Preliminary Inventory of Hexachlorobutadiene (HCBD) in Brazil

The report was developed within the Project on "Supporting inventories development and priority setting as part of the process to develop, review and update NIPs -National Implementation Plans- for POPs listed after the entry into force of the Stockholm Convention" .

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Abbreviations and Acronyms

CAS	Chemical Abstract Service
CETESB	Environmental Company of the State of São Paulo
COP	Conference of the Parties (7/12)
DDT	Dichlorodiphenyltrichloroethane
EDC	Ethylenedichloride (dichloroethylene)
EU	European Union
GDP	Gross domestic product
GRULAC	Group of Latin American and Caribbean region
HCE	Hexachloroethane
HCB	Hexachlorobenzene
HCBD	Hexachlorobutadiene
HCH	Hexachlorocyclohexane
HS Code	Harmonized System Code
IBAMA	*Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis* (The Brazilian Institute of Environment and Renewable Natural Resources)
MDIC	*Ministério do Desenvolvimento, Indústria e Comércio Exterior* (Ministry of Economy, Industry, Foreign Trade and Services)
MMA	*Ministério do Meio Ambiente* (Ministry of the Environment)
NCM	*Nomenclatura Comum do Mercosul* (MERCOSUR Common Nomenclature)
PCNs	Polychlorinated naphthalenes
PIC	Prior Information Consent
POPs	Persistent organic pollutants
PVC	Polyvinyl chloride
SC	Stockholm Convention
SCCPs	Short chain chlorinated paraffins
UNEP	United Nations Environment Programme
UN-ECE	European Economic Commission of the United Nations
USA	United States of America
US EPA	United States Environmental Protection Agency
VCM	Vinyl chloride monomer
WHO	World Health Organization

1 INTRODUCTION

1.1 Background on HCBD

Hexachlorobutadiene (HCBD or HCBu, CAS 87-68-3, molecular Weight: 260.76 g/mol) was initially listed as a persistent organic pollutant (POPs) in May 2015 by the Stockholm Convention in Annex A (Conference of the Parties (COP), SC-7/12), but without a specific exemption as to its persistence, degree of toxicity, bioaccumulation and potential for the transport of long distances (UNEP, 2017, 2019; WANG et al., 2018). After two years of its first indication as a POPs, HCBD was also listed (May 2017) in annex C for presenting relevant unintentional production (uPOP) (BALMER et al., 2019; UNEP 2017, 2019; WANG et al., 2018). As with other signatory countries, Brazil must restrict the use, production and consequently HCBD emissions in its territory. In addition to hexachlorobutadiene (1, 1, 2, 3, 4, 4-hexachlorobuta-1.3-diene, denomination according to IUPAC) synonyms such as: Perchloro-1, 3-butadiene; perchlorobutadiene; 1.3-hexachlorobutadiene; 1.3-butadiene, 1, 1, 2, 3, 4.4-hexachloro-; 1.3-butadiene, hexachloro-; and hexachlorobuta-1.3-diene can also be found in literature (UNEP, 2017, 2019).

HCBD is an aliphatic halogenated substance originated mainly by the chemical industry as a by-product of the manufacture of chlorinated solvents, especially in the production of trichloroethylene, tetrachloroethylene (or perchloroethylene) and tetrachloromethane, In addition to hexachloro-cyclopentadiene (intermediate substance in the synthesis of pesticide cyclodienes). In some countries, the production of these chlorinated solvents accounts for almost all HCBD production in their territories (MUMMA and LAWLESS, 1975; WANG et al., 2018). Even so, the anthropogenic emissions of HCBD may originate from intentional and unintentional sources, added to the historical disposition of residues and the characterization of contaminated areas. As intentional use, HCBD has been widely applied for different purposes (UNEP 2017, 2019). Prior to the recent listing of HCBD by the Stockholm Convention, the Montreal protocol had already decreed the ban on the use of HCBD for having a potential effect on the depletion of the stratospheric ozone layer (UNEP, 2001).

HCBD is produced and marketed as a by-product of the process of synthesis of chlorinated solvents (tetrachloroethylene, trichloroethylene and tetrachloromethane/carbon tetrachloride), more specifically after its separation of heavier fractions. The HCBD can also be produced by chlorination of butane or its chlorine derivatives (UNEP, 2017, 2019). Nevertheless, information about the actual use of this type of synthesis in commercial production is lacking. Once separated, the HCBD can be marketed for numerous applications. Historically, its industrial use is geared towards the production of elastomers, rubberized, calorifiers liquids, transformers, hydraulic fluids and fungicides (UNEP 2017, 2019; WANG et al., 2018; ZHANG et al., 2019). The largest production of HCBD is reported for the decades of the 1970s and 1980s, where it is estimated that only for the year 1982 about 10,000 tons were produced commercially in the World (UNEP, 2013, 2019). Currently the intentional production of HCBD is no longer reported to countries of the European Economic Commission of the United Nations (UN-ECE), also included in the USA and Canada. Previously, the same Commission had already listed the HCBD, for prohibition of production and use, in the

Convention on the Transboundary Transport of Air Pollution in 2009 (annex I) (www.unece.org/env/lrtap/pops_h1.html) (BALMER et al., 2019). On the other hand, data on intentional production of HCBD outside the UN-ECE are scarce and/or unavailable (UNEP, 2017, 2019). Recently, some studies have reported the continued production and unintentional generation of HCBD for Asian countries, especially for East Asia (UNEP, 2017; WANG et al., 2018; ZHANG et al., 2019). This recent profile change can be partially explained by the continental change linked to the production of chlorinated solvents in the world. Even so, in 2014, the USA alone was the country that most produced tetrachloroethylene, accounting for about 40% of all worldwide demand, followed by China (32%) and Europe (10%) (UNEP, 2019). However, the increase in consumption and production of chlorinated solvents by East Asian countries has being demonstrating an increasingly and consistent trend, especially for the last decade. In 2011, China had already exceeded Europe in the consumption of perchloroethylene, with an annual estimate of average consumption well above (7.5% 2014-2019) when compared to the countries of greatest demand for chlorinate solvents (UNEP, 2017, 2019).

In addition to this scenario, the unintentional production of HCBD in the world is considered relevant and can easily exceed its commercial synthesis locally. According to the United States Environmental Protection Agency (US EPA), the annual production of HCBD in 1980 was estimated at 3,300-6.600 tonnes/year. On the other hand, the unintentional generation of HCBD by contaminated waste, derived from the synthesis of chlorinated solvents, exceeded, only for the USA, its intentional production in 14,000 tonnes during the year 1982 (UNEP 2013; WANG et al., 2018).

In order to estimate the unintentional production of HCBD and its emissions in China, Wang and collaborators (2018) observed that the industrial production of perchloroethylene and trichloroethylene are its main primary sources, accounting for a total of about 2,072 (2,234-3,530) tonnes in 2016. According to the authors, in 1992 the production of trichloroethylene and perchloroethylene was 3,474 and 1,102 tons/year, respectively. From this amount, it is estimated that the unintentional production of HCBD was 22% (trichloroethylene) and 7.4% (perchloroethylene). In 2016, the production of trichloroethylene and perchloroethylene increased to 545,000 and 17,000 tonnes/year, which resulted in an unintentional production of HCBD with even more expressive proportions (trichloroethylene: 73.0% and perchloroethylene: 24.5%). Considering the rapid and recent expansion of the chlorinated hydrocarbons industry in China, the authors foresee an increase in HCBD emissions for the coming years (WANG et al. 2018).

1.2 Information on HCBD in the Americas

With the exception of the USA and Canada, little is known about the use, production and emissions of HCBD in the Americas, which includes Brazil. Even with few data available, more recent environmental studies have been pointing out novel data on the presence of HCBD for the Group of Latin American and Caribbean (GRULAC) region (RAUERT et al., 2018). The authors suggest that the region is mainly susceptible to background concentrations of HCBD in air <20-120 pg/m^3), in line with concentrations measured at the Arctic site of Alert (Canada), with long range atmospheric transport as the main source of this POP to the region. However, the two sampling points in Brazil, which showed the lowest concentrations, are far away from highly industrialized areas or even from potential local sources.

According to a recent report on the chlorine industry and construction materials, with the exception of the USA, there are 17 industries that produce chlorinated manufactured in the Americas, highlighting Mexico (5), Brazil (5), Canada (3), Peru (2), Argentina (1) and Venezuela (1) (VALLETTE, 2018). The report also points out that of the 15 largest chlorinated hydrocarbons producing industries in the Americas, 03 (three) are from Brazil. Among them, we highlight the Dow – Aratu (Bahia), Braskem – Maceió (Aracajú) and Unipar Carbocloro – Cubatão (São Paulo), with an annual production of 415,000, 409,000 and 355,000 tonnes, respectively. According to the inventory, Dow-Aratu (Bahia) produced carbon tetrachloride and perchloroethylene up to the year 2009. As previously mentioned in this report, these compounds present high risk over the unintentional generation of HCBD during their production often associated with waste disposal of HCBD and hexachlorobenzene (HCB) often declared as “HCB waste” but containing a large share of HCBD (MUMMA and LAWLESS, 1975; UNEP 2017, 2019).

Nowadays, most of these industries in Brazilian territory declare, however, to produce other chlorinated products with low risk of HCBD generation, such as polyvinyl chloride (PVC), ethylenedichloride/dichloroethylene (EDC), dichloropropylene, vinyl chloride monomer (VCM), among others (VALLETTE, 2018). In some of these processes also HCBD is formed (UNEP 2017d, 2019e). E.g. in the production of ethylene dichloride (EDC), HCBD is formed and present in relevant amounts in the waste. In a monitoring of Dow Chemical, the heavy ends of EDC included 12,000 mg/kg HCBD, 302 mg/kg PCBs, 3000 mg/kg hexachloroethane (HCE), and 30.6 % unidentified compounds (THORNTON 2002). However, such inventories require more detailed information on the processing, disposal and treatment of residues potentially contaminated with HCBD, as well as any environmental damage observed locally. Moreover, although recent data indicate that in general the environmental levels of HCBD are decreasing, they have recently been detected as the POP with the highest air concentration in Japan (TAKASUGA et al. 2018). Also drinking water can be affected around sites where HCBD has been disposed in the past (FORTER 2016). Due to their genotoxicity already low exposure levels are relevant. The risks for human exposure can still be high, especially in synergy with other pollutants (ZHANG et al., 2019).

The major challenge with HCBD is the related waste and (former) landfills and other deposits from which HCBD can leach and which can lead to environmental contamination and related exposure to humans (FORTER 2016; WEBER et al. 2011; UNEP 2019).

1.3 HCBD/POPs and food and water safety

A major human exposure pathway is food and for water soluble POPs like HCBD, PFOS and PFOA also drinking water. Therefore, the protection of food and drinking water is an important part of the lifecycle management of POPs.

Brazil has a particular interest in the protection of its food production which has a major share of its Gross Domestic Product (GDP). In particular meat and other products of animal origin has a high risk for POPs exposure and contamination (WEBER et al 2017; 2018) and a stringent risk management is needed to avoid the extreme high costs of dioxin/POPs food crises (KAMPHUES & SCHULZ 2006). However, the contamination with other POPs including HCBD can have a negative input on Brazil's food production and export.

To discover and mitigate the risks for food and feed contamination, the inventory of POPs and POPs contaminated sites is the basis for the management of POPs and the protection of food and the food to protect human health and the Brazilian food business.

2 HCBD INVENTORY

2.1 HCBD production and unintentional HCBD waste and disposal

A specific inventory was carried out for the production, trade and use of HCBD in national territory. The first action developed in order to construct the inventory of HCBD in Brazil, following its guidance, published by the Stockholm Convention (UNEP, 2019) and after studying deeply the topic, was to identify the potential stakeholders at national level and to carry out a consultation on the entire life cycle of HCBD. Firstly, a consultation was made to the governmental institutions such as the departments of the Ministry of the Environment (MMA – Ministério do Meio Ambiente), the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA – Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis), that is the national authority for the import of some substances controlled by the Stockholm Convention, the actual Ministry of Economy, Industry, Foreign Trade and Services (MDIC – Ministério do Desenvolvimento, Indústria e Comércio Exterior) and all environmental secretariats and industrial federations from the 26 Brazilian states.

The MDIC was officially consulted online via its unified database portal for the international trade, Comex Stat (http://comexstat.mdic.gov.br). The IBAMA was officially consulted, by e-mail, regarding the control information of the substances studied and through the Electronic System of Information Service to Citizen. The IBAMA declared to carry out its control searches in the same general government database, but by the platform Single Portal of Foreign Trade Siscomex. Both the IBAMA and the technical team of the project carried out data collection through codes of the MERCOSUR Common Nomenclature (NCM – Nomenclatura Comum do Mercosul). However, the HCBD trade could not be traced under any NCM code. The IBAMA also reported to do not have any control over the volumes of HCBD international trade.

In parallel, industrial/business associations and individual private companies, potentially involved in some stage of HCBD lifecycle – production, import and export, uses and final destination HCBD or products that can contain HCBD – in national territory were listed for further inquiry. From the exhaustive search on the web, 56 industry associations and 606 individual industries were contacted directly via a circular craft sent by the Ministry of Environment. Through the official document, associations and industries were questioned regarding the use, manufacture, processing, trade and disposal of HCBD in Brazil. Of the total number of circular crafts sent, only 01 (one) questionnaire was answered about the contamination of an old chlorine solvent factory in the municipality of Cubatão, in São Paulo.

According to this report, it is estimated that a chlorine solvent factory produced from 5,000 to 9,000 tons of HCBD, between the years of 1974 and 1993, when it was closed by the judicial interdiction and we can highlight that:

1) HCDB is present in a mass of organochlorine chemical substances in the proportion of 25 to 45% and the mixture of residue (by-product) was buried in the factory area (Cubatão/SP) and discarded unduly in external areas in the cities of Cubatão, São Vicente and Itanhaém;

2) In the areas outside the factory, the large solid part (chlorine residue plus soil) was removed and deposited in a "waiting station" built in São Vicente. The residue remains there since 1987. In some areas, hydro-geochemical barriers and groundwater treatment plants were implanted to remove groundwater residues;

3) Currently, a total of 33,000 tonnes of contaminated soil with HCBD is estimated in the region.

Moreover, an amount of 8,5 tonnes of pure organochlorine residue might be deployed in the ground of that former factory and 3,6 tonnes could be unlocated in the soil and subsoil of the affected areas (Baixada Santista). On the other hand, there is a lack of updated information on HCBD emissions, as well as the degree of contamination of these localities. The report also mentions a former incinerator of that factory, which presented proofs of incomplete incineration by the time. Even though, approximately 70,000 tonnes of organochlorine residue and sand (in a proportion of 10 to 90%, respectively) were incinerated and the remaining sand (~60,000 tonnes) containing 50 ppm or less of total organochlorine residue was dumped behind the factory in open sky. Moreover, from the total 20,000 tonnes of the organochlorine residue which contains from 25-45% of HCBD (5-9 thousand tonnes), around 6,200 to 10,000 tonnes of HCB could also be expected.

The report of HCBD in this questionnaire reinforces the information raised by another document, a representation with Nº 05012004, sent to the Public Federal Prosecution Office in January 2004, specifically to the Federal Prosecution Office of the municipality of Santos. Even with the presence of HCBD not textually cited, the document in question describes the occurrence of "toxic dumps" containing mixtures of different organochlorine compounds. According to the document, these residual mixtures were unduly disposed in the metropolitan region of Baixada Santista, state of São Paulo, during the end of the decade of 70 and the beginning of the years 80. Subsequently the residues were collected partially and packaged in "mag-sacs" polyethylene containers, containing around one tonne of the residue each.

The Baixada Santista metropolitan region, consists of a territory of 2,400 km², including 9 municipalities and 1.67 million inhabitants (IBGE, 2010). Originally occupied by agricultural landscapes, the region was progressively transformed into one of the main industrial areas of Brazil due to a series of investments applied during the 1950's and more intensively on the 1970's after the enlargement of the industrial complex of Cubatão. This region is considered one of the coastal environments most heavily damaged by industrial residues in the world, being also affected by a high population density and a domestic sewage discharge rate of 369,038 m^3 d^{-1} (LUIZ-SILVA et al., 2002). This region is globally known by the case of an irregular settlement in a place where approximately 12 kt of organochlorine residues were irregularly dumped by the multinational Rhodia, which became known as the “Rhodia case” (ACPO – online dossier accessed in October 2019). This company started operating at Cubatão, São Paulo, in the 1960’s together with another industry named CARBOCLORO. This chemical plant was firstly focused on pentachlorophenol production, which is actually also a POP. Later, in 1974, the Rhodia S.A. started a joint venture with Clorogil to produce chlorinated solvents in a plant named TETRAPER (ARRUDA JUNIOR, 2004). This is likely the case implied in the answered questionnaire, from where residues of HCBD, HCB, pentachlorophenol and other organochlorine contaminates had been generated.

Several studies concerning the Rhodia case have been carried out in the Baixada Santista region (ACPO – online library accessed in October 2019). However, in most of them only HCB was measured and used as an indicative of general organochlorine exposure (MINISTÉRIO PÚBLICO DE SÃO PAULO, 1993; MESQUITA, 1994; AUGUSTO, 1995). Augusto (1995), reported the serum blood levels of HCB in workers and former workers to arise from occupational and environmental exposure inside that chlorine solvent plant, since it was significantly higher than in the control group. In this study, the serum blood levels of HCB were positively correlated to the length of exposure in workers and former workers of that factory. The author also highlighted that those directly working in the production of carbon tetrachloride had the highest blood levels of HCB. Despite of that, more recent studies carried out in that region could not prove causal relations, but have reported a higher frequency of pregnancy disturbs (GUIMARÃES et al., 2015), higher occurrence of hypertension to low income populations chronically exposed to those contaminants (RIBEIRO et al., 2016) and increased risk factors linked to liver diseases, due water and food locally obtained (CARVALHO et al., 2014). Moreover, high concentrations of legacy organochlorine pesticides – especially HCB, DDT and HCH – have recently been reported to occur in the atmospheric air of this region, with extreme concentrations in the sampling points closest to the previously mentioned dumping sites (GUIDA et al., 2018). The mean and median atmospheric concentrations of HCB in the air of the Baixada Santista was measured to be higher than many urban areas and even places known to be contaminated by this chemical in Europe (JAWARD et al., 2004; TORRE et al., 2016). However, little is known about the occurrence of HCBD in environmental or human samples regarding this case and region yet.

2.2 HCBD trade

In order to obtain information regarding import and export volumes of HCBD in Brazil, the historical series from 1997 to 2019 was consulted for commercial transactions made available on the Comex Stat platform by the Ministry of Industry, Foreign trade and Services. The search was limited to the number referring to the "Mercosur Common nomenclature – NCM". However, no specific NCM could be found for the HCBD. This result can be explained in view that there is no specification or commercialization of sub-products of chlorine solvents, as is the case of HCBD and that this waste was possibly disposed at the major organochlorine production sites as documented for Cubatão site and HCBD was likely not separated and traded.

Moreover, according to the POP chemicals fact sheet for HCBD, it has been described under the Harmonized System (HS code = 2903299090) in the United Nations Trade Statistic Database (Comtrade database) (UNEP, 2018) but, as the most recent guidance on preparing inventories of HCBD (UNEP, 2019) mentions, HCBD is not listed in the Rotterdam Convention, therefore it is not subjected to the Prior Information Consent (PIC) procedure and does not have a specific HS code – just as for the NCM in the MERCOSUR control. However, this new guidance (UNEP, 2019) states that HCBD is traded under the HS code "Other unsaturated chlorinated derivates of acyclic hydrocarbons" together with other chemicals and that the HS code could be used in combination with the CAS number or trade names for the search of HCBD at the custom level.

When consulting the Comtrade database, the information provided in the new guidance (UNEP, 2019) did not work. The HS code mentioned in the guidance is not available in the referred database. Actually, there are four (4) HS codes regarding unsaturated chlorinated derivates of acyclic hydrocarbons in the Comtrade database (comtrade.un.org/data) and they are as follows:

290321 - Unsaturated chlorinated derivates of acyclic hydrocarbons; vinyl chloride (chloroethylene)

290322 - Unsaturated chlorinated derivates of acyclic hydrocarbons; thrichloroethylene

290323 - Unsaturated chlorinated derivates of acyclic hydrocarbons; thetrachloroethylene

290329 - Unsaturated chlorinated derivates of acyclic hydrocarbons; n.e.s in item no. 2903.2

Although we could expect to find information of HCBD at the custom level using the later HS code (290329), it seemed not to be possible to combine this HS code with the CAS number or trade names as suggested in the guidance (UNEP, 2019). Therefore, it seems very unlikely that the HCBD trade could be traced and it might be mainly addressed as an unintentional POP in its inventories.

3 PRELIMINARY ACTION PLAN CONSIDERATIONS

The following are preliminary suggestions for action plan development for controlling HCBD for the National Implementation Plan. The suggested actions can be further elaborated and refined or further activities added.

3.1 Development of a regulatory frame for HCBD

For an appropriate implementation of the Stockholm Convention countries develop an appropriate regulatory frame for the lifecycle management of POPs. This can include e.g. limit values for food or water to limit human exposure or environmental quality standards. The following information from the World Health Organization (WHO) and selected countries on HCBD limits or environmental quality standards can be considered for the development of a regulatory frame, for comparison of country data with risk derived limits in other countries and for necessary detection limits when HCBD monitoring is carried out:

- **Drinking water:** WHO has establishing a limit for HCBD of 0.6 µg/l considering current TDI (WHO, 2004). Due to the genotoxic potential of HCBD (Brüschweiler et al. 2010), **Switzerland set a drinking water limit of 0.075 µg/l due to mutagenicity of HBCD** (Swiss Federal Office of Public Health, 2010). These limit values could be used for defining a groundwater contaminated in particular if it is used for drinking water.
- **Surface water/Environmental Quality Standard:** the European Water Directive classifies HCBD as a priority substance with 0.6 µg/l as Environmental Quality Standard (European Union, 2013).
- **Biota/environmental quality standards:** For fish, the European Union (EU) has set an Environmental Quality Standard for HCBD of 55 µg/kg wet weight (European Union, 2013). This allows the contamination status of rivers or lakes to be defined.

3.2 Monitoring of HCBD at and around potentially HCBD contaminated areas

Considering the initial information discovered and compiled about HCBD in Brazil, it is highlighted that monitoring of HCBD (and other unintentional POPs and selected indicator pollutants) around the three plants where organochlorine solvents were and/or are produced is needed: This includes the following production sites and areas where waste of these companies have been disposed or released:

- Dow – Aratu (Bahia),
- Braskem – Maceió (Aracajú) and
- Unipar Carbocloro – Cubatão (São Paulo).

Moreover, considering the information gathered in this preliminary inventory, the region of Cubatão, São Paulo, showed to be of high concern and especial attention should be paid in the assessment of the environmental situation and the potential exposure of humans to HCBD.

It is further suggested that the Environmental Sanitation Technology Company (present-day: Environmental Company of the State of São Paulo and Regional Centre of the Stockholm Convention on POPs for Latin America and the Caribbean – CETESB) is the appropriate institution to conduct the monitoring in São Paulo area as responsible State authority for the environmental situation in the region. Also, CETESB should compile previous monitoring data and information. For an appropriate assessment, the monitoring limits in water should reach detection limits of at least 0.075 µg/l (drinking water limit of Switzerland due to genotoxicity of HCBD). For such a monitoring the locations highlighted in the report should be investigated with the highest priority for the assessment of potential HCBD and other organochlorine pollution and stockpiles. Also, for the other two sites, information and data already developed by the local authority, the industry and other stakeholders should be compiled as a first basis to develop monitoring and assessment plans.

3.3 Assessment of current organochlorine productions

Furthermore, current productions with the potential to form and potentially release HCBD should be assessed for HCBD formation and release and the management of their wastes. This include the above-mentioned production sites but also other organochlorine producers.

3.4 Monitoring of imported chemicals and wastes

Also, perchloroethylene and other chlorinated solvents imported and used in Brazil should be analysed for the HCBD content. It should be assessed if limits for HCBD content in such chemicals might be set.

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ANNEX 1 - General Comments on the Guidance Documents

All Parties of the SC are encouraged to use the available guidance and invited to provide comments based on their experience in using them. Therefore, some aspects of the new available guidance (UNEP, 2019) and the previous draft guidance (UNEP, 2017) on preparing inventories of HCBD were considered within this project.

Firstly, it is noteworthy that a HCBD inventory, as it is presented in this report, could be built following either the draft guidance from 2017 (UNEP, 2017) or the guidance from this year (UNEP, 2019). Although the draft guidance (UNEP, 2017) needs to be updated in respect of the Annex C listing of HCBD, it was already considered in this previous version of the guidance and the new guidance (UNEP, 2019) seems a better formatted but resumed version of the draft. Some specific notes are that:

- The new guidance (UNEP, 2019) does not highlight the most relevant source of HCBD as in the draft (UNEP, 2017), which seemed as a wise decision.
- The new guidance (UNEP, 2019) presents two “Table 3” instead of “Table 2” and “Table 3”
- It was not possible to trace the HCBD trade at custom level following the available information in the draft and in the new guidance (UNEP, 2017 and 2019).
- Neither of the guidance (UNEP, 2017 and 2019) list the HS code for HCBD or specify under which HS code number it could be find as it is in the fact sheet (UNEP, 2018) or as it is currently in the Comtrade database.
- Although both guidance documents mention the relation of HCBD with other POP chemical lifecycle (see “Figure 2-2” in the draft and “Figure 2”) neither of them (UNEP, 2017 and 2019) propose an integrated approach for the inventories of HCBD and other POPs in Tier III