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International POPs Elimination Project

*Fostering Active and Efficient Civil Society Participation in
Preparation for Implementation of the Stockholm Convention*

POPs Hotspots in Bangladesh

Environment and Social Development Organization-ESDO

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About the International POPs Elimination Project

On May 1, 2004, the International POPs Elimination Network (IPEN <http://www.ipen.org>) began a global NGO project called the International POPs Elimination Project (IPEP) in partnership with the United Nations Industrial Development Organization (UNIDO) and the United Nations Environment Program (UNEP). The Global Environment Facility (GEF) provided core funding for the project.

IPEP has three principal objectives:

- Encourage and enable NGOs in 40 developing and transitional countries to engage in activities that provide concrete and immediate contributions to country efforts in preparing for the implementation of the Stockholm Convention;
- Enhance the skills and knowledge of NGOs to help build their capacity as effective stakeholders in the Convention implementation process;
- Help establish regional and national NGO coordination and capacity in all regions of the world in support of longer term efforts to achieve chemical safety.

IPEP will support preparation of reports on country situation, hotspots, policy briefs, and regional activities. Three principal types of activities will be supported by IPEP: participation in the National Implementation Plan, training and awareness workshops, and public information and awareness campaigns.

For more information, please see <http://www.ipen.org>

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POPs Hotspots in Bangladesh

In Bangladesh, the POPs hotspots are not yet detected and marked in a proper manner. This report is the first attempt at documenting information on the POPs generating practices and the contaminated sites in the country. The information presented here can be seen as a tip of the iceberg. There is a need to conduct further investigation on the issue and to come up with a comprehensive documentation of the POPs hotspots in Bangladesh. This shall be critical in taking remedial measures.

POPs Hotspots are best described as POPs-contaminated sites within a country, or a country specific pattern of activities or practices that release POPs into the environment, or an existing or proposed facility that could be a significant source of POPs releases.

In the process of collecting information on the existing hotspots in the country, Environment and Social Development Organization-ESDO identified PCBs, Dioxin and Furans generating sites/practices. Some of these include, PCBs-containing equipment such as the power generator and capacitors, ship breaking sites, waste dumping/ landfills, waste incinerators, timber, dyeing, PVC/plastic industry, and others. In addition, there are DDT stocks present at several locations contaminating the environment.

The major concentration of these Hotspots in Bangladesh was found in Dhaka city and the surrounding areas namely Gagipur, Norshindhi, Narayanganj, Chittagong, Khulna, Sylhet and Barishal.

The twelve POPs which are the subject of this report either arises from industries or are used in agriculture and disease vector control. Out of these nine are pesticides used on agricultural crops and/or for public health vector control. By the late 1970s, all of the nine pesticides and PCBs had been either banned or subjected to severe use restrictions in Bangladesh.

BACKGROUND

Agriculture is the main occupation of the people employing 65.5% of the labor force. The use of POP pesticides in agriculture dates back to the mid 1950s in Bangladesh (the erstwhile East Pakistan) which started with the application of endrin in modern rice cultivation in around 1955. Three metric tons of endrin was received in 1955. Subsequently other pesticides were also received.

All the pesticides registered or legally marketed in Bangladesh are imported mostly from China, India, USA, U.K., and Japan. Bangladesh does not manufacture any pesticide active ingredients. However, Bangladesh Chemical Industries Corporation (BCIC) manufactured DDT until 1992. Moreover, some agricultural pesticides, aerosol and mosquito coils are locally formulated out of the active ingredients imported from abroad.

The pesticides procured were centrally stored in Central Stores at Shyambazar and then were distributed to the districts, where they were received by plant protection inspector (PPI) of

Directorate of Plant Protection (DPP) and stored in District Stores and then were distributed to thanas, where they were received by Plant Protection Assistant (PPA) and stored in Thana Stores. From Thana the pesticides were distributed to the farmers free of cost until 1975 and then at 50% subsidy up to 1979. The PPI in the previously greater districts used to maintain buffer stock of pesticides received from Bangladesh Agriculture Development Corporation (BADC) and distribute them down to the Thana under the privatization of pesticide trade in 1979. Even after privatization of pesticide trade in 1979, PPI used to receive buffer stock of pesticides from the DPP till 1982. Following the merger of DPP with DAE (Department of Agriculture Extension) in 1983 Deputy Director/Assistant Director of Agriculture in the Districts used to receive and distribute buffer stock of pesticides.

DDT is a pesticide, which, in accordance with the Pesticide Ordinance of 1971 and Pesticides Rules, 1985, must be registered. But in practice it was never registered and thus no record of DDT is available with the Plant Protection Wing (PPW) or Pesticide Association of Bangladesh (PAB). DDT was mostly used in public health particularly in mosquito eradication program, which started in 1960. DDT was then supplied by the World Health Organization (WHO). In mosquito control program formal use of DDT started in 1965, when every house was sprayed twice a year @ 2 gm per sq. meter. Later on when the mosquito population was significantly reduced, DDT was applied @ 1 gm per sq. meter as “Focal spray” where a significant population of mosquitoes was observed. Gradually the Focal spray was reduced, and was used only in indigenous cases. In around 1992/93 use of DDT was discontinued, and the stock remained and is used only in serious outbreak in some focal areas. For such use, DDT is still kept as buffer stock in different districts

Bangladesh also has a few proven mineral resources. The country has enormous deposits of natural gas. Coal deposits have been found and efforts are under way to exploit them with international assistance. Electricity is produced by both thermal and hydroelectric process. The total generation of electricity amounted to 13,204 million kilowatt hours in 2000. Limestone, the basic raw material for the production of cement, has been found in some places and cement factories are being set up for their utilization. Other minerals found include hard rock, lignite, silica sand, white clay, etc.

Among the industries jute and cotton textile, pulp and paper, sugar, cement, chemicals, fertilizers and tanneries are important. Other notable industries are engineering and ship building, iron and steel including re-rolling mills, refinery, paints, colors and varnishes; electric cables and wires, electric lamps, fluorescent tube lights, other electrical goods and accessories, matches, cigarette, etc. Among the cottage industries, handlooms, carpet making, shoe making, bamboo and cane products, earthenware, brass and bell metal products, bidi, etc. are important. The industrial sector contributing about 15.40% of the GDP, is dominated by Jute processing followed by cotton textile, cigarettes and garment industry.

HOTSPOT MAPPING

POPs Pesticides Stockpiles

Legal provisions ban use and manufacture of POPs pesticides. However, stocks of Dieldrin 18/20EC (7150 Lbs) and Heptachlor 40WP (977 Lbs) were reported in the stock books at the following stores/ godowns: Thana Store, Chhagalnaiya, Feni; Plant Protection (PP) Store, Rajshahi; Thana Store, Kashba, Comilla; Adamdighi Thana Store, Bogra; Santahar PP Store, Naogaon; PP Store, Barisal; PP Store, Jessore; PP Store, Khulna; and Thana Store, Bheramara, Kustia.

However, an inspection of these sites did not reveal any stock except 2,700 Lbs Dieldrin found in stock at Santahar PP Store, Naogaon. At PP Store, Jessore, 150 Lbs of Dieldrin 20EC has been reported in leakage loss and at PP Store, Barisal only some remnants and 10 empty drums of Heptachlor 40WP were found. Other than these, no stocks were found. Authorities claim that the other stocks may have been either destroyed or buried.

Also there are reports of 13668 Kg of obsolete pesticides lying in Department of Agricultural Extension (DAE) at their different offices/stores. The records reveal that at present there is no stock of obsolete POP pesticides at any level of DAE. But there are many containers and remnants of unidentified pesticides and there is a possibility that some of these could be of POP pesticides. These are located at Dhaka, Chittagong, Rajshahi, Khulna, and Barisal.

In addition, empty packaging material for old pesticides could still be available. Also the empty godowns in different locations of the POPs pesticides and their surroundings would still be contaminated.

DDT Stockpiles

DDT was the only pesticide produced in Bangladesh by the Bangladesh Chemical Industries Corporation (BCIC) established DDT Plant at Barabkubndu in Sitakundu of Chittagong in 1966. In 1982, this Plant was renamed as Chittagong Chemical Complex (CCC). The production of DDT by CCC was officially stopped on 1 December 1991 but practically production was discontinued after 1992. During this period (1966 to 1992) DDT plant/ CCC produced a total of 7706 MT of DDT Technical, of which 7604.49 MT was formulated into 12003.17 MT of 75% DDT. Out of its total 75% DDT formulations, 11,793.27 MT was sold to Health Directorate for Malaria eradication program.

Surprisingly, DDT, the most commonly used POPs pesticide in Bangladesh particularly in public health was never registered.

There is 101.69 MT of DDT technical in stock in the country. In addition, 32.037 MT of Microcell/ Wassalom raw material of DDT production are in stock and stored in the godown. Another 209.90 MT of 75% DDT formulation was left in stock, which was distributed, to Department of Health Services (DoHS). As per the records, a total of 12.789 MT of DDT 75WP

are still available as stocks in district reserve stores/ upazila project offices of Malaria Vector Borne Disease Control, DoHS. From these stocks, the required amount of DDT is supplied to Malaia and Kalazar prone areas for their use against vector. The table below shows the location of these stores and the quantity in stock at each of the location.

S.No.	District	Location of Stock of DDT	Number of Bags	Quantity in Kg
1.	Rajshahi	Godagari Upazila Health project	69.5	2979
2.	Madaripur	Shibchar Upazila Health project	44	1751
3.	Barisal	Gouranadi Upazila Health project	42	1428
4.	Pirojpur	Bhandaria Upazila Health project	06	240
5.	Noakhali	Chatkhil Upazila Health project	05	170
6.	Rangamati	District Reserve Store	06	300
7.	Chittagong	Hathazari Upazila Health project	10	475
8.	Kurigram	District Reserve Store	159	5406
9.	Bhurungamari	Bhurungamari Upazila Health project	01	40
TOTAL			342.5	12,789

In 1983/84 under ADB loan, 500 MT of DDT was imported but due to substandard quality the entire stock was unaccepted by DoHS and thereafter remained unused at the Medical Service Department (MSD) godowns at Chittagong. Upon inspection, 482.904 MT in 182,000 boxes held in 4 MSD godown were found.

Cumulatively, 495.694 MT of DDT exist in the stores/ godowns as stock in different parts of the country. This includes DDT Technical 101.69 MT, DDT 75% WP 9local) 12.789 MT, DDT 75 WP (imported) 482.90 MT, DDT 5 Kg and another 32.037 MT Microcell/ Walsom raw material for DDT production.

All these locations are a potential hotspot and the conditions in which these stocks are stored need to be examined. If not properly stored, these are a serious threat to those inhabiting in the vicinity as well as to the environment.

The BCIC Chemical Complex, site of DDT plant at Barbakund, Chittagong itself stands as a hotspot. The years of production would have been responsible for contaminating the site as well as the surroundings. There is also 32 MT of microcell (Wassalom DDT raw material) stored in this abandoned plant.

PCB-Containing Equipment

There is no regulation of handling of the equipment with PCBs, disposal of the equipment with PCB that is out of use and of the waste contaminated with PCBs, transportation of PCBs waste and equipment contaminated with PCBs and banning of PCBs.

PCB compounds are still in use in Bangladesh usually in closed systems (as dielectrics in transformers and capacitors). These equipments hold the potential to contaminate the environment in its vicinity and can be rightfully categorised as POPs hotspots.

Bangladesh Power Development Board (BPDB), Dhaka Electric Supply Authority (DESA), Dhaka Electric Supply Company (DESCO), Power Grid Company of Bangladesh (PGB) and Rural Electrification Board (REB) have 2,481 power transformers, 3,74,132 distribution transformers and 77 oil circuit breakers (OCB) spread over 425 locations throughout the country and contain huge quantity of oils (over 1,07,473 MT). The PCB content in these is not known. All of these 425 locations should be identified as potential POPs hotspots since they could be capable of releasing POPs to the environment.

Upon surveying 1163 transformers, 423 were found to contain 24 different brands of transformer oil and others with unknown contents. Reference information confirms that Askarel and Sovtol contain PCBs. None of the transformers have the record/sign that contain PCBs. Four transformers contained oil of Askarel brand with the total oil quantity estimated at 15,690 Kg and another 22 contained Sovtol-10, the oil quantity being 31,982 Kg. The PCB content is not known.

It was also found that 741 of these 1163 transformers have been fabricated before 1990 while 267 have been fabricated during 1991 to 2000 and the rest after 2000. Older transformers are likely to have PCBs. The pre-1990 transformers contained 11,442 Kg of oil of the trade names Askarel and Sovtol-10. Post-2000 makes contained 36,230 Kg of oil from these two brands alone.

As the transformers are living servant to the power supply system, and the dielectric capacity is monitored, a portion of transformer oil is kept as reservoir for retro filling and subsequently a portion becomes waste. Besides, the power stations use a reasonable volume (over 3800 MT) of lubrication oil. This may also be potential reservoir of PCBs.

If estimates are made using reference guidelines of UNEP, the total quantity of PCBs in oils and waste oils in equipments can be estimated as 51,655.50 Kg and 4,453 Kg respectively.

This equipment is often responsible for contamination of sites caused due to leaks and damaged equipment. The sector being so vast, monitoring is almost impossible.

PCB Stockpiles

In addition to these, there are the stockpiles of PCBs, which largely comprise of usable equipments with PCBs that are not in function but are kept as the stockpile in case of damage to the operating facility, as well as the stockpiles of liquid with PCBs as reserve. Another source is those transformer and capacitors with PCBs that are obsolete and are not anticipated for further use.

The obsolete transformers are stored either in the storehouse or in open places. According to the Bangladesh Power Development Board there are six storehouses in Bangladesh but because of inadequate space huge numbers of obsolete transformers are dumped in the open.

PCB Contamination Sites

Contamination sites include, besides the locations where these equipment are installed or stored, the workshops where these equipments are repaired, overhauled, dismantled or retro-filled. There is one central, two regional and four zonal workshops catering to the power sector. These include: Central Equipment Repairing Shop, Bangladesh Power Development Board (BPDB), Tongi, Gazipur; Zonal Workshop, BPDB, Tongi, Gazipur; Zonal Workshop, BPDB, Bogra; Zonal Workshop, BPDB, Jessore; Zonal Workshop, BPDB, Chittagong; Regional Workshop, REB, Dhaka and Regional Workshop REB, Chittagong.

Moreover, 67 Rural Electrification Boards in different districts in Bangladesh where small transformers are repaired may also be contaminated with PCBs.

Since in Bangladesh there is no disposal mechanism for PCB waste including the obsolete equipment, waste liquid with PCBs and solid PCB waste (metal, non-metal or soil contaminated with PCBs) generated by the leaks, damaged equipment or remediation and cleaning of facilities and sites contaminated with PCBs, many of these find their way in to the landfills.

PCB from the Ship Breaking Industry

Ship breaking sites are another threat since they release POPs into the environment. The concerns have grown since this is a growing industry in Bangladesh.

The ship breaking units are located in Dhaka, Chittagong, Narayanganj and Barishal; but the main site is in Bhatari, Chittagong, just around 8-10 km from the Chittagong City. There are around 20-25 ship breaking yards where over 50 old ships are dismantled annually. It is a known fact that old ships contain PCBs in their electrical systems, paints and coatings, cables, lubricants, engine oils etc. In 1998, about 90% of the world's old ships were disposed in these areas. Based on the most conservative estimates the total quantity of PCBs from the ship-breaking sector is around 22.5 tons. A significant quantity of PCBs have been disposed in the ground as well as spilled into the environment.

Processes Generating Unintentional POPs

Generation and release of POPs is inherent to some of the process. Such processes have been identified in the context of Bangladesh. The sites where these are located as well as the processes by it self are POPs hotspots. The various processes and practices, of special concern to Bangladesh, have been categorized as follows:

1. **Waste Incinerators** including medical waste, waste wood and waste biomass and animal carcass. There are no incinerators for municipal solid waste as well as hazardous waste in the country. The total estimated release of dioxins and furans from this category is 31.13 gTEQ/a.

There are 1,735 hospitals in Bangladesh with approximately 47,752 beds. Out of the total 15,980 beds are in the private sector. Apart from these hospitals, there are 7,478 private clinics, pathological labs and doctor's chambers in the country. In addition there are over 1500 unauthorized private clinics and pathological labs. It was estimated that medical waste generated from each bed is 0.7kg per person per day. The occupancy rate of the beds is more than 100% per day in government hospitals, where the total number of beds is 31,772. Another 15-20% of the patients occupy the floor/ corridors. The total quantity of waste generated from these hospitals is over 39,108.88 kg (47,752 x 17% x 0.7kg). To cater to this waste there are 121 incinerators in the country. Most of these incinerators are old and are not equipped with air pollution control systems (APCS) or any regulatory system for temperature control. As a practice all kinds of waste are mixed and incinerated without segregating them. Estimates on the release of dioxin from these facilities is 31.107 gTEQ/a). The actual release is expected to be much higher.

Waste biomass incineration is another common practice. This is largely done in old furnaces, which has no APCS. The burn materials are waste biomass, paper, cardboard, plastic, waste wood etc. Estimates on release of dioxins from this kind of burning is 0.018 g TEQ/a. The actually emissions would again be much higher than these estimates.

Likewise, animal carcasses are burnt in furnaces, which are old, and not equipped with any kind of APCS. Since the quantity of such waste is not very high, an estimate on the release of dioxin is approximately 0.0045 g/TEQ/a.

2. **Ferrous and non-ferrous metal production** including iron ore sintering, production of iron and steel, copper, aluminum, and others. Secondary production of ferrous and non-ferrous metals is taken up in the country for various purposes.

Bangladesh has production facilities for iron and steel, copper, aluminum, copper, lead, zinc, brass, and magnesium; foundries and thermal non-ferrous metal production as nickel. Of these Iron and steel and Aluminum production are the biggest contributors of dioxins and furans in the environment. The release is largely to air and through residues. The entire category however contributes approximately 31.98 g TEQ/a as per the estimates.

3. **Power generation and heating** including power plants running on fossil fuel, landfill, domestic cooking and heating using biomass and fossil fuels and others. This category is estimated to release 79.49gTEQ/a of dioxins and furans to the environment.

Fossil fuels are the main sources of power generation and heating in Bangladesh. This category includes processes and practices that involve combustion of fossil fuel, biogas and others.

There are heavy fuel fired power boilers. Also use of biomass and fossil fuels for the purpose of domestic cooking and heating are common practices in Bangladesh, especially in the rural areas. Household cooking using biomass itself is estimated to release 79.24 gTEQ/a of dioxins and furans. Landfill and biogas combustion also adds to the release, though quite less (0.00001gTEQ/a). Fossil fuel power plants release 0.115gTEQ/a of dioxins.

4. **Production of mineral products** including cement, brick, glass, ceramic and others. The total release from this category is estimated as 9.091gTEQ/a.

This largely includes processes carried out at high temperature. Bangladesh produces 15,000,000 tons of cement; 145,763 tons of lime, 25,376,000 tons of brick, 16,720 tons of glass, 94,680 tons of ceramics and asphalt mixing at 3,443,616.

Brick production and cement industry are the largest contributors of dioxins. There are over 100 cement factories across the country most of them concentrated in and around Chhatak, Ayeenpur, Dhaka, Chittagong and Mongla. Similarly there are over 6,000 brick manufacturers located near towns or major construction sites.

5. **Transport Sector** in Bangladesh is one of the predominant sectors in terms of energy consumption. The transportation is largely based on petroleum oils and natural gas. Leaded fuel was banned in 1999. This category together is estimated to release 1.514 gTEQ/a of dioxins, a large part contributed by 4-stroke engines, 2-stroke engines, diesel engines and heavy oil fired engines.
6. **Production and use of chemicals and consumer goods** including paper and pulp mills, chemical industry, textile plants, leather industry etc. This category has a high potential to release dioxins. Bangladesh especially has a large number of industries falling under this category. These include textile and leather. The category in total is estimated to release 144.340gTEQ/a of dioxins. Going by the industry-wise contribution, it is 2.52 gTEQ/a for paper and pulp, 23.58 gTEQ/a for the chemicals industry, 50.85 gTEQ/a for textile plants and 67.38 gTEQ/a for leather plants. Besides releases to air, their effluents are often discharged into water.
7. **Waste disposal** including landfills and waste dumps, sewage and sewage treatment, waste disposal in water bodies and disposal of waste oil. The way in which the waste is handled and disposed can effect the formation and release of dioxins. Landfill and waste dumps are a common practice in Bangladesh. These cause leachate and contaminate the soil and water. Also the practice of disposing waste including waste oil to water is very common.
8. There are also **other combustion processes** such as waste burning and accidental fires which are responsible for releases of dioxins. The practice of open burning of harvest residues trees and bushes is very common throughout the country. For this reason it is not possible to make any estimates. In addition, landfill fires, accidental fires in buildings etc. are also reported at times.

If an estimation on the percent contribution of these categories to the total dioxin release in the country is made then Chemicals and Consumer goods has the largest share of 26.6%, closely followed by uncontrolled combustion at 22.5%, Disposal and landfill at 21.9%, Power generation and heating at 15%, Waste incineration and metal production at 6% each, mineral production at 1.7%, transport at 0.28% and the others at 0.08%. This is largely owing to the fact that some of the sectors and industry are more advanced than the others.

All these various sites in the country are POPs hotspots. They are responsible for the release of POPs in huge quantities in the environment. It is important to mention that all these practices/processes are taking place in close proximity to the communities thereby endangering their health. The health of the workers in these facilities is at high risk of exposures.

Impacts on the environment

No attempt has thus far been made to assess the damages caused to the community, economy, or environment, especially at these sites. However, the consequences of these compounds on health and environment are well documented the world over.

As early as 1986, tests conducted on shellfish collected from sea bed around the Bay of Bangle showed the PCBs content to be in the range of 250 -650 ppb clearly exceeding the permitted level set by the WHO of 300 ppb.

Another test conducted in 1999 on water samples from major five rivers in Bangladesh for PCBs residues, showed that the amount was higher in the rivers that flow through industrial or densely populated area. The amount of PCBs detected was found to be in the range of 3.1 - 0.9 milligram per liter. This exceeds the level in the Proposed Interim National Quality Standards for Bangladesh that sets a standard of 0.067 milligram per liter of PCBs in effluents.

Recommendations

- Currently there is no legislation in Bangladesh for disposal and storage of POPs pesticides and PCB waste. Establishing national legislations and laws and ensuring implementation is crucial.
- Since the total stock of DDT is around 496 MT, it is believed that establishing a POPs waste destruction plant in Bangladesh is not an economically viable option to destroy DDT stockpile. Exporting it to a nearby country where destruction facilities exist may be looked into to ensure that they are disposed in an environmentally sound manner. Another option is to destroy them within Bangladesh. A feasible technology can be considered for the same.
- Besides destroying the stockpiles, it is also important to assess the contamination levels of these sites and execute a clean up plan. Since the stocks are under the control of the government, the same should assume the responsibility for its cleanup.

- Alternatives to DDT for vector control need to be adopted so that there is no requirement to hold stocks of DDT in the future.
- Action plan for phase out/ elimination of PCBs could be made success by identifying, tagging and quantifying PCB content in the transformers and other potential PCB containing equipments. Also Bangladesh also does not have an identified site for PCB waste storage/ disposal/ treatment.
- Alkali Reduction technique is an option to destroy PCB from transformer oil and other parts of the transformer without fully destroying it. Reuse and recycling of uncontaminated oil is possible using this technique.
- An underground storage facility is also proposed for disposing low POPs pesticides and PCB waste. Another one is the construction of engineered landfill.
- With regard to Dioxins:
 - Apply best available techniques and practices for environmental; protection;
 - Avoid and/or reduce the use of substances found to generate/ release dioxins.
 - Establish on the national level mechanisms for monitoring of environmental releases
 - Minimise or implement preventive measure for uncontrolled combustion
 - Alternatives such as autoclaves, steam sterilization process and others to treat and dispose waste including medical waste.
 - Promote segregation of waste before disposal.
 - Promote information, education and awareness
- Frame regulations to set limits for the release of U-POPs and regular monitoring to ensure compliance.
- And lastly adopt the Polluter Pays principle to assign accountability for clean up.