

Environmentally sound management of polychlorinated biphenyls in India

Ashwani Sharma

Polychlorinated biphenyls (PCBs) are a family of synthetic chlorinated hydrocarbon compounds of concern having properties and characteristics similar to those of persistent organic compounds and therefore, are listed under the Stockholm Convention for its elimination and ultimate disposal. This commentary discusses environmental sound management of PCBs in India including identification of gaps in implementation of the provisions laid down in the Stockholm Convention and highlights action plan for their sound management.

During the last few decades, large-scale production and use of chemicals in various developmental activities have led to the release of huge quantities of hazardous substances, including persistent organic pollutants (POPs) into the environment. POPs are organic chemical substances, possessing a particular combination of physical and chemical properties, such that, once released into the environment, they remain intact for exceptionally long periods of time (many years); become widely distributed throughout the environment; accumulate in the fatty tissue of living organisms, including humans, and are toxic to both humans and wildlife. Moreover, POPs are transported over a long range by air, rivers and ocean currents, and contaminate regions far from their sources. Long-term exposure to POPs has shown to cause cancer, birth defects, dysfunctional immune and reproductive system and diminished intelligence. It has been identified that for international cross-boundary pollution problems, there is a need for international cooperation and efforts^{1,2}. Given that POPs are ubiquitous in the environment, humans are exposed to these pollutants through dietary intake, inhalation, dermal adsorption, occupational exposure and prenatal transfer from mother to foetus^{3,4}.

Polychlorinated biphenyls (PCBs) are POPs having use in industries as heat exchange fluids, in electric transformers and capacitors, as additives in paint and in plastics. Out of 209 congeners of PCBs, 13 exhibit toxicity, similar to that of dioxin and furans (highly hazardous POPs). Their persistence in the environment corresponds to the degree of chlorination, and their half-lives could vary from a few days to few years. PCBs are hazardous substances having properties and characteristics similar to those of POPs and therefore, are listed under the

Stockholm Convention for their elimination and ultimate disposal. The Stockholm Convention on POPs⁵ is a global treaty supported by the United Nations Environment Programme (UNEP) to protect human health and environment from hazardous and persistent chemicals by reducing or eliminating their production and introduction into the environment. Phase-out and control of POPs, thus, is one of the predominant facets in implementing the Convention.

As on date, including India, there are 179 Parties to the Stockholm Convention. India ratified the Convention on 13 January 2006 and it came into force from 12 April 2006. The Convention has initially placed obligations on the Parties to take appropriate measures (legal and/or administrative) to eliminate or heavily restrict their production and use, thereby reducing the risks to human health and the environment arising from their release. The POPs are listed under various Annexes of the Convention, namely Annex A (elimination): aldrin, chlordane, dieldrin, endrin, heptachlor, hexachlorobenzene (HCBs), mirex, toxaphene PCB; Annex B (restriction): 1,1,1-trichloro-2,2-bis (4-chlorophenyl) ethane (DDT), and Annex C (unintentional production): polychlorinated dibenzo-*p*-dioxins (PCDD), polychlorinated dibenzo furans (PCDF), HCB and PCBs⁵.

According to the Convention, Parties are required to endeavour and develop a National Implementation Plan (NIP) to demonstrate how their obligation to the Convention would be implemented. With financial and technical assistance from the Global Environment Facility (GEF), the Government of India initiated development of NIP in 2007. During the process, ground-level situation of POPs (including PCBs) was assessed through inventorization, sample collection, analysis and interpretation⁶.

The concerns with respect to PCBs in India are mainly due to unaccountability of the used transformer oils and those used in open and partially open applications. Until late 1980s, India was importing PCB-containing electrical equipments (transformers, capacitors, etc.) for specific applications in large facilities. Major owners of PCB-containing equipment and PCB oil in the public sector are the power generation and transmission companies (State Electricity Boards), heavy industries such as steel, cement, fertilizer, etc. and in the private sector the mining, lubricant and ship-breaking industries, etc. Due to the large size of India and with limited time available for the development of the preliminary inventory on PCBs, the geographic area of country was divided into five regions: North, West, East, Central and South covering 28 states and 7 Union Territories. Based on identification of the potential sources of PCB, an inventory was carried out by way of information and responses received from industries and power utilities.

Most of the PCB-containing transformers were with power generating and transmission companies. Only small quantities of PCB were detected in distribution transformers, mainly due to their relatively short shelf-life. Most of the phased-out transformers were recycled and reused. The out-of-service capacitors were stored at the owner's facilities. Generally, the PCBs containing equipment and oil are not managed in an environmentally sound manner. Studies showed that PCB-contaminated electrical devices in the power sector were temporarily stored in the owners' yards throughout the country. Since these utilities lack strict documentation and compliance procedures, the exact number of PCB-containing electrical devices could not be retrieved.

The inventory of electrical equipment and PCBs contained therein showed that the number of existing transformers containing pure and contaminated PCBs was around 1548, with total weight of PCB oil being as high as 10,000 MT. In addition, 400 large steel drums containing pure PCB oil were also found in the premises of some large utilities. It is evident that the power sector owns a major share of PCB-containing equipment (71%), followed by the steel sector (18%), cement sector (1%), chemical sector (0.5%), fertilizer sector (0.3%) and other sources (9.9%). No significant results were obtained in case of PCB-containing capacitors. Given that not all businesses have been affected by the inventory, as well as taking into account that not all regional offices and businesses that have received requests responded to them, the total amount of PCBs in India, according to the general assessment, could reach 28,000 MT.

During the NIP development, it was established that management and disposal PCBs is one of the priorities for the government requiring immediate attention and action. Also, the Convention clearly defined the timeframes to address the management and final disposal of PCBs with elimination of their use in electrical equipment by 2025 and their environmentally sound disposal not later than 2028. Considering its commitment towards implementation of the Convention, the Government of India through the Ministry of Environment and Forests, which is also the nodal agency for planning, promotion and coordination of the environmental programmes, is implementing a GEF-funded project on environmentally sound management and final disposal of PCBs in India. The overall objective of the project is to reduce and eliminate the use and release of PCBs to the environment through promotion of measures to minimize exposure and risks by introducing environmentally sound

management and disposal of PCBs, PCB-containing equipment and PCB-contaminated mineral oil, including wastes in the country. One of the immediate priorities of the project is the treatment and sound disposal of 6000 MT of PCB-containing equipment and waste and 1700 MT of pure PCB oil. The total cost of the project, including GEF incremental funding is around 43.45 million USD and is being implemented through the United Nations Industrial Development Organization.

In India, it is seen that due to limited information available on PCBs in the electrical sector, the management of PCB-containing equipment is a challenge. Disposal of PCB contaminated waste is unsound as all waste oil is sold to local enterprises for different uses. In general, the disposal options for PCBs are lacking. Though management of PCBs is framed under the Hazardous Waste Management Rules, it does not appropriately comply with the obligations of the Convention. There is shortage of dedicated manpower to monitor implementation of rules and regulations concerning it. The legislation pertaining to handling hazardous waste at ship-breaking yards needs better enforcement. There is a need to set up special monitoring bodies at the central, state and district levels for regular enforcement of PCB-related legislations, backed up by well-equipped and accredited laboratories. Good management practices for PCBs even by the owners of such equipment are lacking. Maintaining proper data and management of this hazardous waste is also lacking.

Effective management and control of PCBs largely depends on the comprehensive legal system and effective institutional arrangement. Considering the current situation in India, as a priority, an effective management should be established based on scientific decision-making. Secondly, the existing statutes, including

legislations should be amended to reflect the specific issues of PCBs management in the country. There is a vital need to develop and implement regulations on PCBs and other POPs as considerable time was provided to the Parties after the ratification and actual time of enforcement of the Convention. Public participation must be made an integral part of any decision-making process. It is imperative for taking informed decisions by the respective governments. Without public participation, any problems associated with PCBs cannot be solved satisfactorily with only government administrative branches and research institutions involved in the decision-making. Therefore, the most feasible and effective approach is to promote public awareness, to conduct training among producers, operators, consumers and citizens, and also to popularize knowledge on the environmental and health issues of PCBs.

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*Ashwani Sharma is in the United Nations Industrial Development Organization, New Delhi 110 003, India.
e-mail: ashwani.envis@gmail.com*