Swiss Agency for Development and Cooperation SDC

Swiss Agency for the Environment, Forests and Landscape SAEFL

International POPs Elimination Project

Fostering Active and Efficient Civil Society Participation in Preparation for Implementation of the Stockholm Convention

---

Brominated Flame Retardants in the Russian Federation

Eco-SPES

Russian Federation
March 2006

About the International POPs Elimination Project

On May 1, 2004, the International POPs Elimination Network (IPEN http://www.ipen.org) began a global NGO project called the International POPs Elimination Project (IPEP) in partnership with the United Nations Industrial Development Organization (UNIDO) and the United Nations Environment Program (UNEP). The Global Environment Facility (GEF) provided core funding for the project.

IPEP has three principal objectives:

- Encourage and enable NGOs in 40 developing and transitional countries to engage in activities that provide concrete and immediate contributions to country efforts in preparing for the implementation of the Stockholm Convention;
- Enhance the skills and knowledge of NGOs to help build their capacity as effective stakeholders in the Convention implementation process;
- Help establish regional and national NGO coordination and capacity in all regions of the world in support of longer term efforts to achieve chemical safety.

IPEP will support preparation of reports on country situation, hotspots, policy briefs, and regional activities. Three principal types of activities will be supported by IPEP: participation in the National Implementation Plan, training and awareness workshops, and public information and awareness campaigns.

For more information, please see http://www.ipen.org

IPEN gratefully acknowledges the financial support of the Global Environment Facility, Swiss Agency for Development and Cooperation, Swiss Agency for the Environment Forests and Landscape, the Canada POPs Fund, the Dutch Ministry of Housing, Spatial Planning and the Environment (VROM), Mitchell Kapor Foundation, Sigrid Rausing Trust, New York Community Trust and others.

This report is available in the following languages: English, Russian

Brominated Flame Retardants in the Russian Federation

Acknowledgements

We express our particular gratitude to Olga Speranskaya (Eco-Accord Centre, Moscow, Russia); Oksana Tsitser (the Federal Agency for Environmental, Technological and Nuclear Supervision); Elena Vasilieva (NGO "Volgograd-Ecopress", Volgograd, Russia); Natalia Voronovich ("Kaustik" Co., Volgograd, Russia; we highly appreciate support of Lev Fedorov, Doctor of Sciences (Chemistry), Union for Chemical Security (Moscow, Russia); Yuriy Treger, Doctor of Sciences (Chemistry) ("Sintez" R&D Centre, Moscow, Russia); Aleksey Kiselev (Greenpeace-Russia).

Introduction

This research study, dedicated to assessment of levels of brominated flame retardants (BFRs) in the Russian Federation, was induced by their large-scale production and application in many countries, notwithstanding proven adverse environmental and health impacts of BFRs. Now, their global production and use still continues to grow.

Until recently, there were almost no data on presence of brominated flame retardants in environmental media at the territory of the Russian Federation. In the framework of the Arctic Council project ("Reduction or Elimination of Sources and Releases of Brominated Flame Retardants") the official inventory of sources of these substances was conducted. According to the inventory report, production and use of BFRs in Russia are lower than in other industrialised countries. Now, BFRs are not produced in Russia. The report of the Arctic Council suggests that, from 2000 to 2004, the overall production of BFRs in the country reached 200 tons, including 93 tons of potentially hazardous hexabromocyclododecane. In the same period of time, about 1900 tons of these substances were imported to Russia for production of foam rubber and other heat insulation materials. Many of these products could be exported from Russia. In the period from 2000 to 2004, the overall export/import balance of different BFRs reached 2,200 - 3,300 tons (or about the same level of consumption as in other countries). However, it is necessary to note that the above figures represent approximate estimates. In order to get precise figures, more detailed studies would be necessary.

This study was completed by NGOs in the course of implementation of IPEP. We studied BFRs including polybrominated biphenyls (PBBs) and polybrominated diphenyl ethers (PBDEs). This is the second study of BFRs in Russia and the first to study computer rooms.

Main properties of brominated flame retardants

Flame retardants are added to plastics, textile, electronic circuits and other materials to prevent fire risks. These compounds are physically mixed to host products but they do not bond to them chemically. As a result, under certain conditions they may be released from a host material matrix to the environment. [1]

Technical grade flame retardants contain different organobromine compounds, including polybrominated biphenyls (PBBs), polybrominated diphenyl ethers (PBDEs), tetrabromo-bis-phenol (TBBPA) and hexabromocyclodecane (HBCD). If burned, products with polybrominated flame retardants may release polybrominated dibenzo-p-dioxins/furans to the environment. In terms of their toxic properties, polybrominated dioxins and furans are similar to polychlorinated ones.

Industrial production of polybrominated diphenyl ethers (PBDEs) started in the 1970s and these compounds are still produced. In 1997, overall production reached 67,000 tons/year. Notwithstanding some decrease of PBDEs production, they are still in demand in the global market (see Table 1). These compounds are used as flame retardants in thermoplastics. Similarly to other flame retardants, PBDEs are mixed with polymers but do not bond to host polymers chemically. As a result, PBDEs may diffuse and migrate from the host product. PBDEs are used as additives in different polymers (up to 5 - 30%). In the EU Member States, products with levels of penta- or octa-BDE in excess of 0.1% (mass) cannot be sold since 2004. [1]

Table 1. Industrial demand in BFRs by regions (tons/year), in 2001

	USA	Europe	Asia	Other countries	Total
Penta-BDE	7,100	150	150	100	7,500
Octa-BDE	1,500	610	1,500	180	3,790
Deca-BDE	24,500	7,600	23,000	1,050	56,100
Total	**33,100**	**8,360**	**24,650**	**1,320**	**67,390**

Abbreviations: Penta-BDE - pentabromo-diphenyl ethers;
Octa-BDE - octabromodiphenyl ethers; Deca-BDE - decabromo-diphenyl ethers.[1]

Now, technical grade deca-BDE is the most commonly used brominated flame retardant in the world, followed by technical grade penta-BDE. About 95% of technical grade penta-BDE is used in production of foamed polyurethane for furniture applications. Besides that, foamed polyurethane is used by car manufacturers. Technical grade octa-BDE is mainly used for production of ABS (acrylonitrile butadiene styrene plastic that is used for production of plastic cases of computers and other office equipment.) Technical grade octa-BDE is also used for production of adhesives and surface coatings. Technical grade deca-BDE is primarily used (as a mixture with antimony trioxide) for production of high impact polystyrene (HIPS) for manufacture of cases for electronic equipment (e.g. cases of TV sets). Small amounts of technical grade deca-BDE are used in textile production as flame retardants (e.g. as additives to polyether fabric and as coatings for car interior lining, tents and umbrellas). [3]

Health impacts of BFRs

There are real grounds for concerns about potential health impacts of PBDEs, as these compounds have been found in environmental media, biota, human tissues and breast milk. [1]

Experiments on laboratory animals support assumptions that human exposure to PBDEs and other organobromine compounds may cause neurological and endocrine disorders (including hormonal dysfunction of the thyroid gland and reproductive disorders). Neurobehavioral alterations were found for newly born rodents after exposure to PBDEs. In the case of mice, 0.8 mg PBDEs/kg body weight injected at the tenth day of life caused progressively developing disorders including behavioural deviations and motor dysfunctions. [2]

Experiments on laboratory rats revealed that industrial mixtures, containing penta-BDE, are hepatotoxic at doses of 10 mg/kg/day. In the case of rats, hepatomegaly and an increase of liver cells with cell vacuolization were observed under exposure to industrial grade penta-BDE (doses of 2-9 mg/kg/day for 4-13 weeks). Higher rates of degeneration and necrosis of individual hepatocytes were observed 24 weeks after exposure of rats to industrial grade penta-BDE (doses of 2 mg/kg/day for 90 days). Highly purified deca-BDE generated adverse impacts on the liver of rats only at high doses and at life-long exposures. Exposure to 94-97% deca-BDE at doses of 2,240 mg/kg/day for 103 weeks caused liver thrombosis and degeneration for rats, hypertension and granulomas for mice at doses of 3,200 mg/kg/day. Available results of experiments on laboratory animals suggest that PBDEs with low bromine contents are potentially hepatotoxic for humans.

Deca-BDE was found to be absorbed by humans, animals and fish in much larger quantities than initially assumed. Research studies revealed high levels of deca-BDE in the meat of fish and peregrine falcon. Deca-BDE was found in blood of workers of a facility that recycles electronic equipment in Sweden and in breast milk in the USA.[2]

Thyroid hormones regulate growth and development of newborn children. PBDEs block protein metabolism with mediation of thyroid hormones. Experiments on rodents confirmed reduction of levels of thyroid hormones (hypothyroidism) under impacts of PBDEs. Due to some reduction of levels of thyroid hormones, PBDEs could potentially adversely affect intellectual development of children, including IQ deficiency problems.

Among other polybrominated diphenyl ethers, penta-BDE is particularly prone to accumulation in the human body and is a highly lipophilic compound. In the case of deca- and octa-BDE, rates of bioaccumulation are lower, compared to penta-BDE. Deca-BDE degrades in environmental media and in living organisms, generating simpler and more toxic metabolites that may accumulate in biological objects much easier. [2]

Analysis of human toxic body burdens suggests that ordinary residents (without relevant occupational exposures) are primarily exposed to low bromine content PBDEs (tetra- and penta-BDE). For example, average levels of congeners 47, 153, 183, 209 and total BDE levels (the sum of 4 additional ingredients) reached 0.63, 0.35, 0.17, <1 and 2.2 ng/g lipids. Levels of deca-BDE exceeded applicable limits (1 pmol/g lipids). Levels of PBDEs with low bromine contents in environmental media may be levelling off in Europe, but their levels may be expected to increase in certain regions of Canada and the USA. Total PBDEs levels in ambient air vary from 5.5 pg/m^3 in rural areas to 52 pg/m^3 in urban areas. As PBDEs are hydrophobic, measurable levels of these compounds were not found in water. Areas with high concentrations of commercial brominated compounds (e.g. decabromodiphenyl ether) are usually located nearby fixed pollution sources (in soil and bottom sediments). [3]

Brominated flame retardants in the Russian Federation - basic data

In the course of the research project, we studied indoor air pollution in offices, residential rooms and computer rooms by brominated biphenyls and brominated diphenyl ethers. We sampled air and dust in these facilities.

These samples (see the list of study objects and samples in Table 2) were analysed by the Environmental Analytical Control Centre of "Kaustik" Co. (Volgograd, Russia) (Accreditation certificate No. ROSS RU.0001.513391 of 5.08.2002).

Study objects

Table 2. Description of the study objects

No.	Study objects	Address	Samples	Description of study objects
1.	Office room	Moscow, 3 Bogoyavlenskiy by-St., office. 26	Composite sample. Dust on office equipment and furniture	2 monitors, 3 system units, 1 scanner, computers were in operation for about 3 years. Floor space: 17 m^2.
2.	Office room	Moscow, 6 N.Bashilovka St., offices 4,6	Composite sample Dust on office equipment and furniture	4 monitors, 4 system units, 1 scanner, 1 UPS, 1 modem, computers were in operation for 3 - 8 years. The overall floor space: 40 m^2.
3.	Residential flat	Moscow Oblast, Naro-Fominskiy district, Kalininets township, build. 26 ap.50	Composite sample Dust on appliances and furniture	1 TV set, 1 VCR, 1 music centre, appliances were in operation for 1 - 4 years. Floor space: 15 m^2.
4.	Office room	Nizhniy Novgorod, 2 Kostina St., office 155, Ed. office of "Bereginya" newspaper	Composite sample Dust on office equipment and furniture	3 monitors, 3 system units, 1 scanner, computers were in operation for 5 - 9 years. Floor space: 25 $м^2$.
5.	Computer room of the IT dept	Volgograd, "Kaustik" Co., (IT dept)	Composite sample Dust in the air of the computer room	10 computers, computers were in operation for 3-4 years. The room was used for computers for 10 years.
6.	Computer room of the IT dept	Volgograd, "Kaustik" Co., (IT dept)	Composite sample Air in the computer room (aerosols)	10 computers, computers were in operation for 3-4 years. The room was used for computers for 10 years.
7.	Computer room of the production control dept	Volgograd, "Kaustik" Co., (Pr. control dept)	Composite sample Air in the computer room (aerosols)	10 computers, computers were in operation for 3-4 years. The room was used for computers for 10 years.
8.	Electrostatic paint sprayer	Volgograd, "Volgograd Metal Profile Plant" Co.	Composite sample The ventilation exhaust	"Dekor-2001" electrostatic paint sprayer

Research results

Table 3. Levels of brominated biphenyls and diphenyl ethers in dust of office, residential and industrial rooms (nanograms/g of dust)

Types of rooms	N	Sampling points	Levels of ingredients, ng/g dust							
			Brominated biphenyls				Brominated diphenyl ethers			
			Penta - BB	Octa - BB	Deca - BB	Σ	Penta - BDE	Octa - BDE	Deca - BDE	Σ
Offices and residential rooms	1	Moscow, 3 Bogoyavlenskiy by-St., office 26., office room **(samples of dust on office equipment)**	40.0	12.0	420.0	**472.0**	<0.1	<0.1	<0.1	<0.1
	2	Moscow, 6 Bashilovka St., offices 4,6, office rooms **(samples of dust on office equipment)**	11.0	6.0	240.0	**257.0**	<0.1	<0.1	<0.1	<0.1
	3	Moscow Oblast, Naro-Fominskiy district, Kalininets township, build. 26 ap.50, residential flat, **(samples of dust on appliances)**	24.0	28.0	470.0	**522.0**	<0.1	<0.1	<0.1	<0.1
	4	Novgorod, 2 Kostina St., office 155, Ed. office of "Bereginya" newspaper **(samples of dust on office equipment)**	<0.1	<0.1	840.0	**840.0**	<0.1	<0.1	<0.1	<0.1
Computer rooms	5	Computer room of Volgograd, "Kaustik" Co., (IT dept) **Samples of dust in the air**	13.0	72.0	46.0	**131.0**	16.0	<0.1	200.0	**216.0**

	6	Computer room of Volgograd, "Khimprom" Co., (prod. control dept) **Samples of dust in the air**	52.0	9.0	36.0	**97.0**	120.5	15.6	<0.1	**136.1**
Industrial rooms	7	Volgograd, "Volgograd Metal Profile Plant". **Ventilation exhaust**	<0.1	<0.1	<0.1	<0.1	700.0	50.0	650.0	**1400**
Biological wastewater treatment facilities	8	Volgograd, Krasnoarmeiskiy district, Biological wastewater treatment facilities **(sludge, levels relatively to dry matter)**	<0.1	<0.1	<0.1	<0.1	840.0	390.0	450.0	**1680**

Note: "<0.1" means concentrations under the detection limit.

Table 4. Levels of brominated biphenyls and diphenyl ethers in air of industrial rooms (mg/m^3 of air)

Types of rooms	N	Sampling points	Concentration of individual ingredients, mg/m^3							
			Brominated biphenyls				Brominated diphenyl ethers			
			Penta - BB	Octa - BB	Deca - BB	Σ	Penta - BDE	Octa - BDE	Deca - BDE	Σ
Computer rooms	1	Computer room of Volgograd "Kaustik" Co., (IT dept) **Aerosols in the air (object 5)**	<0.001	<0.001	<0.001	<0.001	0.0049	0.0078	0.0560	**0.0687**
	2	Computer room of Volgograd, "Khimprom" Co., (prod. control dept) **Aerosols in the air (object 6)**	<0.001	<0.001	<0.001	<0.001	0.007	0.0450	0.0060	**0.058**

Note: "<0.001" means concentrations under the detection limit.

Table 5. Total levels of polybrominated biphenyls and diphenyl ethers in dust samples (ng/g of dust).

Objects	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Ingredients	Office 1	Office 2	Res. flat	Office 3	Computer room 1	Computer room 2	Indust. room	Sludge
Penta - BB	40.0	11.0	24.0	<0.1	52.0	13.0	<0.1	<0.1
Octa - BB	12.0	6.0	28.0	<0.1	9.0	72.0	<0.1	<0.1
Deca - BB	420.0	240.0	470.0	840.0	36.0	46.0	<0.1	<0.1
∑ PBBs	**472.0**	**257.0**	**522.0**	**840.0**	**97.0**	**131.0**	<0.1	<0.1
Average levels	**522.8**				**114.0**			
Penta - BDE	<0.1	<0.1	<0.1	<0.1	120.5	16.0	700.0	840.0
Octa - BDE	<0.1	<0.1	<0.1	<0.1	15.6	<0.1	50.0	390.0
Deca - BDE	<0.1	<0.1	<0.1	<0.1	<0.1	200.0	650.0	450.0
∑ PBDEs	<0.1	<0.1	<0.1	<0.1	**136.1**	**216.0**	**1400**	**1680**
Average levels	<0.1				**176.05**			

Note: "<0.1" means concentrations under the detection limit.

Fig 1. Levels of brominated biphenyls in dust of offices and residential rooms (ng/g of dust)

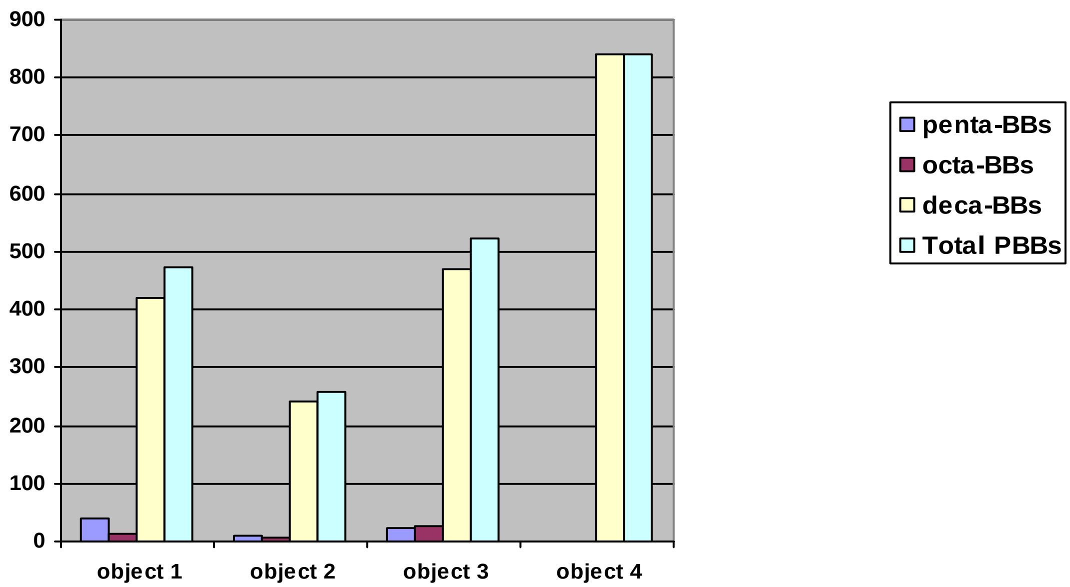


Fig. 2. Levels of brominated biphenyls and diphenyl ethers in dust of computer rooms (ng/g of dust)

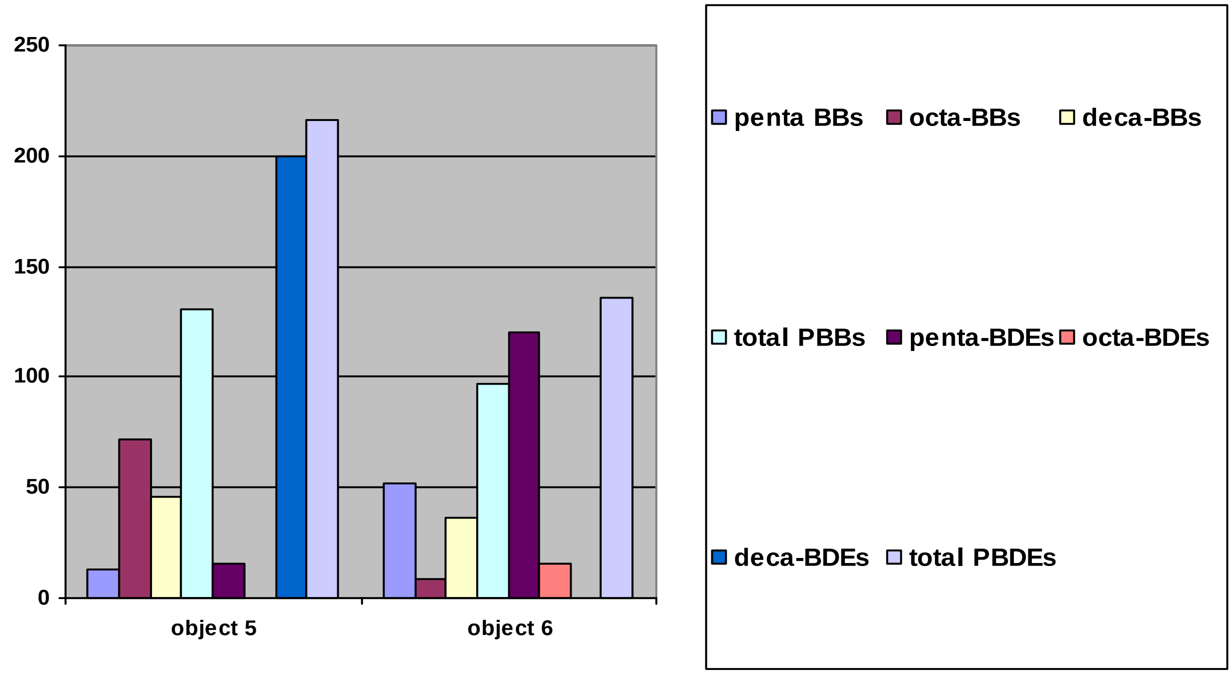


Fig. 3. Levels of brominated diphenyl ethers in air of industrial rooms (mg/m^3 of air)

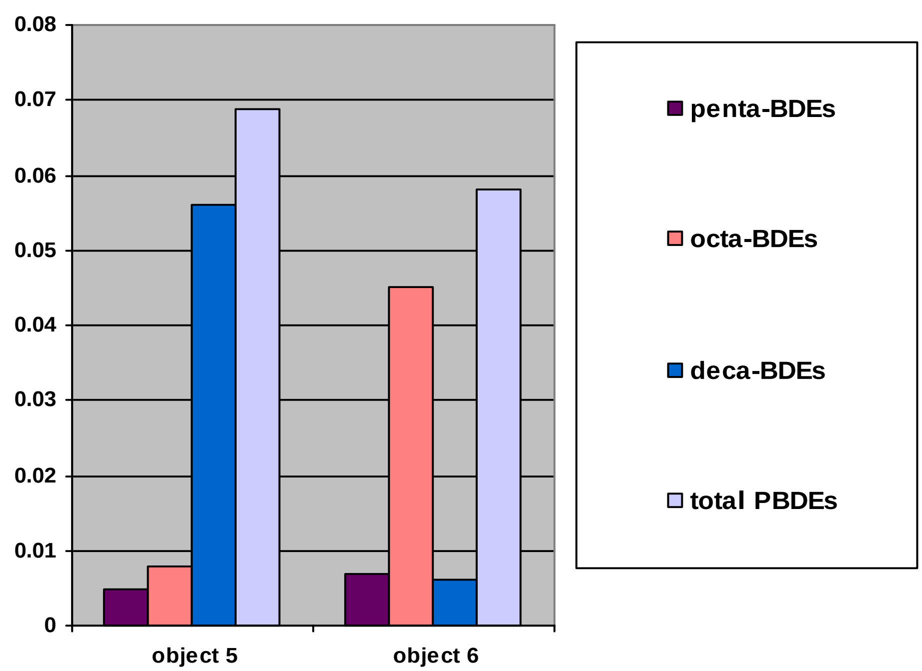


Fig. 4. Levels of brominated diphenyl ethers in dust fraction of the industrial installation exhaust (ng/g of dust)

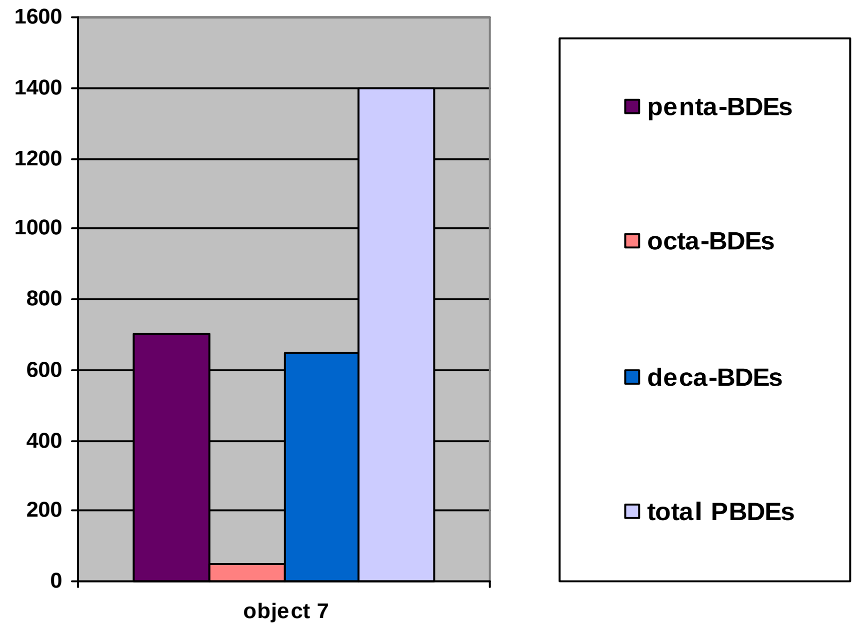
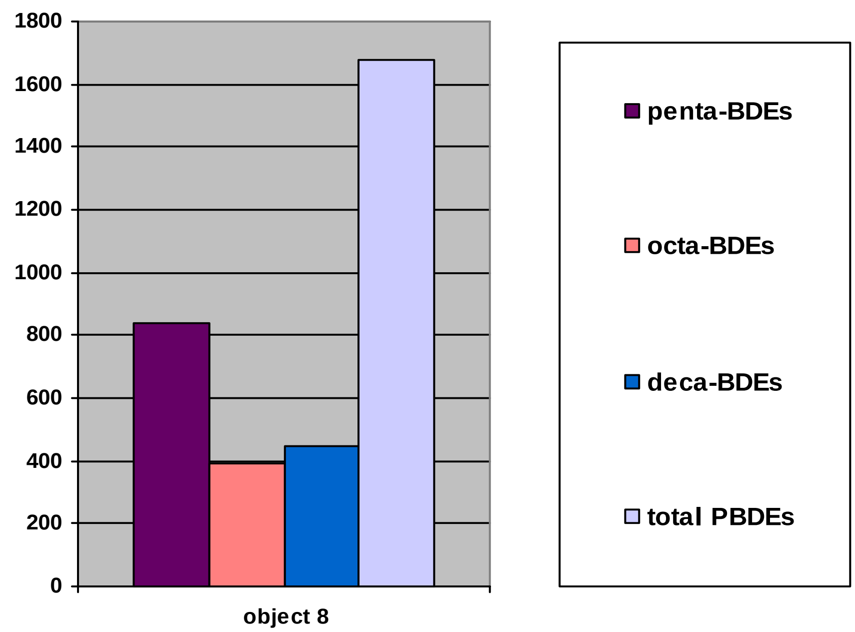


Fig. 5. Levels of brominated diphenyl ethers in sludge of the wastewater treatment facility (ng/g dry matter)



Charts 1 - 4. Levels of brominated biphenyls in dust of offices and residential rooms.

Chart 1.

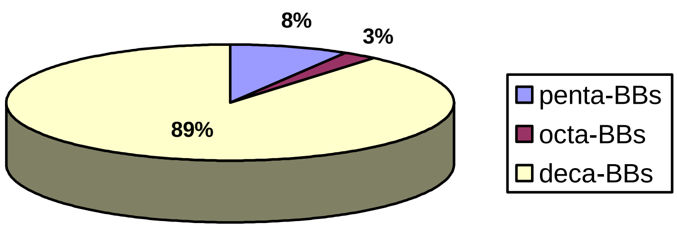


Chart 2.

.

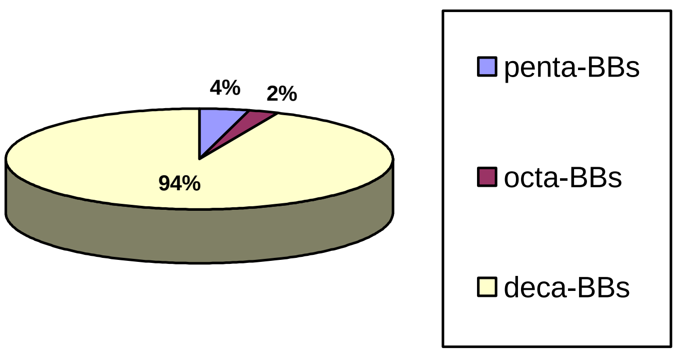


Chart 3.

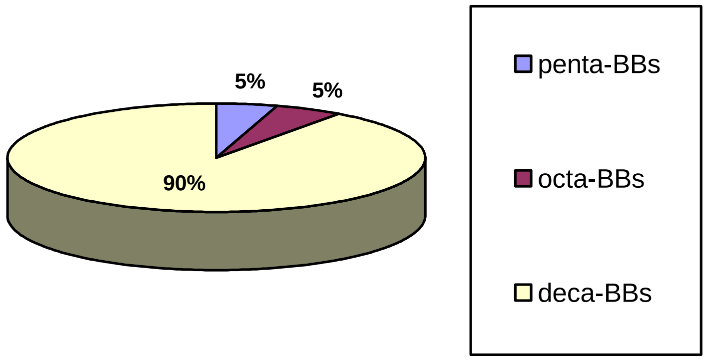


Chart 4.

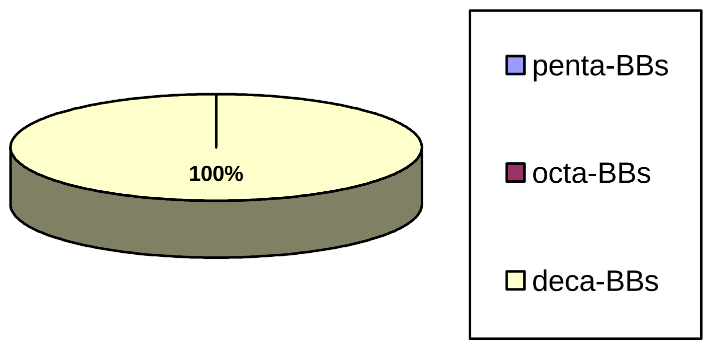


Chart 5. Concentration of brominated biphenyls in dust of computer rooms.

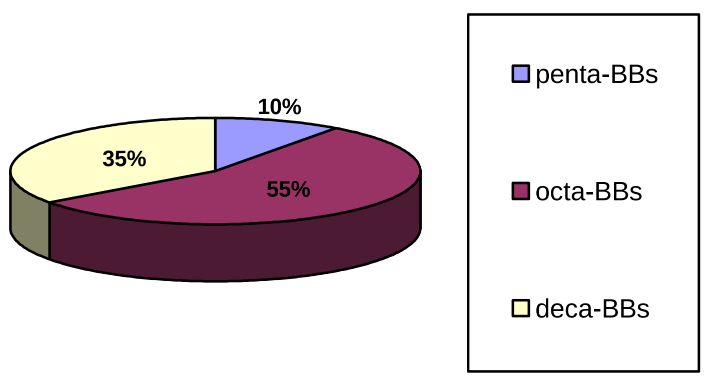


Chart 6. Levels of brominated biphenyls in dust of computer rooms.

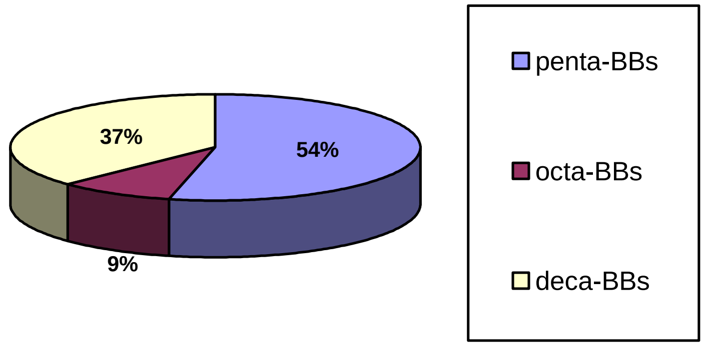


Chart 7. Levels of brominated diphenyl ethers in dust of computer rooms

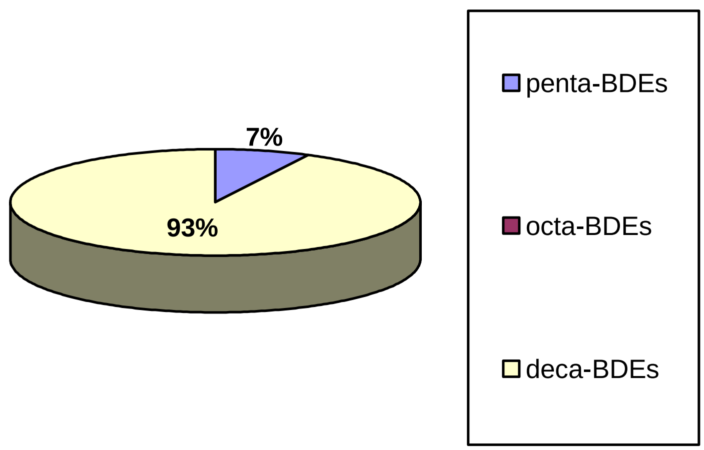


Chart 8. Levels of brominated diphenyl ethers in dust of computer rooms

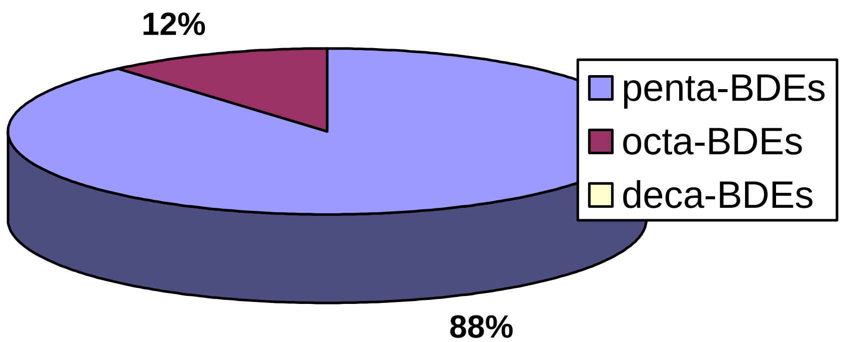


Chart 9. Levels of brominated diphenyl ethers in sludge of wastewater treatment facilities

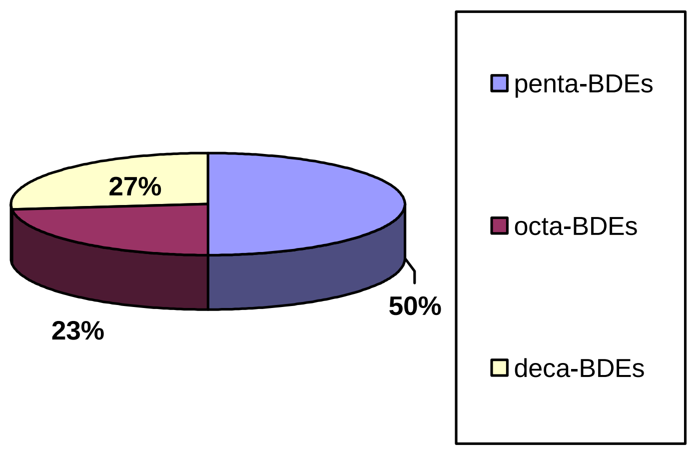


Chart 10. Levels of brominated diphenyl ethers in dust of computer rooms.

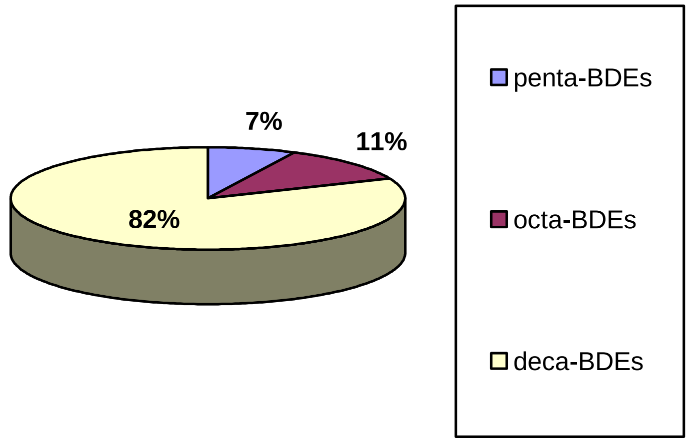


Chart 11. Levels of brominated diphenyl ethers in air of computer rooms.

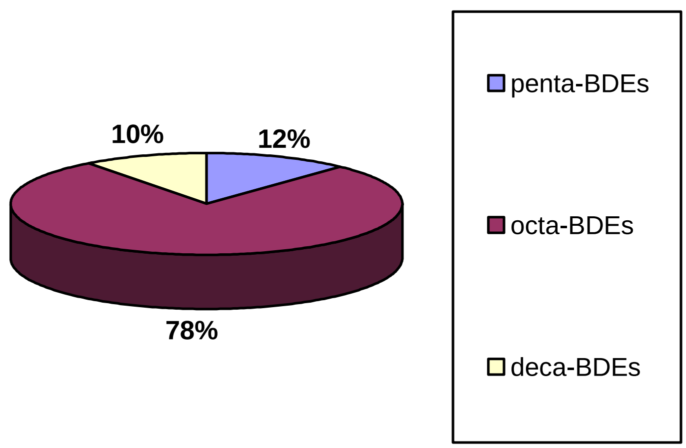
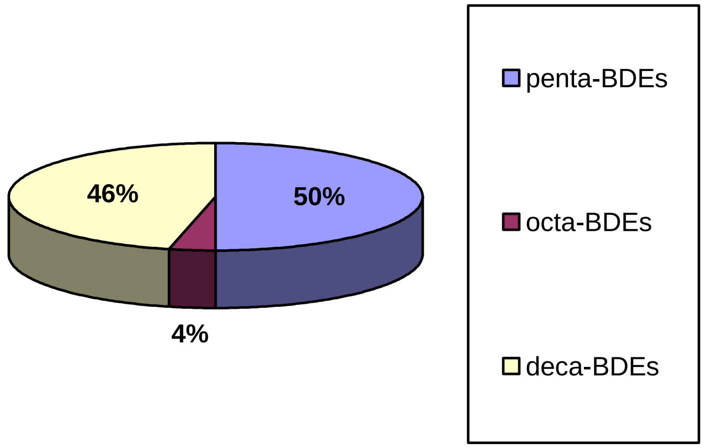


Chart 12. Levels of brominated diphenyl ethers in dust of the exhaust of the industrial facility.



Legislative initiatives to reduce/ban application of brominated chemicals

In some countries, environmental NGOs and governmental bodies promoted initiatives for banning application of brominated chemicals for many years. In Germany, industrial consumers voluntarily refused application of polybrominated biphenyls and diphenyl ethers. The Ospar Convention incorporated the group of BFRs to the list of hazardous materials. See a more detailed account in Table 5. [2]

Table 5. Legislative initiatives[2]

Year	Countries	Initiatives
1989	Germany	Industrial consumers voluntarily refused application of PBDEs
1989	The Netherlands	Industrial consumers voluntarily refused application of PBDEs and PBBs
1989	EU	The ban on application of tri-(2,3 - dibromopropyl)-phosphate and PBDEs in production of textile items that contact with skin was enacted in 1997, pursuant to Ordnance No. 1042 of the Ministry of Power Industry and Environment.
1992	Ospar Convention	The Convention incorporates BFRs to the list of hazardous chemicals and recommends expedited banning of application of PBDEs and PBBs
1993	Germany	PBDEs are banned according to the Ordinance on Dioxins
1995	The North Sea	46 environmental ministers agreed to replace BFRs by less hazardous alternatives
1999	Sweden	The Swedish Chemical Inspectorate (Keml) recommended ceasing application of PBDEs and PBBs in 5 years with an eventual ban on all applications of organobromine chemicals for the sake of a toxins-free future
1999	WHO	WHO stated that BFRs "should not be used if safer alternatives are available"
2000	OECD	The joint session of the Chemicals Committee and the Working Group on Chemicals approved the voluntary agreement of the bromine industry to terminate production of PBDEs
2003	Austria	Austria supported the ban on application of deca-PBDE
2003	EU	The EU considers options to ban hexabromocyclohexane and tetrabromo-bis-phenol
2003	Norway	The Pollution Control Directorate required companies to submit plans for reduction and phase out of BFRs production.
2003	The Netherlands	The country banned production of di-(2,3-dibromopropyl) tetrabromo-bis-phenol
2004	EU	The ban on marketing and application of penta- and octa-PBDEs in all finished goods was enacted
2004	EU	By late 2004, the decision on the current review of deca-PBDE was expected.
2004	Norway	The ban on penta- and octa-PBDE was enacted
2005	Norway	The ban on deca-BDE was planned.
2005	Norway	The ban on HBCD and TBBPA was planned, in absence of EU directives.
2005	Stockholm Convention	Hexabromobiphenyl and penta-PBDE declared to be POPs and both move ahead for risk profile evaluation for possible listing in the Convention
2006	EU	The Directive on reduction of application of hazardous materials imposes the ban on use of penta-, octa- and deca- brominated organic compounds for production of electronic equipment sold or imported to the EU
2006	Maine, USA	The ban on penta- and octa-PBDE
2006	EU	Announces intention to propose octa-PBDE for listing in the Stockholm Convention
2008	Maine, USA	A possible ban on deca-PBDE
2008	California, USA	Ban on penta- and octa-PBDE
2020	Ospar Convention	Planned ban on all BFRs

Conclusions

Commercial octa-BDE is used by producers of polymers as a flame retardant in finished goods. Octa-BDE is used almost exclusively as a flame retardant in ABS plastic (acrylonitrile butadiene styrene), that is used for production of plastic cases of computers and computer monitors. In the EU, the production of ABS plastic consumes about 95% of the total octa-BDE production. About 5% of octa-BDE is used for production of other polymers, including high impact polystyrene, polybutylterephthalate and polyamide polymers. In addition, octa-BDE may be used as a flame retardant in polycarbonates, adhesives and coatings. [4]

About 95% of technical grade penta-BDE is used for production of foamed polyurethane (FPUF) for furniture applications. Commercial penta-BDE is usually used in mixtures with phosphate ethers. A foamed polyurethane mattress may contain 2-3% of flame retardants, while a FPUF-filled pillow may contain up to 3-5% of PBDEs. Polyurethane waste is usually used for production of carpet mounts. As a result, a carpet mount may contain 3-5% brominated flame retardants.

Now, technical grade deca-BDE is the most commonly used flame retardant in the world. Deca-BDE is primarily mixed with high impact polystyrene, used for production of TV cases. Besides that, it is also used in different polymers, applied in production of electric/electronic equipment (computers, electric appliances, cables), including polypropylene (electronic components), different copolymers, e.g. polyvinyl acetate and PVC (cables). In small quantities, these compounds are also added to polycarbonates, polyamides and terephthalates. Other applications of deca-BDE include polyethylene, polyester, epoxy resins, adhesives and fabric mounts. In small amounts, technical grade deca-BDE is used for production of textile (canvas, tents, etc.).

In this research study we identified the presence of polybrominated biphenyls and diphenyl ethers in several regions of the Russian Federation (see Tables 3, 4, and 5).

The results for PBDEs in this study were similar to those found in a 2003 Greenpeace study of house dust in the UK and continental Europe.[5] The Greenpeace study found penta-PBDE in levels ranging from 1.8 – 2100 ng/g while Table 3 shows levels ranging from 16 – 840 ng/g. Deca-PBDE was the most abundant PBDE in house dust in the Greenpeace study with levels ranging from 3800 – 19900 ng/g. This study showed lower levels of deca-PBDE in the samples analyzed with concentrations ranging from 200 – 650 ng/g.

In offices (see Fig. 1), where different types of office equipment (computers, printers, scanners, etc.) were operated up to 8 years, **high** levels of PBBs were found, including in particular, deca-BBs. Deca-BBs were found in a residential room (see Fig. 3) without office equipment. The compound may be released by a TV set, other electric appliances and furniture.

All isomers of PBDEs were found in sludge of wastewater treatment facilities. In the territory of the Russian Federation, all municipal (including wastewater after washing of residential and office rooms) and industrial wastewater, as well as rainfall discharges are mixed at wastewater treatment facilities. We sampled wastewater and sludge at the wastewater treatment facility. Due to the high persistence of brominated biphenyls and diphenyl ethers, they are not oxidised and adsorb to sludge particles. In samples of the sludge we found concentrations of penta-, octa- and deca-PBDE in the range of 50 to 840 ng/g sludge. These results suggest intensive discharge of PBDEs to the environment with municipal and industrial wastewater in the Russian Federation.

Final conclusions

Until 1991, there were several facilities that produced organobromine compounds in the former USSR. Now, there are no such facilities in the Russian Federation, however, there are some plans to launch bromine extraction operations from brine of the Baskunchak Lake and to produce organobromine compounds in Russia. Unfortunately, there is no reliable information on the import of brominated flame retardants to the Russian Federation.

In 2005, Norway proposed nominated penta-BDE to Annex A of the Stockholm Convention. On November 7 - 11, 2005 in Geneva, the first session of the POPs Review Committee under the Stockholm Convention on POPs considered the nomination. Among five candidate chemicals for incorporation into the list, the Committee reviewed penta-BDE. Members of the Committee assessed the candidate chemicals according to the list of criteria, set in the Convention. In the course of the Geneva session, initial steps were made to assess, whether these chemicals have intrinsic properties of POPs (i.e. persistence in environmental media, bioaccumulation, and long-range transfer from sources of release and adverse health and environmental impacts). Penta-BDE passed all criteria and was effectively declared to be a persistent organic pollutant.

Risk profiles for all individual POPs will be assessed based on information, provided by governments, NGOs and other stakeholders. The final step will assess social and economic factors. Accounting for results of the review, the Committee will make a recommendation to the Conference of the Parties on the need to apply international measures. If the Committee decides that actions are necessary, it might recommend bans, limitations and exceptions for a particular chemical.

First and foremost, application of PBBs and PBDEs should be reduced by producers of electronic and electric equipment, car manufacturers, textile producers and construction companies.

Burning of PBDEs-containing materials/waste may be considered as an additional source of environmental releases of polybrominated dibenzo-p-dioxins and/or furans. [1]

In Russia, amounts of consumption wastes, containing penta-BDE (foamed polyurethane), octa-BDE (computer monitor) and deca-BDE (cases of TV sets), increase every year, in parallel with growing application of electronic appliances by residential and industrial consumers. It is necessary to reduce amounts of PBDEs-containing waste, in order to prevent releases of PBDEs and PBBs from landfills. [1]

The presence of these compounds in different media (e.g. dust in residential rooms, air and dust in offices, industrial exhaust) demonstrates that the problem of environmental contamination by PBBs and PBDEs should be considered as a rather important problem for contemporary Russia. These compounds may be found in different environmental media and it is necessary to limit their application.

We believe that the situation may be improved by incorporation of all PBBs and PBDEs congeners to the list of POPs, and they should be incorporated into the list as soon as possible.

Abbreviations

BFRs - brominated flame retardants
PBBs - polybrominated biphenyls
PBDEs - polybrominated diphenyl ethers
TBBPA - tetrabromo-bis-phenol A
HBCD - hexabromocyclodecane.

References

1. Toxicological Profile for Polybrominated Biphenyls and Polybrominated Diphenyl Ethers (PBBs and PBDEs). September 2004, ATSDR, http://www.atsdr.cdc.gov/toxprofiles/tp68-c7.pdf
2. Brominated Flame Retardants in Dust on Computers. May, 2004. Clean Production Action.
3. Toxicological Profile for Polybrominated Biphenyls and Polybrominated Diphenyl Ethers (PBBs and PBDEs). September 2004, ATSDR, http://www.atsdr.cdc.gov/toxprofiles/tp68-c4.pdf
4. Great Lakes Chemical Corporation 2004b
5. David Santillo, et al. Greenpeace. Consuming Chemicals: Hazardous chemicals in house dust as an indicator of chemical exposure in the home. January 2003.