CHALLENGES AND INSIGHTS DURING THE NATIONAL IMPLEMENTATION PLAN OF THE STOCKHOLM CONVENTION IN BRAZIL

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Introduction

At the end of the 20's century, a considerable rise of scientific findings reporting the presence of organohalogenated contaminants in "pristine" areas and their toxicity lead the international community to propose a global treaty with the main objective of protecting environmental and human health from their action. In May 2001, this global legally binding instrument, therefore known as the Stockholm Convention, was adopted and entered into force in May 2004, after the fiftieth country ratification[1]. In the beginning, the Stockholm Convention listed 12 compounds as Persistent Organic Pollutants (POPs) due to their environmental persistence, long-range transport, toxicological and bioaccumulation potentials[2]. Incorporating toxicological, constantly generated, the Convention permanently works in including new hazardous substances, aiming to promote the reduction, substitution, and finally banishment of the related compounds within the signatory countries. Currently, the Stockholm Convention has listed up to 30 chemicals and their congeners (Table 1) and counts with 182 countries-Parties.

Brazil signed the Stockholm Convention since its adoption and approved this instrument via legislative decree n° 204 in May 2004. As Party of the Convention, the Brazilian Government committed to adopt controlling measures regarding the whole life-cycle – such as production, import, usage, export and final destination – of all listed POPs. Furthermore, the Parties assume the compromise of elaborating a National Implementation Plan (NIP) of the Stockholm Convention, aiming to establish the pathways to execute the obligations of the Convention under national particularities and specific context. Therefore, the Parties must build an inventory up regarding each POP life-cycle in a national-scale.

Having already published a first NIP report on 2015[3], all POPs listed until the 6th Conference of the Parties (COP 6 - 2013) were covered. However, due to the listing of seven new POPs and their congeners in the past six years[4,5], an updated NIP is currently being elaborated, aiming to update and revise the information regarding some of the previously addressed POPs – perfluorooctane sulfonic acid (PFOS) and perfluorooctane sulfonyl fluoride (PFOS-F) its salts and related compounds, polybrominated diphenyl ethers (PBDEs) and hexabromocyclododecane (HBCDD) – as well as to include the not mentioned, pentachlorophenol its salts and esters (PCP), polychlorinated naphthalenes (PCNs), Hexachlorobutadiene (HCBD), Decabromodiphenyl ether (DecaBDE), Short Chlorinated Paraffins (SCCPs), perfluorooctanoic acid (PFOA) its salts and related compounds and dicofol. For the five last mentioned substances, the elaboration of a pioneer national-scale inventory is required.

Brazil has a particular interest in the protection of its food production which has a major share of its GDP.In particular meat and other products of animal origin has a high risk for POPs exposure and contamination[6,7] and a stringent risk management is needed to avoid the extreme high costs of dioxin/POPs food crises[8,9]. The current study report on the preliminary risk assessment for food and feed production of Brazil and the experience of POPs inventory development as a crucial base to manage POPs risk in a scientific manner.

Materials and methods

An assessment of the risk for food and feed production and export in respect to POPs was conducted. The Convention provides specific guidance documents for each listed POP and guides to the National Implementation Plans. Following that and considering the specification of each POP, the first approach to be taken is to compile data concerning the national production, import and usage of all compounds. The compilation of scientific data regarding POP reports in the country also needs to be done. After this first assessment, priority samples should also be screened in order to confirm the previous data compilation.

To conduct the review and complementation of the Brazilian NIP-2015, as a first step close to a hundred industrial associations and more than 1500 not affiliated factories, as well as the Federations of industries of each of the 26 states and state environmental agencies were enquired by the Ministry of Environment, in order to assess the past and current used amounts of the referred POPs. The compiled industries included several sectors, such as chemicals, adhesives & sealants, paints, rubbers, cables, firefighting, capacitors, cosmetics, electronics, mining,

food, civil engineering, cutting fluids, petroleum, plastics, polyvinyl chloride materials, wood preservatives, textiles, medical & dental devices, cleaning supplies, transportation and graphic.

Table 1: List of Persistent Organic Pollutants under Stockholm Convention, detailed according to date and conference (Conference of the Parties – COP) in which had been regulated, its potential emission source and the annex of its regimentations

Compound	Conference year of inclusion	Source
Aldrin [A]	COP 1 - 2001	Pesticide
Polychlorinated biphenyls (PCB) [A]* [C]	COP 1 - 2001	Industrial Chemical / Unintentional Production
Chlordane [A]	COP 1 - 2001	Pesticide
Dichlorodiphenyltrichloroethane (DDT) [B]	COP 1 - 2001	Pesticide
Dieldrin [A]	COP 1 - 2001	Pesticide
Dioxins (PCDD) [C]	COP 1 - 2001	Unintentional Production
Endrin [A]	COP 1 - 2001	Pesticide
Furans (PCDF) [C]	COP 1 - 2001	Unintentional Production
Heptachlor [A]	COP 1 - 2001	Pesticide
Hexachlorobenzene (HCB) [A] [C]	COP 1 - 2001	Industrial Chemical / Pesticide / Unintentional Production
Mirex [A]	COP 1 - 2001	Pesticide
Toxaphene [A]	COP 1 - 2001	Pesticide
α- HCH [A]	COP 4 - 2009	Pesticide
β- HCH [A]	COP 4 - 2009	Pesticide
Perfluorooctanesulfonic acid (PFOS) and derivates [B]	COP 4 - 2009	Industrial Chemical / Pesticide
Chlordecone [A]	COP 4 - 2009	Pesticide
Hexabromodiphenyl ether and heptabromodiphenyl ether [A]	COP 4 - 2009	Industrial Chemical
Hexabromobiphenyl [A]	COP 4 - 2009	Industrial Chemical
Lindane γ-HCH [A]	COP 4 - 2009	Pesticide
Pentachlorobenzene [A] [C]	COP 4 - 2009	Industrial Chemical / Pesticide / Unintentional Production
Tetrabromodiphenyl ether and pentabromodiphenyl ether [A]	COP 4 - 2009	Industrial Chemical
Endosulfan technical and isomers [A]	COP 5 - 2011	Pesticide
Hexabromocyclododecane (HBCDD)	COP 6 - 2011	Industrial Chemical
Hexachlorobutadiene (HCBD) [A] [C]	COP 7 and 8 2015/2017	Industrial Chemical / Unintentional Production
Pentachlorophenol and its salts and esters [A]	COP 7 - 2015	Pesticide
Polychlorinated naphthalenes (PCN) [A] [C]	COP 7 - 2015	Industrial Chemical / Unintentional Production
Decabromodiphenyl ether (commercial mixture, DecaBDE) [A]	COP 8 - 2017	Industrial Chemical
Short- chain Chlorinated Paraffins (SCCP) [A]	COP 8 - 2017	Industrial Chemical
Penta-decafluoro-octanoic acid (PFOA)	COP 9 - 2019	Industrial Chemical
Dicofol [A]	COP 9 - 2019	Pesticide

Annex [A], elimination, with prohibited use and production (*-with some specific restrictions); Annex [B], restriction (and perspective of elimination); Annex [C], unintentional production;

Results and discussion:

Risk assessment for POPs for food production and export

Historic cases of feed contamination with PCDD/F showed particular vulnerabilityfor countries which has limited assessment of POPs pollution sources and lack inventories of POPs stockpiles and contaminated sites resulting that the landfill mining dioxin contaminated waste resulted in large scale contamination of animal feed and food[10].

The risk for Brazilian food and feed products where assessed. POPs with high risk for food and feed export are those POPs which are regulated and monitored in the countries and regions where Brazilian food and feed products are exported and are monitored such as e.g. the European Union, China or Japan. Of particular risk exists for those food where frequent such as PCDD/F and PCBs. Furthermore, new listed POPs such as PFOS, PFOA and SCCPs which are still in use are considered to have an increasing risk exposure of and contamination of food[7].

A considerable increase in future risk has been discovered for PCDD/F and PFOS and PFOA where the European Food and Safety Agency (EFSA) has significantly reduced their Tolerable Daily/Weekly Intake (TDI/TWI) for some POPs[11,12]. For PCDD/F the TWI was reduced by a factor of seven [11]. This likely result in future reduction of PCDD/F limits in food of animal origin which are responsible for 90% of TWI with associated higher risk for food production. Another high risk for food and feed production result from the reduction ofthe TWI for PFOS and PFOA by a factor of 100 and 1500 respectively[12], resulting that a share of the population is above this TWI[12]. The risk seems particular high in Brazil for PFOS where still large amounts of PFOS precursors are used in open application against leaf cutting ants[13,14] which releasedup to 487 t of PFOS to the Brazilian environment 2004 to 2015[13] with associated risk for PFOS exposure to food producing animals[15].

Low risk for food and feed where considered for the brominated POPs HBCD, PBDE and HBB in particular due to the lack of regulatory limits for HBCD and PBDE in food and the EFSA estimates that the level in food does not raise a health concern[16]. However, POPs-BFR are endocrine disruptors and a risk to humans and biota. Moreover, the flame retarded plastic contributeto environmental and marine litter pollution [17].

Data gathering for inventory development for POPs management and control

The bases to control and manage POPs are detailed inventories of current use and stockpiles of POPs as well as POPs contaminated sites. Therefore, a key of the development of a NIP are the development of inventories for the individual POPs.

So far, the preliminary results regarding the first assessments for the NIP-update in Brazil raised our attention to some challenges and straight insights. Willing to gather information concerning importations and exportations of the listed compounds, the *Comex Stat* online platform, headed by the Ministry of Development, Industries and Foreign Trade (MDIC), was assessed. Commerce data for each POPs was consulted for all available years - 1997 to 2018 - under the standard code General Mercosul Nomenclature (*Nome Comum do Mercosul-NCM*). As a generic code, however, NCM frequently unites a broad range of substances under the same registry code and, therefore, creates a barrier to track the use of specific chemicals including POPs as described also for other countries[18]. If the generic NCMs or HS codes are considered, a large over-estimation of import and export of POPs would result[18]. Thus, this first challenge highlights the need of specific registry codes (HS codes) in the Mercosul region for POP substances. Moreover, it is extremely unlike that the amount of POPs contained in commercial products imported from all over the world could be estimated.

Regarding the industries enquired by the Ministry of the Environment, less than 1% of all institutions came back with any kind of answer and, among them, most were to deny any information. Although we are still receiving some few replies, even after the deadline imposed, this absolutely small number of answers warns for the neglect of the industries to the importance of the NIP. Also, it is important to remark that many of them are multinational companies which regularly provide information with good grace in their home countries, while adopting an omissive position when outside its borders. Apart from the industries neglect, it is also noteworthy that the Government haven't developed an efficient way to get such information, either by encouraging the industry with tax benefits or marketing advantages such as "ecolabels", nor by legally forcing them to provide the requested information regarding POPs.

In the ideal scenario, following the guidance documents, after the compilations of Tier 1 and Tier 2 information from the governmental institutions, industries and scientific reports, priority samples with potential to confirm the raised information could be chemically analysed. However, in our case, it has shown to be an unlikely task, since without a good assessment of the national import, production and usage priority samples can hardly be addressed.

Therefore, we suggest that better mechanisms to control the entrance of POPs in the national territory, with accessible and clear information and to get information of POP life-cycles from the industry ought to be done. A specific registry code to POP substances and to products known to contain POPs should be implemented as soon as possible and the dialogue with the industry must be improved. This should be preferentially done by encouraging them to provide information in good faith and raising awareness to the impacts in the environment and in the economy in case of contaminated soils, water and food, which could lead to international blocks to

Brazilian commodities and food in if limit values of POPs are exceeded with associated financial implications[8]. For the improvement of sustainable consumption and production (SDG12), the Convention or the UNEP 10YFP could support the development of ecolabels to phase out POPs and other hazardous chemicals from products. Furthermore, the multinational industries should be forced to use the same standards they do in their homeland as a part of their corporate social responsibility.

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References:

1. UNEP - United Nations Environmental Programme (2001); *Stockholm Protocol on Persistent Organic Pollutants. United Nations Environmental Programme*
2. UNEP - United Nations Environmental Programme (2002); *Water Supply and Sanitation Coverage in Regional Seas, Need for Regional Wastewater Emission Targets?* Section I: Regional presentation of data.
3. ME - Ministry of the Environment (2015); *National implementation plan Brazil: Convention Stockholm*
4. UNEP - United Nations Environmental Programme (2015); *Report of the Conference of the Parties to the Stockholm Convention on Persistent Organic Pollutants on the work of its seventh meeting*
5. UNEP - United Nations Environmental Programme (2017); *Report of the Conference of the Parties to the Stockholm Convention on Persistent Organic Pollutants on the work of its eighth meeting*
6. Weber R (2017) Learning from Dioxin & PCBs in meat – problems ahead? *IOP Conf. Ser.: Earth Environ. Sci.* 85 012002.https://iopscience.iop.org/article/10.1088/1755-1315/85/1/012002/pdf
7. Weber R, Herold C, Hollert H, Kamphues J, Blepp M, Ballschmiter K (2018) Reviewing the relevance of dioxin and PCB sources for food from animal origin and the need for their inventory, control and management. *Environ Sci Eur.* 30:42. https://rdcu.be/bax79
8. Lascano Alcoser VH, Velthius AGJ, Hoogenboom AP, et al (2011)Financial Impact of a Dioxin Incident in the Dutch Dairy Chain. *Journal of Food Protection*, 74(6), 967–979.
9. Kamphues J, Schulz AJ (2006) Dioxin: Risk management by agriculture and feed industry – options and limits. *Dtsch. Tierärzl- Wschr* 113. 298-303. (In German).
10. Torres JPM, Leite C, Krauss T, Weber R (2013) Landfill mining from a deposit of the chlorine/ organochlorine industry as source of dioxin contamination of animal feed and assessment of the responsible processes. *EnvSciPollut Res.* 20, 1958-1965.
11. EFSA (2018)Risk for animal and human health related to the presence of dioxins and dioxin-like PCBs in feed and food.*EFSA Journal* 2018;16(11):5333https://www.efsa.europa.eu/en/efsajournal/pub/5333
12. EFSA (2018)Risk to human health related to the presence of perfluorooctane sulfonic acid and perfluoro-octanoic acid in food. *EFSA Journal* 2018;16(12):5194https://www.efsa.europa.eu/en/efsajournal/pub/5194
13 Lerner S (2019) Brazil's pesticide industry is creating massive PFOS contamination. *The Intercept*29.04.2019 https://theintercept.com/2019/04/29/brazil-pfos-sulfluramid-pesticide/
14. Nascimento RA, Nunoo DBO, Bizkarguenaga E, et al. (2018) Sulfluramid use in Brazilian agriculture: A source of per- and polyfluoroalkyl substances (PFASs) to the environment. *Environ Pollut.*242:1436-1443.
15. Brambilla G, D'Hollander W, Oliaei F, et al.(2015) Pathways and factors for food safety and food security at PFOS contaminated sites within a problem based learning approach. *Chemosphere* 129, 192-202.
16. EFSA (2011) Scientific Opinion on Polybrominated Diphenyl Ethers (PBDEs) in Food.*EFSA Journal* 2011,9(5):2156.
17. UNEP (2019) Plastic and toxic additives, and the circular economy: the role of the Basel and Stockholm Conventions. Addendum Report on the activities of the Basel and Stockholm conventions regional centres. UNEP/CHW.14/INF/29/Add.1; UNEP/POPS/COP.9/INF/28/Add.1
18. Korucu MK, Gedik K, Weber R, et.al (2015) Inventory development of perfluorooctane sulfonic acid (PFOS) in Turkey: challenges to control chemicals in articles and products. *Environ SciPollut Res Int*. 22, 14537-14545.