ferrous metal production as nickel: A variety of processes are utilized to produce and refine non-ferrous metals. The exact processes used and their potential to form PCDD/PCDF is complex and not well studied. There is very small-scale use of nickel alloys in Bangladesh. Imported nickel is melted for mixing with baser metals. The emission factor 100 µg TEQ/t of nickel product was used for estimating PCDD/PCDF releases. Total nickel production is 4 t/a.
Shredders: There are no shredders in Bangladesh.
Thermal wire reclamation: There is no thermal wire reclamation in Bangladesh.

Emission factors:

- Coke production; emission factors range: 3µg TEQ/t to 15µg TEQ/t
- Iron and steel production; Emission factors range: 0.1µg TEQ/t to 15µg TEQ/t
- Foundries; emission factors range: 10µg TEQ/t
- Copper production; emission factors range: 0.3µg TEQ/t
- Aluminum production; emission factors range: 150µg TEQ/t to 400µg TEQ/t
- Lead production; emission factors range: 8µg TEQ/t to 80µg TEQ/t
- Zinc production; emission factors range: 0.3µg TEQ/t
- Brass production; emission factors range: 1µg TEQ/t
- Nickel production; emission factors range: 100µg TEQ/t

Table 37: Dioxins and furans released from ferrous and non-ferrous metal production

Sub-category	Air (g TEQ/a)	Water (g TEQ/a)	Products (g TEQ/a)	Residue (g TEQ/a)	Total (g TEQ/a)
Iron ore sintering	00	00	00	00	00
Coke production	0.043365	00	00	00	0.043365
Iron and steel production	5.1943	00	00	10.79325	15.987
Foundries	0.39	00	00	00	0.39
Copper production	0.000571	00	00	00	0.000571
Aluminium production	4.1625	00	00	11.10	15.2625
Lead production	0.227616	00	00	0.05311	0.280726
Zinc production	0.00964	00	00	00	0.00964
Brass production	0.000342	00	00	00	0.000342
Magnesium production	00	00	00	00	--
Thermal non-ferrous metal production as nickel	0.0004	00	00	00	0.0004
Shredders	00	00	00	00	00
Thermal wire reclamation	00	00	00	00	00
Total	9.679734			21.94636	**31.974544**

Source: GoB, MoEF, 2005d

2.3.4.2.3 Power generation and heating

Most releases from this sector are to air and residue. The major source of releases is household heating with biomass as shown in Table 38 below. The major fuel used in domestic heating and cooking is wood, although straw, coconut shells, saw dust, agricultural wastes, tree residues and cow-dung, etc., are also used for cooking and heating purposes. Fossil fuels are the main sources for power generation and heating in Bangladesh. Fossil fuels used by the electrical generating sector include heavy fuel oil, light fuel oil and natural gas. Biomass power plants, landfill biogas and biomass are not used to generate power in Bangladesh. Bangladesh produced 255,039 t of petroleum oils (BBS, 2000) and imported 1,664,072.6 t petroleum oils (GoB, MoEF 2005d, citing Foreign Trade Statistic of Bangladesh, Vol. II, February, 2003). Bangladesh consumed 163,700 tons of petrol, 1,601,439 tons of diesels and 235,360.5 tons of furnace oil. The category of power generation and heating includes power stations and industrial firing places (furnaces), which were fired with fossil fuels.

Emission factors:

- Heavy fuel fired power boilers: emission factor 2.5 µg TEQ/t
- Light fuel oil/natural gas fired power boilers: emission factor 0.5 µg TEQ/t
- Biogas combustion: 8µg TEQ/t
- Household cooking and heating -biomass: emission factors 20-100 µg TEQ/t
- Domestic cooking using coal fired stoves: emission factors 70-5,000 µg TEQ/t
- Domestic cooking using oil fired stoves: emission factors 10 µg TEQ/t
- Domestic cooking using natural gas fired stoves: emission factors 1.5 µg TEQ/t

Table 38. Dioxins and Furans Released from main source category power generation and heating

Sub-category	Air (g TEQ/a)	Water (g TEQ/a)	Products (g TEQ/a)	Residue (g TEQ/a)	Total (g TEQ/a)
Fossil fuel power plants	0. 11531				0. 115
Biomass power plant	00	00	00	00	00
Landfill and biogas combustion	0.000011				0.00001
Household cooking –biomass	78.932			0.315728	79.248
Domestic heating and cooking –fossil fuels	0.070565	00	00	0.060825	0.13139
Total	79.117886	00	00	0.376553	**79. 494**

Source: GoB, MoEF, 2005d

2.3.4.2.4 Production of mineral products

Cement production: In Bangladesh, all cement is produced using a dry process in which the raw materials are ground and dried to raw meal, then fed to the pre-heater or precalciner kiln. There are 63 cement factories in Bangladesh. Total cement production in 2003 was 15,000,000 tons.

Lime production: Total lime production is 145,763 t.

Brick production: The brick industry is a rapid growth industry in Bangladesh. Bricks are predominantly made from clay, with some additional materials added to achieve desired porosity and other characteristics. More basic brick firing may be carried out with a variety of kiln types and different fuels. Almost all brickfields in Bangladesh are small operations that use poorly controlled kilns with no gas-cleaning technology. There were about 10,000 brickfields in Bangladesh. Total production of bricks is 25,376,000 t.

Glass production: Glass is imported and recycled in Bangladesh. Furnaces used for glass manufacture may be continuously or intermittently operated. Typical fuels are oil and gas. The raw materials are principally sand, limestone, dolomite and soda. In addition, a wide range of other materials may be used to achieve desired properties such as colour, clarity and for purification. In 2002, there were 24 glass factories in Bangladesh (BBS, 2002). Total glass production is 16,720 t/a.

Emission factors:

- Cement production; 15,000,000 tons: emission factors 0.003 to 0.15 µg TEQ/t
- Lime production; 145,763 tons: emission factor 10 µg TEQ/t
- Brick production; 25,376,000 tons: emission factor 0.2 µg TEQ/t
- Glass production; 16,720 tons: emission factor 0.2 µg TEQ/t
- Ceramics production; 94,680 tons: emission factor 0.2 µg TEQ/t
- Asphalt mixing; 3,443,619: emission factor 0.07 µg TEQ/t

Table 39. Assessment of environmental releases of dioxins and furans from mineral products

Sub-category	Air (g TEQ/a)	Water (g TEQ/a)	Products (g TEQ/a)	Residue (g TEQ/a)	Total (g TEQ/a)
Cement kilns	2.25	00	00	0.045	2.295
Lime	1.45763	00	00	--	1.458
Brick	5.0752	00	00	--	5.075
Glass	0.003344	00	00	--	0.003
Ceramics	0.018936	00	00	--	0.019
Asphalt mixing	0.241053	00	00	--	0.241
Total	9.046163			0.045	**9.091**

Source: GoB, MoEF, 2005d

2.3.4.2.5 Transportation

The transport sector in Bangladesh constitutes a fleet of around 577,623 registered vehicles (BBS, 2001; BRTA, 2001), characterized as being relatively old and poorly maintained. It is estimated that more than 50% of vehicles are more than 15 years old. The sector is one of the country's leading consumers of energy. Most transportation utilizes petroleum oils and natural gas. Leaded fuel was banned in Bangladesh in 1999, with non-leaded fuels introduced in 2000. All data is from unleaded fuel.

All **four-stroke engines** are imported. There are an estimated 411,442 vehicles using these engines (BBS, 2001; BRTA, 2001). About 30% of cars are fitted with catalytic converters (BRTA, 2003).
Two-stroke engines are used everywhere except in Dhaka and Chittagong, where they are not permitted as a clean-air measure. In 2001, there were an estimated 95,914 two-stroke engines (BBS, 2001), which ran (95,914*100*360) 379,819,440 km/year (average 100 km per vehicle per day). Fuel consumption of two-stroke engines was 232,286.269 t of unleaded petrol (BBS, 2001).
Diesel fuel used in Bangladesh is estimated at 259,092 ton.

Emission factors:

- 4-stroke engines (all imported); emission factor 0.1 µg TEQ/t
- 2-stroke engines; emission factor 2.5 µg TEQ/t

- Diesel engines; emission factor 0.1 µg TEQ/t
- Heavy oil fired engines (all types); emission factor 4 µg TEQ/t
- Natural gas engines; emission factor 0.1 µg TEQ/t

Table 40. Releases of dioxins and furans from the transportation sector

Sub-category	Air (g TEQ/a)	Water (g TEQ/a)	Products (g TEQ/a)	Residue (g TEQ/a)	Total (g TEQ/a)
4-Stroke engines	0.069053	00	00	00	0.069053
2-Stroke engines	0.580715	00	00	00	0.580715
Diesel engines	0.084178	00	00	00	0.084178
Heavy oil fired engines	0.805852	00	00	00	0.805852
Natural gas	0.000032	00	00	00	0.000032
	1.53983	00	00	00	**1.53983**

Source: GoB, MoEF, 2005d

2.3.4.2.6 Uncontrolled combustion

Uncontrolled combustion processes include burning of harvest residues, trees or bushes in the open air, including barrel burning, landfill fires, and accidental fires in buildings, vehicles, etc.

The quantity of generated rural domestic waste is about 10,000,000 ton. Out of generated total rural domestic waste, 1% may be burned accidentally or unintentionally and or intentionally, and the remaining 99.9% of domestic waste is disposed of in landfill or used for composting. The residue from burning is estimated at 20,000 t/a.

This is an extremely low incidence of forest fires in Bangladesh. Accidental fires are not a significant contributor to dioxin and furan releases. Agricultural burning in Bangladesh is insignificant.

Emission factors:

- Biomass burning; emission factors 10 to 30µg TEQ/t.
- Landfill fires, accidental fires in houses, factories, uncontrolled domestic waste burning and accidental fires in vehicles; 18 to 1,000 µg TEQ/t.

Table 41. Releases of dioxins and furans from uncontrolled combustion processes

Sub-category	Air (g TEQ/a)	Water (g TEQ/a)	Products (g TEQ/a)	Residue (g TEQ/a)	Total (g TEQ/a)
Fires/burnings-biomass	00	00	00	00	00
Fires, waste burning, landfill fires, industrial fires and accidental fires.	57.161278	00	00	14.517166	71.678
Total	57.161278	00	00	14.517166	**71.678**

Source: GoB, MoEF, 2005d

2.3.4.2.7 Production of chemicals and consumer goods

PCBs: There are an estimated 55.8 metric tonnes of PCBs in in-service electrical equipment and waste transformer and other oils that will require destruction and another 22.5 MT of PCBs estimated to be contained in ships recycled each year within the ship-breaking industry (hence, presumably, these PCBs are some portion of them are recoverable as wastes **(***see Section 2.3.2***).** Selection of destruction technology for waste PCBs will need to take into consideration the potential for generation of dioxins and furans.

Kraft bleaching process for paper production: There is just one kraft bleaching facility in Bangladesh, located at Karnaphuli on 443 acres. The facility, established in 1943, produces 30,000 MT of paper annually. About 2.5 tons of raw materials are utilized to produce one ton of pulp and somewhat more if additives are used. The facility uses chlorine to bleach the pulp. About 10 metric tonnes of chlorine was used each day in the Karnaphuli Pulp and Paper Mill. There is no effluent treatment plant; hence, wastes are discharged directly to the Karnaphuli River. Other paper-producing industries import their pulp. Total production of paper in Bangladesh, including the Karnaphuli facility, is 150,000 metric tons (BBS, 2002).

Polyvinyl chloride (PVC): Total production of PVC in Bangladesh is 5960 tons/a (BBS, 2002). Dioxins concentrations in PVC products are considered low based on the processes used to produce PVC.

Petroleum refining: The only potential source of dioxin formation in petroleum refining is in the regeneration of catalysts. No activity data were available and the UNEP Toolkit did not provide any default emission factor. Therefore, emissions from the petroleum refining industry are not included in this inventory.

Textiles: In Bangladesh, textile processes include spinning, weaving, knitting, dyeing, printing, finishing, and non-woven fabrics made from imported fibres. Total production of textiles in 2001 was 1,535,923 MT. Total production in 2004 was estimated at 1,689,515.3 MT.

Leather: Leather is the largest growing and foreign earning industry in Bangladesh. Bangladesh exported 50,762 metric tons of leather goods in 2001 (BBS, 2001), with an increase in exports of 10% in 2004 to 55,838.2 metric tons/a.

Tannery wastewater: Of the 270 tanneries in Bangladesh, 243 are situated in Hazaribagh, Boubazar and Kalinagar areas. These tanneries produced 88 metric tonnes of solid wastes and release 7.70 million litres of liquid wastes/day, with all wastes discharged to the Buriganga River. Around 20,000 people live in makeshift thatched houses in the low-lying areas of Hazaribagh, where they are subject to a variety of illnesses, including respiratory problems.

Emission factors:

- Pulp and paper production; emission factors 73 pg-TEQ/t
- Cemical industry; emission factors 15,000 to 300,000 µg TEQ/t
- Textile plants; emission factors 5 to 100 µg TEQ/t

- Leather plants; emission factors 5 to 1,000 µg TEQ/t

Table 42. Releases of dioxins and furans from chemicals and consumer goods

Subcategory	Air (g TEQ/a)	Water (g TEQ/a)	Products (g TEQ/a)	Residue (g TEQ/a)	Total (g TEQ/a)
Pulp and paper	0.000073	1.314	1.2	00	2.5161
Chemical industry	0.000002	0.000178	23.58	0.001192	23.581372
Textile plants	00	8.447575	42.406831	00	50.854406
Leather plants	00	11.550	55.8382	00	67.3882
Total	0.0000419	21.311753	123.025031	0.001192	**144.340078**

Source: GoB, MoEF, 2005d

2.3.4.2.8 Miscellaneous

Crematoria: There are about 67,500 bodies cremated each year in open-air cremation, with total weight was estimated at 3,375 t. There are no closed crematoria with APCS. All are open.

Dry cleaning residue: Typical solvents were perchloroethylene, petrol, and fluorocarbons. It is estimated that total quantity of solvent consumed was 1,250 tonnes, of which about 10% is considered a loss. The overall residues of dioxins and furans in various types of textile products is estimated at 125 tonnes, generated during dry cleaning process and as residues in textiles. However, only 1% of the lost quantity is estimated to remain as residue in textiles or 1.25t.

Biomass includes wood chip drying for products and drying fodder, e.g., for use in cooking.

Emission factors:

- Biomass drying; 0.007 to 0.1µg TEQ/t
- Cremation; 2.5 to 90µg TEQ/event
- Dry cleaning residue; 50 to 3,000µg TEQ/t
- Tobacco smoking; 0.3 µg TEQ/item

Table 43. Releases of dioxins and furans to the environment from miscellaneous sources

Subcategory	Air (g TEQ/a)	Water (g TEQ/a)	Products (g TEQ/a)	Residue (g TEQ/a)	Total (g TEQ/a)
Drying of biomass	0.008376	00	00	0.119658	0.128
Cremation	0.30375	00	00	0.008437	0.312
Smoke house	00	00	00	00	00
Dry cleaning residue	00	00	00	0.002828	0.003
Tobacco smoking	0.001973			0	0.002
Ship breaking	00	00	00	00	00
Total	0.314099	00	00	0.130923	**0.445**

Source: GoB, MoEF, 2005d

2.3.4.2.9 Disposal/landfill

Landfill waste: Based on an estimate of 6.2 millions metric tons per year of solid waste, almost all of which is disposed of in landfills, it was assumed that about 20% of the landfilled waste would generate leachate. The 20% infiltration by rainfall was estimated at ($6.2*10^6*.2$) t for a total of 1,240,000 t leachate.

Sewage treatment/sewage: In Dhaka City, sewage is centrally managed at a treatment plant in Shympur. The plant has 16 sedimentation tanks and four lagoons, each of which has a volume of (217*17*3.6) cubic meters. After treatment, the liquid sludge is discharged into the Buriganga River. Annual dry solid waste remained at a volume 3689 tons. Daily wastewater is L/a = 79,992,721,830,000 L/a.

Waste oil: The total discharged waste oils is 34,838,100L/a. No default factor was given for waste oil estimation.

Open water discharge: More than 1,000 industries of different sizes and categories in Bangladesh (BBS, 2003) discharge to open water.

Emission factors:

- Landfills' leachate and waste dumps; 30µg TEQ/t
- Sewage/sewage treatment; 2 to 1,000µg TEQ/t
- Composting; 15 µg TEQ/t

Table 44. Releases of dioxins and furans to the environment from disposal/landfill

Subcategory	Air (g TEQ/a)	Water (g TEQ/a)	Products (g TEQ/a)	Residue (g TEQ/a)	Total (g TEQ/a)
Landfill and waste dumps		0.000078	00	00	0.000078
Sewage/sewage treatment	00	40.799361	00	0.3689	41.168261
Composting	00	00	75.000	00	75.000
Open water dumping	00	00	00	00	00
		40.799439	75.000	0.3689	**116.17**

Source: GoB, MoEF, 2005d

2.3.5 Information on the state of knowledge on stockpiles, contaminated sites and wastes

2.3.5.1 STOCKPILES OF ANNEX A AND B POPS

The stock distribution record of pesticides maintained by the Bangladesh Agricultural Development Corporation shows no balance of Annex A or Annex B POP pesticides at its central stores. Nevertheless, the Stock Books of District and *Thana* Stores checked during sample survey indicated a total of 8,127 Pounds (Lbs) balance/stock, of which 7,150 Lbs was Dieldrin 20EC and 977 Lbs Heptachlor 40WP. Physical verification of existing *godowns* (warehouses) did not turn up content/stock of any POPs pesticides. Interviews with the persons concerned revealed that the stock shown in the *Stock Book* has either been destroyed or interred some time ago.

The balance or stock of POP pesticides, along with the total initially received during specified periods and distributed to farmers, is shown in Table 45 below. There may be additional small quantities of off-specification or obsolete stocks remaining in different stores (GoB, MoEF, 2005c).

Table 45. Balance/Stock of Annex A POPs pesticides at District/*Thana* Stores after distribution to *thanas*/farmers during 1972–1985

Name of PP Store/ Districts	POP Pesticides	Period	Quantity Received (Lbs)	Quantity Distributed (Lbs)	Balance/ Stock on books (Lbs)	Remarks upon physical Inspection
Thana Store, Chhagalnaiya, Feni	Chlordane 40WP	22.10.75 to 07.02.76	240	240	Nil	5 Kg DDT (reported as seized quantity), along with some unidentified obsolete pesticides were found in store.
PP Store, Rajshahi	Dieldrin 20EC	17.3.80 to 21.4.81	9960	9,940	20	Balance is not in store
	Heptachlor 40WP	-	60	54	6	Balance was declared damaged on 24.4.80; no stock was found.
Thana Store, Kashba, Comilla	Dieldrin 20EC	28.02.80 to 17.03.80	218.40	218.40	Nil	
Adamdighi Thana Store, Bogra	Dieldrin 18.6 %	1974 to 30.6.80	1,297	1,297	Nil	
	Chlordane 40WP	25.6.74 to 5.12.75	2,706	2,706	Nil	
Santahar PP Store, Naogaon	Dieldrin 18.6EC	10.01.72 to 25.5.72	2,5650	22,950	2700	Distributed to *thanas* and 15 sugar mills; zero lbs found in stock
	Heptachlor 40WP	10.1.72 to 11.1.72	3,700	3,700	Nil	Distributed to Rajshahi district

Name of PP Store/ Districts	POP Pesticides	Period	Quantity Received (Lbs)	Quantity Distributed (Lbs)	Balance/ Stock on books (Lbs)	Remarks upon physical Inspection
PP Store, Barisal	Dieldrin 20EC	1.7.75	700	-	700	Committee declared the stock on 20.5.76 unsuitable. Stock not found.
	Heptachlor 40WP	1.7.75 to 20.1.76	2,697	2,302	395	Stock not found except some remnants and 10 empty drums.
	Chlordane 40WP	25.6.74	2,500	2,500	Nil	
PP Store, Jessore	Dieldrin 20EC	13.3.76 to 14.6.80	38,584	34,834	3600	150 Lbs leakage loss. Stock not found.
	Heptachlor 40WP	23.10.75 to 5.10.77	9,275	8,693	582	Stock not found.
	Chlordane 40WP	1.7.74 to 5.10.77	496	496	Nil	.
PP Store, Khulna	Dieldrin 20EC	7.7.79 to 27.6.80	21,500	21,500	Nil	204 Lbs was sold on auction to Pubali trader on 21.4.80
Thana Store, Bheramara, Kustia	Dieldrin 20EC	4.6.76 to 29.6.78	1,038	1,038	Nil	
	Heptachlor 40WP	7.10.75	480	480	Nil	
	Chlordane 40WP	27.4.74	500	500	Nil	
All Sample Survey Stores/Districts	Dieldrin 18.6/20EC	10.1.72 to 30.6.80	88987.4	81837.4	7150	zero lbs found in stock
	Heptachlor 40 WP	10.1.72 to 24.4.80	16152	15175	977	
	Chlordane 40WP	27.4.74 to 5.10.77	6202	6202	0	
	Total Annex A POPs pesticides	**10.1.72 to 30.6.80**	**111,341.4**	**10,3214.4**	**8,127**	**Zero lbs in stock of Annex A pesticides**

Source: GoB, MoEF 2005c, from the EADS case study.

2.3.5.1.1 Current confirmed POPs pesticides stocks

Annex A POPs pesticide stocks: There were reported to be 3.650 MT of dieldrin 20EC remaining in Plant Protection stores at the district and *thana* level. However, physical verification of stores found no existing stocks of dieldrin or other Annex A POPs (Table 47). Additionally, 977 pounds of

Heptachlor 40 WP that were stored at PP stores at the district and *thana* level were reported destroyed or buried between 10 January 1072 to 24 April 1980. Similarly, 7,150 pounds of Dieldrin 20EC held in these stores was reported destroyed or buried between 1 January 1972 and 30 May 1980 (GoB, MoEF, 2005c).

Annex B (DDT) pesticide stocks: As per the production and sale records of the Chittagong DDT plant**,** a total of 209.90 MT of 75% DDT formulation should have been left in stock. However, based on the 2005 EADS pesticide assessment performed for the GoB, it was determined that at plant closure this quantity of DDT 75% formulation had been completely distributed to the Directorate General of Health Services (DGHS), with 101.69 MT of DDT technical left in stock.

The Director General of Health Services (DGHS) of the Department of Health reported in 2005 that 9.81 MT stock of DDT 75WP remained in storage in district reserve stores/*upazila* project offices of the Malaria -Vector Borne Disease Control (Mal-VBDC) project. Of this amount, 3.8 MT was found on physical verification to be in good condition.[36] However, based on recently conducted local studies that indicate the half-life of DDT in the Bangladesh tropical climate is just 24 months, and taking into consideration that all remaining DDT stocks are 13 years old, GoB agencies participating in the 6-7 July 2005 consultation workshop on the NIP concurred that all DDT stocks are obsolete and require destruction (Table 46).

In conclusion, based on records and physical verification of all *godowns* or warehouses, including on Plant Protection (PP) stores at the district and *thana* level, DGHS stores, and stores at the Chittagong DDT plant site, **Bangladesh has a total of 524.752 MT of DDT stocks, all obsolete.**

It may not be economic to destroy this amount of stock within Bangladesh, which would require construction and training in operation of destruction technology that is designed for this purpose. Therefore, while a domestic option could be considered, options currently under examination include export of obsolete stocks to other nations that have environmentally sound technology (preferably, to an environmentally sound facility as close to Bangladesh as practicable to minimize shipping costs, etc., and/or with international support for destruction costs and shipping) will need to be examined (see results of GoB initial survey of POPs destruction technologies in subsection 2.3.5.3 below). Estimated costs of destruction range from about US$3000 – US$5000 a tonne.

Table 46. Department of Health stock of DDT 75WP in district reserve stores and *Upazila* Project Office

Sl.#	District	Location of Stock of DDT	Number of Bags	Quantity (Kg)	Condition*
1	Madaripur	Shibchar Upazila Health Project	44	1751	Good

[36] Communications to EADS from the Director, Disease Control, Department of Health (DOH) based on a report prepared by the Deputy Project Manager (DPM), Malaria -Vector Borne Disease Control (Mal-VBDC) project of DOH.

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Sl.#	District	Location of Stock of DDT	Number of Bags	Quantity (Kg)	Condition*
2	Barisal	Gouranadi Upazila Health Project	42	1428	Good
3	Pirojpur	Bhandaria Upazila Health Project	06	240	Good
4	Noakhali	Chatkhil Upazila Health Project	05	170	Good
5	Rangamati	District Reserve Store	06	300	Good
6	Chittagong	Hathazari Upazila Health Project	10	475	Obsolete
7	Kurigram	District Reserve Store	159	5406	Obsolete
		Bhurungamari Upazila Health Project	01	40	Obsolete
Total			**273**	**9,810**	3, 889 Kg Good **5,921 Kg Obsolete**

*Irrespective of condition of condition of DDT stocks, all stocks are deemed obsolete based on their age (13 years), owing to the very short 24-month half-life of DDT in Bangladesh.
Source: Director, Disease Control (Mal-VBDC), DGHS, Vide Letter to GoB, MoEF, 2005c.

Table 47. Cumulative stock of Annex B POPs pesticides and their current condition

Name of POP Pesticides	Quantity in Stock as per Stock Book	Quantity Physically found in Stock	Location	Reasons for Reduction in Stock	Year of Procurement
DDT formulation (local)	5 Kg (.005 MT)	5 Kg (0.005 MT)	PP Store, Chhagalnaiya, Feni		Seized from a dealer in 1987
DDT 75WP (Local)	9.81 MT	9.81 MT	District & Upazila Stores of DGHS	Obsolete based on condition and age (13 years or >)	1968 to 1992
DDT 75WP (Imported)	500 MT	482.90 MT	4 MSD *Godowns*, DGHS, Chittagong	Some lost; All obsolete	1984
*Microcell/Wassalom DDT Raw Material	32.037 MT	32.037 MT	DDT Plant, BCIC	All obsolete	
Total DDT	545.9895 MT	**524.752 MT**		**All obsolete**	

Source: GoB, MoEF, 2005c.

2.3.5.1.2 Unlabelled pesticides stocks

Although there are no current POPs pesticide stocks at DAE offices/stores, **13.668 MT of unlabelled and unidentified quantities of pesticides were found in 2004 at the division level,** (all divisions except Sylhet) (as shown in Table 48). These stocks would need to be analysed to determine if they

are POPs pesticides or are contaminated by POPs [37] (GoB, MoEF, 2005c). Damaged, leaking and rusting containers is not uncommon.

Table 48. Quantity of pesticides at DAE offices/stores in 2004

Sl #	*Division*	POP Pesticides (Kg)	Non-POP Pesticides (Kg)
1	Dhaka	0	7,605
2	Chittagong	0	2,165
3	Rajshahi	0	1,974
4	Khulna	0	962
5	Barisal	0	962
6	Sylhet	0	0
Total		**0**	**13,668**

***Source*: GoB, MoEF, 2005c, citing results of questionnaire completed by PPW, DAE**

2.3.5.2 PCB WASTES

As previously discussed, the national inventory on PCBs estimated that there are an estimated 519 MT of waste transformer oils contaminated with 259.45 kilograms PCBs. Additionally, of 8,403 MT of waste oils contained in waste electrical equipment, 4.193 MT are estimated to be contaminated with PCBs. Additionally, ships

2.3.5.3 REGIONAL CAPACITY FOR POPS WASTE DESTRUCTION[38]

2.3.5.3.1 POPs wastes requiring destruction

These are POPs wastes that exceed the low POPs content as specified in the Stockholm Convention (for PCBs), UNEP Chemical guidance, and, ultimately, within Bangladesh law, as specific to each type of POP waste. The facilities for POPs waste destruction are not available in Indian Subcontinent. Indonesia uses cement kiln co-incineration technique to destroy PCBs (UNEP 1998). Tables 49 and 50 give the list of global and regional facilities for PCBs wastes and other POPs wastes. Figure 14 shows the regional distribution of the facilities.

[37] Details of containers and remnants including the stocks of obsolete non-POP pesticides at different levels of DAE have been provided in Annex III and Appendix III to the EADS pesticide assessment.

[38] Unless otherwise stated all information in this section is from GoB, MoEF, 2005e.

Table 49. World wide capacity of PCB destruction facilities

High temperature incineration	• "PCB-containing electrical equipment decontamination and thermal PCB destruction Facility" **Russia** (UNEP 2004c) • AKZO-NOBEL - Incinerator of AKZO-NOBEL (CKI) **The Netherlands** (UNEP 2004c) • AVG Abfall-Verwertungs-Gesellschaft mbH, **Germany** (UNEP 2004c) • AVR Nutsbedrijf Gevaarlijk Afval B.V., **The Netherlands** (UNEP 2004c) • Bayer Industry Services GmbH & Co OHG, **Germany** (UNEP 2004c) • Clean Harbors PPM, LLC – Twinsburg, **USA** (UNEP 2004c) • Ekokem Oy Ab, **Finland** (UNEP 2004c) • EMS-Dottikon AG, **Switzerland** (UNEP 2004c) • Envio Germany GmbH & Co. KG, **Germany** (UNEP 2004c) • GSB Sonderabfall-Entsorgung Bayern, **Germany** (UNEP 2004c) • HIM GmbH, Hazardous waste incineration plant, **Germany** (UNEP 2004c) • RWE Umwelt Sonderabfallwirtschaft GmbH - Betriebsstätte Bramsche, **Germany** (UNEP 2004c) • RZR Herten, **Germany**(UNEP 2004c) • SAVA Sonderabfallverbrennungsanlagen GmbH, **Germany** (UNEP 2004c) • Shanks, **UK** (UNEP 2004c) • Tredi Saint Vulbas, **France**. (UNEP 2004c) • TRV Thermische Rückstandsverwertung GmbH & Co. KG, **Germany** (UNEP 2004c) • Novartis Services AG, **Switzerland** (UNEP 2004c) • Valorec Services AG, Regionale, Sondermuellverbrennungsanlage (RSMVA) **Switzerland** (UNEP 2004c) • Cleanaway **UK,** (UNEP 2000) • Rechem International Ltd **UK,** (UNEP 1998) • Bovar Waste Management, **Canada** (UNEP 1998) • Cintec Environnement Inc, **Canada** (UNEP 1998) • Douala/MaKepe Waste Facility, **Cameroon** (UNEP 1998) • Entsorgungsbetriebe Simmering GmbH **Austria** (UNEP 1998) • Kommunekemi a/s, Lindholmvej **Denmark** (UNEP 1998) • Elf Atochem, **France** (UNEP 1998) • SAKAB, **Sweden** (UNEP 1998) • PCBs Incineration Plant, **China** (UNEP 1998) • Integrated waste treatment Plant, **Korea** (UNEP 1998) • Incinerador Rotativo, **Brazil** (UNEP 1998) • CETREL SA, **Brazil** (UNEP 1998)

	• S D MYERS DE MX SA CV, **Mexico** (UNEP 1998)
Cement Kiln	• CVM Mokrã a.s. **Czech Republic** (UNEP 1998) • Norcem AS, **Norway** (UNEP 1998) • PT PPLI, **Indonesia** (UNEP 1998)
Sodium Reduction	• BC Hydro and Power Authority Surrey Oil Business Unit, **Canada** (UNEP 2004c) • Clean Harbors PPM, LLC – Tucker, **USA** (UNEP 2004c) • Dr. Bilger Umweltconsulting GmbH, **France, Germany, the Netherlands, UK. (UNEP 2000)** • Envio Germany GmbH & Co. KG, **Germany** (UNEP 2004c) • Kinectrics Inc., **Canada** (UNEP 2004c) • Kobelco-Eco Solutions Co., Ltd, **Japan** (UNEP 2004c) • Kobelco-Eco Solutions Co., Ltd - additional technology, **Japan** (UNEP 2004c) • Vietnam Environmental Technology and Consulting Company (VENETCO), **Vietnam** (UNEP 2004c) • Fluidex **South Africa, Australia** (UNEP 2000) • Manitoba Hydro **Canada, USA** (UNEP 2000) • Envio Germany GmbH & Co. KG, **Germany** (UNEP 2004c) • Powertech, **Canada, Japan** (UNEP 2000) • Safty-Kleen, **USA** (UNEP 2000) • Shinko Pantec, **Japan** (UNEP 2000) • Tassco, **Canada,** (UNEP 2000)
BCD	• Recetox MU, **Czech Republic** (UNEP 1998) • Powerlink, **Australia** (UNEP 1998) • BCD Technologies PTY. LTD. **Australia** (UNEP 2004c) • S D MYERS DE MX SA CV, **Mexico** (UNEP 2004c)
Gas Phase Chemical Reduction (GPCR)	• ECO LOGIC - GPCR Demonstration Plant, **Canada** (UNEP 2004c) • ECO LOGIC - Semi-Mobile GPCR Plant, **Slovak Republic** (UNEP 2004c) • HIDRONOR CHILE S.A., **Chile** (UNEP 2004c) • ECO LOGIC **Japan** (UNEP 2000) • ECO LOGIC **Australia** (UNEP 1998)
Plasma Arc	• BCD Technologies PTY. LTD. **Australia** (UNEP 2004c) • "Complex environmentally safe PCB-containing electrical equipment decontamination and plasma chemical, PCB destruction Facility" **Russia** (UNEP 2004c) • JSC "Severstal" **Russia** (UNEP 2004c) • Petrochimteknologii, **Russia** (UNEP 2000)
Pyrolysis / gasifiers	• HIDRONOR CHILE S.A. **Chile** (UNEP 2004c)
Advanced Oxidation Process (electro-oxidation)	• Envio Germany GmbH & Co. KG, **Germany** (UNEP 2004c)
Solvent Decontamination	• Powerlink, **Australia** (UNEP 1998) • Haz-Waste Services, **Australia** (UNEP 1998) • Clean Harbors PPM, LLC – Ashtabula, **USA** (UNEP 2004c)

	• Clean Harbors PPM, LLC – Coffeyville, **USA** (UNEP 2004c) • Envio Germany GmbH & Co. KG, **Germany** (UNEP 2004c) • GEP (Générale d'Extraction du Pyralène), **France** (UNEP 2004c) • HIDRONOR CHILE S.A. **Chile** (UNEP 2004c) • Kobelco-Eco Solutions Co., Ltd, **Japan** (UNEP 2004c) • ORION BV, **The Netherlands** (UNEP 2004c) • SEA Marconi Technologies SAS, **Italy** (UNEP 2004c) • SITA (WATCO) Decontamination N.V. **Belgium** (UNEP 2004c) • Terra-Kleen Response Group - Mobile Treatment Facility, **USA** (UNEP 2004c) • Tredi Saint Vulbas, **France** (UNEP 2004c) • Aprochim **(Brazil, France, Spain)** (UNEP 2000) • Cintec **Canada** (UNEP 2000) • Ontario Power, **Canada** (UNEP 2000) • Sanexen **Canada** (UNEP 2000)
Retrofilling	• S D MYERS DE MX SA CV, **Mexico** (UNEP 2004c) • Workshop and warehouse of Cambodian Electricity Authority, **Cambodia** (UNEP 2004c) • ABB Service, **Germany** (UNEP 2000) • S D Myers Canada, Saudi Arabia, United Kingdom, USA (UNEP 2004c)
Thermal desorption	• Kobelco-Eco Solutions Co., Ltd, **Japan** (UNEP 2004c) • Thermopower Process Technology (Pty) Ltd., **South Africa** (UNEP 2004c) • Z.E.R.O. Japan Co., Ltd., **Japan** (UNEP 2004c)
Detoxification	• Clean Harbors PPM, LLC – Coffeyville, **USA** (UNEP 2004c)
Vitrification	• AMEC Geomelt (**Australia, UK, USA**) (UNEP 2000)

Table 50. Regional capacity of PCBs & POPs pesticide destruction

Country	Company	Technology
Australia	BCD Technologies PTY LTD 2 Krypton Street 4504 Narangba Queensland 119 Australia Email bcdt@gil.com.au Web: www.srasma.com	Non combustion Technology High Temp Incineration Mobile, Facilities exist as an industrial unit
Australia	Powerlink, 33 Harold Street, Virginia 4014, Queensland Tel: 00 61 7 3860 2111 Fax: 00 61 7 3860 2100 David Strongman, General Manager	Dechlorination (1997) and retrofilling
Australia	ELI Ecologic Australia Hazardous Waste Destruction Facility Lot 4, Mason Road, Kwinana 6167, Western Australia Tel: 0061 9 439 2074	Hydrogenation – chemical reduction (1995)

Country	Company	Technology
	Fax: 0061 9 439 2363 ecoadmin@ecologic.com.au Nathan Dixon, Quality Control Manager	
Australia	Haz-Waste Services, Jancassco Pty Ltd, PO Box 4012, 101 Ordish Road, Dandenong Sth, Victoria 3164, Australia Tel: 006 13 9706 7966 Fax: 0061 3 9706 5762 K R Carlile, Managing Director	Chemical dechlorination (1994) Solvent extraction (1988)
Cambodia	Cambodia Electricity Authority EDC Building St Yukunthor, Daun Penh Phnom Penh Cambodia Email: edc@bigpond.com.kh	Non combustion Technology Facility does not exist as an industrial unit Workshop and warehouse of the Cambodian Electrical Authority
Japan	Z.E.R.O. Japan Co., Ltd. 163-0558 Tokyo 1-26-2 Nishi-Shinjuku Japan	Non combustion Technology Mobile, Facilities exist as an industrial unit
Japan	Kobelco-Eco Solutions Co., Ltd. 4-78, 1-chome, wakinohama-cho, chuo-ku 651-0072 Kobe Hyogo prefecture Japan Email: t.shiga@kobelco-eco.co.jp Web: www.kobelco-eco.co.jp	Non combustion Technology Facilities exist as an industrial unit
Vietnam	Vietnam Science Institute – Chemicals Institute and Vietnam Environmental Technology and Consulting Company (VENETCO) Nghia Do – Tu Liem Ha Noi Vietnam Email: lilan602003@yahoo.com	Non combustion Technology Mobile, Facilities exist as an industrial unit
Cameroon	Douala/MaKepe Waste Facility c/o Chemicals Management Programme, MINEF/Permanent Secretariat, Yaoundé Centre Tel: 00 237 239231/229482 Fax: 00 237 239461	Static kiln incinerator 220 tonne batches handling all incinerable wastes
China	PCBs Incineration Plant, No. 63 Shashan Street, Heping District, Shengyang 110005 Tel: 0086 24 3316656 Fax: 0086 24 3317668 Shao Chinyan, Senior Engineer	Static kiln and liquid injection incinerator (1995)

Country	Company	Technology
Indonesia	PT. PPLI, Desa Narbo, Cibinong-Bogor, West Java Tel: 0062 21 823 0307 Fax: 0062 21 823 0308 Syarif Hidayat	Cement kiln (1996)
Korea	Integrated Waste Treatment Plant, #2 Complex, Kunsan Industrial Estate, Soryongdong, Kunsan City, Chonbuk Province Tel: 0082 654 467 2285/7 Fax: 0082 654 467 2288 Mr Ho-Jik Kang, Director	Rotary kiln incinerator (due to be commissioned July 1998)
Saudi Arabia	S D Myers (Canada, Saudi Arabia, United Kingdom, USA) Dana S Myers, or Pierre Lefebvre (sdm.lefebvre@videotron.ca)	PCB-Gone: dechlorination
Russian Federation	*Petrochimtekhnologii* Malookhtinskiy pr. 68 195112 St Petersburg Russian Federation fax: + 812 528 8990 tel: + 812 528 0085 e-mail: flash@mail.wplus.net	Solvent washing of electrical equipment, followed by plasma-chemical destruction of PCBs
South Africa	Thermopower Process Technology Pty Ltd. 28 Keramiek Street Clayville 333 Olifantsfontein Gauteng, South Africa Email: process@thermopower.co.za Web: www.thermopower.co.za	High Temp Incineration Mobile, Facilities exist as an industrial unit

Figure 14. Regional capacity for POPs Destruction

Bangladesh reviewed available commercialized technologies that could be considered for destruction or irreversible transformation of POPs wastes and stockpiles in Bangladesh using the following performance criteria:

- Destruction efficiency
- Capability to treat all POPs
- Off gas treatment
- New POPs formation
- Uncontrolled releases
- Minimum pre-treatment
- Capability to treat both solid and liquid wastes.

Based on the GoB assessment, the following technologies are under consideration for use in Bangladesh:

1. Gas Phase Chemical Reduction (GPCR)
2. Base Catalyzed Decomposition (BCD)

3. Alkali Reduction
4. Super-Critical Water Oxidation (SCWO) and
5. Plasma Arc
   5a. PLASCON
   5b. PACT
   5c. PWC
6. Hazardous waste incinerators
7. Cement kiln co-incinerator

The alkali reduction technology is the only one that allows the recycling of electrical devices and high value transformer oil. Since the bulk of the feed material, i.e., transformer oil or potting compound, is not destroyed in the process, the material may be recycled or reused. UNEP observes that for sodium reduction non-combustion technology, the second most established POPs waste destruction technology; there are eight destruction facilities globally.

Descriptions of the technologies — processes, performance, practical aspects of technologies, comparisons as pertaining to criteria and their applicability within Bangladesh — are described in the tables 51 through 55.

Table 51. Process summaries of different commercialized technologies.

Technology	Process Description	Portability	Applicability	Scale
GPCR	Chlorinated organic compounds react with hydrogen at high temperatures (≥850ºC) and low pressure, yielding methane, hydrogen chloride and minor amounts of other low MW hydrocarbons.	Fixed, modular; transportable (but not easily). Thermal desorption unit required for solid wastes.	All POPs, including high strength wastes. Liquids and solids.	Up to 100 tonnes/day depending on waste strength
BCD	Batch treatment of liquid and solid wastes in the presence of a high boiling point hydrocarbon (e.g. fuel oil), sodium hydroxide and a proprietary catalyst. When heated to about 300 °C the reagent produces highly reactive atomic hydrogen, which reacts with organochlorines and other wastes.	Fixed, modular; and transportable. Thermal desorption used for some wastes	All POPs, including high strength wastes. Liquids and solids (<2 cm)	Up to 20 tonnes/hr contaminated solids, 9000 litres per batch liquids, smaller units available.
Alkali Reduction	Reduction of PCBs with dispersed metallic sodium in mineral oil. Has been used widely for *in-situ* removal of PCBs from active transformers. Products include polybiphenyl, sodium chloride, petroleum based oils and caustic.	Transportable and fixed	PCBs, transformer oils & DDT*	Up to 15,000 l/day
SCWO	SCWO destroys toxic and hazardous organic wastes in a compact totally enclosed system, using an oxidant (e.g. oxygen or hydrogen peroxide) at temperatures and pressures above the critical	Current pilot plant systems are fixed configuration, but the units should be transportable	All POPs, liquid wastes or solids less than 200 microns in diameter, and an organic content	Currently up to 400 kg/hr, but planned for 2700 kg/hr

	point of water (374°C and 22.1 MPa). Under these conditions organic materials become highly soluble in water and react rapidly to produce carbon dioxide, water and inorganic acids or salts.		of less than 20%	
PLASCON (Plasma Arc)	Organochlorine waste is injected directly into a plasma torch, where it is pyrolysed under high temperatures in the torch (>3000 °C) and decomposed to CO, CO_2 and HCl. Acid gases are removed in a caustic scrubber and CO is oxidized in a flare prior to discharge to atmosphere.	Transportable and fixed	All POPs. Liquid and gaseous wastes, up to 100% strength.	1-3 tonnes/day (150 kW plant)
PACT (Plasma Arc)	Wastes are fed into a centrifugal chamber heated by a plasma torch. The molten materials reach a temperature of approximately 3000˚C, while gas temperatures range between 927 and 1200˚C. Process gases are passed into a secondary combustion chamber heated (1200˚C) by another plasma torch.	Transportable and fixed	All POPs, solid, liquid and gaseous wastes	1000 kg/hr
PWC (Plasma Arc)	PWC forces gas through an electrical field to ionize gas into plasma. The plasma operates at a temperature of 3000 to 5000˚C. The plasma chamber operates at normal atmospheric pressure. Wastes are reduced to their metallic components, a slag and a gas	Transportable and fixed	All POPs, solid, liquid and gaseous wastes	50 – 100 kg/hr and commercial unit 10 tonnes/day
Hazardous Waste Incinerator	Heating to a temperature > 1000 °C, with a residence time > 2 seconds, under conditions that assure appropriate mixing	Transportable and fixed	All POPs, Solid, liquid and gaseous wastes	82- 270 tons per day
Cement kiln co-incinerator	Long cylinder of 50 to 150 metres, inclined slightly from the horizontal (3 to 4 percent gradient) rotated at about 1 to 4 rev./ minute. The kiln is fired at the lower end of the kiln, temperatures 1400-1500 °C.	Available only in fixed configurations	Demonstrated with PCBs, but should be applicable to other POPs.	Wastes used as a co-fuel are limited up to a maximum of 40% of the heat requirement

*www.powertechlabs.com Canada

Table 52. Process Performance of different technologies

Technology		Performance Data	Emissions	By-products
GPCR		>99.9999% DRE for HCB, PCBs and DDT	All emissions may be captured for assay and reprocessing if needed.	Solid residues should be suitable for landfill disposal. Caustic scrubber liquid.
BCD		>99.99% DRE in trials	No significant emissions (but some dioxins measured in older plants)	carbon residue, the Hydrocarbon oil and salt water.
Alkali Reduction		DRE not reported, but achieves <0.5 ppm PCB removal	Possibly hydrogen if water present	Caustic/salt solutions. Treated oil may be reused
SCWO		>99.99% DRE	No significant releases	Unknown (for POPs)
Plasma Arc	PLASCON	>99.9999% DRE for PCBs	Carbon dioxide and argon	Caustic scrubber solutions
	PACT	99.99% DRE reported, >99.9999% achieved with HCB-contaminated diesel	No significant releases	A solid slag-like material
	PWC	No published data	Carbon dioxide gas	Caustic scrubber liquids and solid residues (slag)
Hazardous Waste Incinerator		>99.9999% DRE for POPs Wastes DE 97.9 – 99.9%	CO, CO_2, HCB, HCl, particulate matter, PCDDs, PCDFs and PCBs. Cyclones and multi-cyclones, electrostatic filters, static bed filters, scrubbers, selective catalytic reduction, rapid quenching systems and carbon adsorption are needed for capturing emissions.	Bottom ash, fly ash, salts and scrubber water
Cement kiln co-incinerator		>99.995 % DRE for PCBs	CO_2, cement kiln dust, HCl, PCBs, PCDDs and PCDFs	Cement kiln dust captured by the air pollution control system

Table 53 : Practical aspects of different commercialized technologies.

Technology	Infrastructure Needs	Operational Needs	Practical Issues	Safety Issues
GPCR	Moderate amounts of propane needed for boiler unless processing high organic wastes. Hydrogen may also be needed during start up	Continuous process with batch storage.	Disposal of treated residues	Potential for hydrogen gas leaks

BCD		Nitrogen gas required for "blanketing". Also needs significant amounts of base.	Batch and continuous systems available	Disposal of treated residues	No major safety issues
Alkali Reduction		Sodium handling facilities	Continuous	Sodium supply	Sodium safety and potential hydrogen hazards
SCWO		No special requirements, but note that SCWO technology has been around for many years, and the earlier systems were plagued by unreliability, corrosion and plugging problems. Recent developments have effectively addressed these problems through use of special reactor designs and corrosion resistant materials.	Continuous	None	None
Plasma Arc	PLASCON	Moderate energy inputs and reliable electricity and cooling water supplies.	Continuous	Significant demand for argon. Cooling water is essential for torch.	Risk of explosion from internal cooling water leaks. Molten metal or slag discharges.
	PACT	Large input of reliable electricity and cooling water supplies are required to generate the plasma arc	Batch process	Electricity and water supply.	Risk of explosion from internal cooling water leaks.
	PWC	Moderate energy inputs and reliable electricity and cooling water supplies	Batch process	Support gases. Cooling water is essential for torch.	Risk of explosion from internal cooling water leaks.
Hazardous Waste Incinerator		Cooling water and lime are required. Fossil fuel requirement is high.	Continuous	Disposal of treated residues and emission of PCDD & PCDF	High operating temperature
Cement kiln co-incinerator		High fossil fuel requirements.	Continuous	Disposal of treated residues and emission of PCDD & PCDF	High operating temperature

Table 54. Comparison between commercialized technologies with respect to criteria set for Bangladesh.

	GPCR	**BCD**	**Alkali Reduction**	**SCWO**	**PLAS CON**	**PACT**	**PWC**	**HWI**	**Cement Kiln**
1. Performance									
Destruction efficiency	DRE-99.9999%, DE-99.9999%	DE 99.99-99.9999% DRE > 99.9999	DE > 99.999% DRE 99.9999%	DRE 99.9999%	DRE 99.9999%	DRE 99.99 to 99.9999 %	No information	DRE 99.9999%	DRE > 99.995%
Capability to treat all POPs	All POPs	All POPs	PCBs & DDT[a]	All POPs	All POPs	All POPs	All POPs	All POPs	All POPs
Off gas treatment	Low	Low	No	Very Low	Very Low	Moderate	Moderate	V. High	V. High
New POPs formation	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Uncontrolled	No	No	No	No	No	No	No	Yes	Yes

releases									
Minimum pre-treatment	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes
Capability to treat both solid & liquid wastes.	Yes	Yes	Yes*	No	No, Pumpable solids	Yes	Yes	Yes	Yes
2. Portability									
Availability of mobile system	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No
3. Costs									
Capital cost	Not known	US$ 0. 8-1.4 m	Not known	Not known	US$ 1m	Not known	US$ 1.6 m	US$ 70 m	Not known
Per tonne costs[b]	AUS$4000 to AUS$6000 for POPs pesticide solids; AUS$4000 to AUS$8000 for PCBs liquids; and AUS$6000 to AUS $11,000 for capacitors.	728-1772 US$	Trans former oils: US$0.15/L, £500 – £1000/t, CAN$4/ gallon, CAN$ 0.90/kg; a nd waste oils: CAN$0 .60/kg	$120 to $140 per dry tonne	AUS$ 1500–2000	AUS$ 4000 – 8000	AUS$413	200-300 Euro	Un known
4. Resource needs[c]									
Electricity requirements	Low	Low	Low	high	high	high	high	Moderate	Moderate
Technician requirement	Moderate	Moderate	Moderate	high	high	high	high	Low	Low
Laboratory requirement	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
Other Energy Requirement	Low	Low	Low	Low	Low	Low	Low	High	High
5. Safety[c]									
Danger of reagents	Yes	No	Yes	No	No	No	No	No	No
Danger of technology	Medium	Low	Low	high	high	high	high	Low	Low
Danger of operation	High	Medium	Medium	high	high	high	high	Low	Low
6. Social Acceptance[c]	High	High	High	High	High	High	High	Low	Low

[a] www.powertechlabs.com Canada, [b] RFI Environment Canada 2004. [c] Assessed considering local conditions.

Table 55. Applicability of the technologies in Bangladesh: advantages and disadvantages (continued).

Technology		Advantages	Disadvantages	Remarks
Plasma Arc	PLASCON	Can treat all POPs wastes of Bangladesh. Performance is good. Portable system available. High social acceptance Relatively low per tonne cost (AUS$ 1500-2000/tonne)	Recycling of electrical devices and transformer oil is not possible. High electricity inputs and reliable electricity Risk of explosion from internal cooling water leaks. Molten metal or slag discharges Significant demand for argon. Cooling water is essential for torch. Recycling of electrical devices and transformer oil is not possible.	Main constraints: High electricity input Recycling of electrical devices and transformer oil is not possible. This technology is not very much suitable for Bangladesh.
	PACT	Can treat all POPs wastes of Bangladesh. Performance is good. Portable system available. High social acceptance	Recycling of electrical devices and transformer oil is not possible. High electricity inputs and reliable electricity and cooling water supplies. Risk of explosion from internal cooling water leaks. Molten metal or slag discharges Relatively high capital costs and per tonne cost (AUS$ 4000-8000/tonne)	Main constraints: High electricity input Relatively high per tonne cost. Recycling of electrical devices and transformer oil is not possible. This technology is not very much suitable for Bangladesh.
	PWC	Can treat all POPs wastes of Bangladesh. Performance is good. Portable system available. High social acceptance Relatively low per tonne cost (AUS$ 413/tonne)	Recycling of electrical devices and transformer oil is not possible. High electricity inputs and reliable electricity and cooling water supplies. Risk of explosion from internal cooling water leaks. Molten metal or slag discharges	Main constraints: High electricity input Recycling of electrical devices and transformer oil is not possible. This technology is not very much suitable for Bangladesh.
Hazardous Waste Incinerator		Can treat all POPs wastes of Bangladesh. Portable system available. Relatively low per tonne cost (Euro 200-300/tonne)	Recycling of electrical devices and transformer oil is not possible. High energy inputs Formation of new POPs & uncontrolled release High capital costs Incineration can attract public opposition. The system need to be switched on continuously, otherwise significant damage of the system takes place.	Main constraints: The system needs to be switched on continuously to prevent damage of the system. Recycling of electrical devices and transformer oil is not possible. Disposal of treated residues and emission of PCDD & PCDF This technology is not suitable for Bangladesh.
Cement kiln co-incinerator		Can treat all POPs wastes of Bangladesh.	Recycling of electrical devices and transformer oil is not possible. High energy inputs Formation of new POPs & uncontrolled release Portable system is not available Incineration can attract public opposition.	Main constraints: Recycling of electrical devices and transformer oil is not possible. Disposal of treated residues and emission of PCDD & PCDF This technology is not suitable for Bangladesh.

2.3.5.3.2 POPs wastes requiring disposal

As per provisions of Article 6.1(d) of the Stockholm convention, wastes that are at or below the low POPs content concentration require disposal. Options for these wastes include (1) packaging the wastes in appropriate containers, labelling and placement of wastes within a properly modified /constructed permanent storage in Maddhapara Hardrock Mine, and (2) placement of wastes in engineered landfills, which would be developed utilizing state-of-the-art procedures. Such landfill sites should be located above groundwater table. Nevertheless, high rainfall and frequent flooding might disseminate the wastes / leachate from landfill sites. Considering these factors, three areas have been proposed for landfill construction:

1. Tertiary Hills of Chittagong or Chittagong Hill Tracts
2. Madhupur Tract
3. Barind Tract

Proper assessment of these sites (see Figure 15), including groundwater vulnerability, has to be made.

2.3.5.4 CONTAMINATED SITES

There is currently no national inventory of contaminated sites. Probable and other potential sites of POPs contamination are discussed below. A plan for sampling sites to determine whether and to what extent they are contaminated will need to be developed, and options considered for remediation, where warranted.

Probable sites contaminated with Annex A and B pesticides are as follows:

1. DDT Plant, BCIC chemical Complex, Barbakund, Chittagong.
2. Shantahar, Rajshahi Division Pesticide *Godown* (warehouse), Bogra.
3. Dhaka Division Pesticide *Godown*, Tejgaon, Dhaka. (Presently abolished, Polar Ice Cream Factory is now located at this site).
4. Khulna Division Pesticide *Godown*, Daulatpur, Khulna.
5. Chittagong Division Pesticide *Godown*, Dewanhat, Chittagong.
6. MSD (Medical Sub Depot) G*odown*, Agrabad, Chittagong (under Directorate General of Health Services)

Other POPs pesticide (Annex A and/or Annex B) contaminated sites may include areas around factories or former factories known to have formulated POPs pesticides in the past, district pesticide warehouses or *godowns* in 18 districts and in some *thanas*, and at locations of DGHS District Reserve Stores and *Upazila* project stores / offices stores, and former DAE burial sites. There are also largely unconfirmed, sporadic reports of pesticide POPs wastes disposed of indiscriminately in open-air landfills (dumps).

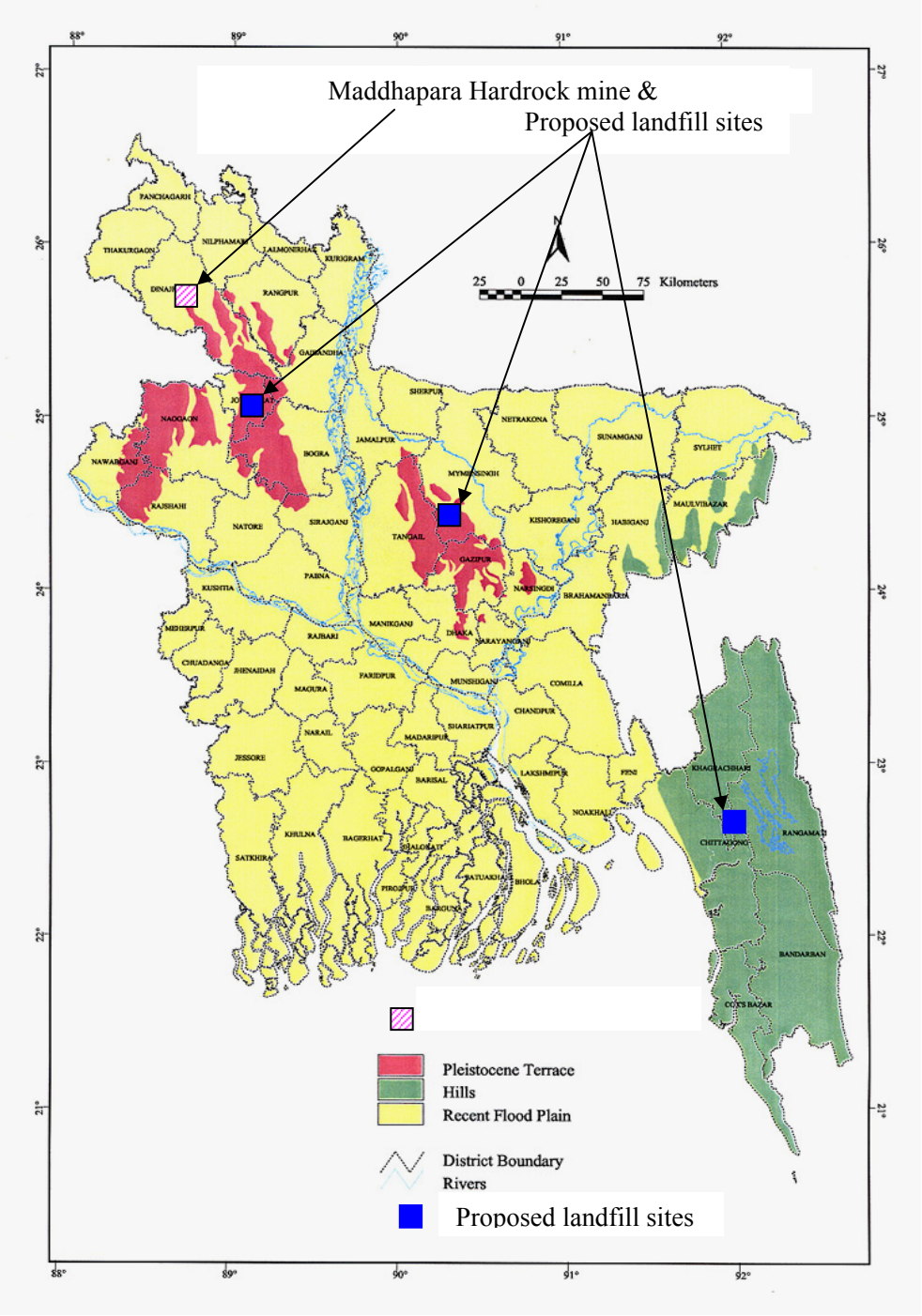

Figure 15. Location of Maddhapara Hardrock mine and proposed landfill sites

Potential sites include workshops where transformer and capacitors are repaired, overhauled, dismantled or retrofilled:

1. Central Equipment Repairing Shop, Bangladesh Power Development Board (BPDB), Tongi, Gazipur.
2. Zonal Workshop, BPDB, Tongi, Gazipur.
3. Zonal Workshop, BPDB, Bogra.
4. Zonal Workshop, BPDB, Jessore.
5. Zonal Workshop, BPDB, Chittagong.
6. Regional Workshop, Rural Electrification Board, Dhaka.
7. Regional Workshop, Rural Electrification Board, Chittagong.

Additionally, there are 67 *Palli Biddhut Samiti* in different districts in Bangladesh where small transformers are repaired.

Shipping industry: Shipyards in Sitakund, Chittagong, and nearby coastal waters could potentially be contaminated with PCBs.[39]

Dredge spoil storage sites: There is no information at this time on PCB content in dredge spoils taken from canals, rivers, and tributaries in Bangladesh, which would indicate if contaminated sites exist where these have been deposited and also within marine and navigable inland waterways.

2.3.5.4.3 Dioxin and furan contaminated sites

Potential sites that might be examined as part of a national survey of sites include:

Shipping industry: Shipyards and coastal waters that could potentially be contaminated with dioxins and furans.

Forest products industry: The Bangladesh Forest Industries Development Corporation (BFIDC) used polychlorophenol for treating wood prior to 2001. After that time, they used alternative processing systems — CCA (Copper, Chromium, Arsenic), and CCB (Copper, Chromium and Borax) — for treating wood. Soil, water and biota of the site and surrounding area should be sampled to determine contamination levels for this POPs component.

[39] The International Maritime Organisation (IMO) has no agreement in place requiring removal of contaminated materials and substances from ships prior to selling them for recycling. Voluntary guidelines are not well respected, with the result that most ships received by Bangladesh for recycling contain a variety of toxic and hazardous materials.

2.3.6 Summary of future production, use and releases of POPs—requirements for exemptions

The GoB notified the Stockholm Convention Intergovernmental Negotiating Committee (INC) in 2001 of its intent at that time to file for an exemption for acceptable purposes under the Stockholm Convention (UNEP, 2001b). Bangladesh intends to formally register for an exemption for DDT upon ratification of the Convention, pending a final determination of effectiveness of alternatives for control of kala-azar, and with respect to options available should resistance develop to the alternatives currently used for malaria control. Registration for an exemption will enable Bangladesh to make a rational determination before its official phase out of DDT. As previously noted, existing stocks of DDT are all deemed obsolete owing to condition and/or age.

Bangladesh will not be using, producing or transporting Annex A pesticides POPs, except for potential shipment for destruction of pesticide POPs wastes. Bangladesh will not be manufacturing or formulating DDT. It is currently exploring options with potential donors for shipping all obsolete stocks of DDT abroad for destruction.

Bangladesh will not be producing PCBs. It will continue to use electrical equipment containing PCBs or contaminated with PCBs in the near-term, but such use will be phased out according to a detailed management plan, which Bangladesh is in the process of developing. The plan will propose timetables for actions that enable it to meet its obligations for PCBs as consistent with provisions of the Stockholm Convention.

2.3.7 Existing programmes for monitoring releases and environmental and human health impacts, including findings

2.3.7.1 MONITORING PROGRAMMES

There is no monitoring programme for POPs in Bangladesh, whether in environmental media (inland waters and sediment; groundwater; marine water and sediment; soil; and air); animals (fish, birds, mammals and other animals including domestic and imported livestock and poultry); animal feeds, or of people. Nor has there been such a programme historically or capacity for such a programme.
A preliminary assessment of POPs pesticides related human and environmental risks was planned as part of the 2005 POPs pesticides assessment, but due to various limitations, particularly constraints in terms of time, facilities and budget for sample analyses, the POPs samples collected at the time of the study have yet to be analyzed (GoB, MoEF, 2005c).

There is currently no systematic surveillance programme in place to determine and track resistance in disease vectors to DDT or pesticide alternatives to DDT, such as deltamethrin (USAID, 2004 a-c).
Bangladesh does not require reporting of pesticide poisonings, nor does it have an established poison control and information centre (i.e., a clinical toxicology facility dedicated to management of poisoning cases). A consultant was appointed to formulate a programme to establish a poison control and information centre. However, resources were not available to establish a centre. In the general hospitals, victims of poisoning are usually treated by doctors who are inexpert in toxicology. Therefore, while poison cases are reported very often in the press and are suspected to be high, there are no comprehensive statistics of death due to pesticide poisoning (FAO/UNEP, 1998). However, some data has been collected from some hospitals as discussed below in subsection 2.3.7.2.1.

Environmental monitoring of chemical pollutants generally is very recent and has focused on common air pollutants and lead generated by vehicular traffic. A few heavy metals (mercury and lead) and a handful

of other chemicals (including chlorine) are the subject of standards for air emissions issued under Schedule 2 of The Environmental Conservation Rules 1997. Government sampling of surface waters, including of industrial effluents in industrialized areas, has focused on physiochemical characteristics such as acidity (pH); dissolved oxygen (DO), biological oxygen demand (BOD), total suspended solids (TSS), suspended solids (SS), total coliform (i.e., from fecal contamination), some heavy metals, electrical conductivity, turbidity, and temperature. In some instances, chloride content is sampled (UNEP, 2001). The government has a series of surface and ground water monitoring stations in place (i.e., for testing oxygen demand, suspended solids, etc.).

None of the laboratories meet the lowest level of UNEP international standards for POPs analysis (Tier-3) at this time and there is no national accreditation system for laboratories in Bangladesh or reference laboratory for POPs. Some laboratories do have equipment that could be used for POPs analysis, but lack of skilled staff to undertake analysis.

2.3.7.2 EXISTING DATA ON EXPOSURE OF HUMANS AND THE ENVIRONMENT TO POPS

The presence of POP pesticides in human samples, particularly in human breast milk (e.g., Smith, 1999; Torees-Areola et al., 1999; Rizvi, 1995; Middlekauf, 1985), and in biota (fish, birds, wildlife, domestic stock) has been reported in many countries of the world. Within Bangladesh, there are, however, only a very few studies of POPs exposure in humans, bird, animals or fish, or of the environment, whether undertaken by international entities, the Bangladesh government, academia or others. Consequently, there is a noteworthy paucity of data on POPs exposure, including as contrasted to other countries in the South Asia region. Similarly, there are very few studies of POPs pesticides alternatives, for which use has increased since POPs were banned (e.g., carbamates and organophosphates).

Systematic quantitative information on human exposure would be useful to identify potentially effected sub-populations as informed by results of first order inventories. For example, repairpersons in utility companies who are in contact with transformer fluids may have been exposed to PCBs much more frequently and at higher concentrations than the general public. Similarly, wholesalers, retailers and farmers who handle pesticides on a regular, and their families (given that pesticide residues remain on clothing, in hair, etc., and can be transferred to other members of the family within the home) should be considered for monitoring. Fishers and their wives and children are another potentially vulnerable subpopulation. If they are known to consume more fish due to occupational circumstances of the household, it is possible that they are at greater risk of exposure. Similarly, populations who regularly consume fish that swim in waters that are found to be polluted at high concentrations, e.g., offshore of a warehouse that is known to have leaked or based on sampling, may also be at elevated risk of exposure.
It is unclear whether there are suitable alternatives to DDT for controlling outbreaks of kala-azar, and also malaria and dengue fever in endemic areas for these diseases, and whether the affected populations are themselves systematically monitored to enable rapid diagnosis and response to disease outbreaks as part of a national population surveillance programme that could help to prevent the spread of disease to other populations and thereby reduce the need for use of pesticides as part of a holistic control programme.

2.3.7.2.1 Exposure of humans to POPs pesticides

Given the past use of POPs in Bangladesh, in some instances for as long as four decades, it is suspected that both rural and urban populations would have been exposed to POPs. However, there is almost no publicly available exposure data of Bangladesh populations (general or vulnerable populations). For example, there is not a single study of levels of chlorinated pesticides in human tissue (breast milk; blood; adipose tissue) reported in the UNEP Chemicals 2002 regional report on persistent organic pollutants in any of the countries of the Indian Ocean region.

The single article found with any reference to pesticide (or other) POPs exposure in the Bangladesh population was in an article by the Pesticide Action Network (PAN) — United Kingdom posted by PAN's Asia Pacific office. The PAN-UP article references a study "Organochlorine Pesticides residues in the beast milk, especially in the coastal region of Chittagong" carried out under joint collaboration with Institute of Marine Science, Chittagong University, Atomic Energy Centre, Savar, Dhaka and Institute of Food and Radiation Biology. Researcher Mohammad Selim Uddin was the lead report author. The PAN article reports that the research study reported detection of nine POPs pesticides in 20 milk samples, collected from mothers who live in the coastal area of Chittagong in one week of the post natal period during 1998-99. The study found that the maximum and minimum concentrations of total DDT in the milk of each women (age below 25) were 0.02031 milligram per litre (mg/1) and 0.00073 mg/1, respectively. In the age group above 25, maximum and minimum total DDT concentrations in the human milk were 0.055765 mg/1 and 0.00071 mg/1, respectively. The highest and lowest concentrations of total DDT and total organochlorine POPs measured were 0.02031-0.00073 mg/1 and 0.00144 mg/1 respectively. The concentration of total DDT was lower than the maximum permissible limit (1.25mg/1). The PAN article also refers to a study of breast milk in the Rajbari agricultural region where POPs concentrations were found to be higher but provides no further details. The study found that the people of Chittagong consume most of the POPs residues from agricultural food products and dried fish (PANAP, 2001).

Table 56. International permissible levels for POPs in human breast milk

Aldrin + Dieldrin Dieldrin	World Health Organization's Acceptable Daily Intake (ADI) allowance is 0.0001 mg/kg body weight combined total aldrin+dieldrin, 1994 WHO ADI for dieldrin is 0.1 microgram/kilogram body weight (µg/kg bw) The international regulatory board, Codex Alimentarius, has set a maximum residue level (MRL) benchmark for dieldrin in breast milk of 6 parts per billion (ppb).
DDT	FAO/WHO ADI 0.01 mg/kg bw, 2000;
Chlordane	WHO ADI is 0.0005 mg/kg bw, 1994
Endrin	WHO ADI is 0.0002 mg/kg bw, 1994.
Heptachlor:	WHO ADI is 0.0001 mg/kg bw, 2000.
Dioxins and Furans	WHO recently lowered by more than half its tolerable daily intake from 10 pg, fixed previously in 1990, to 4 picograms/kg bw, based on a recognition that subtle effects may already occur in the general population in developed countries at levels of 2 to 6 picograms, 2000.

Source: RFI, based on levels referenced by UNEP Global Programme of Action for the Protection of the Marine Environment from Land Based Activities, http://pops.gpa.unep.org/14ddt.htm

While there is no requirement for reporting poisoning cases from chemicals, some statistics on poisoning incidence are available from the Institute of Public Health under the Directorate of Health Service (DGHS) (FAO/UNEP, 1998). The Disease Profile of the Ban*gladesh Health Bulletin 1997* of the Health Information Unit of DGHS published in 1999 tabulated poisonings from 1988 to 1997 on poison cases collected primarily from the government health facilities and hospitals at the *thana* and district level. The Bulletin observed that the incidence of poisoning has been gradually increasing since 1988. A total of 60,756 poisoning cases were reported by the DGHS in 1996, with a significant increase to 309,409 cases (almost a five-fold increase) in 1997. The WHO Bangladesh report on the DGHS statistics speculates the

increase may be partly attributable to an increase in pesticides used to increase high-yield rice crops (WHO, 2001). The increase appears to correlate with increased reliance on carbamates and organophosphates, which are more acutely toxic than POPs.

Accidental poisoning is most commonly encountered in pediatric practice. For the reporting period 1988-1997, kerosene was the most common cause of acute poisoning in children (46%) followed by organophosphorus compounds (19%) (WHO, 2001)

Table 57. Poisoning profile of District and Thana level hospitals 1988–1997

Year	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Poison cases	44086	29418	17584	38135	43536	37734	44338	58876	60756	309409

From 1993-1997, there were 20,800 fatalities from poisoning, with the number of deaths increasing each year, from 3500 deaths in 1993 to 5000 in 1997 (FAO/UNEP, 1998). Most of the pesticide deaths are reported to be from intentional use (i.e., suicide or attempted suicide).

Table 58 : Poisoning profile of Dhaka Division, WHO, 2001

SL. No.	Hospital	Period	Poisoning Cases	Most Common Poison	Nature of Poisoning	Fatality
01	Dhaka Medical College Hospital	1993	311 (2.63%)	Organo-phosphorus	Suicidal (79%)	22.19%
02	Sir Salimullah Medical College Hospital (Emergency Unit)	1998-99	180	Organo-phosphorus	_____	____
03	Munshigonj Modernized district Hospital	1991	114 (2.76%)	Organo-phosphorus compound	Intentional (69%) Suicide (51%)	(25%)
04	Z.H. Sikder Women's Medical College & Hospital, Dhaka	Jan 1998 to May 1999	16 (3.21%)	Organo-phosphorus compound	Intentional	0%
05	Dhaka Medical College Hospital	1983	Tot. death 1030 Death from poisoning 45(4.4%)		_____	____

1. M.M. Rahman and et al. Clinical pattern of acute poisoning in medical units of DMCH; J. DMC 1994; 3(1): 1-5
2. Emergency Patient Register of Sir Salimullah Medical college, 1998-99
3. Choudhury S.M. A study on acute poisoning cases attended in a selected district hospital.
4. Poisoning cases of ZH Sikder Women's Medical College Hospital, 1998-99.
5. Khan, Ahmed: A retrospective study of mortality pattern in medical wards of DMCH during 1983.

2.3.7.2.2 Exposure of environment to Annex A and Annex B POPs pesticides

In addition to the few examples noted below, a very limited number of references were found in literature pertaining to analysis of organochlorines in some environmental matrices.

While few studies have been performed in Bangladesh, a number of studies of sediment in Bay of Bengal samples collected offshore of the Indian jurisdiction were found to contain concentrations of aldrin, dieldrin and DDT (UNEP, 2002, citing Sarker and Sengupta, 1998). Additionally, a 1999 study of Ganges river biota found high levels of DDT metabolites in the blubber of migratory dolphins in the Ganges River (21,000-64,000 ng/g wet wt) and in fish that comprise the dolphin's diet. Also found in dolphin blubber were chlordane compounds (45-240 ng/g wet wt) and lindane. These levels were double those of an earlier study performed in 1988-1992 (UNEP 2002, citing Senthilkumar et al. 1999 and Kanan et al. 1994). These dolphins are also found in the Bangladesh section of the Ganges River.

Water: Most of the pesticides used in Bangladesh are for rice cultivation. As a result, rice fields receive the highest amount of pesticides, and the water in rice fields, as well as lakes and rivers that receive run-

off water from these fields, can be expected to contain pesticide residues. However, no comprehensive study has been conducted in this regard.

There are a few sporadic studies in the literature pertaining to POPs pesticide residues in freshwater. One study of a Meghna Dhonagoda Irrigation Project found organochlorines in surface waters at concentrations of 1.82, 1.91 and 2.39 ng/ml, while the water samples from some other locations of the same habitat contained residues of DDD, DDE, aldrin, dieldrin, endrin and heptachlor at concentrations ranging from 0.20 to 6.75 ng/ml (Alam et al., 1999). A 1995 study of surface water quality by a consultant to the Bangladesh Ministry of Agriculture indicated that while most water samples showed low concentrations of pesticide residues, approximately 11% contained pesticide residues that exceeded WHO guidelines (Hossain 2000, citing GoB, 1995). An earlier study indicated slight organochloride pesticide pollution in floodplain ecosystems in the early 1990s, and some bioaccumulation of these pesticides in fish muscle tissue (Hossain 2000, citing GoB 1993).

Both surface and underground water samples collected from different regions of Bangladesh were found in another study to contain residues of DDT, heptachlor, lindane, and dieldrin within the WHO maximum residue levels (MRLs), with the exception of water samples from the Begumganj irrigation project. Samples from the project contained DDT residues at 19 mcirograms/litre (µg/l), well above the WHO guideline value of 2 µg/l (Matin et al. 1998). In another study, 59 samples of drinking water were collected from various locations in Bangladesh to assess the impact of agricultural practices on groundwater quality. The study included measurements of concentrations of endrin, heptachlor and DDT. The ranges of the organochlorine pesticides heptachlor and DDT were 0.025-0.789 mg/l and 0.010-1.527 mg/l, respectively. Two samples exceeded WHO allowable limits for heptachlor, and seven for DDT (Alam, 2001). Most recently, surface and ground water (and also soil samples) of Dhaka City confirmed the presence of organochlorine pesticides in t he environment. The study found that lake water samples contained concentrations of total DDT ranging from 0.014 µg/l to 0.163 µg/l, in 16 out of 20 samples, while aldrin was detected in one sample at 0.018 µg/l and lindane (BHC) concentrations ranging from 0.006 µg/l to 0.029 µg/l was found in four samples. In pond water, total DDT was detected in six out of 11 samples, with concentrations ranging from 0.032 µg/l to 0.150 µg/l Water samples from a shallow aquifer supplying Dhaka City collected from and tube wells were also sampled. Out of 14 samples, four contained DDT in concentrations varying from 0.015 µg/l to 0.099 µg/l. Of the samples, 11 had residual organochlorine pesticides at concentrations below the detection limit (0.002 µg/l). Total DDT in soil samples collected from lake, rice field and rivers varied from 0.0012 mg/kg to more than 0.018 milligrams/kg (Malek, et al., 2002).

Freshwater fish: Median levels in fish, reported in various countries by WHO are of the order of 100 micrograms/kg (on a fat basis) (WHO, 1993). Only a very few studies referencing levels of POPs in Bangladesh fish were found in the literature. One study found analyzed organochlorine pesticide residues (p,p' DDT, DDD, DDE, Aldrin, Dieldrin, Lindane, Heptachlor and BHC) in the dry and wet seasons in Ganges Perch, and of *Lates calcarifer*, from the Ganges-Brahmaputra-Meghna estuary (collected in October-November-December, 1996 and May-June-July, 1997). The residues were analysed by using gas chromatography (GC) equipped with electron capture detector (ECD) mode and were verified by thin layer chromatography (TLC). Pesticide residues were found in the order sigma DDT > Heptachlor > Dieldrin > Aldrin. Higher levels of residues were found during the dry season, attributable to the higher lipid content in the fish. The concentrations of pesticide residues in muscle, liver and gut were below the FAO/WHO recommended permissible limit. Concentrations in eggs exceeded the recommended limit (Jabber, 2001). Another study found levels of total DDT (including its metabolites DDE and DDD) in the amount 0.025 mg/kg and 0.0171 mg/kg, and of dieldrin in contaminated fish to be within the Maximum Residue Limits (MRLs of 0.3 mg/kg) (GoB, MoEF, 2005c, citing Matin et al., 1996).

In 2002, the Dhaka Water and Sewerage Authority (WASA) were reported to have used poison at Pagla on the outskirts of Dhaka to kill several tonnes of fish considered to be deadly if consumed. The nature of the pollutants and poison used were not noted in the reference, although it was mentioned in the article that most lakes, canals and the Buriganga River around the Bangladesh capital had been polluted by harmful chemicals and other wastes from hundreds of small and big industries that operate without waste treatment facilities (Reuters, 2002 as reproduced in Planet Ark website).

Stored foods: Stored products destined for market, including fried fish, were often treated in the past with different pesticides including DDT, lindane, heptachlor etc. for their protection against insect pests and diseases. Such products, even after a long lapse of storage period, may contain residues of these pesticides. Additionally, illegal importation and use of POPs for this purpose could be continuing. A comprehensive study would be required to determine the extent and severity of this problem. Review of some sporadic studies indicates that DDT residues, although they decreased with time in both rice and wheat, were still considerable after 150 days of storage. For example, after 150 days in storage, surface residues, extractable residues, bound residues and total residues of DDT in rice were 0.038µg (25%), 0.015µg (10.0%), 0.007µg and 0.06µg, while those in wheat were 0.04µg (27%), 0.019µg (12.8%), 0.008µg (5.2%) and 0.067µg (45%), respectively (Rahman et al. 1996). Similarly, varied quantities of DDT and its metabolites were detected in rice, wheat and pulses at different storage time interval. On the first day, surface residues of DDT were 39.40 mg/kg, 37.73 mg/kg and 40.05 mg/kg in rice, wheat and pulse respectively, of which 60%, 80% and 92%, respectively, dissipated after 240 days of storage. The rate of formation of P, P' DDD gradually increased during 90-180 days, and gradually declined thereafter (Saifullah et al., 1995a; Saifullah et al. 1995b; Saifullah et al. 1995c).

2.3.7.2.3 Exposure of environment to PCBs

A 1994-96 Indian study of Ganges River dolphins that are migratory and occur in both the Indian and Bangladesh portions of the river, found PCBs congeners in dolphin blubber, milk and liver tissue, prey fish of the dolphin and benthic invertebrates. The concentrations found in blubber were 1100-13000 ng/g wet wt with an average of 4000 ng/g wet wt; in liver tissue 180-390 ng/g wet wt and in one sample of milk 620 ng/g wet wt. The highest blubber concentration observed was in an immature male dolphin collected near Chhapra area that was considerably higher than those in dolphins collected from other locations, suggesting a local source of PCB contamination (UNEP 2002, citing Senthilkumar et al., 1999). Measured concentrations of PCBs in dolphins and fish in 1994-1996 were two-fold greater than those reported for the samples during 1988-1992 (UNEP 2002, citing Kannan et al., 1994). The TEQs estimated in river dolphin blubber were greater than those that cause adverse effects in mink. Although uncertainties are involved in extrapolating effect levels in mink to dolphins, this may suggest vulnerability of river dolphins to the toxic effects of PCBs (UNEP, 2002).

Only one Bangladesh study was found —published in 2000 by Det Norske Veritas —in which PCBs in an environmental matrix were collected and analyzed. As part of the study, Det Norske Veritas sampled soil from a steel plate reprocessing site, cable sheathing, and marine sediment located near the Chittagong ship-dismantling facility for PCBs.

Soil samples collected from a steel plate re-processing site were found to contain PCBs at concentrations from 7 times to 48 times above the maximum background levels in Norway (used in the absence of an established background level for PCBs in Bangladesh), as per Table 59 (Table 3.6.1 of the DNV study).

Table 59. Det Norske Veritas PCB soil analysis: ship-breaking industry.

Table 3.6.1 PCB analyses of soil from a steel plate re-processing site.

Sample	PCB-28	PCB-52	PCB-101	PCB-118	PCB-153	PCB-138	PCB-180	Sum 7-dutch (mg/kg)
Sample 1 on steel plate re-processing site, (µg/kg, dry weight)	12	194	310	199	268	353	108	1.444
Sample 2 on steel plate re-processing site, (µg/kg, dry weight)	3.4	12	19	22	45	57	42	0.2
Level of quantification, (µg/kg, dry weight)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	-
Background values from Norway[1], /20/	-	-	-	-	-	-	-	0.003-0.03

[1]: No background value is available for the region. However PCB is not a natural existing substance and therefore background values from Norway is referred to /20/.

Concentrations of PCBs in a paint sample and in cable were reported to be low in contrast to those found in Norwegian ships. Concentrations of PCBs in cable resembled the PCB congener pattern forAroclor 1260. Results of analysis of PCBs in cable are shown in Table 60.

Table 60. PCBs in cable sheathing from sampled ships.

Table 3.8.1 Results of analyses of PCB in a cable.

Sample	PCB-28	PCB-52	PCB-101	PCB-118	PCB-153	PCB-138	PCB-180	Sum 7-dutch
Cable (µg/kg, dry weight)	<0.2	0.5	9	9.2	50	52	9	130
Level of quantification (µg/kg, dry weight)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	

The study observed that the PCBs, together with the PVC in the cables, may result in dioxin pollution to the air and contamination of the ground if the insulation if not combusted sufficiently in a controlled and monitored manner.

Four marine sediment samples taken from the inter-tidal zone (up to 600 meters of the ship-breaking site) were analyzed for PCBs and none were found (Det Norske Veritas, 2000).

A research on "DDT and PCBs in food items and environmental samples" under the POPs NIP Project.

A research on "**DDT and PCB in food items and environmental samples**" was conducted by the Department of Environment in collaboration of DAE and BPDB under the POPs NIP project to determine the status of POPs DDT and PCB in the environment (DoE, PMU, 2006).

Recently it has been a common allegation and also a buzz word that DDT is being used in the fish drying processes and other food items in the local markets of the country. It is continuously reporting in series by one of the highest circulating national dailies '**The Daily Ittefaq**' in its article "**What are we eating**" and claimed that there are evidences of DDT use in the dried fish to keep it free from the pests and insects. It was also reported that a law enforcing magistrate found the truth of it and lodged cases and also fined vendors for dried fish with DDT. In case of PCB it was reported in the dailies that obsolete transformer oils were sold in the open markets which contained the POPs PCBs which are the most hazardous chemicals to both man and environment.

Yet, no comprehensive study has been conducted on DDT and PCBs in food items in Bangladesh to identify the exact contamination levels of DDT and PCBs in food. It is necessary to know the

contamination levels of DDT and PCBs in food items primarily to draw a conclusive remark by which the policy makers can take necessary action to protect human health and environment by phasing out of the toxic chemicals, DDT and PCBs, from the environment. Availing the opportunity, under this project, a short research were conducted on POPs DDT and PCBs to detect the contamination levels of those pollutants primarily.

A total of 130 samples were collected from Cox's Bazar, Saint-Martin, Kishorganj and Kuakata, Chittagong, Dhaka City Markets, Gazipur and Syedpur. The categories of samples were dried fish (Silver pomfret, *(Stromateus cinereus),* Giant seaperch (*Lates calcarifer,* Bombay duck (*Harpodon nehereus*), Puntius (*Puntius puntio*)), fresh fish ((Silver pomfret, *(Stromateus cinereus),* Giant seaperch (*Lates calcarifer,* Bombay duck (*Harpodon nehereus*), Puntius (*Puntius puntio*)); fruits (mango, banana and papaya); vegetables (brinjal, potal and tomato); poultry, poultry eggs and poultry feed; transformer and capacitor oils; and environmental samples, such as soil, sediments, water and human blood. Samples were collected randomly as per sampling strategies and preserved those as per sample preservation roles. Collected fresh fish and poultry meat samples were covered with aluminum foil and preserved in a chilled box and then sent to the laboratory and stored in a freezer at -20^0C before analysis. In case of dry fish followed the same procedure. Poultry eggs and poultry feed, fruits and vegetable samples were collected and were preserved at + 4^OC in a refrigerator until analysis. The same fresh fish species were collected from the same localities as commercially dried fish were collected and the fresh fishes were dried at controlled condition without spraying any pesticide/ chemicals and analyzed in the laboratory and compared the results with that of commercially dried fish of the same species and same localities. Dry fish samples were collected from dry fish processing locations as well as wholesale markets. Blood samples were collected from the central workshop of BPDB and other places and centrifuged immediately and then preserved at -20^0C until analyses. Environmental samples such as water, soil and sediments were sampled from different suspected contaminated places such as Chittagong Chemical Complex (DDT manufacturing area), Bangladesh Forest Industries Development Corporation (BFIDC), Teknaff, Kishorganj, Syedpur, Saint Martin and Kuakata. During sampling a social survey was carried out according to a prepared questionnaire.

Collected samples were analyzed for DDT and PCBs at the laboratory of the Department of chemistry, University of Dhaka using Gas Chromatography (GC) with electron capture detector (Shimadzu 17A & Shimadzu 14A). The samples were analyzed following the procedures such as grinding, homogenous, extraction, cleaning-up and injection.

Quality of analyses was insured following the replicate analyses, reagent blanks, recovery test and standard reference samples. About 5% samples were analyzed in the Pesticide laboratory of Sweden. The results were within the acceptable ranges. The analyses were quantified following the standard protocols and methodologies. All necessary measures were taken for proper quality control and quality assurances. The samples were analyzed by two different GCs (Shimadzu 17 A and Shimadzu 14 A) and two columns of different polarities. Measures were taken to eliminate contamination from different sources. Replicate analyses were carried out in each set of experiment and the result was taken from the arithmetic mean.

All the collected species of fresh fish samples were analyzed for DDT and its metabolites and different selective congeners of PCBs. The detection limits of DDT and its metabolites were for DDT = 0.05 ng/g, DDD = 0.005 ng/g, and DDE = 0.0025 ng/g of our analyses. No DDT or PCBs was found in fresh fish within the limits of detection. The collected same spices of fresh fish were dried in the laboratory without spraying DDT or any other insecticides and analyzed at the same laboratory following the same methodologies. No DDT or PCBs was found in the controlled dried fish within the limits of detection of the analyses.

All the commercially dried fish samples were analyzed for DDT and PCBs. Only DDT was found in commercially dried fish from Chittagong, Cox's Bazar and Kishorganj in different amounts which varied from 187 to 38,370 ng/g. Some of which were above the human maximum residual limit value of 5 mg/kg DDT in food. But no DDT or PCBs was found in the commercially dried fish collected from Saint-martin, Kuakata, Syedpur and Dhaka City Markets. The unexpected highest amounts of DDT (38,370 ng/g) was found in the commercially dried fish Harpodon (Latia) from Chittagong. Only some species of commercially dried fish samples were contained DDT. The amounts varied from area to area. The rest of the bulk number of dried fishes was free from DDT and PCBs. This result indicated that DDT might spray during fish drying processes and preservation in some localities.

None of the Poultry, Eggs, and Poultry feed samples were found to contain DDT and PCBs within the limits of detection. It is indicated that no DDT or PCBs containing component was mixed in the poultry feed (dry fish is one of the principal ingredients of poultry feed) by which poultry accumulated these two toxic contaminants into the fats. For the determination of the exact levels of those contaminants, samples covering the whole fish drying processes and preservation centers of those dried fish by which poultry feed prepared will obviously be required.

No DDT or PCBs was found in fruits and vegetables samples collected from Dhaka City Markets within the limits of detection. DDT and PCBs are non-polar contaminants. These chemicals accumulated in the fatty tissues of living organisms. It also depends on time. Generally, fruits and vegetables are seasonal (short duration of maturity) contained very little fats and oils; detectable amount of DDT and PCBs were not accumulated within the fatty tissues of the analyzed samples.. This preliminary result indicated that the non-polar contaminants did not accumulate in the fatless tissues. Any exceptional accumulation may occur in any or some plants. It is also recommended that the country-wide random sampling survey will be necessary to draw a conclusive remark of DDT content of the agrarian crops.

In some soil, sediment and water samples from Chittagong Chemical Complex (CCC) and Bangladesh Forest Industrial Development Corporation (BFIDC) were found to contain DDT in various amounts. The ranges of DDT in soil of CCC and BFIDC were (2,440 -3,021 ng/g) and (2,648-2,961 ng/g); sediment (47-75 ng/g) and (536-832 ng/g); and water 32 ng/g and 62 ng/g, respectively. These residual concentrations of DDT in CCC were due to DDT manufactured there from 1966 to 1992; and in BFIDC area DDT was used in wood processing and preservation processes until 1992. So, residual effects of DDT remained in those two areas because DDT persists in the environment for many years (4 – 30yrs above). Except these two contaminated places, soil, sediment and water samples from Cox's Bazar, Saint-Martin, Kuakata, Tecknaf, and Syedpur were free from DDT and PCBs contents.

All collected fried food samples from foot-path fry food shops in Dhaka City Markets were found to contain PCBs in different amounts which varied from 50 to111 ng/g; but DDT content was below the limit of detection of the analyses. The sources of PCBs in the fried food samples may be some illegal traders mixed PCBs containing oils for frying tasty foods which cause harmful effects to human health.

Transformer and capacitor oils from Bangladesh central workshop of PDB of Tongi and other places were found to contain PCBs. Results varied from brands to brands of oils. Some of the oils contained very high amounts, on the other hands, some contained very low amounts. The ranges of PCBs were from 0.55 to 840,000 μg/g. According to UNEP guideline, 50 μg/g is considered as free of PCBs in transformer and capacitor oils. In this study, out of 18 [(transformers (13) and capacitors (5)] oils, 7 were free from PCBs. The highest quantity of PCBs containing oils may be imported from 1960 to 1980s from Russia (840,000 μg/g; 9070 μg/g), China (3190 μg/g), and Belgium (2812 μg/g). Now the recently imported transformer and capacitor oils are free from PCBs.

The residual concentration of DDT and PCBs were found in soil, sediment and ponds water of CCC and BFIDC areas. In some places, not all, DDT was used during fish drying processes and preservation. It can be concluded that a country-wide comprehensive research covering the whole boarder areas will be needed for conclusive remarks.

2.3.8 Current level of information, awareness, and education among target groups, existing systems to communicate such information to the various groups; mechanism for information exchange with other Parties to the Convention

It is evident from various qualitative assessments, such as group discussion with potential target audiences, consultation meetings with stakeholders, and pre-testing of some communications materials with vulnerable groups that most Bangladeshi are not aware of POPs issues. Only a few professionals have some knowledge about POPs, including within academia and among industry sectors that use Pops. With respect to existing systems, Bangladesh, along with its various non-governmental partners and organizations, has considerable experience with developing and implementing national awareness-raising programmes, for example, pertaining to health and family planning, literacy, HIV/AIDS, agriculture, livestock, fisheries, malaria control, and micro-credit. Many of these efforts have been recognized internationally for their success.

Bangladesh is committed to provision of POPs information that is broadly accessible and transparent. As part of its initial efforts with respect to NIP development, its consultation efforts included awareness raising components.

A GoB website has also been developed for POPs by the MoEF, available at www.doe-bd.org/POPS.pdf. This site includes draft and final versions of inventories, as well as overview documents on POPs and links to international sites.

2.8.3.1 TARGET AUDIENCES AND STAKEHOLDERS

While POPs are a concern to the general population, it will be particularly important to develop strategies for raising awareness among potentially vulnerable populations. As monitoring is undertaken, specific subgroups may be identified with respect to outreach needs. Initially, outreach can be of a broad awareness-raising nature, so as to prepare key “actors” within government, the private sector and local communities who can assist with disseminating awareness-raising strategies once they themselves have been made aware of the issues pertaining to POPs and government commitments and implementation strategies. The table below provides further details with respect to key actors and stakeholders that could be enlisted for this purpose.

Ultimately, community leaders, industry leaders, health-care providers, women’s groups, religious leaders and other stakeholders could then assist with awareness raising on a broader scale, for example to women, farmers, workers in the electrical power sector and in those industries that potentially generate by-product POPs, etc.

Table 61. Target audiences of POPs

POPs Types	Organizations and People	Suitable Interventions
Pesticides	a. Department of Agriculture b. Department of Health c. Department of Justice d. Ministry of Education e. Customs officials f. Academia g. Pesticide Importers h. Pesticide dealers i. Block Supervisors j. Farmers k. Schools l. NGOs m. General public	n. Seminars, roundtables, newsletter, website, information booklet, poster, leaflet, traditional and electronic media intervention
PCBs	o. Department of Health p. Power Development Board q. Private electricity generating companies r. Food processing sector s. Ship-breaking sector t. Respective ministries u. Academia v. NGOs w. Schools x. General public	y. Seminars, roundtables, newsletter, website, information booklet, poster, leaflet, traditional and electronic media intervention,
Dioxin and Furans	z. Department of Health aa. Academia (University departments) bb. Industry sectors (as per inventory) cc. Opinion mobilizers dd. NGOs ee. Women (stove makers/food preparers)	ff. Seminars, roundtables, newsletter, website, information booklet, poster, leaflet, traditional and electronic media intervention

2.3.8.2 EXISTING SYSTEMS TO COMMUNICATE INFORMATION TO THE VARIOUS GROUPS

A National Media Survey conducted in 2002 provides information on media access and reach within Bangladesh, which provides an initial basis for determining effectiveness of various types of media interventions. The survey indicates that television has the most extensive reach, followed by radio and print media. Radio reach has declined significantly in urban areas, from 42% in 1998 to 24.1% in 2002, perhaps attributable to the rapid increase in opportunities for watching television. In urban areas, 83% of the population regularly view television, as compared to 50% in rural areas. Only 25.8% of the population read newspapers and 7.9% read magazines. Readership of newspapers in rural areas was substantially lower (18.7%) than in urban areas (40%). In rural areas, traditional media (e.g., folk song, drama, recital and others) remains an effective channel for 80% of the population. Schools present another mechanism by which information can be disseminated (e.g., teachers can be asked to provide messages that children can take home to parents, such as safe storage for pesticides.)

2.3.8.3 MECHANISM FOR INFORMATION EXCHANGE WITH OTHER PARTIES TO THE CONVENTION

Bangladesh will develop programmes and initiatives to address mechanism for information exchange among the parties. The government will make information available to other parties whichever is deemed necessary for sharing experiences and information that collated from the activities undertaken by Bangladesh to reduce and eliminate POPs.

The Bangladesh government will take necessary steps in share its possible programme intervention results and its technology adopted in eliminating POPs. The information sharing will be done in consonance of the Convention taking into consideration the NGOs and private sector activities, as they will be part and parcel of the NIP activities.

2.3.9 Relevant activities of non-governmental stakeholders

The Government of Bangladesh encourages non-governmental organizations (NGOs) and private sector organizations to partner in developmental activities. While there are currently no Bangladesh NGOs working on POPs specifically, there are about 250 NGOs that work in the field of environment and ecology. The activities of the majority these NGOs pertain to safe environment, preservation of nature and ecology, and protection and improvement of environment. Awareness rising is an activity engaged in by most NGOs. Some of the more prominent NGOs are noted below:

1. Wildlife and Nature Conservation Society of Bangladesh (WNCSB)
2. Nature Conservation Management (NACOM)
3. Friends of the Earth Bangladesh/Institute for Environment and Development Studies
4. Forum of Environmental Journalists of Bangladesh (FEJB)
5. Coastal Area Resource Development and Management Association (CARDMA)
6. Centre for Sustainable Development (CFSD)
7. Centre for Coastal Environmental Conservation (CCEC)
8. Social Welfare Organisation for Research and Development (SWORD)
9. Centre for Natural Resource Studies (CNRS)
10. Bangladesh Environment Network (BEN)
11. Bangladesh Unnayan Parishad (BUP)
12. Bangladesh Rural Advancement Committee (BRAC)
13. Bangladesh Poush (BP)
14. Bangladesh Environmental Lawyers Association (BELA)
15. Bangladesh Centre for Advanced Studies (BCAS)
16. Women's Environment and Development Organization (WEDO)
17. Wildlife Society of Bangladesh (WSB) (Source: IUCN Bangladesh: Web)
18. Initiative for People’s Development (IPD)

2.3.10 Overview of technical infrastructure for POPs assessment, measurement, analysis, alternatives and prevention measures, management, research and development-linkage to international programmes and projects

The overall capacity to manage POPs in Bangladesh is varied and generally low, in particular with respect to capacity to carry out basic and essential operational actions.

2.3.10.1 POPS ASSESSMENT

Bangladesh has limited capacity for risk assessment and relies primarily on international information to evaluate POPs.

2.3.10.2 MEASUREMENT AND ANALYSIS

2.3.10.2.1 Current status

The ability to analyze and therefore measure POPs in various environmental matrices (soil, marine and freshwater, groundwater, industrial effluent, sediment, air) and in fish, wildlife, animals, food and people is necessary to establish a baseline of exposure and to determine if particular populations are at risk of adverse health effects. Analysis capacity will also enable Bangladesh to gauge progress in elimination /reducing exposure over time, and to determine compliance with legislative standards developed for POPs.

At this time, Bangladesh does not have a national accreditation system for laboratories, nor does it have a reference laboratory for POPs. Taking into consideration both government and academic laboratories, there are at this time facilities to test just nine of the different pesticides of the 300 marketed in Bangladesh. With respect to POPs pesticides, DAE laboratories are not currently capable of analyzing for POPs impurities in active ingredients at a sufficiently low level of concentration (GoB, DoE, 2005). None of the existing laboratories has, as yet, achieved Tier 1 capacity (the lowest of three tiers for POPs analysis[40] recommended by UNEP guidance for global monitoring for any of the POPs) (GoB, DoE, 2005). Therefore, strategies for monitoring will need to bear in mind that until Bangladesh has adequate laboratory infrastructure in place, near-term monitoring strategies will need to be adjusted accordingly (e.g., use of rapid-immuno assays; sending samples to outside laboratories for analysis).

Some POPs (chlordane; DDT; PCBs, dioxins and furans) are comprised of mixtures of different congeners or analysts. Analysis focuses on those congeners for which toxicity is a concern for humans and animals. The essential POPs analysts that the Global Monitoring Programme (GMP) of UNEP Chemicals recommends be analyzed are shown in Table 62.

Table 62. POPs analysts recommended for analysis

Chemicals	Analytes
HCB	HCB
Chlordane	*cis*- and *trans*-chlordane *cis*- and *trans*-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	$\sum PCB_7$ (Congeners 28, 52, 101, 118, 138, 153 and 180) PCB with TEFs*: 12 congeners.
PCDD/PCDF	2, 3, 7, 8 substituted tetra- to octachlorodibenzo-*p*-dioxins and dibenzofurans (17 congeners)

[40] The DoE does have a laboratory to support its basic monitoring activities for chemical generally. The DoE has a project to strengthen is regional laboratories and establishing a library and documentation center in Dhaka.[40] However, at present, the DoE laboratory is not equipped to undertake analysis of POPs chemicals. It would require upgrading of analytical equipment and training of analysts to have this capability.

Source: UNEP Chemicals, 2001.
* PCBs with TEFs (Toxic Equivalency Factors) are those congeners that have found to have dioxin-like effects.

2.3.10.3 ALTERNATIVES AND PREVENTION MEASURES

Bangladesh has performed very little research on POPs alternatives. However, POPs alternatives are evaluated utilizing Pesticides Rules, 1985, registration evaluation criteria. Research on adverse effects of POPs on Bangladesh population and the environment has not been performed.

Prevention measures have been taken with respect to cancellation or deregistration of some POPs pesticides as discussed earlier. However, legislation is needed for PCBs and Annex C POPs. Additionally, implementation of BAT and BEP within the private sector is needed, as is awareness raising as a form of prevention (e.g., relative to spills and accident prevention, poisoning, etc.).

2.3.10.4 MANAGEMENT

Managerial capacity within the MoEF relative to the environment generally has been strengthened considerably in recent years with international support (see subsection 2.3.10.6). However, managerial capacity for POPs requires strengthening within MoEF as well as other ministries and institutions. For example, the DoE needs to fully implement its restructuring plan relative to staffing and training to enable it to carry out managerial tasks that pertain to implementation of legislation on POPs. Other agencies have similar needs. The health sector generally has focused on contagious diseases but recent experience working with arsenic has enhanced its capacity to work on toxics and hazardous substances and is to some extent transferable to POPs. The Ministry of Agriculture and DAE have fairly extensive staffing and networks for managing agricultural undertakings. The power sector was reorganized in recent years to improve its efficiency. It will utilize its new managerial infrastructure with respect to POPs and needs to strengthen capacity with respect to private customers to whom transformers, etc. have been sold.

2.3.10. 5 RESEARCH

Bangladesh has capacity for research, but would require both technical and financial assistance for research on POPs. The need to undertake research on POPs alternatives is particularly acute and as linked to monitoring POPs (bio-monitoring and environmental monitoring).

2.3.10.6 LINKAGES TO INTERNATIONAL PROGRAMMES

Bangladesh has participated in a number of international programmes, including with UNDP on a $24 million Sustainable Environment Management Programme (1998-2005) and the Bangladesh Environmental Management Project (BEMP), a $10 million joint project of the Government of Canada and the Bangladesh Department of Environment, funded by the Canadian International Development Agency (CIDA).

The overall goal of BEMP is to increase the capacity for sustainable environmental management in Bangladesh. It is intended to do so by strengthening the institutional capacity of the DOE to enable it to carry out its legislative powers and functions.

2.3.11 Identification of impacted populations or environments, estimated scale and magnitude of threats to public health and environmental quality and social implications for workers and local communities

As discussed above, Bangladesh does not have monitoring programmes for human populations or the environment (inclusive of fauna). It will be particularly important to ascertain whether food sources are contaminated or vulnerable to such contamination and whether workers in particular sectors have been or are being exposed to POPs. Without such monitoring (and attendant access to analyses) Bangladesh cannot determine whether and to what extent its population, including potentially vulnerable sub-populations, may have been affected by POPs.

2.3.12. Details of any relevant system for assessment and listing of new chemicals

Bangladesh has limited assessment capacity and therefore relies primarily on information available via international sources in making determinations regarding chemicals, for example with respect to those registered under its pesticide legislation. With respect to pesticides, the Pesticide Technical Advisory Committees created to implement provisions of the Pesticide Act and Rules screen and evaluate pesticides.

2.3.13 Details of any relevant system for the assessment and regulation of chemicals already in the market

Bangladesh does not have national legislation for industrial chemicals and there is no system in place for assessment of industrial chemicals already on the market.

3.0 Strategy and action plan elements of the national implementation plan

3.1 Policy statement

Sustainable growth of the Bangladesh economy and health of Bangladesh depends on the natural resource base, together with the biological and physical environment. Additionally, Bangladesh recognizes that the measures it takes nationally to protect its people and environment will contribute to protection of the global environment from POPs compounds.

The Government of Bangladesh is therefore committed to support for sustainable development that includes development and implementation of a national policy for management of POPs chemicals and POPs alternatives, with the aim of protecting the health of its people and environment. To this end, Bangladesh will work to reduce the exposure of humans and the environment to POPs, including by:

1. phasing out the remaining POPs in use within Bangladesh (PCBs in electrical equipment and DDT);
2. continuously reducing and, to the extent feasible, eliminating releases of by-product POPs (dioxins and furans, HCB and PCBs) resulting from human activity;
3. eliminating POPs wastes in an environmentally sound manner, as consistent with its obligations under the Stockholm Convention;
4. improving its capacity to determine the nature and extent of exposure of the Bangladesh ecosystems, fish and wildlife, and especially humans, to POPs and POPs alternatives so as to be able to undertake actions, as appropriate, to protection of exposed populations.

3.2. Implementation strategy

Bangladesh will implement its National Implementation Plan (NIP) with the involvement of different government, semi-government, and private sector and non-government organizations, in recognition that management of POPs compounds requires the active participation of government, the public and stakeholders. Oversight for work will rest with a National Implementation Agency (NIA) comprised of representatives of key ministries and their agencies involved with POPs management (e.g., DoE, Ministry of Agriculture-DAE, Ministry of Health-DGHS; Ministry of Power, Energy and Mineral Resources), with a broadened constituency, inclusive of stakeholders, as needed to implement specific actions.[41] Representatives from donor agencies will also be invited and encouraged to sit on the NIA. The National Focal Point of the Stockholm Convention (the Director General, DoE) will be the coordinator of the NIA (see Subsection 3.3.5.1, Action 1 below for more detail). The key ministries with POPs management responsibilities (inclusive of implementation of aspects or aspects actions as described in Subsection 3.3) are described below in Table 63.

[41] Examples of ministries include the Ministry of Agriculture, Ministry of Fisheries and Livestock, Ministry of Labour and Employment, Ministry of Education, Ministry of Primary and Mass Education, Ministry of Finance and Planning, Ministry of Industries, Bangladesh Ministry of Law, Justice and Parliamentary Affairs, Ministry of Women and Children's Affairs. Examples of stakeholders include the private utility sector, Dhaka City Corporation, NGOs working on chemicals and women's NGOs, various ship yards organizations and operators, etc.

Table 63. Institutional framework for NIP implementation

Institutions	Responsibilities
Lead Ministry &Agency: Ministry of Environment and Forests (MoEF), DoE, Other Government Departments: DAE, DGHS	• Strengthening legislative framework to address POPs and enforcement • Coordinator for the National Implementation Agency interagency for POPs NIP implementation • Arranging for funding and resources for implementing NIP actions. • Oversight for NIP actions for environmentally sound disposal of POPs wastes. • Oversight for development and responsibility for identification and remediation of POPs contaminated sites. • Joint oversight with DGHS for development of national monitoring plan (health) • Oversight for national environmental monitoring • Upgrading NIP and reporting its progress of implementation to the Convention. • Application of BAT and BAP in different social and economical activities. • Arrangement of training for POPs management. • Oversight for awareness-raising activities.
Lead: DAE, Ministry of Agriculture Other Government Departments: DGHS	• Identification of Annex A POPs pesticide contaminated sites and remediation in association with DoE. • Provide information to support monitoring of POPs pesticides.
Joint lead: DGHS, Ministry of Health and Family Planning; DoE	• Responsibility for health monitoring actions within NIP (DGHS) • Handle, collect and store of Annex B POPs pesticide (DDT) in environmentally sound manner. • Arrangement of environmentally sound disposal of DDT wastes. • Identification and remediation of DDT contaminated sites in association with DoE. • Rationalization of medical wastes disposal practice.
Lead: Ministry of Power, Energy and Mineral Resources (NPMN) Other Government Departments: DoE Stakeholders: (i.e., BPDB, PGCB, REB, DESA, DESCO, IPP)	• PCB Work Plan inclusive of o Upgrading and modernizing laboratory capacity for PCBs (coordinated with Laboratory Upgrading). o Inventory efforts (sampling for PCB presence in equipment and follow up sampling to determine concentrations and volumes) o Based on results, determination of destruction requirements and selection of technology option o Destruction of PCB wastes consistent with Stockholm Convention o Decontamination of electrical equipment from PCBs o Provide information to support monitoring of POPs PCBs o Identification and remediation of PCB contaminated sites in association with DoE
Lead: DoE **Other key institutions:** DAE; Bangladesh Atomic Energy Commission (BAEC) **Stakeholders:** Environmental Research Laboratory of the Institute of Food Radiation the Agrochemical and Biology; Analytical Research Laboratory of BCSIR; DoE and DAE	• POPs Pesticides: Laboratory Upgrade Work Plan • By-product POPs laboratory upgrade • PCB laboratory upgrade (as coordinated with NPMN-led PCB Work Plan implementation above)

Institutions	Responsibilities
pesticides laboratory, and the PDB, BCSIR, BPDB; the Organic Research Laboratory of the Chemistry Department of Dhaka University	
Joint Lead: DoE and DGHS Stakeholders: Ship-breaking industries; Labour organizations; ILO; WHO	• Ship-breaking sectoral POPs Plan • POPs wastes guidance/protocols • Annex C release monitoring • Worker safety guidance/protocols
Joint Lead: DoE, DGHS Other ministries: Ministry of Science & Technology Stakeholders: Academia	• Monitoring & Research Work Plan (environment; people) o Environment (baseline; contaminated sites identification, etc.) -DoE o Research on resistance of disease vectors to DDT and POPs alternatives – DGHS o Research on effects of POPs and POPs alternatives on human health
Lead: DoE	• Public awareness, outreach, education & risk communication

3.3 Activities, strategies and action plans

The actions below include indication of whether they are to be undertaken in the:

- near term (1-5 years);
- mid term (6-10 years); or
- long term (11-20 years).

Under the timeline for NIP implementation, most priority actions will be undertaken in the near- to mid term. The GoB expects to complete all actions by or before 2025.

3.3.1 Activity: institutional and regulatory strengthening measures

3.3.1.1 PROBLEM DEFINTION

Institutional strengthening:

(*1) Implementation of the DoE restructuring plan* will be needed to enable the DoE to implement basic environmental protection processes (e.g., as provided for within the Environmental Conservation Act, 1995, and Environmental Conservation Rules, 1997), including as these apply to licensing of new facilities within categories identified as sources of Annex C by-product POPs (dioxins and furans);

(*2). Strengthening of inter-department linkages* that was initiated with the NIP development process will need to continue on an ongoing, regularized basis;

(*3) Laboratory capacity***,** currently unable to meet international standards, requires considerable strengthening for all POPs and is a near-term priority as analysis capacity is linked to implementation of other actions, such as legislative enforcement, and development and application of monitoring strategies for POPs in humans and the environment. Aspects of such strengthening may be incorporated into projects on specific types of POPs, as well as by actions specific to laboratory capacity.

Legislative strengthening: The Bangladesh legislative framework for POPs legislation requires strengthening (amendment of existing legislation, promulgation of news laws and/or rules under existing

legislation) in the near term to address gaps in life-cycle management of the 12 Stockholm POPs[42] (e.g., relative to health considerations and worker safety, environmentally sound management of POPs, inclusive of handling, labelling, packaging, transport, storage, transboundary movement, destruction/disposal, emergency contingency planning, release, spills and accident reporting, etc.). Audit and compliance measures (e.g., inspection and penalties) will also be required. Legal provisions for PCBs and by-product POPs can be issued under existing legislation. Legal prohibition against import of toxaphene and mirex, never used in Bangladesh, will be addressed, as appropriate, under the Pesticide Rules, 1985 and within the Import Policy Order. The registration status of DDT, currently unregistered, needs to be clarified within the Pesticide Rules, 1985 and under the Import Policy Order.

3.3.1.2 OUTSTANDING UNRESOLVED ISSUES OR QUESTIONS

Legislation has been evaluated and no outstanding issues or questions identified beyond legislative strengthening, as discussed here and elsewhere in this report.

3.3.1.3 OBJECTIVES

Bangladesh will strengthen institutional mechanisms, inclusive of near-term priorities relative to (1) its legislative framework (2) implementation of DoE restructuring, and (3) laboratory capacity for analysis of POPs.

3.3.1.4 IMPLEMENTATION MECHANISMS

DoE Restructuring: DoE, working with Ministry of Finance, donor organizations, etc.

Legislation: National Implementation Authority (NIA), with inter-ministerial input on legislative drafting and amendments, as required, from DoE, DAE, DGHS, in consultation with Bangladesh Ministry of Law, Justice and Parliamentary Affairs, stakeholders from the power sector, industry, NGOs (e.g., the Bangladesh Environmental Lawyers Association), etc. With respect to PCB legislative provisions involving the electrical sector, the Bangladesh Power Development Board will play a lead role, working in consultation with stakeholders.

Laboratory capacity: The Department of Environment (DoE), Ministry of Environment and Forests as the leading laboratory, will work with the Organic Resaearch Laboratory of the Department of Chemistry, University of Dhaka, Bangladesh Atomic Energy Commission (BAEC)- Agrochemicals and Environmental Research Laboratory of the Institute of Food Radiation and Biology; Analytical Research Laboratory of BCSIR and DAE pesticides laboratory. The NIA will provide general oversight.

3.3.1.5 ACTIONS FOR INSTITUTIONAL AND REGULATORY STRENGTHENING

1. **The GoB will establish an inter-ministerial National Implementation Authority (NIA) to provide oversight for implementation of the NIP as its first near-term priority.**

   The NIA, to be established within the first three months of NIP implementation, will be comprised of representatives of key ministries and their agencies involved with POPs management (e.g., DoE, Ministry of Agriculture-DAE, Ministry of Health-DGHS; Ministry of

[42] See subsection 2.2.5.2 for details.

Power, Energy and Mineral Resources), with a broadened constituency, inclusive of stakeholders, as needed to implement specific actions.[43] Representatives from donor agencies will also be invited and encouraged to sit on the NIA. The National Focal Point of the Stockholm Convention (the Director General, DoE) will be the coordinator of the NIA.

The National Implementation Authority will be responsible for overall coordination, interagency collaboration and, as needed, inclusion of a broader constituency (e.g., the power sector; academia, NGOs), with respect to NIP implementation mechanisms and actions. For each action as described in the NIP, there will be an implementation mechanism or designation of the relevant ministry (ies) and their departments charged with responsibility for implementation of the action, with one lead agency designated to coordinate their activities for the specific action(s), to submit work plans for NIA approval and to report on progress in implementation of work plans.

The NIA's responsibilities will include the following tasks:

a. Arranging for availability of funds and resources for implementing the NIP.
b. Supervision of NIP activities, coordinate among different departments
c. Review and authorization of work plans submitted by implementation mechanisms (ministries responsible for actions)
d. Upgrading POPs inventories and the NIP on regular basis as prescribed by the Convention.
e. Evaluating progress of NIP implementation every three years.
f. Collection and dissemination of information about POPs domestically and internationally.
g. Provision of oversight for development and implementation of a programme to promote application of the BAT and BEP principles in various social and economical activities.
h. Arrangement for training of appropriate specialists (e.g., customs officer, border control officers, engineers, technicians) responsible for management of POPs.

2. **The GoB will strengthen its legislative framework and infrastructure for POPs management as a near-term priority**. The measures to be taken include utilizing existing legislation and promulgating new legislation as required toaddress gaps in life-cycle management of POPs, as well as other gaps that may be identified by the National Implementation Agency (Implementation Mechanism) during the course of its work.

3. **DoE will engage in discussions with the relevant ministries (finance, etc**.) regarding funding strategies as these apply to implementing its restructuring plan.

[43] Examples of ministries include the Ministry of Agriculture, Ministry of Fisheries and Livestock, Ministry of Labour and Employment, Ministry of Education, Ministry of Primary and Mass Education, Ministry of Finance and Planning, Ministry of Industries, Bangladesh Ministry of Law, Justice and Parliamentary Affairs, Ministry of Women and Children's Affairs. Examples of stakeholders include the private utility sector, Dhaka City Corporation, NGOs working on chemicals and women's NGOs, various ship yards organizations and operators, etc.

4. **The GoB will develop laboratory capacity as a near-term priority, by undertaking the following activities (as contingent on available financing):**

    a. Establishing National SMOC/POPs Monitoring Network (NPMN) with DoE the lead laboratory
    b. Upgrading existing laboratories through provision of modern equipment, analytical techniques and protocols, training technical staff and sustainable financing
    c. Establishment of a national accreditation system
    d. Linking up with the regional and global POPs monitoring programme.
    e. Upgrading laboratory practices through introduction of Quality Control/Quality Assurance (QA/QC), inter-laboratory proficiency testing scheme and accreditation of laboratories.
    f. Establishment of a POPs reference laboratory
    g. Development of an inter-laboratory collaborative approach to promote comparable data
    h. Instituting measures for sustainable financing of laboratories

3.3.2 Annex A pesticide POPs: production, import and export, use and prevention of releases

3.3.2.1 PROBLEM DEFINITION

None of the Annex A pesticide POPs were ever produced in Bangladesh. The Annex A POPs pesticides *aldrin, dieldrin, chlordane, endrin, heptachlor*, and *hexachlorobenzene* registrations were either cancelled or withdrawn by 1997. Hence, in accordance with Article 4 of the Pesticides Ordinance 1971, they cannot be imported, manufactured, formulated, repacked, sold, held in stock for sale or advertised in any manner. However, legislation governing Annex A POPs (the Pesticide Rules, 1985) requires amendment with respect to provisions for management of POPs pesticide wastes (e.g., worker safety; proper handling, packaging, labelling, transport, storage and destruction and disposal procedures) given that current provisions, while adequate for non-POPs pesticides, could result in releases of pesticide POPs to the environment, and, potentially, exposure of people and other organisms. Provisions with respect to exports of Pesticide POPs will need to be examined to ensure export is allowed for purposes of environmentally sound destruction. This is a near-term priority linked to actions on Annex A and Annex B pesticide wastes.

Although toxaphene and mirex were never imported or used within Bangladesh and therefore never registered, their import and use should be prohibited within legislation (to be accomplished via Action 2 of Subsection 3.3.1.5).

3.3.2.2 OUTSTANDING UNRESOLVED ISSUES OR QUESTIONS

There are anecdotal reports suggesting that illegal transboundary importation of Annex A POPs into Bangladesh may occur from time to time. Currently, laboratory analysis capacity is inadequate for verifying such claims, while customs officials would also require training (e.g., relative to protocols for

packaging and sending samples suspected to contain POPs for analysis to a laboratory). This issue would most effectively be addressed after laboratory capacity is strengthened, hence, most likely in the mid term.

3.3.2.3 OBJECTIVES

The Government of Bangladesh will maintain and ensure complete prohibition of the production, import and use, and export of Annex A POPs (with the exception of exports of Annex A POPs wastes for the purpose of environmentally sound destruction, which is addressed below in subsection 3.3.3.). The Government of Bangladesh will take appropriate measures to prevent releases of Annex A pesticide POPs, for which the source is obsolete stocks.

3.3.2.**4** IMPLEMENTATION MECHANISM

The National Implementation Authority (NIA), with inter-ministerial input on legislative drafting and amendments, as required, from DoE, DAE, DGHS, in consultation with Bangladesh Ministry of Law, Justice and Parliamentary Affairs, stakeholders from the power sector, industry, NGOs (e.g., the Bangladesh Environmental Lawyers Association), etc.

3.3.2.5 ACTIONS FOR ANNEX A PESTICIDE POPS: PRODUCTION, IMPORT AND EXPORT, USE AND PREVENTION OF RELEASES

Legislative strengthening for Annex A POPs is addressed via Action 2 of Subsection 3.3.1.5 above.
Measures for prevention of releases of Annex A pesticide POPs are addressed via Action 2 of 3.3.3 below. (Guidance for POPs pesticides wastes has been developed by the DoE as part of this project).

3.3.3 Disposition of Annex A POPs pesticides wastes, Annex B (DDT) wastes, and unidentified POPs pesticide wastes

Amendment of the legislative framework for POPs pesticides, inclusive of wastes, will be accomplished via Action 2 of 3.3.2.5.

3.3.3.1 PROBLEM DEFINITION

The Bangladesh pesticide inventory found that **the remaining 524.752 MT of DDT stocks are obsolete and therefore require destruction.** This estimate includes 3.889 MT of DDT 75WP stored in Department of Health district reserve stores and *Upazila* Project offices that, while found to be in good condition, exceeds the 24-month half-life of DDT in Bangladesh' tropical climate. The minimum age of DDT in Bangladesh is 13 years (based on last year of production). There is currently no environmentally sound destruction facility for DDT in Bangladesh or elsewhere in South Asia. These wastes require repackaging and labelling for shipment to environmentally sound interim storage facilities pending destruction. Such destruction should occur in the near term to minimize the potential for releases to the environment.

3.3.3.2 OUTSTANDING UNRESOLVED ISSUES OR QUESTIONS

There remain *13.668 MT of unlabelled and unidentified quantities of pesticides* at the division level, which will need to be sampled to determine if they contain or have been contaminated by POPs, in which case they would also require destruction. Current laboratory capacity will need to be strengthened to enable analysis of samples, so as to confirm content.

3.3.3.3 OBJECTIVES

So as to prevent the potential for releases to the environment and thereby reduce the risk of exposure posed by Annex A and Annex B pesticide wastes, the GoB will undertake as a near-term priority the sound management of POPs pesticide wastes, inclusive of their elimination in an environmentally sound destruction facility. Export of Annex A and B POPs pesticide wastes will be permitted for purposes of environmentally sound destruction.

3.3.3.4 IMPLEMENTING MECHANISM

NIA working with DoE as lead agency. DoE will coordinate its work on specific activities with DAE and DGHS, as appropriate.

3.3.3.5. ACTIONS

1. Annex A and Annex B POPs pesticide wastes identified by the Bangladesh national pesticide inventory (i.e., 524.752 MT of obsolete DDT stocks) will be repackaged in internationally acceptable containers, labelled appropriately, and segregated within a secure interim storage facility, pending their destruction. Such storage facilities will be constructed, as required, to receive these pesticide wastes.
2. The DoE will seek to secure funding for destruction of Annex A and Annex B POPs wastes (action currently in progress).
3. The DoE will identify appropriate overseas environmentally sound destruction facilities for POPs pesticide wastes (taking into account costs for transport and destruction), and, once funding is secured, make the appropriate arrangements for shipment for destruction of pesticide wastes to the selected destruction facility (ies).

3.3.4 Activity: Action Plan for DDT import and export, use, stockpiles of DDT (Annex B chemicals)

3.3.4.1 PROBLEM DEFINITION

Bangladesh has limited capacity at present for research regarding effectiveness of DDT alternatives (e.g., malathion and deltamethrin) in control of some disease vectors, in particular kala-azar, which poses a threat to portions of the Bangladesh population. For example, with the cessation of the widespread use of DDT in 1971 for disease vector control, kala-azar, beginning in the mid-seventies, made resurgence and was reported to have reached epidemic proportions in recent years. The number of cases of kala-azar increased from 2,397 in 1993 to 7,032 in 1998 (Bangali 2000). As well, research is needed to determine resistance of vectors to POPs alternatives and to DDT. While DDT is no longer produced in Bangladesh (production having ceased in 1993), and has not been used for disease vector control since 2000, the effectiveness of alternative pesticides needs to be confirmed prior to phase out of DDT use for disease vector control.

3.3.4.2 OUTSTANDING UNRESOLVED ISSUES OR QUESTIONS

In addition to the above, there is the potential, based on past reports, for illegal importation of DDT for use in agriculture and as preservative in dried fish. Toxic Links reports a significant amount of DDT (100 MT) may be illegally exported to Bangladesh. In a survey of farmers conducted during the GoB 2005 national pesticide inventory, some respondents reported using DDT in agricultural that they indicated was

obtained from transboundary sources, with such use heaviest before 1980. However, farmers reported they no longer used DDT (or any other POPs pesticides) after 2000 when stocks in local stores remaining following the 1977 ban had been used up. Anecdotal reports (e.g., in newspapers) of use of DDT-contaminated substances to preserve dried fish have appeared as recently as June 2005. Laboratory capacity for analysis and customs procedures for transboundary inspections will be needed to monitor imports and confirm whether food preservatives, foods, and other substances contain DDT (or other POPs pesticides).

3.3.4.3 OBJECTIVES

The GoB is committed to elimination of its remaining waste DDT stocks and their destruction in an environmentally sound destruction facility, as soon as suitable alternatives are confirmed to exist or are developed. The GoB is committed to preventing illegal importation and illegal use of DDT.

3.3.4.4 IMPLEMENTATION MECHANISM

NIA; DGHS and DOE working on research with Ministry of Science & Technology; Academia working with DAE and DGHS. International and bilateral assistance may also be sought.

3.3.4.5 ACTIONS FOR DDT IMPORT AND EXPORT, USE, STOCKPILES OF DDT (ANNEX B CHEMICALS)

1. **The DGHS will propose research (seeking guidance from and potentially participation of international experts, such as WHO) to determine the most effective approach to disease vector control** (e.g., for kala-azar, dengue fever, malaria, etc.), so as to determine if POPs alternatives can be effectively used in place of DDT for all vectors of concern and whether there are additional non-POPs alternatives that can be utilized should vectors develop resistance to those chemicals currently in use. **Implementation of this action will be dependent on securing international funding.** (*near term*).
2. **Based on the outcome of research on vector resistance, the DGHS will develop and implement strategies for DDT use and /or phase out** (*mid term*).
3. **The GoB will register DDT for disease vector control, and make such legislative amendments as required, to permit export of DDT wastes for destruction and, if it is decided that DDT will be required for disease vector control, to permit imports of DDT for this acceptable purpose (***near term***). Once suitable alternatives are known to be effective and in place, DDT legislation will be amended to prohibit all uses and imports (***mid term to long term***).**
4. **Once laboratory capacity is in place, DoE will train inspectors in detection of DDT**.

Note: Monitoring activities and communications strategies for DDT are addressed via other actions below. There are no DDT stockpiles in Bangladesh that are usable (non-waste).

3.3.5 Activity: register for specific exemptions and the continuing need for exemptions (Article 4)

3.3.5.1 PROBLEM STATEMENT

As discussed in the previous action, Bangladesh will need to confirm that non-POPs alternatives are effective in control of kala-azar, prior to phasing out use of DDT.

3.3.5.2 OUTSTANDING UNRESOLVED ISSUES OR QUESTIONS

As noted in the problem statement

3.3.5.3 IMPLEMENTATION MECHANISM

NIA working with DoE as lead agency. DoE will coordinate its work on specific activities with DGHS, other ministries and institutions, as appropriate.

3.3.5.4. OBJECTIVES

The Government of Bangladesh is committed to protecting the health of its population from diseases caused by disease vectors and to prohibiting use of DDT as soon as is practicable, as consistent with its commitment to protecting the health of its citizens.

3.3.5.5 ACTIONS FOR REGISTERING FOR SPECIFIC EXEMPTIONS AND THE CONTINUING NEED FOR EXEMPTIONS

Bangladesh will register for exemption of Annex B pesticides (DDT) for acceptable purposes in light of its need to determine whether POPs alternatives can be effectively applied in place of DDT for disease vector control.

3.3.6 Annex A, Part II chemicals (PCBs): actions applying to their production, import and export, use, identification, labelling, removal, storage and disposal of PCB wastes, and decontamination/disposal of equipment containing PCBs (Annex A, Part II chemicals)

3.3.6.1 PROBLEM STATEMENT

Electrical power sector: The Stockholm Convention requires that PCBs in electric equipment be eliminated from use by 2025 and all PCB wastes and stockpiles, be destroyed or decontaminated by 2028. PCBs were never produced in Bangladesh. However, they have been used for many years and continue to be used within the electrical power-generating sector. PCBs may still be imported as oils within electrical equipment as there is currently no law governing PCBs. There are an estimated 55.8 metric tonnes of PCBs used in-service electrical equipment. Additionally, 403 MT of oils contained in waste equipment are contaminated with an estimated 4.193 MT of PCBs and 519 MT of waste transformer oils are contaminated with an estimated 259.45 kilograms of PCBs. Hence, the total electrical sector PCBs requiring destruction is estimated at 55.8 MT. Specific guidance for handling, packaging, storing and transporting waste PCBs has been developed but remains to be implemented, for example, creation of adequate storage facilities for PCB wastes and in-service PCB oils (pending retirement and destruction of these PCBs). The 2005 preliminary inventory of the electrical sector does not include PCB-containing hydraulic fluids, which will be estimated as part of future activities.

Ship breaking sector: There are an estimated 22.5 MT of PCBs in materials in old ships that are brought into Bangladesh ship years each year for ship breaking. The ship-breaking sector requires protocols for identification, handling, and safe removal and destruction/disposal of these PCBs, including with respect to protection of workers and the environment.

Destruction facilities*:* Bangladesh currently lacks environmentally sound destruction facility (ies) to destroy PCB wastes (i.e., all PCBs in liquid matrices; wastes that exceed low PCB content, e.g., 50 mg/kg or 0.005% and volume greater than 0.05 litres), or for decontaminating PCB equipment.

Legislation*:* Existing law requires amendment so as to ban production, import or use of PCBs, and to allow for export only for environmentally sound destruction. Specific names of PCB-containing substances and their threshold levels (i.e., the lowest allowable concentration), in useable substances or applicability of non-destructive disposal techniques need to be well defined in law, and Convention timetables for elimination of PCBs from in-service electrical equipment and destruction of PCB wastes incorporated in law. Guidelines for safe handling, labelling, storage, transport, disposal and destruction of PCBs will need to be well described in law governing PCBs.

3.3.6.2 OUTSTANDING UNRESOLVED ISSUES OR QUESTIONS

Adequate laboratory capacity for analyzing PCBs (not currently available in Bangladesh) is required to enable Bangladesh to determine the presence of PCBs used in-service electrical equipment and in wastes and, subsequently, to determine the characteristics of wastes identified as containing PCBs (PCB concentrations, congeners, etc.). This information will, in turn, inform decisions regarding the most suitable PCB waste destruction option(s).

3.3.6.3 OBJECTIVES

The objectives of this activity are to:

- phase out the use of equipment containing PCBs (greater than 0.005% and volume greater than 0.05 liters) by 2025;
- eliminate or destroy existing stockpiles and wastes consisting of, containing or contaminated by PCBs through environmentally sound destruction, transformation and/or disposal by 2028;
- prevent releases of PCBs to the environment; and
- ensure the safe handling, packaging, labeling, storage, transport, destruction/disposal, of in-use and waste PCBs, as consistent with Stockholm Convention provisions, and to protect the health of human populations and the environment.

3.3.6.4 IMPLEMENTATION MECHANISMS

Electrical sector: NIA; Ministry of Power, Energy and Mineral Resources (lead agency), working with the Bangladesh Power Development Board (BPDB), with participation of DoE, PGCB, REB, DESA, DESCO, and IPP.
Ship-breaking sector: MoEF, DOE will lead activities, coordinating its work with the appropriate ministries and stakeholders from this sector, as well as international agencies (e.g., UNDP, ILO, WHO).
Sampling and analysis: MoEF will supervise sampling of electrical industry equipment and wastes to determine if PCBs are present.

3.3.6.5 ACTIONS FOR PCB MANAGEMENT, PHASE OUT AND PCB WASTES

The Government of Bangladesh will:

1. **Upgrade its PCB inventory through sampling and analysis to determine presence of PCBs in electrical equipment and wastes.** This *detailed inventory of PCB-containing materials is the most important task for management of PCBs.* Implementation will commence in the near term (*within the first year*).
2. **Develop regulatory framework for PCB management and phase out, draft PCB legislation and regulations and implement legislation and regulations,** inclusive of provisions for safe handling, labelling, storage, transport, disposal, export and import of Annex A part II POPs chemicals (PCBs), environmentally sound disposal of PCBs wastes, and direction for phase out of PCBs used in the electrical generating sector, consistent with the Stockholm Convention provisions for PCBs (*near term*).

   With respect to classification PCB-containing materials, legislation will reflect the following:

   - *Scheduled PCB Material*: Threshold concentration of 0.005% (50 mg/kg) and threshold volume of 0.05 litre. Any material containing PCB exceeding the threshold concentration and threshold volume will be designated as scheduled PCB materials that require destruction.
   - *Non-scheduled PCB Material*: Any material containing PCB not exceeding the threshold concentration and threshold volume and having concentration greater than the level defined as PCB free (i.e., 2 mg/kg) will be designated as non-scheduled PCB material that requires adequate disposal.
   - *PCB free material*: Any material containing PCB not exceeding 0.0002% (i.e., 2 mg/kg) is designated as PCB free for the purpose management.

   Other provisions for PCB legislation will include (but not necessarily be limited to) the following:

   a. Prohibition of import of PCB containing transformer oil, electrical equipment or any other material.
   b. Prohibition of use of PCBs in open systems.
   c. Provisions for removal or phase out of PCB containing equipment
   d. Prohibition on use of PCBs in closed system within the time frame as described by the Convention.
   e. Prohibition on recycling and reuse of PCB containing materials with concentration greater than 0.005%.
   f. Provisions for identification and remediation, as warranted, of PCB contaminated sites.
   g. Occupational health and safety in connection with the handling of the substances that contain PCBs.
   h. Provisions for monitoring, sampling and analysis of PCBs.
   i. Provisions for interim storage of PCBs prior to destruction
   j. Provisions for regular inspections of facilities where PCBs have been or are in use or where PCBs and PCB wastes are stored.
   k. Provisions for destruction of PCB waste, inclusive of timeline for decontamination or destruction of PCB wastes (either liquid or solid exceeding the threshold concentration of 0.005% and threshold volume of 0.05 litres), consistent with the Convention deadline for elimination of the equipment by 2025 and for treatment of PCB-waste by 2028.
   l. Provisions for public awareness raising, outreach and consultation

m. Provisions for reporting spills, leaks and accidents
n. Provisions for emergency contingency and response measures for spills, leaks and accidents (fires, etc.).

3. **Design and implement a rapid-assay PCB sampling project** (*near term*)
4. **Design and implement a full-scale rapid-assay sampling project and provide follow-up analysis of equipment and wastes found to contain PCBs to determine the concentrations, congeners, and volume of PCBs** (*near term*).
5. **Develop and maintain a national database/inventory of PCB-containing equipment** (*near term)*.
6. **Construct safe and secure storage sites for PCB wastes and store PCBs, pending destruction or disposal (***near term***).**
7. **Feasibility study of destruction technology infrastructure best suited to Bangladesh, taking into account the outcome of sampling and analysis actions (***near and mid term***)**
8. **Train inspectors relative to compliance with the PCB legislation (***mid term***).**
9. **Implement destruction infrastructure option(s) for PCB wastes and decontamination/destruction of PCB contaminated equipment**, as consistent with Article 6 of the Stockholm Convention and taking into consideration Bangladesh domestic capacity as informed by finalized inventory of PCB wastes and analysis of technologies in the *Report on The Persistent Organic Pollutants (POPs) Stockpile and Waste Management* and other analyses (e.g., by international chemical institutions and technical groups of conventions) (*mid to long term*);.
10. **Phase out the use of equipment containing PCBs (greater than 0.005% and volume greater than 0.05 litre) by 2025**;
11. **Destruction/disposal, as appropriate, of PCB stockpiles and wastes consisting of, containing or contaminated by PCBs through environmentally sound destruction, transformation and/or disposal by 2028** (*mid to long term*);
12. **Identify PCB-contaminated sites** in association with DoE (*mid to long term*) and remediation of sites, as warranted (*long term*).
13. **Provide information to support monitoring of PCBs** (*ongoing, near to long term*).
14. **Revise the PCB management plan** (these actions, together with work plans to implement them. and, if necessary, PCB regulations, based on results of activities 1-13, and recommendations from the implementation mechanisms).(*mid term*)
15. **Sponsor a workshop with the ship-breaking industry sector on best practices for POPs relative to worker safety, and protection of the environment.** The purposes of the workshop will be to (1) raise awareness regarding the Stockholm Convention and NIP implementation actions and (2) consultation on a work plan for implementation of actions as applicable to this sector. The GoB will seek input from experts in this industry (e.g., ILO, WHO) and donor funding (e.g., UNDP) to support this activity (*near term*)

3.3.7 Activity: Annex C POPs: Measures to reduce releases from unintentional production (article 5)

3.3.7.1 PROBLEM DEFINITION

There is currently no legislation governing releases of Annex C POPs (dioxins and furans, hexachlorobenzene and PCBs). The preliminary national inventory identified leading and other sources to which Best Available Techniques (BAT) and Best Environmental Practices (BEP) will need to be applied to reduce releases of these POPs. Monitoring will be required to measure releases in stacks and effluent, and in the environment, etc., in order to measure progress over time (addressed via monitoring actions below).

Based on consolidated results of dioxins and furans inventory conducted for each main category and sub-categories throughout the country, there were an estimated 485.81 g TEQ/a are released in 2005 to all environment compartments (air, water, products and residues), as shown in Table 64 below. The top six ranked emitters are shown below:

Table 64. Dioxins and Furans releases, 2005

Category	Air		Water		Product		Residue		Total	
	g TEQ/a	%	g TEQ/a	%	g TEQ/a	%	g TEQ/a	%	g TEQ/a	%
Production of Chemicals and Consumer Goods	0	0.00	21.31	34.3	123.02	62	0.001	0.00	**144.34**	29.71
Disposal/Landfill	0	0.00	40.8	65.7	75	38	0.36	0.97	**116.17**	23.91
Power Generation and Heating	79.18	42.03	0	0	0	0	0.316	0.85	**79.49**	16.36
Uncontrolled Combustion Processes	57.16	30.34	0	0	0	0	14.51	38.9	**71.67**	14.75
Ferrous and Non-Ferrous Metal Production	10.09	5.36	0	0	0	0	21.89	58.7	**31.98**	6.58
Waste Incineration	31.11	16.51	0	0	0	0	0.015	0.02	**31.13**	6.4
Production of Mineral Products	9.05	4.80	0	0	0	0	0.045	0.12	**9.09**	1.87
Transport	1.51	0.80	0	0	0	0	0	0.00	**1.51**	0.31
Miscellaneous	0.31	0.16	0	0	0	0	0.131	0.35	**0.44**	0.09
Total	**188.41**		**62.111**		**198.02**		**37.268**		**485.809**	

Source: GoB, MoEF, 2005d

3.3.7.2 OUTSTANDING UNRESOLVED ISSUES OR QUESTIONS

The preliminary inventory represents an estimate of releases based on production volumes, etc. Releases will require subsequent verification (field measurement). These, in turn, may lead to adjustments in emission factors and source release estimates for some sectors.

3.3.7.3 OBJECTIVE

The Government of Bangladesh seeks to continually reduce and eliminate releases of Annex C POPs compounds from unintentional production.

3.3.7.4 IMPLEMENTATION MECHANISM

NIA; MoEF as lead for Annex C POPs-specific actions, working with monitoring and laboratory mechanisms, representatives of industry associations from the sectors identified as sources of releases of Annex C chemicals, academia, the NGO community and others as identified by MoEF.

3.3.7.5 ACTIONS FOR ANNEX C POPS SOURCES

The Government of Bangladesh will:

1. **Develop a legislative framework for Annex C POPs** (*near term*)
2. **Institute and require/encourage industry (i.e., through awareness raising and outreach actions) to apply BAT/BEP guidelines and environmental code of practice, with emphasis on leading sources of dioxins and furans, including within sector sub-categories** (*near to long term*), including:

   Reduction of the use of chlorinated chemicals in industries (e.g., chlorine-free beaching technology for pulp and paper mills)

Introduction of Air Pollution Control Systems (APCS) in power generation plants, motor vehicle and other sources of emission.
Effluent treatment plants in industries
Treatment of sewage sludge
Improvements to household burners and rice hull cooking stoves
Improvements to incinerators currently in use
Development of strategies for educating people and awareness raising
Establishment and organization of national monitoring of environmental releases of dioxins and furans
Introduction of bio-gas for household cooking
Medical waste management through segregation of waste at source, sterilization of waste, and incineration of pharmaceutical and cycotoxic wastes

3. **Build laboratory capacity to analyze dioxins and furans** (*mid to long term*).
4. **Develop a more detailed inventory of Annex C POPs** (*mid to long term*).
5. **Develop a national system for toxic and hazardous waste management, including waste segregation** (*mid to long term*)

3.3.8 Strategy: identification of contaminated sites (Annex A, B and C Chemicals) and remediation in an environmentally sound manner, as warranted

3.3.8.1 PROBLEM DEFINITION

Bangladesh does not have an inventory of contaminated sites of POPs. A number of probable contaminated sites have been identified. A full inventory is needed, which will require analysis capacity to determine whether sites are indeed contaminated, and, if so, whether the contamination poses a significant risk to humans and/or the environment.

Probable contaminated sites include the following:

Pesticide POPS

1. DDT Plant, BCIC chemical Complex, Barbakund, Chittagong.
2. Shantahar, Rajshahi Division Pesticide Godown (warehouse), Bogra.
3. Dhaka Division Pesticide Godown, Tejgaon, Dhaka. (Presently abolished, Polar Ice Cream Factory is now located at this site).
4. Khulna Division Pesticide Godown, Daulatpur, Khulna.
5. Chittagong Division Pesticide Godown, Dewanhat, Chittagong.
6. MSD (Medical Sub Depot) godown, Agrabad, Chittagong. (under Directorate General of Health Services)

Other sites potentially contaminated by Annex A and B pesticide POPs include warehouses in 18 old districts and in some *thanas*, DAE burial sites of obsolete pesticides, and Directorate General of Health Services (DGHS) District Reserve Stores and *Upazila* project stores or offices. Sites where facilities formerly formulated POPs may also be contaminated.

PCBs

Workshops that repair, dismantle, overhaul and retrofill transformers and capacitors are probable contaminated sites. These include the following:

1. Central Equipment Repairing Shop, Bangladesh Power Development Board (BPDB), Tongi, Gazipur.
2. Zonal Workshop, BPDB, Tongi, Gazipur.
3. Zonal Workshop, BPDB, Bogra.
4. Zonal Workshop, BPDB, Jessore.
5. Zonal Workshop, BPDB, Chittagong.
6. Regional Workshop, Rural Electrification Board, Dhaka.
7. Regional Workshop, Rural Electrification Board, Chittagong.

Additionally, 67 *Palli Biddhut Samiti* in different districts in Bangladesh where small transformers are repaired and ship breaking yards in the coastal area of Sitakund, Chittagong, may be contaminated with PCBs.

3.3.8.2 OUTSTANDING UNRESOLVED ISSUES OR QUESTIONS

Laboratory capacity is required to analyze samples from sites to determine if and to what degree they are contaminated by POPs. Remediation is typically extremely costly. Sites will need to be ranked in order of significance relative to potential exposure to humans and the environment, and funding found for those sites for which remediation is deemed warranted.

3.3.8.3 OBJECTIVE

Reducing the risk of exposure to humans and the environment through identification and remediation, as warranted, of contaminated sites.

3.3.8.4 IMPLEMENTATION MECHANISM

NIA; DoE working with DAE and DGHS, laboratories, engineers, and other stakeholders.

3.3.8.5 ACTIONS FOR CONTAMINATED SITES IDENTIFICATION (ANNEXES A, B AND C CHEMICALS) AND REMEDIATION, AS WARRANTED

The GoB, via the MoEF, will:

1. **Develop and maintain a database of national contaminated sites** (*mid term*)
2. **Examine sites suspected or known to be contaminated with POPs** (*mid term*), inclusive of the following sites and activities:
    a. The former DDT production facility and former storage sites/stores of POPs pesticides, in particular where people are now known to inhabit such sites and develop plans for these sites, as warranted;
    b. PCBs workshops and repair shops
    c. Collection of soil samples from surface and under ground using hand auger.
    d. Collection of water samples from the aquifer just underneath the contaminated sites and from the downstream direction of groundwater flow to determine the probable plume.
    e. Collection of samples from surrounding flora and fauna.
    f. Analysis of those samples in well equipped POPs compound analytical laboratory.
    g. Plotting data on the base map.

h. Comparing the data with acceptable standard, and finally,
i. Identification and determination of the extent of pollution.

3. **Rank sites according to the risks they pose to humans and the environment and identify which sites warrant remediation**. Seek funding for sites for which remediation is warranted (*mid term)*.
4. **Take such measures, as warranted, to protect people from exposure to POPs at contaminated sites, pending remediation and promote public awareness** of the contaminated sites, and of any clean-up activities requiring public knowledge, participation and support (*near- and mid term*).
5. **Prepare main investment areas for implementing proposed remedial activities** *(mid- and long- term)*

3.3.9 Activity: Facilitating and undertaking information exchange and stakeholder involvement

3.3.9.1 PROBLEM DEFINITION

The success of NIP implementation relies on engagement of multiple actors, including those within the international community, and, within Bangladesh, among ministries, industry, academia and civil society, including relative to information exchange and implementation activities. Bangladesh has begun to build its national stakeholder base and has gathered information through a variety of methods, including inventories. It will need to continue this work to reach stakeholders more broadly within various institutions, sectors, etc.

3.3.9.2 IMPLEMENTATION MECHANISM

NIA; National Focal Point for POPs (DoE).

13.3.9.3 OBJECTIVES

Include stakeholders within implementation mechanisms and/or NIP implementation activities, as appropriate, and continue to consult with stakeholders to invite information exchange.

13.3.9.3 ACTIONS FOR FACILITATING AND UNDERTAKING INFORMATION EXCHANGE AND STAKEHOLDER INVOLVEMENT

The Government of Bangladesh, via its national focal point, will:

1. **Exchange information among the Parties and/or with the Convention Secretariat, as appropriate, on activities undertaken by Bangladesh to eliminate the production, use and release of POPs; and on POPs alternatives**, including the risks, as well as economic and social costs associated with their use.
2. **Communicate on a routine basis with the international donor community** regarding GoB assistance requirements relative to NIP implementation as part of resource mobilization efforts for NIP implementation.
3. **Build new partnerships** between governments, civil society including local communities, opinion mobilizers, community leaders (formal and informal), women's groups, the private sector and the citizenry in general relative to POPs awareness and implementation activities.

The table below lists communications techniques that will be invoked under the overarching communications strategy.

3.3.10 Activity: Pubic awareness, information and education

3.3.10.1 PROBLEM DEFINITION

It is evident from various qualitative assessments, such as group discussion with potential target audiences, consultation meetings with stakeholders, and pre-testing of some communications materials with vulnerable groups that most *Bangladeshi* are not aware of POPs issues. Only a few professionals have some knowledge about POPs, including within academia and among industry sectors that use or have used POPs in the past.

3.3.10.2 OUTSTANDING UNRESOLVED ISSUES OR QUESTIONS

Outreach channels that are effective in developed countries (e.g., the Internet) have limited application for awareness raising, information and education within Bangladesh.[44] Outreach activities therefore require a variety of approaches and are labour intensive with respect to implementation of actions. Bangladesh has very little experience with risk communications on chemicals. Special care will need to be taken to ensure that any risks are put in proper context and perspective so as not to unduly alarm populations. In this respect, Bangladesh can benefit from lessons learned from developing nations with respect to their risk communications experiences.

3.3.10.3 OBJECTIVES

(1) Familiarize the general population, potentially vulnerable subpopulations (including women, children and the least educated) , and industrial and other sectors involved with or potentially affected by POPs (currently or in the past) to increase awareness of health and environmental hazards posed by POPs and best practices for POPs management.

(2) Develop targeted outreach strategies in response to monitoring and analysis information, including for vulnerable populations and particular sectors, as warranted.

(3) Provide training for managers, workers, scientists, technical and education personnel, and enforcement personnel (customs officials and inspectors) on POPs.

3.3.10.4 IMPLEMENTATION MECHANISM

NIA; MoEF, working with other ministries (e.g., DAE, DGHS, the education ministries) and representatives of the private sector, including industry, academia and NGOs.

[44] A National Media Survey conducted in 2002 indicates that radio has the most extensive reach, followed by TV and print media. The survey suggests that TV is one of the most important mediums of mass communication. In urban areas 83% of the population regularly view TV, as compared to 50% in rural areas. Radio reach has declined significantly in urban areas, from 42% in 1998 to 24.1% in 2002. Only 25.8% of the population read newspapers and 7.9% magazines. Readership of newspapers in rural areas was substantially lower (18.7%) than in urban areas (40%). In rural areas, traditional media (e.g., folk song, drama, recital and others) remains an effective channel for 80% of the population. Schools present another mechanism by which information can be disseminated (e.g., teachers can be asked to provide messages that children can take home to parents, such as safe storage for pesticides.)

3.3.10.5 ACTIONS FOR PUBIC AWARENESS, INFORMATION AND EDUCATION

The GoB, via the implementation mechanism for this action, will:

1. **Maintain the national internet site for POPs** (MoEF-DOE), which is geared to professionals, who are most likely to have internet access, and also as one means of efficient information exchange with the international community (*on-going*).
2. **Work with universities to identify areas where curriculum requires strengthening to build basic capacity for POPs** (*near- to long term*)
3. **Develop materials and targeted strategies to raise general awareness about POPs and the Stockholm Convention, beginning with key stakeholders** (industrial sectors that use, generate or may come into contact with POPs; agricultural community, e.g. farmers living in border areas; pesticide formulators, wholesalers, etc.). (*near- to long term)*
    a. Specific materials will be developed for outreach to the electrical and ship breaking sectors (for PCBs and Annex C POPs issues and relative to worker safety);
    b. Specific materials will be developed for outreach to pesticide associations, formulators, commercial fish dealers, etc., regarding appropriate provisions and procedures with respect to POPs and POPs alternatives
4. **Implement targeted strategies with regard to suspected and known vulnerable populations** (e.g., women and children, workers and other populations as indicated by monitoring data) in the interests of protecting health *(mid- to long- term)*.
5. **The DGHS will develop and apply on a regularized basis within the medical sector systematic and comparable reporting of acute poisoning cases**, so as to better track experiences with POPs alternatives *(near term)*
6. **Provide outreach to environmental journalists, electronic and print media** to raise awareness of POPs issues and actions being taken to address them (*near term)*
7. **Develop a work plan for outreach at the community level**, as warranted (*near term*)
8. Provide training-the-trainer, awareness-raising and consultation workshops, as appropriate, with stakeholders and as required to implement NIP actions. Table 65 indicates typical constituencies that implementation actions are designed to reach:

Table 65. Common programme of information activities

Awareness Intervention	Representative of competent organizations	Expert Public	Technical and Managerial Staff (ministries and private sector)	Workers	Women and Children	Media personnel	Opinion mobilizers	Others
Publications	✓	✓	✓			✓	✓	
Instruction and guidelines				✓	✓		✓	✓
Posters and other prints	✓	✓	✓	✓	✓	✓	✓	✓
Seminars, Roundtables	✓	✓				✓		
Courses				✓		✓		
Knowledge base competitions					✓			✓
Information centre				✓	✓	✓		✓
Electronic and other media	✓	✓	✓	✓	✓	✓	✓	✓

Source: MoEF, 2005

The table below lists communications techniques that will be invoked under the overarching communications strategy.

Table 66. Communications techniques under the overarching communications strategy

Communications activities	Features	Advantages
1. Community interventions with interpersonal communications	• Personal visit • Involvement of community leaders, groups • Interactive information	• Personal caring • Interaction with knowledgeable person and professionals
2. Informal meeting	• Community groups • Religious congregation	• Two-way communications • Immediate feedback • Promote public participation
3. Workshops, seminars, roundtables	• Meeting with key stakeholders • Involvement of policy makers	• Involvement of key state and professional personnel • Hands-on knowledge and experiences
4. Parliamentary Group development	• Involvement of law makers • Interactive groups • Promotes public participation	• Direct interaction with law makers
5. Electronic media (TV, Radio Spot, mobile phone, video film, drama serial)	• Help shaping people opinion • Risk communications to educate media on aspects of risk management	• Faster information dissemination • Easy reach to all possible target groups
6. Print media (poster, leaflet, paper insertion, booklet)	• Provide first-hand information • Create interest • Risk communications to educate media on aspects of risk management	• Credibility of the information
7. Exhibit	• Visual displays • Brief text insertion	• Interactive information dissemination
8. Advocacy (journalists, press kits, website, notice board, news conference)	• Involvement of various groups and journalists	• Endorse ideas and concepts.
9. Training (professional groups and students of graduate and higher level)	• Help developing skilled and knowledgeable professionals	• Interactive • Experiential

Source: MoEF, 2005

3.3.11 Activity: reporting

3.3.11.1 PROBLEM STATEMENT

Monitoring data will be important to informing the government of progress.

3.3.11.2 OUTSTANDING UNRESOLVED ISSUES OR QUESTIONS

Laboratory capacity is linked to provision of monitoring data as previously discussed for other actions.

3.3.11.3 OBJECTIVES

As per Article 15 of the Convention, report on measures taken to implement the NIP and effectiveness of such measures in meeting Convention provisions. Indicators of progress will be required to evaluate progress.

3.3.11.4 IMPLEMENTATION MECHANISM

NIA; National focal point. Ministries, stakeholders (provision of data to ministries).

3.3.11.5 ACTIONS FOR REPORTING TO THE COP

The Government of Bangladesh will report on progress in implementing the NIP, including with respect to the following:

- Legislation reform
- DDT registration status
- Progress in implementation of PCB actions
- Progress in application of BAT and BAP within facilities that are sources of Annex C POPs.
- Laboratory capacity
- Other aspects of institutional strengthening
- Data on the environmental monitoring of POPs compounds
- Research on POPs (DDT); and POPs alternatives (progress and outcomes)
- Environmentally sound destruction of Annex A and B pesticide wastes
- Stakeholder engagement and public awareness, outreach and education
- Outstanding issues and concerns.

3.3.12 Activity: research, development and monitoring (article 11)

3.3.12.1 PROBLEM STATEMENT

Capacity within Bangladesh for monitoring needs to be strengthened in the near term for effective monitoring to occur.

3.3.12.2 OUTSTANDING UNRESOLVED ISSUES OR QUESTIONS

Financial assistance will be important with respect to support for actions involving research, development and monitoring.

3.3.12.3 OBJECTIVES

The objective of this activity is to build capacity for and engage in research and monitoring of POPs and POPs alternatives in Bangladesh such that national policies and objectives for POPs, and specific actions within the NIP can be supported by reliable research and monitoring that achieves international standards. This, in turn, will enable the government to determine the presence, levels and trends of POPs exposure of Bangladesh people and the environment, to enable promotion of the safe and efficient use of POPs alternatives, to ensure compliance and enforcement of POPs legislation (e.g., standards) and to track progress on elimination of POPs.

3.3.12.4 IMPLEMENTATION MECHANISMS

NIA; DoE, DAE, DGHS, NPMG, laboratories, NGOs, etc.
National POPs Monitoring network (NPMN) will be established under the NIA and will become leading agency for the implementation.

3.3.12.5 ACTIONS FOR RESEARCH, DEVELOPMENT AND MONITORING

The Government of Bangladesh will:

1. **Establish a monitoring program,** inclusive of specific strategies, for determining the presence, levels and trends of POPs in humans and the environment (*near to long term*). The program will identify and take into consideration actions for:
    a. the general population
    b. vulnerable populations, e.g., repair persons in utility companies who come into contact with PCBs; wholesalers, retailers and farmers who regularly handle pesticides; people living in homes that were formerly known to be pesticide storehouses; fisherman and their families; shipyard workers and their families; people living adjacent to facilities that formerly manufactured/formulated or imported POPs, etc.

3.3.13 Activity: Technical and financial assistance (articles 12 and 13)

3.3.13.1 PROBLEM DEFINITION

The Government of Bangladesh will seek technical and financial assistance to implement actions that it cannot fully implement without such support.

3.3.13.2 IMPLEMENTATION MECHANISM

NIA; DoE

3.3.13.3 ACTIONS FOR TECHNICAL AND FINANCIAL ASSISTANCE

1. **The Government of Bangladesh will seek international technical and financial assistance for the following priority actions**:

    Near term (1-5 years)

    a. National POPs management capacity building project
    b. Improvement of existing legal framework and legislative provisions for POPs
    c. Awareness raising, outreach and education
    d. Creation of national SMOC laboratory network and laboratory capacity for analysis of POPs compounds.
    e. Safe packaging, labelling and storage of Annex B (DDT) obsolete stockpiles
    f. Shipment of Annex B (DDT) obsolete stockpiles for destruction
    g. DDT sampling in dried fish
    h. Detailed PCB management plan, PCB legislation and rapid-assay pilot project
    i. Full-scale PCB rapid assay and follow-up sampling to determine presence of PCBs and verify PCB content; packing and safe storage of PCB wastes. Feasibility study for PCB destruction and decontamination technology options (building on results of sampling and analysis)

j. Determination of final PCB destruction and decontamination options as informed by feasibility study
k. Identification and remediation of PCB contamination within the ship-breaking sector
l. Procurement of BAT for application in different social and economic activities
m. Identification of POPs contaminated sites

Mid term (6-10 years)

n. Determination of final PCB destruction and decontamination options as informed by feasibility study (*started in near term and completed in the midterm*)
o. PCB waste equipment decontamination/destruction infrastructure created
p. PCB contaminated waste destruction/disposal initiated
q. Training (industrial sectors; inspectors; customs officials)
r. Outreach and procurement of BAT for application in different social and economic activities
s. Monitoring
t. Awareness raising, outreach and education on POPs (ongoing)

Long term (11-20 years)

u. Decontamination and/or destruction of PCB equipment as removed from service and destruction of PCB wastes (ongoing as PCBs and contaminated equipment removed from service)
v. Monitoring
w. Procurement of BAT for application in different social and economic activities
x. Contaminated site remediation as warranted (1 or 2 priority sites)

At a 14 July 2005, the Department of Environment, MoEF sponsored a workshop in Dhaka on *Brainstorming Downstream Project Concepts on POPs for the Bangladesh National Implementation Plan.* The workshop sought to create linkages with the international donor community with regard to priority actions proposed by the GoB for management and phase out of POPs. The workshop was chaired by the Director General of the DoE and attended by representatives from government ministries and the donor community, including, among others, the World Bank, UNDP, FAO, WHO and the Canadian International Development Agency. Ten priority projects were identified for NIP implementation. As an outcome of the workshop, the UNDP committed to seeking funding from the Global Environment Facility (GEF) for four projects:

1. Development of a national laboratory network for chemicals sampling, inclusive of certification, and building capacity within one leading laboratory DoE for POPs sampling and analysis;
2. A DDT project for management of obsolete stocks, for which GEF would be a co-funder and partnering with an EU country with the appropriate environmentally sound destruction facilities. The Netherlands expressed interest in such a partnership. The project would address packaging, labelling, collection, and secure storage of DDT obsolete stocks, followed by their shipment for destruction to the Netherlands' facility in Rotterdam. The project could also address research on alternatives to DDT for use in control of disease vectors.
3. PCB management, inclusive of development of a detailed overall management plan, draft legislation and near-term sampling of PCBs in waste oils, waste equipment and in-service equipment and oil reserves, initially using rapid assay kits, with more detailed follow up analysis as indicated by assay results. Management would include repacking and secure storage in suitable facilities, determination of destruction technology options and selection and implementation of an

option. The GoB will initiate this project by developing a detailed overall management plan. The plan will include a pilot project to sample electrical equipment oils using rapid assay kits to determine presence of PCBs, followed by more sophisticated analysis where PCB content is indicated. The GoB will seek funding for the management plan.

4. Outreach and communication. UNDP will seek funding via the GEF for this project.

The FAO expressed interest in expanding an existing fisheries project to include research on use of DDT as a preservative in dried fish.

WHO expressed an interest to work with GoB in the areas related to human health.

The Government of Bangladesh will work with these partners to develop full project proposals and will continue to seek additional international partners and funding for priority projects.

3.4 Development and capacity-building proposals and priorities

The successful implementation of the NIP in Bangladesh requires national capacity building for implementation of actions plans. These action plans are sometimes interrelated in such a way that they should be performed following a sequence; otherwise, the goal of environmentally sound management of POPs becomes difficult to achieve. As well, human and financial resources to enable implementation of capacity building activities will be required.

The successful implementation of NIP will depend mainly on management capacity building and technological infrastructure capacity building.

A. Management capacity building

1. Establishing a National POPs Management Authority

The National Implementation Authority (NIA) will be formed by the Ministry of Environment and Forests (MoEF) as the lead agency for NIP implementation. The National Focal Point of the Stockholm Convention (Director General, DoE) will be the coordinator of the NIA. NIA will comprise representatives of major stakeholders (e.g., DoE, DAE, Power Sector, DGHS, researchers, academicians and donor agencies). NIA will supervise the implementation of action plan and future planning of the activities related to POPs and for reporting the development to the Secretariat of the Stockholm Convention. It will act as an umbrella institute to co-ordinate activities of different organizations. Successful implementation of NIP activities will depend on proper co-ordination among different organizations and stakeholders.

2. Promulgation of new law or amendment of existing law for environmental sound management of POPs

National legislation needs to be changed and modified either by promulgating new law or by amendment of the existing law to comply with the requirements of Stockholm Convention.

3. Assigning responsibilities to different institutions for carrying out different action plans

Institutions currently dealing with POPs (i.e., possessing or using POPs, or controlling use of POPs) must have clearly defined responsibilities.

4. Development of human resources

The staff in regulatory and implementing authorities (e.g., DoE, PWDB, DAE, different laboratories) will need training to enable them to enforce new regulations and guidelines and environmentally sound management of POPs.

B. Technological infrastructure capacity building

The economic conditions and technical advancement of Bangladesh are inadequate for implementing the NIP successfully within the timeframe as stated in the Convention. Bangladesh will require international assistance for capacity building in the arena of technological infrastructure development, whether it utilizes facilities external to Bangladesh or develops domestic capacity (the latter being preferable except, perhaps in the case of destruction technology for some POPs).

1. Establishment of laboratories with the capability to analyze POPs compounds

A National POPs Monitoring Network (NPMN) is needed to enable environmental monitoring of POPs residue and analysis of POPs compounds. The current level of research and monitoring is insufficient for assessing the trend of POPs compounds in the environment and its adverse affects on human health. The network should be designed with broader utility (all toxic and hazardous chemicals) in mind, with capacity for POPs analysis a near-term priority.

2. Development of safe storage for collection of POPs wastes

Environmentally sound storage of Annex B POPs pesticide (DDT) in Bangladesh is an important task. This will require repacking in proper containers and development of new storage facilities. The same applies to PCB wastes, including waste equipment.

3. Development of POPs wastes destruction and/ or decontamination facilities

Development of POPs wastes destruction and/ or decontamination facilities is important. Bangladesh does not currently have any commercial destruction facility in place or experience with toxic or hazardous waste destruction. It will need assistance and resources to enable it to determine the appropriate solutions for POPs wastes (PCBs in particular). Bangladesh lacks the overall context for POPs waste management at this time (i.e., a national waste management system). It will likely need assistance to establish such a programme, including infrastructure and training in its operation and maintenance.

C. Cost & Funding on Priority Proposed Projects in NIP

An initial costing of the prioritized major proposed projects that have been identified for execution under the Bangladesh NIP is as follows:

1. National POPs Management Capacity Building
2. Awareness Raising Program
3. Improvement of Existing Legal Framework on POPs
4. DDT Management
5. Management and Implementation of PCBs Phase-out
6. Environmentally Sound Management of Ship-breaking

7. Minimization of U-POPs Releases Through BAT and BEP
8. Identification and Remediation of POPs Contaminated Sites
9. Environmental Monitoring of POPs

Budgetary mechanism

Aims and purposes
Budgetary scope
Methodologies adopted
Assumptions and related risks

Aims and purposes:

The overall aims and main purposes of preparing the NIP Projects Costing can better be described as under:

- Forecast and identifying the potential financial implications of the expected projects as identified by the POPs NIP consultants' regarding the management of POPs in Bangladesh;
- Serving as a basis for further efforts to strengthen the national system for management of POPs through involvement of all concerned parties;
- Identifying needs for technical and financial assistance for mobilizing resources available from international and bilateral sources; and finally,
- Facilitating communication and dialogue with governments and other bodies that best describes country's requirements especially from the financial points of view to phase out POPs from Bangladesh.

Budgetary scope:

The projects identified by the NIP technical consultants are characteristically descriptive and superficial. It occupies a particular niche in research in which systems or habitats are described rather than analyzed. Therefore, the technical consultants projects identification are not without merit but there seems to be no overall direction in respect of projects conceptual designing that should help identifying the targeted costing. With this in mind, the proposed budgetary efforts are to materialize only as a means of addressing the above weaknesses and filling the gaps to complete the draft NIP for Bangladesh in terms of projects financing within the existing economic framework. In other words, the scope of these budgetary efforts are to be counted as an indication only to help finding potential donors and to provide users an idea in respect of required financial means to implement the NIP projects.

POPs NIP Project arranged workshop at IDB Bhaban (4th Floor) Conference hall on 6-7 July 2005. The workshop was well attended and well received. It was advised in the workshop that the NIP projects should explore ways to develop and build linkages with national and international research institutes, viz., Bangladesh Atomic Energy Commission (BAEC), ICDDRB, and other potential private sector agencies e.g., the association of journalists' forum, private universities in addition to public universities that have laboratories with chemical research facilities etc. But the NIP intended prioritized projects, by at large, have to win the hearts and minds of the people in the government sector because of the nature and magnitude of the problems.

Methodologies adopted:
It is important to note here that the projects budgets are mostly based on the **"worst case scenario"** concept, meaning maximum cost using the most expensive technology. The concept has been applied in all the projects budgetary forecasts where the technology choices and selections of methodologies are duly to be intervened during the time of actual project implementation. Therefore, the budget has to be necessarily re-defined once the volume of the materials to be disposed off is determined and the choice of technology is finalized. Also all future inputs should seek to develop the skills necessary in this regard.

Assumptions and related Risks:
It is very difficult to decide or finalize the technology to be adopted at this stage until the volume or percentage of POPs contamination in the environment is analyzed and explained. The approach adopted to make budgetary provisions require future amendments that need to be considered and incorporated in due course while implementing the projects. It is unlikely that all the project constraints have been correctly appraised and targeted while preparing the costing phase of the projects budgets.

Moreover, it is true that the technology available worldwide for the proposed projects have never been tested in Bangladesh and the potential impact of the technologies are not known. Therefore, while implementing the projects, the merits of the identified technologies shall need to be verified by the international and local experts in the field. It is also important to know to what extent environmental damages have emerged by the POPs chemicals, and its level of contaminations in Bangladesh that adversely affects the livelihoods of the Population. Certain activities also need to be tested at pilot scale before scaling them up to implementation at the national level.

There is no doubt that an enhanced research capability is needed by the DoE, being the focal establishment responsible for the environmental management in Bangladesh, or by other few notable laboratories in the country, but it is difficult to provide a clear indication as this stage to how sustainable funding for research in this field might be obtained. A clear understanding of incentives and how incentives may be directed to the implementing partners or projects collaborators are also critical to fostering sustained industrial process change.

The NIP projects costing strategy also recognizes that once the stockpiles, products and articles containing POPs are identified, these stockpiles need to be managed in a safe, efficient and environmentally sound manner. This is because the Stockholm Convention desires wastes containing POPs to be handled, collected, transported and stored in an environmentally sound manner. Their toxic content needs to be destroyed. The Convention does not allow recovery, recycling, reclamation, direct reuse or alternative uses of POPs, and it prohibits their improper transport across international boundaries.

The Stockholm Convention also recognizes the important role that NGOs can play in promoting the protection of health and the environment from POPs chemicals and wastes. Therefore, much consideration has been given whenever possible to co-opt NGOs and other private bodies to sharing the project activities. The reasoning behind this is that the last decade has seen an increase in partnerships and alliances among various stakeholders, including the public and private sectors. The public sector in our country is coming to realize that the private sector is a driving force behind growth and that it should not be overlooked when poverty alleviation initiatives are being formulated.

Another important issue that has been counted is that the NGO clients are generally poor and hence the NGOs have better information about the needs of the poor and the marginalized. Especially, women (including children) get particular attention amongst the NGOs and therefore, they must significantly be involved in the NIP prioritized projects, especially in the U-POPs (*Dioxins and Furans*) elimination project, since the women and children are the most affected population in this regard. The U-POPs minimization project is particularly expected to work with private marketing outlets or NGOs to help

engage, and popularize use of low cost stoves as originated by the BANSDOC and to implement bio-gas plant projects familiarization at rural community level to reduce release of dioxins and furans in the environment. However, the project will only impact upon the poor if the above-mentioned low cost stoves or bio-gas plants (BATs) are taken up by the poor. The risky assumption is that a sector agent (NGOs) will disseminate the technology and must be convinced that the technology will be profitable and require external assistance so that the poor will benefit directly or indirectly. However, the truth is NGOs have the strong capacity and net work for BATs acceptability and awareness disseminations among the wider stakeholders both vertically and horizontally. There is high potential for continuation of the use of BATs technology and marketing services including further improvement and maintenance supports by the NGOs through their various program.

Fulfilling the obligations of the Stockholm Convention an approximate funding requirement has been summarized and presented in **Table-67**.

Table 67 below shows preliminary resource estimates for actions and timetable for NIP implementation.

Sl. No.	TABLE - 1 Proposed Priority Projects	Key Implementing Agencies	Execution Period (year)	Approximate Amount needed in US$ Project Component Costs	 Total costs (Key Project)
1	National POPs Management Capacity Building	DoE, MoEF; DAE, MoA, BPDB, MoPEMR	5		8,698,805
1.1	Component A: Establishment of Network (NPMN) Office (at DOE)			980,357	
1.2	Component B: Establishment of NPMN Laboratory (at DOE)			1,647,734	
1.3	Component C: Capacity Enhancement of Existing Laboratories			5,028,571	
1.4	Component D: Training & Development (Lab. Skill Development)			746,429	
1.5	Component E: Information Exchange among Local, Regional & Global Networks			295,714	
2	Awareness Raising Programme	DoE, MoEF; DAE, MoA, BPDB, MoPEMR	5		6,828,600
3	Improvement of Existing Legal Framework on POPs	DoE, MoEF; DAE, MoA, BPDB, MoPEMR	2		748,500
4	DDT Management	DoE, MoEF, MoHFP; DAE, MoA	5		3,965,145
4.1	Phase-1: Environmentally Sound Storage & Training		2	740,145	
4.2	Phase-2: Research on DDT: DDT use in Fish, and Alternatives of DDT for Vector Control		2	725,000	
4.3	Phase-3: Disposal / Destruction of DDT		1	2,500,000	
5	Management and Implementation of PCB Phase-out	DoE, MoEF; BPDB, MoPEMR	15		59,987,300
5.1	Phase-1: Preparatory Phase		2	749,200	
5.2	Phase-2: Analysis & Determination of PCB contamination (5 Years)		5	9,938,000	
5.3	Phase-3: Clean-up & Transformer Decontamination (5 Years)		5	29,300,100	
5.4	Phase-4: Final Disposal / Destruction (3 Years)		3	20,000,000	
6	Environmentally Sound Management of Ship-breaking	DoE, MoEF; BPDB, BIWTA	5		5,852,880
	Phase 1: Development of Industrial Safety in Ship-Breaking		3	702,880	
	Phase 2: Management of Hazards in Ship-Breaking		2	5,150,000	

7	Minimisation of U-POPs release through BAT & BEP	DoE, MoEF; MoPEMR	13		45,854,700
7.1	Phase-1: Preparatory Phase		3	746,645	
7.2	Phase-2: NGO Component Delivery Phase		5	9,880,020	
7.3	Phase-3: Management of U-POPs through BATs		5	35,228,035	
8	Identification & Remediation of POPs Contaminated Sites	DoE, MoEF; DAE, MoA, BPDB, MoPEMR	8		9,479,656
8.1	Phase-1: Contaminated Sites Identification		1	731,216	
8.2	Phase-2: Analysis and Pollution Determination		2	748,440	
8.3	Phase-3: Remedial Measures		5	8,000,000	
9	Environmental Monitoring of POPs	DoE, MoEF; DAE, MoA; BPDB, MoPEMR, DoF, MoFLS	5		4,429,000
9.1	Phase-1: BIOMONITORING		5	2,984,000	
9.2	Phase-2: Physical Environmental Monitoring		5	745,000	
9.3	Phase-3: Follow-up Management Action		5	700,000	

Project -1

Title: National POPs Management Capacity Building Project

Objective: To create and maintain an ongoing infrastructure for POPs implementation by the GoB in order to meet the obligations of the Stockholm Convention

Budget: US$ 8.7 Millions initially for 5 years

Project overview and budgetary justifications:

Bangladesh needs to design, build and keep the toothed-wheel for POPs chemical management, which ensures that their impacts to health and the environment are prevented and minimized. Such a toothed-wheel must be an active part of the management apparatus that contributes to generate responsible-use attitude and thus boosts the countries sustainable development. Current status reveals that the information produced on chemicals is used mainly for the purposes of those who generate it; it is scattered and is not useable as a tool for global approach. But the availability of reliable and accurate information in an adequate format is very much essential for a timely decision making. Therefore, the budget for above project tiled *"National POPs Management Capacity Building Project"* has been made considering a number of key issues.

The lack of institutional and technical capacity, knowledge, skills etc. can be of crucial barrier to implementing and materializing the Conventions objectives. Bangladesh capacities for chemical management are insufficient due to short of skilled human resources, budgetary limitations, and due to limited articulation between organizations. Among the most important factors are lack of proper, adequate tools and equipment, analytical capacity related to organic pollutants, and insufficient control measures etc. are the areas that need immediate attention and action. Therefore, due consideration has been given on capacity building issues while preparing this project budget. However, no new or radical approach has been suggested, but greater capacity building has been expected to be realized by exploring more of what are already being carrying on. With a view to achieving the objectives spelled out above, the budgetary allocations have been provided to address the following two significant inadequacies of specific parts of the operation with regard to POPs management.

- **Analytical Capacity** - The laboratories of DoE, DAE or other mentionable labs are not equipped to undertake analysis of POPs chemicals. These are not capable of analyzing for POPs impurities in active ingredients at a sufficient low level of concentration. It would require upgrading of analytical equipment and training of analysts to have the capability.
- **Research and Monitoring Capacity** - There is a lack of monitoring for POPs pesticide residues in plants, soil, water and biota on a systematic basis. While there exists some research studies by academics but these tend to be of specific areas for a specific time. However, there was never any systematic monitoring program carried out by the DoE or DAE. Therefore, trained personnel to undertake activities in this regard need to be developed with utmost consideration.

The estimated budget for the whole project is **US$ 8.7 Millions** (62.46 Crores Taka approx.) approximately for an initial period of 5 years expected to be allocated from state contribution and potential donor(s) sources need to be identified.

Project -2

Title: Awareness Raising Programme

Objective: To raise awareness of POPs problems in the country and to mobilize stakeholder and political support for finding and implementing solutions

Budget: US$ 6.83 Millions for 5 years

PROJECT OVERVIEW AND BUDGETARY JUSTIFICATIONS:

There is a widespread need for greater awareness and understanding of the provisions of the conventions and of the benefits of joint activities at both the national and regional levels. It is necessary to launch and maintain an effective, ongoing awareness campaign that can reach out to politicians, stakeholders, opinion leaders, NGOs, affected communities, farmers, etc. to make them aware of POPs problems and gain their support for actions that will be necessary to combat these problems. In Bangladesh, however, communications programmes have a proven record in bringing about behaviour change in health and environmental projects. The awareness raising programme shall prepare and disseminate high quality information on POPs to a variety of stakeholders in a targeted fashion to ensure maximum dissemination via the most effective means for the target group. This will be in the form of workshops, seminars, printed material, pamphlets, radio/TV, engagement of the mass media of the country, etc.

Overall, this project budget has been drawn up giving consideration to appropriate resource provision on all possible communication and dissemination media to raise POPs awareness. The budget for the whole project is estimated at approximately US$ 6.83 Millions (47.8 Crores Taka approx.) for a period of 5 years.

Project -3

Title: Improvement of Existing Legal Framework on POPs

Objective: To set out a strategy for the sound management of chemicals (including POPs) in Bangladesh

Budget: US$ 0.748 millions for initial 2 years period

PROJECT OVERVIEW AND BUDGETARY JUSTIFICATIONS:

This project would assist the GoB in establishing a legal and policy framework for the sound management of chemicals in Bangladesh. The draft National Implementation Plan (NIP) recommends that there are a number of laws need to be reviewed and amended for their appropriateness to address various environmental issues and fill the gaps. Also there is need to develop necessary new laws to be enacted to enable a comprehensive legal framework on chemicals and chemical wastes in Bangladesh. While existing laws address certain chemicals, they do not provide a holistic framework for dealing with all chemicals that may pose an environmental or human health threat in a systematic way.

According to the NIP legal consultant study report[45], it is very clear that although we have some laws on environmental management but specific legal instruments in application of the framework law on environmental management do not either exist or yet to be elaborated. Furthermore, no national standards on quality of environmental compartments such as water, soil, air and biota exist. In the USA, for example, 'any person, company or organization that purchases or controls a pesticide is legally responsible for proper use, handling, storage, and disposal. It is illegal to bury burn or discard a pesticide or its container in a manner inconsistent with instructions found on the label'. We may also need such type of very precise rules/regulations regarding POPs. This is important for several other reasons as well. A pesticide that can no longer be used must be disposed in a way that protects human health and the environment. The longer a pesticide is held in storage the greater the risk of spillage that will cause injury to people or contamination of the environment. Old pesticides neglected or in poor storage, may be exposed to children, livestock and pets causing serious injury or death. Containers may corrode causing leaks. Fire or flooding may cause pesticide releases that can contaminate soils and groundwater leading to costly cleanup. When *hazardous waste* is dumped indiscriminately, spilled accidentally or managed improperly, it can cause severe health problems, even death and poison water and land for decades.

With a view to achieving the above mentioned targets, this project is estimated to cost about US$ 0.748 Millions approximately (5.24 Crores Taka approx.).

Project -4

Title: DDT Management

Objective: Elimination of DDT stocks and their destruction in an environmentally sound destruction facility, as soon as suitable alternatives are confirmed to exist or are developed and to prevent illegal importation / use of DDT in Bangladesh

Budget: US$ 3.97 Millions for 5 years

PROJECT OVERVIEW AND BUDGETARY JUSTIFICATIONS:

In Bangladesh, DDT was never formally registered for use. Nevertheless, it has a history of use in disease vector control as well as in agriculture where its use was reportedly widespread, including on banana, potato, and cotton fields. During the inspection in 2005, as a part of the Bangladesh preliminary national pesticides inventory, it was revealed that an amount of approximately 500 MT of obsolete DDT remained as stockpile mainly in Medical Sub Depot warehouses of the Directorate of Health Services at Chittagong region in poor condition (GoB, MoEF, 2005c) that require destruction. However, there is currently no environmentally sound destruction facility for DDT in Bangladesh. Therefore, the above titled project budget is aimed to cover the issues mainly the following:

- Ensuring an interim / temporary environmentally safe storage facility for DDT stockpile;
- Repackaging and labelling obsolete DDT and wastes for transferring those to the above interim storage;
- Shipment of DDT stockpile to a suitable country with the environmentally sound destruction facility;
- Delivery training to the customs officials in detection of DDT at import stage to prevent smuggling, and elimination of illegal uses / trade of DDT;
- Ensure research to determine resistance of vectors to POPs alternatives and especially to DDT, although there are limited capacity at present for research regarding effectiveness of DDT alternatives, in particular *kala-azar* and *malaria* which pose a threat to portions of Bangladesh population. Based on the outcome of research on vector resistance, Strategies for DDT use and /or phase out need to be developed and implemented.

With a view to achieving the above-mentioned objectives, the project budget has been estimated for amount of US$3.97 Millions (BDT 27.75 Crores approximately).

Project -5

Title: Management and Implementation of PCBs Phase-out

Objective: To prepare a national strategy for the safe management and phase-out of all PCB uses in Bangladesh and assure their safe destruction

Budget: US$ 60 Million for 20 years

PROJECT OVERVIEW AND BUDGETARY JUSTIFICATIONS:

The main period for the PCB use has been between 1960 and 1985-world-wide. As the PCB containing liquid costed about 5 to 7 times more than oil (transformer filled with it about double the price of an oil-filled one) the majority of the transformers are filled with oil. The good electrical properties of these PCB containing liquids and the circumstance that it is not inflammable led the today's owners of PCB containing transformers and capacitors to their decision for them. Furthermore a lot of oil-filled transformers have been contaminated by using contaminated equipment for filling them up or during maintenance. It is known that waste PCBs can leak into groundwater under landfills. If consumed by drinking contaminated water, PCBs are carcinogenic, even in very tiny amounts.

Therefore, the above PCB management project will include development of a detailed overall management plan, draft legislation and near-term sampling of PCBs in waste oils, waste equipment, in-service equipment and oil reserves, initially using rapid assay kits or PCB test kits. This will be followed by more sophisticated analysis through improved laboratory capacity to determine the volume of contamination as indicated by the initial assay results. In addition, the management plan will include repacking and secure storage in suitable facilities, determination of destruction technology options including selection and implementation of an option.

With a view to achieving the above mentioned objectives but not limited to those, this long-term project budget gas been designed for an estimated amount of US$ 60 Million (BDT 419.76 crores approximately).

Project -6

Title: Environmentally Sound Management of Ship-breaking

Objective: To prepare a national strategy for environmentally sound ship-breaking in Bangladesh

Budget: US$ 5.852 Millions

PROJECT OVERVIEW AND BUDGETARY JUSTIFICATIONS:

At the end of their average 25-year life span, ocean-going ships are scrapped, primarily for their recyclable steel content. There are roughly 45,000 ocean-going ships in the world including container ships, general cargo ships and cruise liners. Each year thousands of ships are taken out of service and scrapped to retrieve their steel content. While ships have historically been demolished in shipyards all across the industrialised world, today, due to the high costs of reducing risk from accidents and toxic contamination in most industrialised countries, the industry has shifted to Asia. Now most of the world's ships are exported to developing countries like Bangladesh, India, Pakistan, and China. It is now a fact that two of the more infamous ship breaking yards are located in Alang (India) and Chittagong (Bangladesh). The reason is that the scraping work needs huge labour and capital; scrapping operations involve high risks and problems. So, the owners of the vessels prefer to sell out the unserviceable vessels to the countries where there is demand for scrapped steel and other items of old ships, where labour cost is relatively low and where there is less concern about hazards, toxicity and environmental pollution.

Ship-breaking (often referred to as ship scrapping) is a dirty and dangerous business. The cutting and removal of the steel structure itself is extremely hazardous, posing serious risks for the scrap-yard workers.

In Bangladesh, ship breaking is popularly known as 'beaching' which was started growing as a business during 1972 after liberation. However, ship-breaking was initiated in this area in 1969 and has now grown into a considerable industry occupying a large number of people, not only in the breaking process itself, but also in association to the processes of refining and material re-use. It is believed that more than 100,000 individuals earn for their livelihood from the scrapping activities of Chittagong. According to the draft National Implementation Plan (NIP) ship breaking is a significant industrial sector in Bangladesh. It meets about 80% of the nation’s need for iron and its economic contribution is considered very large as well. Currently, on an average 90 ships are being recycled annually through approximately 70 Ship-breaking Yards providing scrapping facilities into an area of about 10 km^2 starting from a point near 'Baro Awlia' under Sitakundu Police Station of Chittagong. All the yards are located on the beach of the Bay of Bengal.

Therefore, it is expected that training, information and awareness raising activities are essential components for providing occupational safety and health assurance needed in the ship breaking industry and these should be expanded with necessary legal/administrative backups as well. In this respect, budgetary commitment has been provided in the intended ship breaking project to deal with all the above-mentioned issues and this particular project budget has been designed for an estimated amount of US$ 5.852 Millions (BDT40.97 Crores approx.).

Project -7

Title: Minimization of U-POPs (Dioxins & Furans) Releases through BAT & BEP

Objective: Continually reduce and eliminate releases of Annex C POPs compounds from unintentional production.

Budget: US$ 45.8 Millions for 20 years

PROJECT OVERVIEW AND BUDGETARY JUSTIFICATIONS:

A wide variety of contaminants are to be found in our environment − in soil, sediments, water and air. Among those, dioxins are a family of 75 polychlorinated dibenzo-p-dioxin (PCDD) compounds and furans are a family of 135 polychlorinated dibenzo-furan (PCDF) compounds. These are two of the twelve Persistent Organic Pollutants (POPs) under the Stockholm Convention. Once released in the environment they travel long distances, they are deposited and they can become a part of the food chain. Their main way of contact with human beings is food, and in a lower proportion through inhalation and dermal absorbsion.

In Bangladesh, there is currently no legislation governing releases of U-POPs (dioxins, furans etc.). However, the preliminary national inventory identified leading and other sources to which *Best Available Techniques (BAT) and Best Environmental Practices (BEP)* shall need to be applied to reduce releases of these POPs. Based on consolidated results of dioxins and furans inventory conducted for each main category and sub-categories throughout the country, there were an estimated 485.81 g TEQ/a are released in 2005 to all environment compartments (air, water, products and residues).

One specific component that may be worthy of early development relates to cooking stoves. The draft National Implementation Plan for POPs for Bangladesh identifies household cooking as the largest source of dioxin and furan releases in the country. A targeted approach specifically related to cooking stoves could oversee the development of a strategy and pilot project to review past efforts to introduce new technology stoves, identify training and capacity development needs and prepare technology assistance documents. These concepts (BATs) of cooking stove and bio-gas plant have been considered while designing the project budget and allocation has been made for those under NGO component of the project.

Finally, with a view to achieve the above-mentioned objectives, an estimated amount of US$ 45.85 millions (BDT320.98 Crores approximately) is expected to be required over a period of 20 years for this project.

Project -8

Title: Environmentally Sound Management of Contaminated Sites

Objective: Reducing the risk of exposure to humans and the environment through identification and remediation, as warranted, of contaminated sites.

Budget: $9.48 Million (USD)

PROJECT OVERVIEW AND BUDGETARY JUSTIFICATIONS:

The chemical and allied industries are rapidly emerging as a key sector of economic development in developing countries. Their sustained development has been often hampered by generation of significant amount of toxic and hazardous wastes and waste water, especially of persistent organic pollutants. Persistent organic pollutants, by definition, are resistant to degradation in the environment. The resistance of the chemicals makes them survive in the popular biological treatment in the industrial sites as well as public sectors places and eventually cause serious environmental problems. This is more evident in Bangladesh where necessary infrastructure and capabilities to face these issues effectively are absent or inadequate or inappropriate. A wide variety of contaminants are suspected to be found in its environment − in soil, sediments, water and air. As a result there is need to understand and to tell when these contaminants are at concentrations that may be harmful. In this connection, environmental guidelines which are constantly being developed and reviewed for use in the developed countries and these may be followed here to reflecting improvements in the understanding of toxicity and risk posed by hazardous substances. However, it is important to ensure that the guideline value to be used is current or up to date. Reducing the risks from POPs is no simple task, but it can and must be done. The key is promoting shifts to alternatives, both chemical and non-chemical. Therefore, in addition to managing contaminated sites, alternatives to POPs can be encouraged through voluntary programmes, public awareness campaigns, economic incentives, restrictions, and as a last resort, bans or use or production.

In consideration to the above, the project has been categorised broadly into three phases, where *Phase-1* is expected to cover the activities mainly on identifying and classifying the suspected contaminated sites of Bangladesh. *Phase-2* shall deal with the analysis, pollution determination, reclassification, and evaluation parts of the project. Finally, depending on the results from the earlier phases, *Phase-3* shall cover the costs of taking remediation measures for the contaminated sites. Thus, the overall project budget has been estimated for an amount of US$ 9.48 millions (BDT66.36 Crores approx.).

Project -9

Title: Environmental Monitoring of POPs

Objective: To build capacity for and engage in research and monitoring of POPs and POPs alternatives in Bangladesh such that national policies and objectives for POPs, and specific actions within the NIP can be supported by reliable research and monitoring that achieves international standards.

Budget: US$ 4.43 millions for 10 years

PROJECT OVERVIEW AND BUDGETARY JUSTIFICATIONS:

The main local sources of release of POPs are agriculture, industry and wastes (both municipal and industrial), but no detailed quantitative estimates of such uses exist. POPs destroy plants such as mangroves and cause endocrine disorders and cancers in man. In terms of environmental and health risks, some recent overseas studies on water quality and food show high and dangerous concentrations of some POPs. The socio-economic component of the POPs NIP project emphasized that there is a strong need to engage in several researches to address many social and economic issues in Bangladesh in regard to potential exposure of POPs in human and its food chain (bio-monitoring) as well as in other physical environmental factors.

Bio-monitoring is a population based laboratory analysis of blood, urine, serum, saliva or tissue (such as body fat) for the purpose of identifying the presence of certain chemicals in the human body. Exposure monitoring can be used to determine whether a person has been exposed to a chemical that has been taken up into their body. This information can be helpful in determining whether chemical exposures are causing illness. In addition, policy makers need to know about which toxic substances accumulate in human tissue and at what levels to make decisions on environmental and public health issues. It is, therefore very important to know to what extent environmental damages have emerged by the POPs chemicals, and its level contaminations in Bangladesh that adversely affects the livelihoods of the Population. In addition, the capacity for follow-up management actions needs to be strengthened in the near term which will lead to enhance the overall POPs monitoring capacity within Bangladesh. This will further help effectively to eliminate the source of POPs exposure, to enable promotion of the safe and efficient use of POPs alternatives, to ensure compliance and enforcement of POPs legislation (e.g., standards etc.).

Considering all the above issues and to justify an integrated picture to facilitating the overall sustainable environmental planning in Bangladesh, an estimated amount of US$ 4.43 Millions (BDT31 Crores approx.).

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Annexes

Annex 1. Methodology used to develop NIP
Annex 2. Endorsement documents
Annex 3. List of stakeholders consulted and record of consultation.
Annex 4. Supporting information on chemicals (Detailed information on POPs, if desired in addition to website referral)
Annex 5. Legal Regime Final Report.
Annex 6. Pesticide Assessment–Final Report
Annex 5. PCB Assessment–Final Report
Annex 6. Dioxins and Furans Assessment–Final Report
Annex 7: Stockpiles and Waste Management– Final Report.
Annex 8: Non-Governmental Organizations working on chemicals
Annex 9: Bangladesh public enterprises
Annex 10: International project proposals for Bangladesh NIP implementation