Format for submitting pursuant to Article 8 of the Stockholm Convention the information specified in Annex E of the Convention

Introductory information	
Name of the submitting Party/observer	
Contact details (name, telephone, e-mail) of the submitting Party/observer	
Chemical name (as used by the POPS Review Committee (POPRC))	Pentabromodiphenyl ether CAS number: 32534-81-9
Date of submission	

(a) Sources, including as appropriate (provide summary information and relevant references)	
(i) Production data: Quantity Location	
Other	
(ii) Uses	
(iii) Releases: Discharges Losses Emissions Other	

(b) Hazard assessment for endpoints of concern, including consideration of toxicological interactions involving multiple chemicals (provide summary information and relevant references)

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(c) Environmental fate (provide summary information and relevant references)	
Chemical/physical properties	
Persistence	
How are chemical/physical properties and persistence linked to environmental transport, transfer within and between environmental compartments, degradation and transformation to other chemicals?	
Bio-concentration or bio-accumulation factor, based on measured values (unless monitoring data are judged to meet this need)	

(d) Monitoring data (provide summary information and relevant references)

(e) Exposure in local areas (provide summary information and relevant references)	
- general	**Mexican blood and mothers' milk samples were analysed for polybrominated diphenyl ethers (PBDEs) and compared to Swedish samples.** **The Mexican blood samples were taken from urban women and the Mexican milk samples were taken from indigenous rural women.** **The mean level of PBDEs was approx. 20 ng/g l.w. in plasma from Mexican women living in the urban environment. These women showed a much higher concentration than the indigenous women for which mothers' milk was analysed. The mothers' milk from Mexican women living in a rural environment and Swedish mothers were similar.** Reference A Preliminary Study on PBDEs and HBCDD in Blood and Milk from Mexican Women. López D., Athanasiadou M., Athanassiadis I. Yañez L., Díaz-Barriga F., and Bergman, A. (2004). The Third International Workshop on Brominated Flame Retardants, BFR 2004. **(A copy of the paper is included in Annex I)**
- as a result of long-range environmental transport **- information regarding bio-availability**	

(f) National and international risk evaluations, assessments or profiles and labelling information and hazard classifications, as available (provide summary information and relevant references)

(g) Status of the chemical under international conventions

ANNEX I

A Preliminary Study on PBDEs and HBCDD in Blood and Milk from Mexican Women

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Introduction

Brominated flame retardants (BFRs) have routinely been added to consumer products for several decades in a successful effort to reduce fire-related injury and property damage[1]. Common applications of those chemicals are as additive or reactive compounds in polymers and textiles[2]. There are three major BFR classes or chemicals: tetrabromobisphenol (TBBPA) and its derivatives, polybrominated diphenyl ethers (PBDEs), hexabromocyclododecane (HBCDD), representing an annual production volume of more than 200.000 tons[2]. These BFRs are used in a wide range of consumer products, such as electronics and electrical equipment (computers, TV sets), textiles, foam use in furniture, insulating foams, styrofoam [3].

The PBDEs theoretically involve 209 different congeners but in practice it is much less as reported on when different PBDE products were analysed[2,4,5]. Those chemicals are major industrial products of approximately 67.000 metric tons/year, with an approximate use of 50% in North America, whereas the European consumption is 12%[6]. PBDEs can be absorbed and metabolized, but in particular the PBDEs are bioaccumlative in wildlife and in humans, as shown in numerous studies that have recently been reviewed[7]. Human milk samples from Sweden, Japan, Canada, and the United Sates were compared, resulting in large differences between Swedish and Japanese median levels (3.2 and 1.4 ng/g lipid, respectively) on one side and Canadian and U.S. PBDE medians being an order of magnitude higher, 25 and 41 ng/g lipid, respectively [3,8]. The temporal trend for the PBDEs indicate increasing levels in North America [9], the Faroe Islands[10], while the increase in PBDE concentrations seem to have reached it optimum in Sweden in the late 1990s' [11]. Some extreme PBDE levels in humans have been reported from the U.S. indicating this environment to be much more contaminated than the European and Japanese environments [7,12-14]. No studies have hitherto been performed in Mexico to determine human or environmental levels of PBDEs.

Commercial HBCDD, a mixture of at least three conformational isomers, is used mainly as an additive to polystyrene products, known as e.g. Styrofoam [3]. The HBCDD production figure is indicating 16.000 tons being consumed annually [6]. HBCDD was recently reported to have redoubled in guillemot eggs from 1970 to 2001 [15] and also reported in sediments [16]. No data has to our knowledge been reported for this compound in humans previously but at this very time also Weiss and collaborators report on HBCDD in human blood, in a study of a Dutch cohort with mothers and infants[17].

The aim of the present study was to screen some blood and mothers milk samples from Mexico for both PBDEs and HBCDD and compare to Swedish samples. The Mexican samples were taken from women living in an urban environment and from indigenous rural women.

Materials and Methods

Samples: Blood was kindly donated by 5 women from San Luis Potosi City, and milk from 7 women from La Huasteca Potosina, located 300 km east of San Luis Potosi City. Swedish milk (5 individuals) was bought from the mothers' milk central at a hospital pharmacy in Stockholm.

Clean up: The extraction of PBDEs and HBCDD from the blood plasma was based on the method developed and validated elsewhere[18]. Blood-plasma (5g) was spiked with the internal standard (BDE-138). Hydrochloric acid (1ml, 6M) and the 2-propanol (6 ml) were added; the sample was vortexed after each addition. Hexane/methyl t-butyl ether (MTBE, 6ml 1:1, v/v) was added, and the sample was rotated for 5min and then centrifuged. The organic layer was transferred to a new tube with 1% potassium chloride (4 ml), and the plasma was extracted with hexane/MTBE (3ml). The two organic fractions were combined, and lipid determination was done. The lipids were removed by conc. sulfuric acid (1 ml) treatment with the extract dissolved in hexane (4 ml). Each sample was rotated for 5 min and then centrifuged, and thereafter the organic phase was transferred to a new tube. The sample was re-extracted with hexane (3ml), whereafter the organic phases were combined, the solvent volume was reduced to 1 ml. Each sample was transferred to a sulfuric acid/silica gel column (0.1g silica in the bottom with 1g conc. sulfuric acid:silica gel 1:2 on top). The silica gel was pretreated at 280 °C overnight and thereafter further purified by hexane/dichloromethane (DCM) (9 ml 1:1, v/v). The analytes were eluted from the column with hexane/DCM (8ml, 50% DCM in hexane). The DCM was replaced by hexane and the volume was adjusted to approximately 100 µl prior to GC/MS analysis.
The extraction of PBDEs from the milks samples was performed similarly but with some slight modifications. The hydrochloric acid (6M) was replaced by conc. formic acid (1ml) and the MTBE was replaced by diethyl ether.

Quantitative analysis: The analytes were quantified by comparison to authentic reference PBDE and HBCDD standards by GC/MS. All PBDE congeners were synthesised in house and the HBCDD used was a 1:1:1 mixture of α-, β- and γ-HBCDD obtained as the individual compounds from Cambridge Isotope Laboratories (Andover, MA, U.S.A.). The analyses of HBCDD was performed as described by Weiss et al[17] and for BDE-209 as described by Björklund and co-workers[4].

Results and Discussion

The concentrations of six PBDEs, ∑PBDEs and of HBCDD as determined in women blood and milk from Mexico are listed in Table 1 and compared to the concentrations of the same analytes in Swedish mothers milk from 2003. The mean concentrations and ranges of PBDEs and HBCDD in the three investigated groups are given. The PBDE congener patterns, based on mean levels, in blood and mothers milk, are visualised in Figure 1.

Table 1. Concentrations (ng/g lipid weight) of the individual PBDE congeners, the sum of PBDEs, and of HBCDD in plasma and milk samples from Mexican, and milk samples from Swedish women.

Analyte	Mexican plasma (n=5)		Mexican milk (n=7)		Swedish milk (n=5)	
	Mean	Range	Mean	Range	Mean	Range
BDE-47	9,0	3,0 - 14,5	1,7	1,1 - 4,3	1,5	0,8 - 2,4

BDE-99	2,0	0,6 - 3,6	0,6	0,3 - 1,2	0,5	0,2 - 0,8
BDE-100	3,7	1,8 - 7,4	0,8	0,5 - 1,3	0,6	0,3 - 1,1
BDE-154	1,0	0,5 - 1,3	0,2	0,1 - 0,3	0,5	0,3 – 1,0
BDE-153	3,9	0,9 - 6,6	0,8	0,4 - 1,6	1,7	1,1 - 2,4
BDE-209	9,5	4,8 - 14,6	0,3	0,1 - 0,6	0,4	0,3 - 0,4
ΣPBDEs	29,1	21,5 - 37,5	4,4	2,7 - 9,0	5,2	3,5 - 7,3
HBCDD	1,2	0,7 - 2,5	2,1	0,8 - 5,4	1,1	0,3 - 3,2

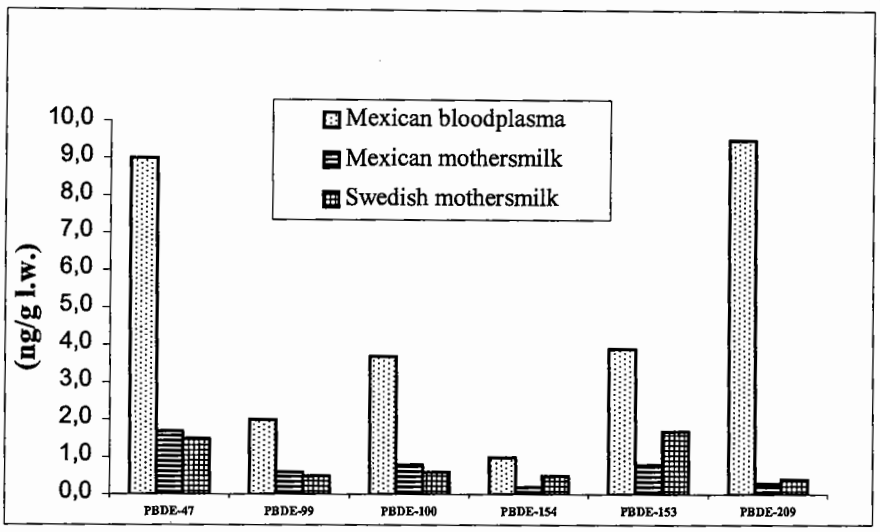

Figure 1. PBDE congener mean level profiles in Mexican plasma, mothers milk and in Swedish mothers milk. The concentrations of the PBDE congeners are reported in ng/g lipid weight (l.w.).

It must be emphasised that the present study is a first screening of PBDEs and HBCDD in humans from Mexico and should be taken as an indication of the presence of these BFRs also in the Mexican environment. Still it must be stressed that the concentrations determined are well above the European levels for PBDEs, reported so far, even if the concentration of decabromodiphenyl ether (BDE-209) is excluded. When doing so the mean level of PBDEs is approx. 20 ng/g l.w. in plasma from Mexican women living in San Louis Potosi City. These women are showing a much higher concentration than the indigenous Mexicans for which mothers milk was analysed (Table 1, Figure 1). The mothers milk from Mexican living in a rural environment and Swedish mothers are similar. No high levels of BDE-209 were detected in any of these women. However, the BDE-209 levels are rather high in the Mexican city women indicating a very different exposure than the other groups analysed and also in comparison to previous reports from Sweden [19]. The level in these Mexicans is approx. three times the BDE-209 concentration in a male referent group from Sweden [20].

The present study also shows the presence of HBCDD in blood and in mothers milk, both from Mexican and Swedish women (Table 1). This is one of the two first reports on HBCDD in humans. The other report is presented by Weiss and coworkers [17] at this workshop showing similar concentrations of HBCDD in Dutch mothers and infants (as determined by analysis of cord blood). The sample levels varies but there is possibly an indication of somewhat higher levels in the indigenous Mexican women. The study shows that HBCDD is a BFR that has properties to accumulate in humans and HBCDD will be transferred via the mothers' milk to the nursing child.

A well-designed and thorough study of the BFR exposure to humans in Mexico is suggested. The exposure to different groups in the society should be included in such a future study.

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References

1 WHO Environmental Health Criteria 192. Flame Retardants: A General Introduction; International Program on Chemical Safety, World Health Organization: Geneva, Switzerland, 1997.
2 Alaee, M., Arias, P., Sjödin, A. and Bergman, Å. *Environment International* 2003, *29,* 683-689.
3 Birnbaum, L. S. and Staskal, D. F. *Environ. Health Perspect.* 2004, *112,* 9-17.
4 Björklund, J, Tollbäck, P, and and Östman, C. 2003, 163-166.
5 Sjödin, A., Jakobsson, E., Kierkegaard, A., Marsh, G. and Sellström, U. *J. Chromatogr. A* 1998, *822,* 83-89.
6 BSEF. Major brominated flame retardants volume estimates. http://www.bsef-site.com/docs/BFR_vols_2001.doc . 2003. Bromine Science and Environmental Forum.
7 Hites, R. A. *Environ. Sci. Technol.* 2004, *38,* 945-956.
8 Ryan, J. J., Patry, B., Mills, P., and Beaudoin, N. Organohalogen Compounds. 2002, 58, 173-176.
9 Sjödin, A., Jones, R. S., Lapeza, C., Focant, J.-F., Wang, R., Turner, W. E., Needham, L. L., and Patterson, D. G. Jr. Organohalogen compounds. 2003, 61, 1-4.
10 Fängström, B., Athanassiadis, I., Strid, A., Grandjean, P., Weihe, P., and Bergman, A. The Third International Workshop on Brominated Flame Retardants, BFR 2004. 2004.
11 Meironyté Guvenius, D. and Norén, K. The Second International Workshop on Brominated Flame Retardants, BFR 2001. 1-1-2001, 303-305.
12 Mazdai, A., Dodder, N. G., Abernathy, M. P., Hites, R. A. and Bigsby, R. M. *Environ. Health Perspect.* 2003, *111,* 1249-1252.
13 Petreas, M., She, J., Brown, F. R., Winkler, J., Windham, G., Rogan, E., Zhao, G., Bhatia, R. and Charles, M. J. *Environ. Health Perspect.* 2003, *111,* 1175-1179.
14 Schecter, A., Pavuk, M., Päpke, O., Ryan, J. J., Birnbaum, L. and Rosen, R. *Environ. Health Perspect.* 2003, *111,* In press.
15 Sellström, U., Bignert, A., Kierkegaard, A., Häggberg, L., de Wit, C. A., Olsson, M. and Jansson, B. *Environ. Sci. Technol.* 2003, *37,* 5496-5501.
16 Remberger, M., Sternbeck, J., Palm, A., Kaj, L., Strömberg, K. and Brorström-Lundén, E. *Chemosphere* 2004, *54,* 9-21.
17 Weiss, J., Meijer, L., Sauer, P., Linderholm, L., Athanassiadis, I., and Bergman, A. The Third International Workshop on Brominated Flame Retardants, BFR 2004. 2004.
18 Hovander, L., Athanasiadou, M., Asplund, L., Jensen, S. and Klasson Wehler, E. *J. Anal. Toxicol.* 2000, *24,* 696-703.
19 Sjödin, A., Patterson, D. G. Jr. and Bergman, Å. *Environment International* 2003, *29,* 829-839.
20 Thuresson, K., Jakobsson, K., Hagmar, L., Sjödin, A., and Bergman, Å. Organohalogen Coumpounds. 2002, 58, 165-168.