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	World Wild Fund for Nature (WWF)
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Chemical name (as used by the POPS Review Committee (POPRC))	Pentabromodiphenyl ether
Date of submission	January 26, 2006

(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)

- **Increasing concentrations of PBDEs in biota and breast milk pose concern about possible developmental effects in nursed babies. A study examined the endocrine-mediated effects of developmental exposure to PBDE-99. When pregnant rats were exposed to PBDE-99 (1 or 10 mg/kg body wt., daily from gestational day 10-18) pronounced decreases in circulating sex steroids in male offspring at weaning and in adulthood were observed. Anogenital distance was reduced in male offspring. Puberty onset was delayed in female offspring at the higher dose level, while a slight acceleration was detected in low-dosed males. The number of primordial/primary ovarian follicles was reduced at the lower dose. Decline of secondary follicles was more pronounced at the higher dose. Sweet preference was dose-dependently increased in PBDE exposed adult males, indicating a feminization of this sexually dimorphic behavior. These results support the hypothesis that PBDE are endocrine-active compounds and interfere with sexual development and sexually dimorphic behavior (Lilienthal et al 2005).**
- **Another study on the effects of developmental exposure to PBDE-99 on juvenile basal motor activity levels and adult male reproductive health showed that i*n utero* exposure to a single low dose of PBDE-99 disrupts neurobehavioral development and causes permanent effects on the rat male reproductive system apparent in adulthood. Wistar rat dams were treated by gavage on gestation day 6 with a single low dose of 60 or 300 µg PBDE-99/kg body weight. In offspring, basal locomotor activity was evaluated on postnatal days 36 and 71, and reproductive performance was assessed in males at adulthood. The exposure to low-dose PBDE-99 during development caused hyperactivity in the offspring at both time points and permanently impaired spermatogenesis by the means of reduced sperm and spermatid counts. The doses used in this study (60 and 300 µg/kg bw) are relevant to human exposure levels, being approximately 6 and 29 times, respectively, higher than the highest level reported in human breast adipose tissue. This is the lowest dose of PBDE reported to date to have an *in vivo* toxic effect in rodents and supports the premise that low-dose studies should be encouraged for hazard identification of persistent environmental pollutants (Kuriyama et al 2005).**
- **An *in Vitro* studies has shown that a pentaBDE mixture (DE-71) disturbs intracellular signalling mechanisms in rat brain, which are critical for the normal function and development of the nervous system (Kodavanti and Ward 2005) and induces respiratory burst in human neutrophil granulocytes (Reistad and Mariussen 2005).**
- **Neurotoxic effects of BDE 99 include hyperactivity during adolescence in rats and decreases total circulating thyroxine levels (Branchi et al 2005)**

(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)

- **In a study that WWF conducted to test chemicals in the blood of families of three generations from Europe, PBDEs were detected in many samples, including BDE 47 in 24 and BDE 99 in 15 out of total 39 tested(WWF 2005).**
- **In another study that WWF conducted to test chemicals in the blood of Members of the European Parliament, PBDEs were also detected, with BDE 47 found in 24, BDE 99 in 16 of total 47 tested, with a range from 3.4-51 and 3.1-32 ng/g blood, respectively (Annex 3 page 58) (WWF 2004).**
- **A WWF-UK Chemicals and Health campaign report indicated that BDE 47 and 99 were found in 25 and 4 out of 33 tested people, with maximum of 24.1 and 12.5 ng/g serum lipid, respectively (WWF-UK 2004)**
- **WWF-UK has found BDE 47 in 105, BDE 99 in 63 of total 155 tested people in its national survey of 2003, ranging from 0.4-180 and 0.36-150 ng/g lipid, respectively (Table 2 on page 40) (WWF 2003).**
- **Concentration of BDE 47 in contemporary California women with a median of 16.5 (ranging from 5 to 510) ng/g lipidh was 3-10 times higher than those reported in Europe. In contrast, PBDEs were not measurable in any of 420 archived serum samples collected in 1960s from the same geographic area. Concentration of BDE 47 did not increase with age or with concentration of PCB 153, suggesting other routes of exposure in addition to diet (Petreas et al 2003)**
- **PBDEs were detected in 3 out 37 individual human milk samples from Kahramanmaras region, Turkey (Erdog˘rul et al 2004) and the highest value for the sum of PBDEs was 0.014 ng/g ww. BDE 47 was the dominant congener, followed by BDE 99. Although the number of samples is relatively low and they are not representative for the whole Turkish population, the results of the present study are important to provide additional data on the concentrations of persistent organochlorinated pollutants in Turkey and show as the first PBDE levels in Turkish population.**
- **Studies show that different levels of BDE 47 and 99 were found in marine mammals such as dolphins and whales at ng/g of lipid weight, with high levels found in killer whales and bottlenose dolphins. The levels vary from 0.8 in bird's beaked whale to 87 in bottlenose dolphins for BDE 99 and 3.0 in bird's beaked whales to 275 in killer whales, with the levels in striped dolphins and mink whales falling in between (Marsh et al 2004, Wolkers et al in press).**
- **Measurements of six BDE congeners that are common components of the pentaBDE commercial mixture within the entire Lake Michigan aquatic food web in the US indicate that BDEs were detected in all samples. The dominant BDE congener was BDE 47. BDE 47 levels were consistently greater than BDE 99, although these two compounds have the similar levels in the commercial mixture (Stapleton and Baker 2003)**
- **A comparison study of British Columbia grizzly bears rely entirely on terrestrial foods and some that switch in late summer to returning Pacific salmon (Christensen 2005). While the bears consuming a higher proportion of terrestrial vegetation ("interior" grizzlies) exhibited POP patterns dominated by the more volatile organochlorine (OC) pesticides and the heavier polybrominated diphenyl ethers (PBDEs: e.g., BDE-209), the bears consuming salmon were dominated by the more bioaccumulative POPs (e.g., and BDE-47). The ocean-salmon-bear pathway appeared to preferentially select for those contaminants with intermediate partitioning strength from water into lipid (log Kow 6.5). This pattern reflects an optimum contaminant log Kow range for atmospheric transport, deposition into the marine environment, uptake into marine biota, accumulation through the food web, and retention in the bear tissues. It is estimated that salmon deliver 70% of all OC pesticides, up to 85% of the lower brominated PBDE congeners, and 90% of PCBs found in salmon-eating grizzly bears, thereby inextricably linking these terrestrial predators to contaminants from the North Pacific Ocean.**

(e) Exposure in local areas (provide summary information and relevant references)	
- general	
- as a result of long-range environmental transport	• **Various organochlorine pesticides and brominated diphenyl ethers (BDE-47, -99, and -100) were measured in sea ice algae, water column plankton, and juvenile and adult krill collected in the Palmer Long-Term Ecological Research (LTER) region west of the Antarctic Peninsula during late austral winter and midsummer, 2001-2002. BDEs were 100-1000 times higher in ice algae and 2-10 times higher in phytoplankton than the most abundant organochlorine pesticide, hexachlorobenzene (HCB), reflecting the current production and use of BDEs versus organochlorine pesticides. However, concentrations**

- information regarding bio-availability	**of HCB and BDEs were significantly lower in summer plankton than in ice algae indicating lower atmospheric inputs, removal from the water column, and/or biodilution of persistent organic pollutants at the base of the food web during summer. Concentrations of HCB (juvenile and adult krill) and BDEs (juvenile krill) were not significantly different from their primary food source (ice algae, phytoplankton), and BDEs were significantly lower in adult krill versus phytoplankton, indicating no biomagnification of HCB or BDEs during transfer from plankton to krill. The high concentrations of BDEs and HCB in ice algae and associated juvenile krill illustrate the importance of sea ice as a vector for entry of POPs into the Antarctic marine ecosystem (Chiuchiolo et al 2004)** • **BDE 47, 85 and 99 can be effectively taken up by adult mice and retained in fatty tissues and concentrated in some specific organs such as the liver, adrenal cortex, ovary, lung and (initially) the brain. At long post-injection time, the concentration in most tissues was lowered with residues left mainly in fat depots and the liver (Darnerud and Risberg 2006).**

(f) National and international risk evaluations, assessments or profiles and labelling information and hazard classifications, as available (provide summary information and relevant references)
• **A Danish study on POPs and their long-term temporal changes and effects on eggs of a bird of prey has shown the levels of BDE 47, 99 and other congeners in biota. The concentration levels for brominated flame retardants, was posted at the Appendix 3 of the study (Sørensen et al 2004)**

(g) Status of the chemical under international conventions

References:

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