MANAGING POLYCHLORINATED BIPHENYLS IN COMPLIANCE WITH THE STOCKHOLM CONVENTION: BANGLADESH IN CONTEXT

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Abstract

The use of hazardous substances (HS), chemicals and hazardous waste (HW), invites multifaceted issues affecting the economy, society and natural environment. The findings of literature by authoritative scientific bodies confirm that the production and excessive use of HS and HW are deleteriously impacting the environment, ecosystems, human health, and wildlife. Due to their ability to persist in nature for long periods and cause harm, some of these chemicals are classified as persistent organic pollutants (POPs). Among these POPs, polychlorinated biphenyls (PCBs) are significant and have been used in various industrial and commercial products, mainly in electrical equipment. The environmentally sound management (ESM) of PCBs, other hazardous POPs, and their wastes is a pressing concern for all States regardless of their size and nature. Developing countries, in particular, have become victims of excessive use for various reasons. To address issues pertaining to POPs, the Stockholm Convention (StC) was adopted in 2001. Bangladesh, as a party to the StC, has taken various regulatory initiatives to control the release and ensure the ESM of POPs and various HS, chemicals and HW. This article assesses the extent to which and the effectiveness with which Bangladesh's legal and policy instruments have integrated the obligations of the StC regarding the ESM of PCBs. The findings of this research have the potential to guide the stakeholders of Bangladesh in bringing necessary changes in its regulatory framework, and also for other developing countries in charting their future directions regarding PCBs management.

Keywords: *Hazardous Substances, Chemicals and Hazardous Waste, Natural Environment, Persistent Organic Pollutants, Polychlorinated Biphenyls*

I. INTRODUCTION

The shift from manual work to technological advancements that started widely in the later decades of the eighteenth century in Europe led to the proliferating use of hazardous substances (HS) and chemicals in commercial products and industrial appliances. A 2020 survey report opined that more than 350,000 chemicals and their various mixtures have been registered globally for production and use,[1] whereas it was much lower, only 30,000, as per a 2015 report.[2] However, the World Health Organization (WHO) mentions the number of over 160 million.[3] Despite their escalating use, some of these chemicals have been proven as hazardous. They pollute and cause damage to their surroundings, and remain in the environment, especially in soil, sediments, air and biota for a long time, resulting in being termed as 'persistent organic pollutants' (POPs).[4] The actual number of POPs is still unknown, but it is a continuous process of identification. Among the identified POPs, polychlorinated biphenyls (PCBs) are vital ones, an admixture of chlorinated hydrocarbons, commonly used as a cooling agent in the dielectric fluid, industrial applications and commercial products. PCBs are still used globally, amounting to between 1 and 1.5 million tons. However, since the late 1920s, only twelve countries were their producers.[5] The hazardous characteristics of

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1 Zhanyun Wang et al., 'Toward a Global Understanding of Chemical Pollution: A First Comprehensive Analysis of National and Regional Chemical Inventories' 54 (5) (2020) *Environmental Science & Technology* (2020) 2575–84. <https://doi.org/10.1021/acs.est.9b06379>.

2 R Miniero et al, 'Persistent organic pollutants', in Reference Module in Earth Systems and Environmental Sciences (Elsevier, 2015). <https://www.sciencedirect.com/science/article/abs/pii/B9780124095489094963?via%3Dihub>.

3 'Guidance on chemicals and health', World Health Organization (Web Page) <https://www.who.int/tools/compendium-on-health-and-environment/chemicals>.

4 K C Jones and P de Voogt, 'Persistent organic pollutants (POPs): state of the science' (1999) 100(1–3*) Environmental Pollution* 209 <https://doi.org/10.1016/S0269-7491(99)00098-6>.

5 'PCBs – a forgotten legacy?', *UN Environment Programme* (Web Page)

PCBs harmfully affect the environment, flora, fauna, ecosystem and human health, and the products containing PCBs ultimately become hazardous waste (HW). PCBs cause liver dysfunction, thyroid toxicity, developmental neurotoxicity, and possibly cancer.[6] The impact of PCBs on human health was first revealed through the mass consumption of contaminated rice bran oil in Japan in 1968, followed by similar incidents in Taiwan in 1979.[7] In the USA, the dumping of PCBs contaminated soil at the landfill site in 1978 sparked the community movement against the 'toxic aggression' by the local governmental authority and is considered the birthplace of 'environmental justice'.[8] The severe mercury pollution in food chains from 1932 to 1968, known as Minamata disease in Japan, realized the need for regulation.[9]

Conceiving the ominous ramifications of POPs, a global convention, namely the Stockholm Convention on Persistent Organic Pollutants, was endorsed in 2001, under the auspices of the UN, to ensure their environmentally sound management (ESM). Embracing the international responsibility, Bangladesh accepted the StC. Bangladesh, as a country representing the Global South, encounters challenges in the release of PCBs into the environment, which may likely hinder the country's attainment of the UN Sustainable Development Goals (SDGs).

The core objectives of this research are to identify the obligations under the StC for the ESM and elimination of PCBs, assess the compliance status and gaps in the pertinent major legal instruments of Bangladesh in cascading the StC obligations regarding PCBs and provide recommendations for the ESM of PCBs in Bangladesh. The authors explore around 30 legal instruments of Bangladesh pertinent to PCBs and the StC. As no exclusive legal research has been conducted previously regarding Bangladesh's compliance with the StC obligations on PCBs, this article will be a distinct guide to legal researchers and enhance their knowledge base about PCBs management. Moreover, it will

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<https://www.unep.org/topics/chemicals-and-pollution-action/pollution-and-health/persistent-organic-pollutants-pops/pcbs>.

6 H Y Kaw and N Kannan, 'A review on polychlorinated biphenyls (PCBs) and polybrominated diphenyl ethers (PBDEs) in South Asia with a focus on Malaysia', in Pim de Voogt (ed), *Reviews of Environmental Contamination and Toxicology* (vol 242, Springer, 2016) 153 <https://doi.org/10.1007/398_2016_14>.

7 S T Hsu et al, 'Discovery and epidemiology of PCB poisoning in Taiwan: a four-year follow-up' (1985) 59 *Environmental Health Perspectives* 5 <https://doi.org/10.1289/ehp.59-1568088>.

8 'We birthed the movement — introduction', *University of North Carolina* (Web Page) <https://exhibits.lib.unc.edu/exhibits/show/we-birthed/introduction>.

9 Justin McCurry, 'Japan remembers Minamata' (2006) 367(9505) *Lancet* 99,<https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(06)67944-0/fulltext#:~:text=The%20tragedy%20visited%20on%20Minamata,the%20people%20who%20ate%20them>.

assist the policy makers of Bangladesh in adopting necessary regulatory mechanisms, based on the recommendations proposed here. While cascading the relationship of the StC in the domestic context, the paper outlines a comprehensive approach to the possibility of applying the standard of this Convention in the domestic framework of Bangladesh. For the international community and other members of the Global South, the article may help shape relevant discourse towards ensuring the ESM of PCBs, leading to achieving global SDGs.

II. POPS AND PCBS: CONCEPTS AND ANALYSIS

POPs are mainly synthetic chemicals that have toxic elements. Thousands of POPs were explored by scientists after World War II for their commercial uses.[10] They clearly demonstrated their positive role in reducing diseases like malaria, addressing pest infestation, producing crops and manufacturing industrial products, resulting in their multiplying increase in production and use worldwide, over centuries. Besides the planned production of the POPs for use, they may also produce unplanned- because of an action (e.g. the creation of dioxin, through the burning of wastes). Later, the adverse impacts of POPs on human beings, biodiversity and the natural resources and environment surfaced and were ultimately proved by scientific research. It may take centuries to degrade POPs, as they can be volatile.[11] For example, POPs may be entered, mixed and remain easily in micro/nano plastics, acting as carriers. These POPs infused plastics may find their way into the stomach and membranes of fish (or other aquatic creatures); these living creatures work as vectors to disperse POPs in different ecosystems and environments. For their lipophilic and hydrophobic features, POPs may be absorbed in human/wildlife organs and fat cells through the consumption of POPs contaminated fish.[12]

PCBs associate a broad family of human-made organic chemicals, namely chlorinated hydrocarbons, having carbon, hydrogen and chlorine atoms. These have altogether 209 types/congeners which are tasteless and smell less, having a consistency range from oil to waxy solid.[13] PCBs were first manufactured in

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10 'Persistent organic pollutants: a global issue, a global response', *United States Environmental Protection Agency* (Web Page) <https://www.epa.gov/international-cooperation/persistent-organic-pollutants-global-issue-global-response>.

11 PRS Kodavanti et al, 'Toxicology of persistent organic pollutants', in *Encyclopedia of Toxicology* (3rd ed, Elsevier, 2014) <https://doi.org/10.1016/B978-0-12-801238-3.00211-7>.

12 Bart Hens and Luc Hens, 'Persistent threats by persistent pollutants: chemical nature, concerns and future policy regarding PCBs — what are we heading for?' (2017) 6(1) *Toxics* 1, <https://doi.org/10.3390/toxics6010001>.

13 K von Stackelberg, 'PCBs', in *Elsevier eBooks* (Reference work entry, 2011) 346–56, <https://doi.org/10.1016/B978-0-444-52272-6.00580-8>.

1929 in the USA and gradually became popular for use because of their non-flammability and stability at high boiling points.[14] As PCBs have insulating properties, they have been used in different industrial appliances, electrical and hydraulic equipment, such as transformers, capacitors, voltage regulators, switches, florescent light ballast, cable insulation, paints, plastic and rubber products, dyes, etc. PCBs used in open applications (e.g. paints, building materials) account for one-fifth of the global PCB sources, exposing humans to risk through their release.[15] As PCBs can resist chemical deterioration, they lead to bioaccumulation in aquatic/marine species and human beings, which is harmful for health, biodiversity and the environment. Various physical complications, such as dysfunction of the endocrine, type II diabetes, liver non-function, etc., may have relevance to PCBs. Eating contaminated food (fish, dairy products, etc.) is the main way of ingesting PCBs into human bodies.[16] Having carcinogenic elements, PCBs may adversely impact humans' immune systems, digestive, reproductive and nervous systems.[17]

The USA banned PCBs manufacturing in 1979, realizing their long-lasting adverse impact. However, even after the ban on the commercial production of PCBs by the industrialized countries, the persistence of PCBs in the environment is a great global concern due to their unintended spills, irresponsible disposal practices and ability to resist biodegradation.[18] PCBs may be released into the environment through the poor maintenance of the HW site, illegal or improper dumping of PCBs waste, dumping PCBs containing consumer products in the municipal waste dumping sites, and burning of HW through incinerators. PCBs can mix with, travel through, pollute and degrade the air, water, soil, environment and ecosystems.[19] One region of the world, because of transportation, may be affected where people have never used

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14 'Learn about polychlorinated biphenyls', *United States Environmental Protection Agency* (Web Page) <https://www.epa.gov/pcbs/learn-about-polychlorinated-biphenyls>.

15 'PCB: A Forgotten Legacy? 2028: Final Elimination of PCB', *United Nations Environment Programme*,<https://wedocs.unep.org/bitstream/handle/20.500.11822/20786/PCB%20Brochure%20(2017).pdf?sequence=1&isAllowed=y>.

16 Erin Perkins, The Stockholm Convention on Persistent Organic Pollutants: A Step Toward the Vision of Rachel Carson, (2001) 13(3) *Colorado Environmental Law Journal* 191,194.

17 Luigi Montano et al, 'Polychlorinated Biphenyls (PCBs) in the Environment: Occupational and Exposure Events, Effects on Human Health and Fertility' (2022) 10(7) *MDPI, Toxics* 365, <https://doi.org/10.3390/toxics10070365>.

18 O Boucher, G Muckle and C H Bastien, 'Prenatal exposure to polychlorinated biphenyls: a neuropsychologic analysis' (2009) 117(1) *Environmental Health Perspectives* 7, <https://ehp.niehs.nih.gov/doi/10.1289/ehp.11294>.

19 'Learn about polychlorinated biphenyls', *United States Environmental Protection Agency* (Web Page) <https://www.epa.gov/pcbs/learn-about-polychlorinated-biphenyls>.

them.[20]

III. PCBS MANAGEMENT UNDER INTERNATIONAL MECHANISMS

The ramification of POPs on the environment was highly realized by the international community. The post Stockholm Declaration on Environment has opened systematic actions on environmental protection, leading to the adoption of numerous international instruments.[21] As part of the obligation to ensure ESM, the StC is the principal Convention adopted by the international community. Apart from the StC, numerous other international and regional-level instruments were endorsed to regulate PCBs. All these legal instruments guide the international community to promote environmental ethics, set environmental standards, practice sustainable development, protect the environment, human health and biodiversity through incorporating appropriate institutional setups, funding and framing necessary national laws/rules to address different HS and HW, including PCBs effectively.

A. *PCBs under the Stockholm Convention 2001 (StC)*

The StC initially listed twelve chemicals popularly known as the 'dirty dozen' as POPs. Among these, PCBs are the most recognizable and commonly known.[22] The list has been increased over time, deriving from pesticides, industrial chemicals and various unintentional productions.[23] The StC aims to follow the precautionary approach as recognized in principle 15 of the Rio Declaration.[24] It has defined PCBs as "an aromatic compound formed in such a manner that the hydrogen atoms on the biphenyl molecule (two benzene rings bonded together by a single carbon-carbon bond) may be replaced by up to ten chlorine atoms".[25]

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20 Erin Perkins, 'The Stockholm Convention on Persistent Organic Pollutants: a step toward the vision of Rachel Carson' (2001) 13(3) *Colorado Environmental Law Journal* 191,192.

21 Mohammad Ershadul Karim, 'Bangladesh', in Kurt Deketelaere (ed), *International Encyclopedia of Laws: Environmental Law* (2nd ed, Kluwer Law International, 2024) 56.

22 Erin Perkins, 'The Stockholm Convention on Persistent Organic Pollutants: a step toward the vision of Rachel Carson' (2001) 13(3) *Colorado Environmental Law Journal* 191, 193.

23 'All POPs', Stockholm Convention (Web Page) <https://www.pops.int/TheConvention/ThePOPs/AllPOPs/tabid/2509/Default.aspx>.

24 *Stockholm Convention on Persistent Organic Pollutants*, opened for signature 22 May 2001, 2256 UNTS 119 (entered into force 17 May 2004) art 1.

25 Ibid, annex C pt IV para 1(a).

The StC elaborates various actions and standards related to PCBs management including:

- elimination, reduction, control, prohibition on production, use, export and import;
- screening, identification, the ESM of stockpile, disposal, destruction and phase out of contaminated articles, equipment, liquids, and wastes;
- rehabilitation of contaminated sites;
- formulating national implementation plan (NIP), appropriate management plans and strategies;
- applying the best environmental practices (BEP) and best available techniques (BAT) as a risk control mechanism;
- exchange of information, public awareness and education, research and development, monitoring and evaluation, reporting mechanisms, review at the Conference of Parties (CoP) technical and financial assistance;
- non-compliance, dispute settlement procedures, arbitration and conciliation procedures.

The key aspects enshrined in the StC, particularly for PCBs management, are described below.

1. PCBs Release from Intentional Production under StC

Article 3, 6 and Annex A of the StC provide provisions regarding the prohibition on the production, use, export, and import of PCBs. However, Article 3 also allows (i) import and export for sound disposal; (ii) use in the manner mentioned in Annex A, ensuring to protect human health and prevent its release into the environment; (iii) use in lab-scale research or as a reference standard. To combat the deleterious impact of PCBs, Article 6 urges to (i) develop strategies to identify and manage PCBs stockpiles, products in use and wastes having PCBs contents, and contaminated sites; (ii) handle, collect, transport, store, dispose or destroy articles, products and wastes containing/consisting of PCBs, ensuring their ESM; (iii) transform products, where destruction is not possible, in a manner not to exhibit their POPs characteristics or may remain as low (which is internationally permitted). While disposing PCBs waste and products, it obligates (i) not leading to their recovery, recycling, reclamation, direct reuse or an alternative use; (ii) follow international guidelines for transboundary transport; (iii) take remedial measures for the ESM of contaminated sites.[26]

Annex A entails eliminating PCBs use from equipment (e.g. transformers,

[26] Ibid, art 6(d).

capacitors or other receptacles having liquid stocks) by 2025 and upon review at the CoP. It prohibits the import and export of such equipment, except for the ESM of HW. It compels to identify, label, and remove PCBs, in the following priorities, from use equipment, having more than (i) 10% PCBs and volumes greater than 5 litres; (ii) 0.05% PCBs and volumes greater than 5 litres; (iii) 0.005% PCBs and volumes greater than 0.05 litres. To reduce and control the exposure and risk of PCBs, Annex A also directs (i) using only in the unbroken and non-leaking equipment and in areas where risks from environmental release can be minimized/remedied, fast; (ii) prohibiting the use in areas connected with food/feed production or processing; (iii) allowing the use in populated areas (e.g. schools and hospitals), taking reasonable steps to prevent the electric failure and fire, and inspecting the equipment leaks. It also prohibits PCBs recovery for reuse in other equipment of liquids, having PCBs content above 0.005%, except for any maintenance and servicing operations. For that, it prescribes (i) take measures for the ESM of waste of liquids or equipment containing/contaminated with PCBs, having PCBs content above 0.005%, by 2028, and upon review at the CoP; (ii) identify and manage any other articles (e.g., cable-sheaths, cured caulk and painted objects), having PCBs content above 0.005%; (iii) submit the NIP regarding PCBs elimination progress, in every five years, at the CoP for its review.[27]

2. PCBs Release from Unintentional Production under StC

The StC postulates taking continuous measures to reduce the total PCBs emission, leading to the ultimate elimination of its unintentional release from various anthropogenic sources, as listed in Annex C. To address the same, Article 5 directs to develop and implement an action plan (treating as the NIP) which must contain (i) evaluation of current and projected PCBs releases, maintaining an inventory of the release estimate; (ii) evaluation of the efficacy of pertinent domestic laws and policies on release management; (iii) strategies to meet the StC obligations; (iv) steps to promote education, training and awareness on strategies; (v) review and inclusion of the implementation progress, in every five years, in the NIP; (vi) schedules for implementing the action plan and strategies.

Annex C requires to promote (i) taking practical steps to eliminate the source or meaningfully reduce the PCBs release; (ii) creating and using substitute articles to prevent release; (iii) applying general guidance on BAT (for any new source category of release) and BEP (for already identified categories of release), with technologies, installations, applications which are most effective and advanced to limit or reduce the release from various sources

27 Ibid, annex A pt II.

categories of activities (e.g. thermal processes, waste incinerators, fossil fuel fired utility or industrial boilers, textile or leather dying, waste oil refineries, etc.), having the most appropriate combination of environmental control mechanisms with low-waste technology, less hazardous products, stopping of open burning of wastes, good housekeeping initiatives, etc.

B. *Other Legal Instruments on PCBs Management*

Apart from the StC, numerous international, regional and country-specific legal initiatives have been taken to regulate PCBs. The global instruments include the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal 1989, the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade 1998, the Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, 2009, and the SDGs 2015. Other key instruments to follow are the UNEP- PCBs Phase-Out Plan 2023, facilitated by the PCBs Elimination Network (PEN), and the FAO & WHO-Code of Practice for the Prevention and Reduction of Dioxins, Dioxin-Like PCBs in Food and Feed.[28] This Code permits PCBs intake in food of 6 micrograms per kilogram, per day.[29]

At the regional level, the Convention on Long-Range Air Pollution 1979, the Aarhus Protocol on POPs, 1998 (as amended in 2009), the OECD Decision on the Recommendations of the Council on Further Measures for the Protection of Environment by Control of PCBs,[30] EU Council Directives on the Disposal of PCBs and PCT,[31] & Restriction on the Use of Certain HS in Electrical and Electronic Equipment,[32] Guidelines for the ESM of PCBs in the Mediterranean 2015.

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28 Codex Alimentarius Commission, *Code of Practice for the Prevention and Reduction of Dioxin and Dioxin-like PCB Contamination in Food and Feed*, CXC 62-2006 (adopted 2006, rev 2018).

29 'What standards and regulations exist for PCB exposure?', *Agency for Toxic Substances and Disease Registry* (Web Page, 24 May 2023) <https://www.atsdr.cdc.gov/csem/polychlorinated-biphenyls/standards.html>.

30 OECD, Decision-Recommendation of the Council on Further Measures for the Protection of the Environment by Control of Polychlorinated Biphenyls, OECD/LEGAL/0230 [1987] & OECD; Decision of the Council on Protection of the Environment by Control of Polychlorinated Biphenyls, OECD/LEGAL/0108 [2024].

31 Council Directive 96/59/EC of 16 September 1996 on the disposal of polychlorinated biphenyls and polychlorinated terphenyls [1996] OJ L 243/31.

32 Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment [2003] OJ L 37/19.

C. *Notable National Initiatives on PCBs*

At the domestic level, the Code of Federal Regulations (Title 40, Part 761, 2024) on PCBs Manufacturing, Processing, Distribution in Commerce and Use Prohibitions of the USA; the Environmental Protection (Disposal of PCBs and Other Dangerous Substances) Regulations 489/ 2020 of England and Wales; the Regulation (849/2013) to Phase-out the Use of PCBs Materials in South Africa; the Special Measure Laws against PCBs Waste (65/2001) of Japan; the Regulation (29/2020) on the Management of PCBs and HS Management Regulations (GR 74/2001) of Indonesia; the Chemicals Control Administrative Orders for PCBs (DENR/CCO 2004-01) of the Philippines;[33] the Environmental Quality (Scheduled Wastes) Regulations 2005 of Malaysia; the PCBs Regulation Order 2016 & Guideline on PCB Waste Identification, Tracking and Record Keeping 2015 of India are a few notable examples of instruments to address and regulate PCBs issues. The Japanese regulation on PCBs defines the obligations of PCB waste holders, manufacturers, and the government. It outlines the time frame for treatment of PCBs waste and requires public reporting and registration of stored PCB waste. It is worth mentioning that the standards set in the US law include PCBs presence from 0.5 to 1.0 microgram per cubic metre for air at the workplace of ten-hour work, the maximum contaminant level- 0.0005 parts per million (ppm) for drinking water, ranges from 0.2-3.0 ppm for all foods, and 10 ppm for food packaging materials. It prescribes the ways for PCBs remediation of waste.[34]

D. *Current Global Status and Challenges of PCBs Elimination*

Despite the global ban on PCBs production, many countries are still using them. The 2016 UNEP report stated that regions are not responding similarly in eliminating PCBs. Only 17% of the total identified electrical transformers and other articles (PCBs contaminated) of the world have so far been disposed of since 2000 and the rest 83% are still not addressed. It is apprehensive about the insignificant effort to stop the PCBs use by the year 2025 and to destroy the

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33 Department of Environment and Natural Resources (Philippines), *Department Administrative Order No 2004-01: Chemical Control Order for Polychlorinated Biphenyls (PCBs)*, *EMB Memorandum Circular No 2015-004: Clarifications to the Chemical Control Order (CCO) for Polychlorinated Biphenyls (PCBs) & EMB Memorandum Circular No 2015-007 Technical Guidance Document on Polychlorinated Biphenyls (PCBs) Management* (Philippines).

34 'Managing remediation waste from polychlorinated biphenyls (PCBs) cleanups', *United States Environmental Protection Agency* (Web Page, 19 September 2025) <https://www.epa.gov/pcbs/managing-remediation-waste-polychlorinated-biphenyls-pcbs-cleanups>.

PCBs containing equipment and contaminated liquids by the year 2028. So far only 30% of countries are on the pathway to reach the StC targets.[35] The UNEP PCBs Phase-out Plan 2023 emphasizes identifying the vital stakeholders for taking concrete actions, preparing national inventories of all PCBs contaminated equipment, and strategies and roadmaps of PCBs phase-out activities by countries. It also postulates that most of the age-old PCB contaminated electrical transformers are not energy efficient, leading to impeding the global target of 'zero-energy', entailing replacing them with better ones.[36]

A report opined that following the COP 2017, only 9.8% of the African States have submitted their updated NIP and there is insufficient data about PCBs inventory, leakage and resale of contaminated transformer oils for other use, indicating their limitations to comply with the StC obligations.[37] Another study on 42 States showed that PCBs persistence in the air is still high in 15 States, necessitating to adoption of reduction mechanisms.[38] It remains a big global challenge to implement, comply and get funding for the StC commitments.[39] To choose the best technology for the ESM and disposal of PCBs, countries should emphasize the principle of technology transfer and consider different criteria of the social, environmental, technical and economic factors for attaining the expected result.[40]

The reasons for non or tepid compliance with the StC and the challenges of PCBs elimination by most countries are succinctly portrayed by the Global Environment Facility (GEF) in its report.[41] It opined that as the StC deadlines

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35 'PCBs — a forgotten legacy?', *UN Environment Programme* (Web Page, 4 December 2024) <https://www.unep.org/topics/pollution-and-health/persistent-organic-pollutants-pops/pcbs-forgotten-legacy>.

36 'Toward elimination of PCBs', *UN Environment Programme* (Web Page, 4 March 2025) <https://www.unep.org/toward-elimination-pcbs>.

37 Olumide E Akinrinade et al., 'Implementation of the Stockholm Convention on the Persistent Organic Pollutants (POPs) in Africa- Progress, Challenges and Recommendations After 20 Years', *Environmental Science Advances* (2024) 3(5) 623, 634, <https://doi.org/10.1039/d3va00347g>.

38 Jacob de Boer et al., 'Persistent Organic Pollutants in Air from Asia, Africa, Latin America and the Pacific', *Elsevier, Chemosphere* (May 2023) 324, <https://doi.org/10.1016/j.chemosphere.2023.138271>.

39 C Ahlgren, *Future challenges to the Stockholm Convention on persistent organic pollutants* (Bachelor Thesis, Lund University, 2014) 19, <http://moodle.toxoer.com/pluginfile.php/8422/mod_imscp/content/1/Future_Challenges_to_the_Stockholm_Convention_on_Persistent_Organic_Pollutants__Final2_.pdf >.

40 M S M Mujeebur Rahman et al., 'Destruction Technologies for Polychlorinated biphenyls (PCBs)', *ICS-UNIDO* (2000) 44, <https://www.clu-in.org/download/remed/destruct_tech.pdf>.

41 The GEF, 'Accelerating progress with electricity upgrades', (Feature Story, 24 April 2025), <https://www.thegef.org/newsroom/feature-stories/accelerating-progress-

are looming, the tempo in taking initiatives to eliminate PCBs is not the same around the world. It also mentioned that the countries are facing diverse difficulties in PCBs identification and measuring the use of PCBs in equipment. The quality of data as furnished by countries is another issue due to having inconsistent laws or for their lukewarm compliance, using different methods of tracking, the inability of the stakeholders to provide complete accounting, etc. The report also pointed out that the safe disposal of PCBs after removal from equipment is a big challenge, as the shipping cost is rising and many countries need foreign assistance in doing so. In addition, replacing the contaminated equipment with modern and efficient ones is costly too, requiring funding and technical help. Hence, it is crucial to take international and national initiatives to comply with the StC timeline of PCBs phase out which may help attain the SDGs by 2030.

IV. STC APPLICATION AND PCBS MANAGEMENT IN BANGLADESH

In this head, how Bangladesh has incorporated the StC obligations is evaluated. The issues and institutional challenges for Bangladesh in terms of PCBs identification and management have been analysed.

A. *Incorporating International Law into the Legal System of Bangladesh*

The application of an international treaty does not always take effect at the domestic level after its ratification. The enforcement of treaty standards at the domestic level varies from State to State. International law, amidst urging States to carry out their international obligations by ratifying international treaties, the process of incorporating international treaties at the domestic level is governed by domestic law. To analyse the StC application in the domestic sphere of Bangladesh, it needs to reflect the general rule of treaty incorporation in Bangladesh, the scope of the application of treaty standards in the domestic legal system and its interpretation by the domestic court.

On the incorporation aspect, most of the States do not give primacy to international law over their municipal law.[42] Rather, they consider international law and domestic law to be usually understood as distinct legal systems of rules and principles.[43] Based on diverse States' practice, the application of

electricity-upgrades#:~:text=The%20goal%20of%20the%20Global,efficiency%20and%20reduce%20carbon%20emissions>.

42 *Statute of the International Court of Justice* art 38(1)(d).

43 Antonio Cassese, 'Modern constitutions and international law' (1985) 192 *Recueil des Cours* 331.

international treaties at the domestic level is streamlined by two theories, namely *monist* and *dualist*. As a dualist country, in the context of Bangladesh, international treaties do not automatically form part of national law. They must, where appropriate, be incorporated into the legal system by legislation made by the Parliament.[44] The fundamental provision regarding the adoption and codification of international treaties is enshrined in the Constitution. Article 145A states that-

> "All treaties with foreign countries shall be submitted to the President, who shall cause them to be laid before Parliament.[45] It is further stipulated that any such treaty connected with national security shall be laid in a secret session of Parliament."[46]

The above constitutional provision requires a treaty to be placed before Parliament only for discussion, not for ratification.[47] The Second Proclamation Order No IV of 1978 has clarified this function by empowering the Prime Minister and the cabinet to determine the treaty-making policies of Bangladesh. Though there is an obligation to lay a treaty before Parliament, the failure to lay a treaty before Parliament will not affect its validity.[48] For making any treaty relevant to Bangladesh, the State ratifies the instrument accordingly. The StC was signed by Bangladesh on 23 March 2001 and ratified on 12 March 2007.[49] For Bangladesh, the treaty entered into force on 10 June 2007.[50] On the aspect of incorporating the standards of PCBs and POPs enshrined in the StC, assessing the approach of Bangladesh is significant. Firstly, in the domestic sphere, the constitution of Bangladesh is the supreme law.[51] Thus, in the hierarchy between international treaties and constitutional law, the

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44 Dinah Shelton, *International Law and Domestic Legal Systems: Incorporation, Transformation, and Persuasion* (Oxford University Press, 2011) 10.

45 Article 145A was substituted by the Constitution (Fifteenth Amendment) Act, 2011 (Act XIV of 2011), section 43.

46 The proviso was substituted by section 20 of the Constitution (Twelfth Amendment) Act, 1991 (Act No. XXVIII of 1991).

47 Sheikh Hafizur Rahman Karzon and Abdullah Al Faroque, 'Status of international law under the Constitution of Bangladesh: an appraisal' (1993) 3(1) *Bangladesh Journal of Law* 23.

48 Mahmudul Islam, *Constitutional Law of Bangladesh* (3rd ed, Mullick Brothers, 2012) 1026.

49 'Parties and signatories', *Stockholm Convention* (Web Page) <https://www.pops.int/Countries/StatusofRatifications/PartiesandSignatoires/tabid/4500/Default.aspx>.

50 Ibid.

51 Article 7(2) of the Constitution declares that '*the Constitution is …….. the supreme law of the Republic, and if any other law is inconsistent with this Constitution; the other law shall, to the extent of the inconsistency, be void*'.

supremacy of the constitution will prevail. Secondly, in terms of determining the StC standard with other domestic laws of Bangladesh, the general approach of the judiciary reflects that such other domestic laws will generally prevail, provided they reflect clarity on the issue. In the case of *Bangladesh v Sombon Asavhan,*[52] the Appellate Division of the Supreme Court held that it is well settled that where there is municipal law on an international subject, the national court's function is to enforce the municipal law within the plain meaning of the statute.[53] In the separate opinion in the case of *Ershad v Bangladesh and others,* Justice B.B. Roy Chowdhury was of the view that "Where the domestic laws are clear, but inconsistent with the international obligations of the state concerned, the national courts will be obliged to respect the national law." In the same case, Justice Roy declared,

> "Although universal human rights norms, whether given in the UDHR or in the Covenants, are not directly enforceable in national courts, they are enforceable by domestic courts if such norms are incorporated into the domestic law." [54]

The approach of the Court was further strengthened in the case of *BNWLA v. Government of Bangladesh and others,*[55] where the Court vehemently declared "Our courts will not enforce those Covenants as Treaties and Conventions even if ratified by the State, as they are not part of the *corpus juris* of the State unless those are incorporated in the municipal legislation." Therefore, it is evident that Bangladesh prioritizes applying the national law over international laws, like other common law countries; however, in line with Articles 25 and 145A of the constitution, it may consider the implementation of international laws.[56]

While considering the practice of Bangladesh to treaty incorporation at the domestic level as a dualist State, the following status is apparent in relation to the StC. Firstly, as a paramount rule of customary international law and the Vienna Convention on the Law of Treaties, international treaties ratified by Bangladesh create an obligation upon it to comply with the pertinent treaty obligation. Secondly, all ratified international treaties do not automatically apply in the domestic sphere of Bangladesh. State practice dictates that the

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52 (1980) 32 DLR 198.

53 Ibid, 201.

54 *H M Ershad v Bangladesh* (2001) 21 BLD (AD) 69; *Ershad v Bangladesh* (Bangladesh, 16 August 2000) ILDC 476 (BD 2000).

55 *Bangladesh National Women Lawyers Association v Government of Bangladesh and others* (2009) 14 BLC 703.

56 B Khan and E Haque, 'Core nine international human rights instruments and Bangladesh: an overview' (2019) 13 *Journal of Indian Legal Thought* 55.

enactment of domestic law is required to give effect to and enforce the treaty standards. Thirdly, domestic courts cannot directly endorse the StC standards and obligate the State to follow accordingly unless domestic law is enacted. However, where there is a gap or lack of clarity in domestic law, the courts can resort to the StC as an aid to interpret and fill up the lacuna.

B. *PCBs Identification in Bangladesh*

Bangladesh is not a PCBs producing country, but uses them largely in a closed environment, mostly in electrical appliances by the power sectors of Bangladesh. The major sources of PCBs stockpile and wastes include the dielectric fluids, heat-transformer fluids, electrical transformers, and capacitors, which were once imported into Bangladesh. PCBs have also been used in various commercial products like plasticizers, lubricants, inks, and paints/surface coatings, etc. PCBs may also be found in the open environment of Bangladesh. The old ships, which are scrapped in the ship breaking (SB)/ ship recycling (SR) yards, may also have PCBs in the electrical equipment and liquids/oils. Besides, it may be released at the municipal or medical HW disposal grounds if PCBs wastes are burnt or incinerated without taking proper precautions.

No accurate amount of PCBs stockpile and waste can be stated precisely, for want of updated data in Bangladesh. A report mentioned that the Bangladesh Power Development Board (BPDB) obtained 200,000 barrels of transformer oil annually for use in different electrical equipment and in 70 SB yards, which might have PCBs.[57] Another report suggested that in 425 locations of Bangladesh, various electrical articles had been used, which might be the potential PCBs hotspots. A limited field survey was conducted on 1163 electrical transformers; of those 423 were found to contain different unknown transformer oils, and 741 were found manufactured before 1990, which possibly have PCBs.[58] The NIP,[59] as submitted by the Ministry of Environment, Forest and Climate Change (MoEFCC) at the 2007 CoP of the StC, estimated that a total of 376,697 electrical transformers that were used by

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57 '*Country Situation Report on Persistent Organic Pollutants in Bangladesh*' (IPEN, 2005) 27, <https://ipen.org/sites/default/files/documents/1bgd_bangladesh_country_situation_report-en.pdf>

58 *POPs hotspots in Bangladesh* (IPEN, 2005) 7, <https://ipen.org/sites/default/files/documents/2bgd_pops_hotspots_in_bangladesh-en.pdf>.

59 Department of Environment (Bangladesh), *Bangladesh National Implementation Plan (NIP) for Management of Persistent Organic Pollutants (POPs)* (2007) 72, 93–94, <https://faolex.fao.org/docs/pdf/BGD219540.pdf>.

the power sectors and about 107,473,175 kilograms of transformer oil as used by power stations, might be PCBs contaminated. The identification of PCBs contaminated sites in the SB yards, HW dumping sites at open fields, and PCBs stockpiles and wastes in various industrial products and food items is also crucial to undertake for Bangladesh. According to the 2016 PEN report on the Preliminary PCBs Inventories of Bangladesh, about 55.8t of PCBs are in use, 403t of contaminated oil contained in waste equipment, 519t of contaminated waste transformer oils, and 22.5t of PCBs contained in materials of old ships.[60]

C. *Institutional Initiatives and Challenges of PCBs Management*

Bangladesh is committed to cascading the StC obligations through its various statutory laws and national institutions. Taking appropriate PCBs management is a task of all its associated stakeholders.

In particular, the MoEFCC is the vital entity to oversee ESM, disposal, and prevention of PCBs release into the environment and to protect public health. It has formulated the National Environment Policy (NEP) 2018, which spells out numerous policy objectives and action plans to be undertaken by different governmental agencies. The pertinent provisions of the NEP relating to PCBs management include to (i) identify risks and formulate sector specific contingent plans for disaster risk reduction and initiate rehabilitative measures for any affected/protected area; (ii) waste treatment before its disposal, prevent establishing waste dumping ground near any water source and compulsory waste cover while transporting; (iii) apply the 3R principle and precautionary principle for waste reduction and implement the StC and other relevant conventions; (iv) make inventories of chemical substances, imported chemicals and internationally prohibited chemicals for their phase out; (v) take steps to amend/frame relevant laws, rules, regulations and guidelines to supervise and monitor the preservation, transportation, movement and the ESM of imported chemicals, assess the conditions of their use, storage and environmental impacts; (vi) consider the public safety of using chemicals in electricity generation, invent and implement clean technology for the ESM; (vii) motivate to apply the internationally set standards.[61]

The Department of Environment (DoE), as the primary subordinate agency of the MoEFCC, has been working to implement StC commitments. The 2007 NIP, as prepared by the MoEFCC and the DoE, mentioned that a letter was

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60 *PCB inventory guidance* (PCB Elimination Network, 2016) 35.

61 3.22 of the NEP prescribes about the management of chemical substance which is the most relevant part of the Policy; The other relevant parts of the Policy are 3.23 which provides other pollution control and 3.24 of the NEP which articulates about Environment Friendly Economic Development, Sustainable Production and Consumption.

issued on 15 March 2005 to the BPDC and other relevant organizations requesting to buy 'PCBs free' electrical transformer, transformer oil, capacitors and to store safely all unserviceable PCBs containing equipment and oil, keeping those away for human contact, and preventing their sale in market for any other use. The 2007 NIP further elucidated various issues of PCBs management, highlighted the absence of any exclusive law on PCBs management, identified some workshops of power sectors where PCBs had been used; and apprehended PCBs presence in the SB yards as contaminated sites. Currently, the DoE, in association with UNIDO, is undergoing a sampling survey to detect PCBs containing electrical transformers of the power sectors for safe disposal, and has drafted a PCBs rulebook, following the StC. Moreover, a separate rule titled 'Chemicals Management Rules', has been drafted, though not yet finalized. However, it is vital to update the NIP of Bangladesh for identifying the PCBs stockpiles and wastes, leading to the initiation of an appropriate PCBs management in line with the StC and other relevant international instruments.

As the prime PCBs user, the Ministry of Power, Energy and Mineral Resources (MoPEMR) must initiate ESM and disposal of PCBs. However, no adequate step has been taken so far by the power sector agencies. Other connected ministries, such as the Ministries of Commerce, Employment, Food, Health, Industry, Local Government, Water Resources, Shipping etc. along with their subordinate agencies, should also act to ensure the ESM of PCBs.
PCBs contamination in food products is invariably another grave human health issue. The WHO had surveyed over fifty countries, as part of its biomonitoring of the presence of PCBs and few other POPs in breastmilk, but Bangladesh was not surveyed.[62] The Bangladesh Safe Food Authority (BSFA) is responsible for checking the PCBs presence in foods. The Bangladesh Standard and Testing Institution (BSTI) assesses the quality standard of, and chemicals found in various organic and inorganic products which are manufactured, processed, used, and imported into Bangladesh. Bangladesh Reference Institute for Chemical Management (BRICM) is established to measure the reference value of chemicals.

Several committees have been formed under various environmental laws of Bangladesh, for example, the National Technical Committee (NTC), National Coordination Committee (NCC), National Committee to Control Air Pollution (NCCAP), EIA Committee, Bangladesh Ship Recycling Board (BSRB), having direct or indirect connection with HS, chemicals, HW and PCBs management. Apart from these, respective local government (LG)

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62 M van den Berg et al, 'WHO/UNEP global surveys of PCDDs, PCDFs, PCBs and DDTs in human milk and benefit–risk evaluation of breastfeeding' (2017) 91(1) *Archives of Toxicology* 83-96, <https://doi.org/10.1007/s00204-016-1802-z >.

authorities and inspection authorities for checking the labour and industry perspectives are also associated with PCBs management.

The institutions of Bangladesh have initiated actions to address HS, HW and PCBs, though much more to do yet for the proper compliance of the StC. These institutions have been facing various types of challenges for ensuring the ESM of PCBs, which include a lack of updated data and information, adequate and proper lab facilities and experts. These facilitations are pivotal to identify and measure the actual amount, ensure the proper storage, treatment and disposal of PCBs stockpile and wastes. A report depicts that ships have been brought with forged 'toxic free' certificates, and no proper treatment, storage and disposal facility (TSDF) is built yet, rather the toxics are posing greater harm to local communities and environment, through dumping or re-sale.[63] The World Bank Group (WBG) has estimated that Bangladesh may bring 240,000 tons of PCBs between 2010 and 2030, through importing toxic ships; and the higher judiciary has directed in a few Public Interest Litigations (PILs) to do SB and SR in compliance with relevant laws.[64]

To become an upper middle-income country with poor environmental global performance (175^{th}),[65] having a huge population density (1333 per km^2),[66] and being a climate-vulnerable country, ensuring proper environmental protection is a big challenge for Bangladesh. Accommodating an effective ESM mechanism, from its planning through implementation, may help reduce the remediation cost, resulting from any environmental emergency caused by HW.[67] Replacing the business-as-usual approach (BAU) in HW management with modern and efficient technology is another key challenge for Bangladesh, as it requires huge fund allocation, building technical know-how of relevant stakeholders, and constant monitoring. Furthermore, numerous governmental agencies, non-governmental organizations (NGOs), and community participation are involved in it, for which their proper coordination and synergies in taking actions are tough to ensure due to the relaxed enforcement of laws and also poor application of institutional good governance (IGG).

Therefore, unless the issues mentioned above are addressed, the ESM of any type of HS, chemicals, and HW, including PCBs, would remain as

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63 'Impact Report 2020-2021', *NGO Shipbreaking Platform*, 12, <https://shipbreakingplatform.org/wp-content/uploads/2022/11/NGO-SBP-Annual-Report-2020_2021.pdf >.

64 *Bangladesh Environmental Lawyers Association (BELA) v Bangladesh and Others* (Writ Petition 7260/2008; 1207/2009).

65 'Bangladesh', *EPI Index* (Web Page, 2024), <https://epi.yale.edu/country/2024/BGD>

66 'Bangladesh Population (Live)', *Worldometer* (Web Page, 2024), <https://www.worldometers.info/world-population/bangladesh-population/>.

67 Abdullah Al Faruque, *'Environmental Law: Global and Bangladesh Context'*, (New Warsi Book Corporation, 2017) 208.

challenges for Bangladesh, leading to a delay in attaining the SDGs, like many other countries of the Global South.

D. *Status of the StC Compliance in Bangladesh's Legal Instruments*

To assess the compliance of the StC in Bangladesh, it is pertinent to assess the Constitutional standards of Bangladesh on environmental protection and human health issues. Part II mentions the State's responsibility to maintain public health, conserve and safeguard the natural environment, forest, wetland and wildlife for posterity. Part III directs to ensure 'right to life'.[68] Since Part II is not justiciable, interpreting the constitutional 'right to life' in different public interest litigations (PILs), the apex court recognizes 'right to a healthy environment' for protecting humans' normal longevity.[69] Despite these proactive judicial pronouncements, their enforcement, in many cases, is found to be relaxed or partial, giving an illusory status as to their compliance.[70]

The legal instruments of Bangladesh, having relevance with the different aspects of PCBs management are the Carriers Act 1865,[71] the Railway Act 1890,[72] the Import and Export (Control) Act 1950[73], the Dangerous Cargo (DC) Act 1953,[74] the Customs Act 2023,[75] the Bangladesh Power Development Board Order 1972,[76] the Dhaka Electric Supply Authority (DESA) Act 1990,[77] the Bangladesh Environment Conservation Act (BECA) 1995,[78] the Bangladesh Energy Regulatory Commission (BERC) Act 2003,[79] the Bangladesh Labour Act (BLA) 2006,[80] the Local Government (LG) (City Corporation) Act 2009, [81] the Hazardous Waste and Ship Breaking Waste

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68 *Constitution of the People's Republic of Bangladesh 1972* arts 18, 18A, 31, 32.

69 *Dr. Mohiuddin Farooque v Bangladesh and Others* (2003) 55 DLR 69; (1996) 48 DLR 438

70 Bahreen Khan, 'Efficacy & Implementation Gaps in the 'Core Environmental Laws' of Bangladesh: An Overview' (2022) 33(1) *Dhaka University Law Journal* 73, 95, <https://doi.org/10.3329/dulj.v33i1.61510>.

71 Carriers Act 1865 ss 3, 8.

72 *Railway Act* 1890 (Bangladesh) ss 4, 7, 47, 59, 84, 107.

73 *Import and Export (Control) Act* 1950 (Bangladesh) s 3.

74 *Dangerous Cargo (DC) Act* 1953 (Bangladesh) ss 2, 3, 6.

75 *Customs Act* 2023 (Bangladesh) ss 17, 62, 63, 64, 69.

76 *Bangladesh Power Development Board Order* 1972 (Bangladesh) arts 10, 15, 17.

77 *Dhaka Electric Supply Authority (DESA) Act* 1990 (Bangladesh) s 4.

78 *Bangladesh Environment Conservation Act* 1995 (Bangladesh) ss 4, 4A, 5, 6C, 7–15B, 17.

79 *Bangladesh Energy Regulatory Commission (BERC) Act* 2003 (Bangladesh) ss 22, 23.

80 *Bangladesh Labour Act* 2006 (Bangladesh) chs V–VII.

81 *Local Government (City Corporation) Act* 2009 (Bangladesh) ss 41, 98, 121, 122; schs III, V, VII, VIII.

Management (HWSBWM) Rules 2011,[82] the Ship Breaking and Ship Recycling (SBSR) Rules 2011[83], the Food Safety (FS) Act 2013,[84] the Rural Electrification Board (REB) Act 2013[85], the Bangladesh Labour Rules (BLR) 2015,[86] the Ecologically Critical Area Management (ECAM) Rules 2016,[87] the Safe Food (Chemical Pollutant, Toxin, Residue Limit) Regulations 2017,[88] the Bangladesh Standard and Testing Institution (BSTI) Act 2018,[89] the Electricity Act 2018,[90] the Ship Recycling (SR) Act 2018,[91] the Import Policy Order 2019-2024,[92] the Bangladesh Reference Institute for Chemical Measurement (BRICM) Act 2020,[93] the Electricity Rules 2020,[94] the Hazardous Waste (E-Waste) Management Rules 2021,[95] the Solid Waste Management (SWM) Rules 2021,[96] the Air Pollution (AP) (Control) Rules 2022,[97] the Environment Conservation Rules (ECR) 2023.[98]

The important requirements relating to PCBs management under the StC, their direct or indirect compliance in the above-listed legal instruments of Bangladesh and the gaps are discussed in the table below:

The StC on PCBs Management	Specific Provisions of Bangladesh's Laws on StC Compliances	Gaps in the Laws
1. Imposing Ban on the Import, Export, and Illegal Movement	-PCBs import is prohibited under Import Policy Order, issued under the Import and Export (Control) Act, 1950. - HWSBWM Rules 2011 prohibit the import of HW, articles containing PCBs and illegal movement of HS/HW; any authorized	-Relevant other laws have no clear mention of PCBs import prohibition (e.g. Customs Act).

82 *Hazardous Waste and Ship Breaking Waste Management Rules* 2011 (Bangladesh) rr 3–23; schs 1–14; tbls 1–3.
83 *Ship Breaking and Ship Recycling Rules* 2011 (Bangladesh) rr 3, 8–11, 15–19; annex V.
84 *Food Safety (FS) Act* 2013 (Bangladesh) ss 5, 21, 28, 43, 46, 52, 55, 64, 86, 87.
85 *Rural Electrification Board (REB) Act* 2013 (Bangladesh) ss 6, 11, 16, 18.
86 *Bangladesh Labour Rules* 2015 (Bangladesh) rr 40, 47.
87 *Ecologically Critical Area Management Rules* 2016 (Bangladesh) rr 4, 18, 21.
88 *Safe Food (Chemical Pollutant, Toxin, Residue Limit) Regulations* 2017 (Bangladesh) reg 7; sch 4.
89 *Bangladesh Standard and Testing Institution (BSTI) Act* 2018 (Bangladesh) ss 6, 15–17, 21, 22.
90 *Electricity Act* 2018 (Bangladesh) ss 4, 19, 29, 46.
91 *Ship Recycling (SR) Act* 2018 (Bangladesh) ss 4–8.
92 *Import Policy Order* 2019–2024 (Bangladesh) cl 3(1)(a); annex 1.
93 *Chemical Measurement (BRICM) Act* 2020 (Bangladesh) s 6.
94 *Electricity Rules* 2020 (Bangladesh) chs IV, V.
95 *Hazardous Waste (E-Waste) Management Rules* 2021 (Bangladesh) r 14; schs 1, 3.
96 *Solid Waste Management Rules* 2021 (Bangladesh) rr 4–14; sch 1; tbl 1.
97 *Air Pollution (Control) Rules* 2022 (Bangladesh) rr 4, 6–8, 12, 15.
98 *Environment Conservation Rules* 2023 (Bangladesh) rr 3–26, 31–33; forms 1–6; schs 1–5, 9–14.

	transboundary movement should follow recognized international guidelines (e.g. Basel Convention). - Safe Food (Chemical Contamination, Toxin and Deleterious Residue) Regulations 2017 prohibit the import of food with chemicals beyond the permissible limit.	-HWSBWM Rules have no direct mention of PCBs ban.
2. Preventing the Harmful Release into Environment and Human Health through Control, Reduction, Elimination, Prohibition on Use, Process, Re-use, Recycle, Marketing, Sale, Possess, etc. & Permitted Level of Use in Various Products and Food Items	-All the pertinent statutory laws such as BECA 1995, HWSBWM Rules 2011, SBSR Rules 2011, FS Act 2013 and Safe Food Regulations 2017 provide the responsibilities of the operator/user and government for these topics. FS Act and Safe Food Regulations prohibit the marketing, sale and use of PCBs oil in food; withdraw food which is risky for consumption; and set the maximum tolerable limit of PCBs intakes in food products (0.2-20 microgram per kilogram). BECA directs formulating necessary rules to control, regulate, etc. of HW; prevent the release of environmental pollution; declare prohibited activities. HWSBWM Rules permits the recycling of PCBs below its detection limit; prohibits issuing Environmental clearance certificate (ECC) for import prohibited HW; provides detailed procedures to be followed by the HS/HW/SBW producers, operators. SWM Rules and E-Waste Rules require preventing the non-mixing of waste, leaching and burning in open space; entails deciding chemical's threshold limit of presence. E-Waste Rules obliges managing E-waste in a way not to be harmful for the environment and human health. -AP Rules direct preventing the industrial AP through gaseous emission and wastes; ECR requires preventing environmental pollution and declaring any area as ecologically critical area (ECA); SR Act entails declaring the designated zones as SR yards; initiating any advance procedure or alternative of beaching for SR.	-Relevant other environmental laws have no particular mention about PCBs presence limit and related necessary prohibitions, e.g. E-Waste Rules, AP (Control) Rules, ECR.
3. Formulating Action Plan, Implementation Plan, Code, Contingency Plan, Clearance Certificate, Guidelines, Strategies,	-Procedures for obtaining the ECC, EIA, setting the various environmental standards and emission limits of wastes are well explained in the BECA and ECR. The Rules on HWSBWM, ECAM, E-Waste, AP, SWM entail formulating specific management, development and contingency plans, strategies, guidelines and taking ECC and permits in prior. -BPDB Order, BERC Act, REB Act, Electricity	-None of these laws have any specific direction on labeling, putting required signs on articles and wastes containing or consisting of PCBs (e.g. HWSBWM Rules.

Permit, License, Management Plan, Development Plan, Standards & Putting Labels, Marks, Seals	Act and Rules prescribe formulating the comprehensive plan and standard of maintenance of power houses' operation, code of quality equipment/products, and adopting better technology in electricity related tasks. Railway Act and Customs Act requires putting seals and marks on goods/ dangerous goods. -BSTI Act necessitates putting Bangladesh Standard Mark for the use, sale, distribution and advertisement of any product having licence; obtaining permit/clearance for imported goods. -BRICM Act obliges developing reference value and chemical measurement, assessing the chemical reactions risks and providing technical support to other agencies in such measurement, research activities and guideline development. SR Act and SBSR Rules require taking license, permit, ECC and approving SR and facilities plans. LG Act empowers respective LG agencies to undertake waste disposal activities and directs making necessary regulations.	-No exclusive provisions are found in these laws about PCBs management. -None of the power sector laws have mentioning to compel the use of 'PCBs free' equipment and about PCBs waste disposal guidelines. -Railway Act and its latest draft of 2021 has no mentioning of a list of dangerous goods.
4. Assessment, Identification, Inspection, Sample Collection, Examination, Testing, Notification, Reporting, etc. for Accident Prevention, Controlling the Release of Environmental Pollution and Restoring the Degraded Ecosystem	-BECA and all its Rules have elaborated different obligations on these topics. The Rules on HWSBWM, ECAM and SBSR discuss identifying toxic chemicals, their concentration limits; preparing various reports (e.g. site visits, safety information, annual assessment, emergency plan); verifying data sheets and publishing various notices. SBSR Rules obliges providing information of facilities necessary for PCBs handling. FS Act requires collecting samples for testing, inspecting places and seizing adulterated foods; the food business operator withdraw foods which are found risky for consumption. -BSTI Act entails inspecting and assessing product quality. BRICM Act directs extending technical support the BFSA, BSTI and DoE, etc. for assessing and measuring the chemical reactions risks. BERC Act empowers the authorized persons to act like a civil court for investigating any occurrence; REB Act directs developing necessary infrastructure; Electricity Act and its Rules entail doing the inspection, examination, investigation, survey of any place and occurrence and its reporting. Electricity Rules obliges establishing a high-voltage testing laboratory for the certification of	-Most laws have no specific mentioning about PCBs identification, collection, testing procedure (except HWSBWM Rules and SBSR Rules). - None of these laws has any clear direction regarding the prevention of accidental release of PCBs. -DC Act has not listed PCBs as DC and no clear steps on accident prevention and safety mechanisms of HS, HW or chemicals.

	transformers and other electrical equipment; putting caution notes on/near electrical generators; having fireproof walls and pits to absorb transformer oils; covering cables with non-flammable substance and generators/switch gears with metal covers. -BLA and BLR prescribe collecting samples, investigating into and reporting any accidental/dangerous occurrence. DC Act empowers issuing orders to prevent fire or explosion and to remove/demolish useless things.	
5. Ensuring ESM, Applying BAT and BEP, regarding Safe Storage, Processing, Handling, Packaging, Transportation, Treatment, Removal, Disposal, Destruction to Protect Environment and Occupational Health and Safety & Phase Out Timeframe (by 2025 and 2028)	HWSBWM Rules specifically requires applying ESM, BAT and BEP by the producer, operator, incinerator owner, seller/buyer, processor; preserving HS/HW safely; identifying sites for storage; lays down few requirements of storage and transportation. -SWM Rules gives extended producer's responsibility on waste segregation, collecting HW in red-coloured bins; entails preventing the leaching or burning in open place; and disposal through landfill or incineration. -ECR details the requirements of obtaining ECC; doing EIA for specific types of actions. REB Act and the Electricity Rules provide few directions regarding storage and keeping electrical equipment in heat-resistant dry places. -SR Act and SBSR Rules direct evaluating and making the inventory of toxic materials in imported ships; handling by registered vendors; constructing facilities like the central incinerator and TSDF for PCBs handling and removal through designated manager; doing works by trained male workers; providing training for workers and life insurance. FS Act prohibits the storage of PCBs/industrial oil and waste in any food establishment, intended to use in food items. -Carrier Act entails the common carriers (except governmental agency) to carry and deliver things without any negligence. Railway Act provides general rules to declare and regulate dangerous/offensive goods transportation; directs the owner to give prior notice and putting proper marks of the nature of goods on the body of the package. -The BLA and BLR have elaborated provisions of taking effective measures for waste disposal	-None of the laws provides any clear guidelines on how to do ESM or the requisites of applying BAT and BEP and especially the procedures for the safe storage, packaging and transportation of PCBs stockpile or waste. Even, the ECR has no specific mentioning about PCBs management. - DC Act and the Carriers Act have not listed PCBs and no mentioning about the transportation mechanism of HS/HW or hazardous chemicals. -Railway Act provides a negligible fine of taka 50 for not retaining goods in the designated warehouse, taka 500 for not disclosing them. Its latest draft Bill of 2021 also has no mentioning about the procedure of HS/HW transportation. -LG Act has no

	to ensure the occupational health and safety of workers (e.g. provide personal safety equipment to workers; ensure using separate waste box with lid for removing chemical wastes; obtain ECC and any other additional measures to protect human health and to prevent pollution). NEP directs implementing the requirements of the StC.	detailed provision on PCBs or HW disposal or destruction. -None of these laws contain any timeframe of PCBs phase-out, as mentioned in the StC.

V. FINDINGS

Based on the above table of summary, it is evident that Bangladesh is committed to take actions for the ESM of various HS, HW and POPs (including PCBs), as a party to the StC and other international instruments. There are various governmental agencies of Bangladesh responsible for ensuring ESM of PCBs. However, the DoE, the principal environmental agency under the MoEFCC, oversees and implements actions for the compliance of the StC. The power sector agencies, being the primary PCBs users in Bangladesh, are required to identify and eliminate PCBs stockpile and waste from electrical equipment.

All the relevant agencies of Bangladesh have been facing various challenges in implementing the ESM of POPs, HS, HW and chemicals. In particular, lack of institutional coordination, IGG, strict enforcement of laws, different types of resources (infrastructure, knowledge/technology and funding, etc.), accurate information, and community engagement through awareness raising are some of the severe challenges in ensuring the ESM of PCBs.

The application of the standards of the StC is at the discretion of the domestic authorities. On the use of POPs, courts cannot directly endorse the StC standards due to the rigid approach of the State to dualist doctrine.

These challenges are likely to show the 'snowball effect', exacerbating the environmental performance and climatic impacts in Bangladesh, which is already recognized as vulnerable in international organizations' reports. Consequently, these challenges may lead to slower down the attainment of the SDGs.

Since the StC requires PCBs disposal by 2025 and 2028, the government of Bangladesh has a very limited time to do so. Upon perusal of around 30 national legal instruments, it is divulged that Bangladesh has no dedicated legal instrument detailing the ESM of PCBs in compliance of the StC. In particular, only a few laws cover a few PCBs issues directly, but with either little or no proper details. These laws have either direct or indirect relevance to some fundamental aspects of the ESM of POPs, HS, chemicals and HW but none has accommodated each and every requirement of PCBs management, following the StC. However, being a party to this Convention and realizing

environmental protection as '*erga omnes'*, it is crucial for Bangladesh to take a quick decision whether a separate and distinct law to regulate POPs, including PCBs is necessary to adopt, or amending the existing laws and policies to accommodate PCBs regulation, in line with the StC, will suffice.

Scrutinizing the pertinent legal instruments of Bangladesh, their compliance status with the StC and the gaps are summarized below:

i. Environmental laws, namely the BECA, its Rules on HWSBWM, ECAM, SWM, E-Waste, AP, and ECR mandate to: identify HS, chemicals and HW stockpile, waste and contaminated site; handle, label, store, transport, use, process, recycle, control, reduce, eliminate, dispose and destroy, prevent accident, rehabilitate; export, import prohibit illegal trans-boundary movement; develop and implement different plans, guidelines, standards, permissible presence and emission limits; inspect, assess, notify and report; aware and ensure occupational health and safety. The HWSBWM Rules mainly focus on compliance with the Basel Convention.

ii. Laws regulating transboundary movement, namely the Import and Export (Control) Act, Customs Act, Import Policy Order impose ban on PCBs import. However, in the absence of a proper facility for environmentally sound disposal, PCBs export is allowed.

iii. Food and chemicals related laws, namely the FS Act, Food Regulation, BSTI Act, BRICM Act elucidate about: identification, inspection, assessment, fixing standards and tolerable limits of PCBs (0.2 to 20 microgram per kilogram), measuring chemicals' reference value; prohibition on import and use, exceeding the permissible limits.

iv. Transportation laws, namely the Carriers Act, Railway Act, DC Act, prescribe about: goods/cargo handling, labeling, storage, loading/unloading and transportation; accident prevention and safety; inspection and assessment; making rules/regulations. But there is no explicit provision on HS/HW transportation procedures.

v. Occupational health and safety related laws, namely the BLA, BLR, SR Act, SBSR Rules, and LG Acts explicate: identification, inspection, and assessment of HS, HW, including PCBs stockpile and wastes; developing facilities and management plans; handling, storage and disposal; awareness and training on accident prevention. The SR Act directs to apply the Hong Kong Convention.

vi. Electricity Act and other power sector laws of the BWDB, DESA, BERC and REB emphasize: developing standards of quality equipment; storage and disposal; accident prevention, inspection, assessment and reporting. But these laws have no direct provisions on PCBs management.

VI. CONCLUSION AND RECOMMENDATIONS

Like many countries of the Global South, the ESM of different types of POPs and other HW is a crucial yet challenging task for Bangladesh. Progress in environmental management requires taking plenty of developmental initiatives, an action agenda, leading to generating a gargantuan amount of HW. The country has persistent environmental and climatic vulnerability. PCBs released into the environment and food chain may bring enhanced complexities and harm to Bangladesh. But it is a good sign that Bangladesh has banned the import of PCBs. Therefore, Bangladesh should design a necessary plan of action, aligning with various international legal instruments, dealing with HS, HW, chemicals, and POPs, of which it is a party. In particular, the requirements as entailed by the StC for the ESM of PCBs are to be addressed as priority concerns since the PCBs phase out ought to happen by 2025 and in some cases by 2028, following the StC. The power sector companies of Bangladesh are the major PCBs waste generators, and they should come forward in proper identification and disposal of the same to prevent PCBs release into the environment. Moreover, the dumping at open spaces, of various types of HW through SB, SR and commercial/industrial articles having or contaminated by PCBs, should strictly be prevented. To better combat the generation of PCBs, Bangladesh must update its NIP without any further delay. The NIP will explore the current status and gaps in implementing necessary actions regarding the intentional and unintentional release of PCBs into the environment. The legal instruments of Bangladesh, which have been reviewed to check the compliance of the StC and the gaps in these laws, should be considered for necessary amendments in line with the findings and recommendations depicted in this research. Bangladesh may follow the best practices of other regions to ensure the ESM of PCBs. It should consider scaling up of necessary legal research with different regional and global experts in this field to act on other significant chemicals, which are known as ‘forever chemicals’. Therefore, countries of Global South, including Bangladesh, must sketch pragmatic management plans with concrete timeline and defined responsibilities of all relevant stakeholders which are pivotal to ensure peoples’ healthy living, protect biodiversity, environment and ecosystem and to achieve the objectives of various international legal instruments pertaining to POPs, HS, chemicals and HW as well as the goals set in the SDGs.

Based on the analysis reflected in this research, the following specific recommendations are proposed for Bangladesh to safeguard the environment and to prevent the deleterious effects of PCBs-

1. The MoEFCC and DoE should update the NIP, following the StC, for taking appropriate action on PCBs management, as it was last prepared in 2007. The updated NIP will guide Bangladesh to take the necessary plan of action for the identification, accounting and management of PCBs stockpile, waste and contaminated sites.
2. The judiciary of Bangladesh, being the pivotal institution, can play a proactive role in interpreting the domestic legal framework on the StC. The standards of this Convention can be used where the domestic system lacks a comprehensive framework on PCBs. The recent approach of the Court suggests that it directly applied the customary international law principle of *non-refoulement*.[99]
3. As the StC deadlines for PCBs management are imminent, and on the contrary, the full compliance with the StC standard may be time-consuming and requires significant funding, Bangladesh should seek assistance/resource grants from the development partners and industrial houses to enhance capacity, knowledge and develop infrastructural facilities and for awareness raising. Proper kits and adequate lab facilities should get priority for PCBs identification and safe disposal, for which the multilateral banks may be approached by the government. Under the StC, developed nations have committed to offering financial and technical assistance to the developing nations.[100] The technology transfer under the StC includes capacity building of regional centers.[101] The mandate further obligates developed nations to provide funding in order to meet incremental costs of developing countries while implementing the Convention.[102] Therefore, Bangladesh should pursue extensive diplomatic efforts as a developing country party of the StC to the developed State parties.
4. Extensive research should be initiated by research-based institutions to design and apply BAT and BEP, along with motivating and ultimately compelling all relevant stakeholders to adopt any environmentally sound and sustainable technology, discarding the BAU attitude. Necessary financial incentives (e.g. tax deductions) may be given initially to those who are applying for BAT and BEP.

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99 *Refugee and Migratory Movements Research Unit (RMMRU) v Government of Bangladesh* (Supreme Court of Bangladesh, Writ Petition No 10504 of 2016, 31 May 2017) 9–10.

100 *Stockholm Convention on Persistent Organic Pollutants*, opened for signature 22 May 2001, 2256 UNTS 119 (entered into force 17 May 2004), arts. 6, 12, 13.

101 Erin Perkins, 'The Stockholm Convention on Persistent Organic Pollutants: a step toward the vision of Rachel Carson' (2001) 13(3) *Colorado Environmental Law Journal* 191, 200–201.

102 Joel A Mintz, 'Two cheers for global POPs: a summary and assessment of the Stockholm Convention on persistent organic pollutants' (2001) 14(2) *Georgetown International Environmental Law Review* 319, 327.

5. Detailed rules, regulations or guidelines must be made entailing the steps for the ESM of PCBs, especially for handling, labeling, storage, transportation, disposal, removal and destruction of stockpiles and waste. It is required to establish proper TSDF of international standard for the management of various types of HW, including PCBs and for preventing accidental spills into the environment, causing harm to human health, biodiversity and ecosystems.
6. All pertinent laws need to insert PCBs in their lists of dangerous/offensive/hazardous goods, and to compel the use, import of products certified as 'PCBs free'. Power sector laws require amendment to provide specific directions on PCBs disposal from electrical equipment. For PCBs remained stockpiled for prolonged years, clear strategies must be adopted so that perfect disposal of PCBs is ensured.
7. The HWSBWM Rules 2011 require amendment to insert the missing significant provisions of StC 2001 on PCBs management, such as: co-opting members from the power sector agencies in the NTC; banning PCBs import; labelling, handling, storage and transportation of PCBs stockpiles and wastes; timeline of PCBs elimination, phase-out and detailed plan of destruction.
8. Rigorous and timely enforcement of laws and inculcating strong IGG by the relevant stakeholders should be ensured to reflect environmental justice. For that, the personnel/authorities may be awarded as a recognition for their timely actions.
9. Constant awareness raising in local communities about the impacts of HS/HW and 'forever chemicals' should be undertaken by community organizations/NGOs. The students, from primary to tertiary level, should learn about the ominous impacts of HS/HW and chemicals.
10. As PCBs management involves multiple agencies, synergies in taking actions by all these cross-sectoral agencies of Bangladesh are imperative while replicating the obligations under other associated global conventions, besides the StC. In particular, following other countries notably Japan, USA, England, Indonesia, the Philippines and South African best practices, Bangladesh may consider framing a separate 'PCBs Regulations' or the 'Chemicals Management Rules' which is currently at the draft stage should be finalized in a way to cover the obligations of all pertinent international agreements in which Bangladesh is a party with specific compliance to the StC. Since the past practice of Bangladesh suggests that framing a new and comprehensive legal instrument is time-consuming and the StC deadlines are imminent, it is preferred to amend the HWSBWM Rules 2011, incorporating the missing requirements of the StC, to march forward. The adoption of such a measure will facilitate the compliance mechanism in the transitional phase; however, the proposal to incorporate a new comprehensive law should not be negated, but rather pursued for the future to develop a sustainable regulatory framework for POPs, including PCBs in compliance with the StC obligation. Any progress

on this issue remains at the discretion of the government, provided that it consults with all concerned stakeholders, particularly on the timeframe prescribed in the StC as well as other international instruments for the ESM of all POPs, other HS/HW and chemicals.