

# CHALLENGES TO IMPLEMENT STOCKHOLM CONVENTION IN RELATION TO PBDEs IN DEVELOPING COUNTRIES, ESPECIALLY IN GRULAC

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## Introduction

New Persistent Organic Pollutants (POPs) have been added to the list of the Stockholm Convention in 2009, one of them the group of polybrominated diphenyl ethers (PBDEs) which resist degradation, are transported far from their place of release, where they accumulate in terrestrial and aquatic ecosystems and possess toxic properties, since they are classified as endocrine disruptive chemicals. These substances were used as brominated flame retardant and applied in many articles/consumer products such as electronics, textiles, vehicles, furniture and building materials.

The signatory countries must comply with obligations and measures established by the Convention, however they are facing challenges in order to implement them, since at the moment only a few countries submitted the specific PBDE National Implementation Plan (NIP) to the Convention secretariat. This study aims at identifying the institutional, legal, technical and political aspects in order to recognize challenges to transpose those measures to a national level.

## Materials and Methods

It was conducted a review of the literature on consumer products that may contain c-BDE put in the market besides recycling articles consisting of, containing or contaminated with POP-BDEs after their end-of-life. It was used the Thomson Reuters Web-of-Science platform ([www.thomsonreuters.com/WebOfScience/#](http://www.thomsonreuters.com/WebOfScience/#)) and the Organohalogen Compounds Database ([www.dioxin20xx.org](http://www.dioxin20xx.org)) starting by using PBDE as the search topic, and then proceeding with two other topics, consumer products and recycling. In the Organohalogen Compounds Database the search was done using PBDE as the key word. Case study method was used characterized by the most different cases and most similar outcomes, designed for two countries, in Czech Republic and Sweden, supported by the congruence analyses and presenting the experience of two of institutional building and vercountries in implementing NIPs in relation to PBDEs. The selection of these two countries was based on the design of most different cases with the same result, since they have historical background y different policy among themselves. However, they have similar results when it comes to preparation and presentation of the updating NIPs for POP-BDEs to the Conference of the Parties of the Stockholm Convention (SC).

Standardized interview were applied to professionals involved in elaborating and implementing the Stockholm Convention in these two countries. Interview consisted of three blocks of questions: Part I - General Information: date of the interview, interviewed person function, institution; Part II - Perception and Vision About the Convention: benefits and opportunities with three questions; Part III - Previous Approaches to Implementation NIP, legal and institutional aspects and the action plan for POP-BDEs, with seven questions. Interviews were done personally with the country representatives for the NIP elaborating and implementing in Sweden and Czech Republic. All interviews were recorded, transcribed, translated into Portuguese language and extracted according the appropriate question.

## Results and Discussion

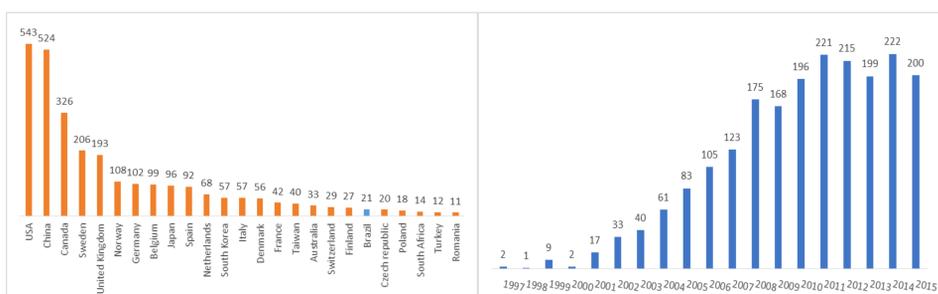


Figure 1. Number of papers on PBDE published from 1996 to 2015 according to the refined search on the Web-of-Science platform, by country (left) and year (right) of publication.

The Organohalogen Database revealed a total of 431 papers presented in the Dioxin 20xx Symposia, about PBDE, in the period 1996 to 2015. Publication about PBDE started in 1996 with one paper. The year 2005 was the one with more papers published in this database (35 papers) followed by the year 2009 (33 papers) and 2008 (32 papers). In the last three years a total of 39 papers were included in this database (13 papers in 2013, 21 papers in 2014 and again 13 in 2015). The GRULAC region has contributed with only 5 papers, being 3 from Brazil and 2 from Mexico, as shown in Figure 2.

The search on the Web-of-Science platform continued by using several filters and indicated the existence of 101 papers published on consumer products containing PBDEs and 254 papers published on the presence of PBDEs in recycling units, both for the period of 1996-2015, as shown in Figure 3 and 4, respectively. In the years of 2008 and 2009, the papers published increased in both cases, since the POPBDEs were included in Annex A of the SC, and it shows the scientific community interest in obtaining more information and data on this issue. There was an increase on the number of papers published since 2008 about the presence and the occurrence of PBDEs in indoor of houses, offices and recycling units. Dust and air exposure in the indoor and outdoor environments nearby waste electronic and electric equipment recycling units were important issues in publications.

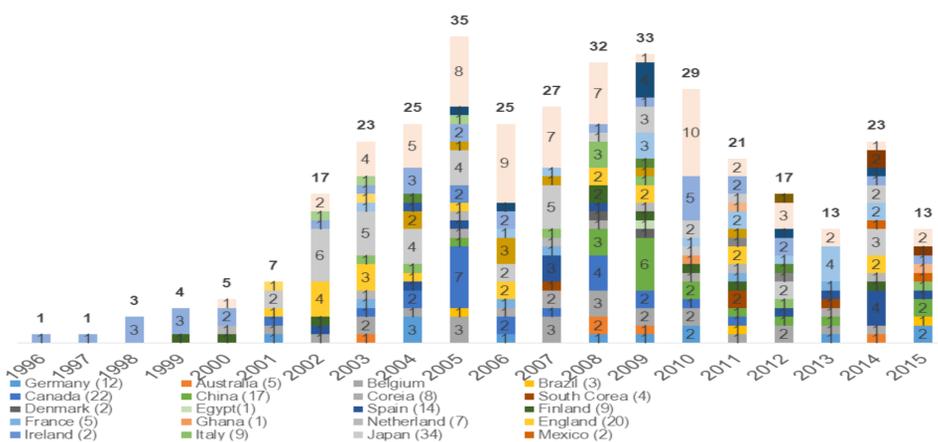


Figure 2. Number of papers on PBDE published from 1996 to 2015 according to the refined search on the Organohalogen Compounds Database, by country and year of publication.

### Case Study<sup>3</sup>

**Sweden:** the country has a reduced number of ministry bodies with political decision roles and the SC focal point is shared with Environment Agency (SwEPA) and Chemicals Agency (KemI); the later is more involved in the preparation and implementation of the NIP updating<sup>4</sup>, as POP-BDEs, along with the industry associations and society representatives. Sweden had already inventoried the PBDEs pollution sources, continued the POP-BDEs monitoring programs in the environment and human health; the e-waste recycling units segregate the plastics contained brominated flame retardant, which has been incinerated. KemI controls chemical contained in articles placed on the market and it enforces and apply the UE Regulation on POPs and others related to.

**Czech Republic:** this country created a toxic compounds national council composed by ministries involved in POP issues, industry associations, society representatives and technical and scientifically supported by Research Centre for Toxic Compounds in the Environment (RECETOX) for the preparation and implementation of the NIP updating<sup>5</sup>.

In the Web-of-Science platform the search was initially done by using keyword PBDE in topic, and the period of time 1996-2015, which resulted in a total of 7,611 publications. The search on the Web-of-Science platform continued by using several filters and indicated the existence of 2961 papers published in 68 countries in the period 1996-2015. Twenty-five countries published more than 10 papers as shown in Figure 1, which shows also the number of papers published by year from 1996 to 2015. USA and China were the two countries with more papers published and they had almost the same number of papers published (543 and 524 respectively), followed by Canada with 326 papers, Sweden with 206 papers and United Kingdom with 293 papers. There was almost a continue increase on the number of papers published since the year 2000 until the year 2011, and then an stable number of papers published with an average of 211 papers published by year in the last 5 years. The year 2014 presented the highest number of papers published, with 222 papers, followed by the year 2011 with 221 papers published. The increase in the number of publications shows the importance of the theme in the last twenty years and mainly and possibly due to the influence of the Stockholm Convention.

The search also revealed that, from 1996 to 2015, in the Group of Latin America and Caribbean Countries (GRULAC) only 39 scientific articles were published, being Brazil with 21 articles, Argentina with 9 papers, Chile with 6 papers and Colombia with 3 papers. The result shows the existence of gaps on data and information about the presence of PBDEs in the environment, in biota and in humans and in consumer products/articles, and also on sources of pollution.

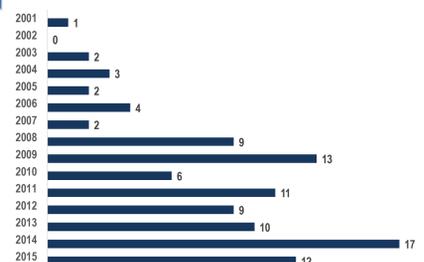


Figure 3. Number of papers published on consumer products containing PBDE for the period 1996-2015.

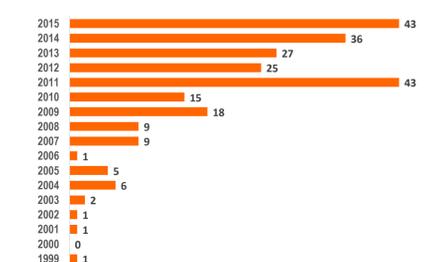


Figure 4. Number of papers published on the presence of PBDE in recycling units for period 1996-2015

Czech Republic has inventoried the POP-BDEs source pollutions and suspected articles in the market containing PBDEs by means of pilot projects and it counts on a broad POP-BDEs monitoring programs in the environment and in humans by means of Košetice observatory, MONET network and GENASIS systems on POPs.

The comparative case study of these two countries revealed the importance of a complex chemical substances management approach in order to transpose the PBDEs obligations to the national level, including the industrial chemical and environmental legislation, especially on POP-BDEs in products/ articles, and an integrated institutional arrangement with the strong scientific and institutional support, environmental monitoring programs and chemical control of the spread of POP-BDEs substances present in a number of consumer products put on the market; as the main challenges are the segregation of plastics containing PBDE in order to avoid recycled articles containing PBDEs and the importance of dialogue with industrial sector in order to identify the PBDE content in articles in use and to evaluate technology that can be applied and alternatives to PBDEs as well as to promote technical capacities to raise awareness about chemicals to importers and private sector. From the case study results it can be stated that the Convention implementation leads to several benefits such as protection of health and of the environment, governance improvement, technical assistance promotion, POPs visibility, science and politics integration and the increase of scientific research. If there are challenges to be overcome in both countries studied, certainly greater still is the challenge for developing countries, especially countries with growing chemical industry, such as several countries in the GRULAC region, and Brazil in particular, which recently presented its NIP. Monitoring of PBDE content in products and articles and recycling technology will be two important challenges. The implementation of action plans for PBDEs can no be done in separate, it must be part of a systematic approach for chemicals listed in the Stockholm Convention and also for other toxic chemicals, like mercury in the Minamata Convention. A country must decide the type of approach for the management of toxic chemicals listed in the Stockholm Convention would be more appropriate. The two cases discussed in the Study Case could serve as examples of two types of approaches with very good results. Training, increase of knowledge, awareness, technology assessment, monitoring of POP-PBDE content in products and articles, control of import and export of products and articles that could contain POP-PBDE, appropriate legislation, cooperative work, and increase on research on PBDE in developing countries would be key points for the success for the internalization of the process and to comply with obligations and measures established by the Convention, in developing countries.

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