Annex II

Key findings and potential gaps identified in information provided by parties and observers and other relevant information on newly listed persistent organic pollutants

The present annex has been prepared by the Secretariat based on the information compiled in accordance with the annex to decision SC-4/19.[1] It summarizes key findings and potential gaps identified in the information submitted and in other relevant sources, including scientific literature. Detailed information on brominated diphenyl ethers found in such sources has been integrated in the technical review on brominated diphenyl ethers[2] and its associated appendices.[3]

I. Information on brominated diphenyl ethers found in the scientific literature

A. Key findings relevant to brominated diphenyl ethers

1. Thirty-four countries responded to the request for information on brominated diphenyl ethers (Algeria, Austria, Brazil, Bulgaria, Canada, Costa Rica, Côte d'Ivoire, the Czech Republic, Estonia, Germany, Honduras, Iceland, Indonesia, Japan, Lithuania, Mauritius, Monaco, Morocco, Mozambique, the Netherlands, New Zealand, Norway, Peru, the Republic of Korea, the Republic of Moldova, Romania, Serbia, Sierra Leone, Sweden, Switzerland, Trinidad and Tobago, Ukraine, Uruguay and the United States). Some of these countries reported that they had no relevant information.

2. The level of detail in the information submitted varies considerably. In summary, the following information was provided:

(a) *Manufacture and use of articles containing listed bromodiphenyl ethers*: eight countries responded that articles containing listed bromodiphenyl ethers were previously manufactured in their territories. Fifteen responded that they had no relevant information;

(b) *Types and quantities of articles containing brominated diphenyl ethers, including concentrations of those substances in the articles, including recycled articles*:

(i) Information was limited;

(ii) Austria reported data on the levels of brominated diphenyl ethers in recycling operations that included decabromodiphenyl ether and was not specific to the listed bromodiphenyl ethers;

(iii) A market survey carried out in Switzerland in 2008 concluded that no articles containing commercial pentabromodiphenyl ether, and only very few articles containing commercial octabromodiphenyl ether, were on the market;

(iv) New Zealand supplied a detailed report based on an X-ray fluorescence spectrometry assessment of the quantity of bromine-containing products in the country;

(c) *Types of articles recycled, extent of recycling, types of articles produced from recycling, options for the environmental management of recycling operations and releases or potential releases resulting from recycling operations*: Canada reported that new articles were recycled from articles that might contain listed bromodiphenyl ethers. Two manufacturers were aware that their recycled carpet padding consisting of flexible polyurethane rebond foam might contain listed bromodiphenyl ethers;

(d) *Cost-effectiveness of different management options and options for environmentally sound disposal*:

---

1 UNEP/POPS/POPRC.6/INF/5.

2 UNEP/POPS/POPRC.6/2/Rev.2.

3 UNEP/POPS/POPRC.6/INF/6.

(i) Options for environmentally sound disposal reported by the Czech Republic included secured landfills, hazardous waste incineration, non-hazardous waste incineration, environmentally sound remediation, base catalysed decomposition and thermal desorption by authorized facilities. Austria commented that plastics containing brominated diphenyl ethers were incinerated because landfilling was not allowed. New Zealand suggested secured landfilling;

(ii) No information was provided on the cost effectiveness of different management options.

(e) *Methods for identifying the presence and levels of brominated diphenyl ethers in articles*: Many countries reported using gas chromatography-mass spectrometry (GC/MS), including Germany's "Standard measurement method for the determination of polybrominated flame retardants (pentabromodiphenyl ether, octabromodiphenyl ether) in products".[4] Austria specified hot solvent extraction with cyclohexane for analysis by GC/MS. The Czech Republic indicated United States Environmental Protection Agency Method 1614 using a high resolution gas chromatograph/high resolution mass spectrometer (HRGC/HRMS). Estonia, the Netherlands, New Zealand, Norway, Serbia, Sweden and Switzerland referred to X-ray fluorescence spectrometry;

(f) *Identification of, and remediation methods for, contaminated sites pursuant to subparagraph 1 (e) of Article 6 of the Convention*: the Czech Republic reported that an inventory of sites contaminated with new persistent organic pollutants was being developed and would be available by January 2011. New Zealand stated that excavation of contaminated soils and disposal in secured landfills was available and cost-effective.

B. Information gaps in respect of brominated diphenyl ethers

3. Information gaps in respect of brominated diphenyl ethers were identified as follows:

(a) Screening and analytical methodology:

(i) Current analytical methodology using GC/MS is costly and time consuming for regular screening operations. Less costly and more rapid techniques exist, but most of them only achieve the separation of bromine containing materials from non-bromine containing materials. Techniques that allow faster, less costly and more accurate analysis targeting specific brominated diphenyl ethers would be desirable;

(ii) Some technologies that allow the separation of brominated diphenyl ethers and other brominated flame retardants from plastics and printed circuit boards are being or have been developed. Further assessment of obstacles to the full-scale application of such technologies is needed;

(b) Global material flow:

(i) There are significant gaps in information relating to substance flow, including production, use, recycling and end-of-life of articles containing bromodiphenyl ethers;

(ii) Some studies have shown that bromodiphenyl ethers are found in plastic products that are not treated with flame retardants, including children's toys, household goods and video tapes. The extent of this secondary contamination is unknown;

(c) Destruction efficiency of bromodiphenyl ether incineration:

(i) The operating temperature required for municipal waste incinerators to destroy bromodiphenyl ethers is known to be 850 °C, while polychlorinated biphenyls require 1,100 °C. Information on incinerators operated in line with specifications for best available techniques and best environmental practices is limited;

(ii) Brominated diphenyl ethers, polybrominated dibenzo-*p*-dioxins, polybrominated dibenzo furans (PBDD/PBDF), mixed polyhalogenated dibenzo-*p*-dioxins and mixed polyhalogenated dibenzo furans (PXDD/PXDF)

4 www.umweltdaten.de/publikationen/fpdf-l/2971.pdf (see also IEC 62321:2008, EN 62321:2009).

may be released from incinerators due to unstable conditions or to corrosion in the boiler sections of incinerators caused by high waste loads. No assessments of long-term destruction efficiency of bromodiphenyl ethers have been reported;

(iii) No information is available on quantities of brominated diphenyl ethers, PBDD/PBDF or PXDD/PXDF released from incinerators not operated in accordance with best available techniques and best environmental practices, including in developing countries and countries with economies in transition;

(iv) Products of combustion such as bottom ash, grate siftings and fly ash are analyzed to assess and control releases of hazardous chemicals. Bottom ash is composed of non-combustible materials or materials too large to be combusted. Grate siftings are small particles that fall through incinerator grates during the combustion process. Fly ash is made up of very small non-combustible particles. Analytical data for brominated diphenyl ethers, PBDD/PBDF, or PXDD/PXDF in fly ash are limited. Only a few countries have policies on the handling of grate siftings;

(d) Other end-of-life treatment technologies:

(i) Other end-of-life treatment technologies include copper smelters, electric arc furnaces, primary steel plants (blast furnaces, coke plants and sinter plants), secondary aluminium smelters, antimony plants, cement kilns, pyrolysis and gasification. Many materials containing brominated diphenyl ethers are treated in copper smelters and electric arc furnaces;

(ii) Evaluation of the environmental and health impacts of these technologies requires the following information:

a. Types and quantities of articles containing brominated diphenyl ethers being treated in plants using these technologies;

b. Monitoring data for releases of bromodiphenyl ethers, PBDD/PBDF and PXDD/PXDF that could be used for substance flow analysis and impact assessment on occupational health and environment;

c. Destruction efficiency of brominated diphenyl ethers as required by best available techniques and best environmental practices;

d. Information on available technology to reduce emissions of brominated diphenyl ethers sufficiently, in addition to related hazardous chemicals such as PBDD/PBDF, PXDD/PXDF and chemicals formed due to debromination of brominated diphenyl ethers;

(e) Effect of background exposure on human health:

(i) High outliers are often reported in studies on human exposure to brominated diphenyl ethers but potential sources of high-level contamination have not been identified. Further assessment of the risks of exposure to brominated diphenyl ethers, in particular for children, is critical;

(ii) The United States Environmental Protection Agency defines maximum acceptable oral dose of a given toxic substance as a “reference dose” (RfD). A recent study on neurodevelopmental toxicity of brominated diphenyl ethers indicates that there is an adverse effect at very low doses of brominated diphenyl ethers (Herbstman J.B., et al., 2010) which implies a need for further evaluation of current indicators such as RfD for brominated diphenyl ethers;

(f) Debromination of listed bromodiphenyl ethers in technical processes and landfills:

(i) During the development of the technical review of brominated diphenyl ethers,[5] the issue of the debromination of brominated flame retardants was raised. New information on the subject was provided to the Persistent Organic Pollutants Review Committee[6] for consideration at its sixth meeting and will be further considered at its seventh meeting;

(ii) Information such as rates of debromination in the environment and in landfills as well as on the impact of debromination in various technical processes would be vital;

(g) Risk assessment scenarios for recycling and end-of-life treatment:

(i) Risk assessment for chemicals has been focused mainly on the production and use phases and less on the end-of-life or recycling phases;

(ii) Little is known about the long-term environmental effects of brominated diphenyl ethers deposited in landfills.

II. Information on perfluorooctane sulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride (PFOSF)

A. Key findings relevant to PFOS, its salts and PFOSF

4. Thirty-two countries responded to the request for information on PFOS, its salts and PFOSF (Algeria, Austria, Brazil, Bulgaria, Canada, Côte d'Ivoire, the Czech Republic, Estonia, Germany, Honduras, Iceland, Indonesia, Japan, Lithuania, Mauritius, Monaco, Morocco, Mozambique, the Netherlands, Norway, Peru, the Republic of Korea, the Republic of Moldova, Romania, Serbia, Sierra Leone, Sweden, Switzerland, Trinidad and Tobago, Ukraine, Uruguay and the United States). Several of these countries reported that they had no relevant information. The European Semiconductor Industry Association also submitted information in response to the request.

5. In summary, information was provided on the following topics:

(a) Types and quantities of articles containing PFOS, its salts and PFOSF, including concentrations of those substances in such articles:

(i) Several countries indicated that there was a lack of information;

(ii) Stockpiles of fire-fighting foams were reported by Austria, Canada, Iceland, the Netherlands, Norway, the Republic of Korea and Switzerland, with some countries including information about the amount of such stockpiles. Some countries reported that the labels on containers of aqueous film forming foams (AFFF) did not specify whether the foams contained PFOS-related substances or other fluorinated compounds. Switzerland reported on aviation hydraulic fluids and photo imaging, and Brazil reported on insect baits for control of leaf-cutting ants and insecticides for red imported fire ants and termites;

(iii) No information was provided on former major uses of PFOS-related substances in carpets, paper, textiles and furniture;

(b) Types of processes using PFOS, its salts and PFOSF, including concentrations of those substances used in such processes, options for the environmental management of such processes, recycling operations and releases and potential releases resulting from such processes:

(i) Several countries indicated that there was a lack of information;

5 UNEP/POPS/POPRC.6/2/Rev.2.

6 UNEP/POPS/POPRC.6/INF/20/Rev.1.

(ii) Many countries mentioned the use of PFOS-related substances in metal plating, primarily chromium plating (Austria, Canada, Germany, Japan, the Netherlands, Norway, Switzerland and the United States). Switzerland also reported their use in nickel plating. Austria has evaluated alternatives to PFOS-related substances in metal plating, while Japan has phased them out. The United States has conducted a study of chromium plating;[7]

(iii) Brazil reported on the amination process to synthesize sulfuramid, an active ingredient of leaf-cutting ant bait;

(iv) The Republic of Korea reported the use of PFOS-related substances in semiconductor production. The European Semiconductor industry reported that the voluntary agreement by the global semiconductor industry has been applied to photolithography applications of PFOS-related substances since 2006. The industry group highlighted that PFOS-related substances continued to perform an important role in the manufacture of semiconductors while its non-critical uses has been gradually reduced or eliminated. The voluntary agreement also ensured the environmentally sound management of the incineration of solvent wastes containing PFOS-related substances;

(c) No information was provided on the types of articles recycled, the extent of recycling, types of articles produced from recycling, options for the environmental management of recycling operations and releases or potential releases resulting from recycling operations;

(d) No information was provided on the cost effectiveness of different management options;

(e) Methods for sampling and analysis of PFOS, its salts and PFOSF in articles:

(i) Several countries reported on sampling and analytical methods for PFOS-related substances, including methods based on national or international standards and scientific literature (Austria, Brazil, Canada, the Czech Republic, Germany, Norway, Serbia and the United States);

(ii) Examples of the international and national standards include ISO 25101:2009, ONR CEN/TS 15968 and DIN 38407-42;

(f) Identification of remediation methods for sites contaminated with chemicals as indicated in subparagaph 1 (e) of Article 6 of the Convention: Norway mentioned remediation of soil contaminated by fire-fighting foam containing PFOS at Rygge airport as an example of excavation and disposal in secured landfills in accordance with national regulations on the safe disposal of hazardous waste.[8] Sweden mentioned a pilot study on assessment of activated carbon for treatment of water contaminated by PFOS-related substances. The United States reported on a study on the extent of pollution, including potential routes of exposure and potential health effects, caused by bio-solids containing PFOS-related substances;[9]

(g) Other relevant information:

(i) In several countries regulations have been developed to control PFOS-related substances. In the European Union, PFOS-related substances are covered by under the regulation on the registration, evaluation, authorization and restriction of chemicals (REACH). Japan has developed a comprehensive framework governing the use and import of PFOS-related substances. Norway has developed a framework governing processes using PFOS, its salts or PFOSF and has prohibited the production, import, export and marketing of articles containing more than 0.005 per cent of PFOS-related substances. Mauritius mentioned that it was preparing to include PFOS in its Dangerous Chemicals Control Act;

7 www.epa.gov/oppt/pfoa/pubs/pfoschromeplaterstudypdf_final.pdf.

8 www.klif.no/publikasjoner/2444/ta2444.pdf.

9 www.epa.gov/region4/water/PFCindex.html.

(ii) Germany published an information document on perfluorinated and polyfluorinated chemicals;[10]

(iii) Special care is required when selecting technologies for the destruction of PFOS-containing articles and the treatment of related waste flue gases. The carbon-fluorine bond is more stable than the carbon-chlorine bond and therefore the destruction technologies for PFOS require equivalent or greater potency than those for polychlorinated biphenyls. Some degradation products of fluorinated organic compounds are highly toxic (perfluoroisobutene, vinyl fluoride, monofluoroacetic acid, tetrafluoroethane and hydrogen fluoride); could contribute to climate change (volatile perfluorinated organic compounds); have ozone-depleting properties (volatile hydrofluoro organic compounds, volatile fluorinated-chlorinated organic compounds); or are corrosive (hydrogen fluoride);

(iv) Many studies indicated adverse effects of PFOS-related substances on reproductive health. High levels of PFOS detected in serum samples of young Danish men were associated with fewer normal sperm (Joensen et al., 2009). Delayed pregnancy was observed at higher levels of PFOS and perfluorooctanate (PFOA) in plasma samples from Danish women (Fei et al., 2009). Correlation between prenatal exposure to PFOS and PFOA and reduced foetal growth was reported (Washino et al., 2009). A linkage between cord serum concentrations of PFOS and PFOA and reduced weight and size at birth was reported (Apelberg et al., 2007). Increased odds of Attention Deficit Hyperactivity Disorder (ADHD) were observed in children with higher serum levels of PFOS and related substances (Hoffman et al., 2010);

(v) Fluorinated or non-fluorinated alternatives to PFOS-related substances are available for a wide range of PFOS applications. The guidance document on alternatives to PFOS and its derivatives was endorsed at the sixth meeting of the Review Committee;[11]

(vi) Several reports indicated that deposition of PFOS-related substances at dump sites and landfills contaminated the surrounding environments, potentially posing risks to human health and the environment. Other reports indicated that the use of PFOS-related substances resulted in contamination of environmental matrices including soil and groundwater (Weber et al., 2010a,b);

(vii) Information on the application of PFOS-related substances in 2000 indicated that over 75 per cent had been used in consumer products such as carpets, paper, textiles, furniture, leather and surface coating. Some consumer products remain in use for several years, in particular carpets, and will eventually be deposited in landfills (Fricke et al., 2008). Some information indicates that carpets containing PFOS-related substances are being recycled or used for other purposes, e.g., in the United States[12] and the United Kingdom.[13]

B. Information gaps in respect of PFOS, its salts and PFOSF

6. Information gaps in respect of PFOS, its salts and PFOSF were identified as follows:

(a) Articles containing PFOS-related substances exist in the waste and recycling stream. Information on the types of articles recycled, the extent of recycling, the types of articles produced from recycling, options for the environmental management of recycling operations and releases or potential releases resulting from recycling operations is, however, not available. A globally coordinated survey to gather such information is critical to enable the assessment of the possible health and environmental impacts of recycling articles containing PFOS-related substances;

(b) Articles containing PFOS-related substances are treated in waste incinerators, cement kilns and other thermal treatment plants. Information on the destruction efficiency for PFOS-related

10 www.umweltdaten.de/publikationen/fpdf-l/3818.pdf.

11 UNEP/POPS/POPRC.6/13/Add.3.

12 www.carpetrecovery.org/.

13 www.carpetrecyclinguk.com/.

substances is limited. Tests, including preliminary tests, have been conducted in municipal waste incineration and sewage sludge incineration. Further assessment of the destruction efficiency for PFOS-related substances for different levels of technology and requirements for best available techniques and best environmental practices would be relevant;

(c) Articles containing PFOS-related substances enter end-of-life treatment schemes, including landfills. Information on the fate of PFOS-related substances introduced to landfills, including on the extent of their release from landfills, is lacking however;

(d) No country suggested appropriate or sustainable remediation methods for sites contaminated with PFOS-related substances;

(e) Analytical methodologies for PFOS-related substances, including precursors, applicable to different matrices are limited. In particular analytical methods for chemically bound PFOS precursors contained in articles such as carpets, paper and textiles are not available;

(f) Information on levels and timing of releases of PFOS from articles such as carpets paper and textiles was not found;

(g) The extent of occupational exposure to PFOS-related substances has not been reported in the public domain. Information on the effect of exposure to multiple chemicals, including information on the genotoxicity of PFOS-related substances, is limited. Assessment of the toxicity of potential alternatives to PFOS-related substances is limited.

III. Information on other chemicals added to Annex A or B of the Convention at the fourth meeting of the Conference of the Parties

A. Lindane, alpha hexachlorocyclohexane and beta hexachlorocyclohexane

1. Key findings relevant to hexachlorocyclohexanes

7. Hexachlorocyclohexanes (HCHs) have three main isomers: alpha hexachlorocyclohexane, beta hexachlorocyclohexane and lindane, (also known as gamma hexachlorocyclohexane). During the production of lindane, alpha and beta hexachlorocyclohexane are also produced as by-products.

8. Seventeen countries responded to the request for information on HCHs (Algeria, Bulgaria, Côte d’Ivoire, Croatia, the Czech Republic, Honduras, Indonesia, Lithuania, the Netherlands, the Republic of Korea, the Republic of Moldova, Romania, Serbia, Switzerland, Trinidad and Tobago, Ukraine and the United States).

9. In summary, the following information was provided:

(a) HCHs contained in articles:

(i) Eleven countries provided information on the extent of lindane in articles (Algeria, Bulgaria, Côte d’Ivoire, Croatia, Honduras, Indonesia, the Republic of Korea, Serbia, Switzerland, Trinidad and Tobago and the United States);

(ii) Switzerland reported that two veterinary medical products for use against fleas and lice contained lindane. The use was to be phased-out according to a draft amendment to the ordinance on risk reduction, which would enter into force by the end of 2010. Trinidad and Tobago reported that lindane was only used in head lice treatments and pet care. The United States reported that lindane was currently approved by the Food and Drug Administration for human pharmaceutical use in the treatment of lice and scabies. Serbia reported that lindane had been withdrawn from the market in December 2007 and had not been in use since then;

(b) Stockpiles of HCHs: several countries reported detailed information regarding lindane stockpiles (Bulgaria, the Czech Republic, the Republic of Korea, the Republic of Moldova, Romania, Serbia, Ukraine and the United States). Bulgaria reported on the destruction of HCH stockpiles and the Republic of Moldova on the repacking of HCH wastes. Some other countries have addressed stockpiles of HCHs in their national implementation plans or are planning to do so;

(c) Sites contaminated with HCHs:

(i) Some countries provided information on HCHs at contaminated sites and in waste deposits (Algeria, Bulgaria, the Czech Republic, Honduras, Lithuania, the Netherlands, the Republic of Moldova and Romania);

(ii) The Czech Republic reported that approximately 10,000 tons of HCHs had been deposited at a former production site, that 5,000 tons had been deposited at another site and that groundwater and soil at both sites were highly polluted. It further stated that the conditions at both sites posed potential human-health and ecological risks and that remediation of the contaminated sites was currently being considered by the Ministry of the Environment and the Ministry of Finance;

(iii) Lithuania reported intensive contamination of the environment by pesticides, including persistent organic pollutant pesticides. Persistent organic pollutants had been detected in the soil at 58 sites and in the groundwater at 32 sites. Lithuania included HCHs in its survey, which showed that despite the clean-up of former pesticide storage sites and the removal of pesticides, previous activities had left a large volume of contaminated soil and groundwater and that the sites still posed potential risks to human health and environment. Lithuania's national programme on the management of former pesticide storage sites and sites contaminated with pesticides concluded that investigation and remediation of such sites should be intensified;

(iv) The Republic of Moldova highlighted that investigations of sites contaminated with HCHs showed risks to the environment and local populations because access to the sites by people and animals was unrestricted. Some sites were close to residential areas and water basins;

(v) Honduras highlighted that there were currently no projects on sites contaminated with HCHs due to a lack of laboratory capacity. The country had no legislation on contaminated sites but had assessed persistent organic pollutant stockpile storage.

10. The risk management evaluations for lindane,[14] alpha hexachlorocyclohexane[15] and beta hexachlorocyclohexane,[16] in addition to other sources, reported that between 4 million and 7 million tons of wastes containing HCHs, primarily alpha hexachlorocyclohexane (80 per cent) and beta hexachlorocyclohexane, were estimated to have been deposited globally during the 60 years of lindane production in Argentina, Austria, Brazil, China, the Czech Republic, France, Germany, Hungary, India, Italy, Japan, the former Yugoslav Republic of Macedonia, Nigeria, Poland, Romania, Slovakia, South Africa, Spain, Switzerland, Turkey, the Netherlands, the United Kingdom and the United States. This represents the largest total stockpile of a single persistent organic pollutant. The fate of approximately 1.9 million tons of HCH wastes has been documented (Vijgen et al., 2006).

11. Groundwater contamination at a former lindane production site in Germany was reported. Over 60,000 tons of HCHs have been deposited at that site (Weber et al., 2008). Heavy contamination of groundwater, surface water and soil and associated risks to human health and the environment in the area surrounding a former lindane production site in India were reported: approximately 36,000–54,000 tons of HCHs were said to have been deposited there (Abhilash et al., 2009; Jit et al., 2010).

12. Detailed inventories of HCHs have been prepared in some countries. Extensive clean-up work has been undertaken in the Netherlands, including clean-up of 200,000 tons of HCH-contaminated soils over a period of more than a decade.

2. Information gaps in respect of HCHs

13. Information on approximately 2–5 million tons of HCH wastes is missing. While a large part of those wastes has probably been deposited, some might have been recycled. The proportion of any deposited or recycled waste is unknown.

14. Little is known about the impact of HCH waste deposits on the environment and human health.

---

14 UNEP/POPS/POPRC.3/20/Add.4.

15 UNEP/POPS/POPRC.4/15/Add.3.

16 UNEP/POPS/POPRC.4/15/Add.4.

15. More information should be shared on the efficacy and availability of alternatives to lindane, including for control of head lice and scabies.

B. Chlordecone

1. Key findings relevant to chlordecone

16. Three countries responded to the request for information on chlordecone (Côte d'Ivoire, Lithuania and the United States). Lithuania and Côte d'Ivoire reported that no information was available.

17. According to the risk management evaluation on chlordecone,[17] approximately 160,000 tons of chlordecone were produced in the United States between 1958 and 1976. Chlordecone was also produced in France from 1981 to 1993 and also in Brazil. The United States reported the existence of sites contaminated with chlordecone.

18. The unrestricted application of chlordecone in banana plantations has contaminated large areas of the French West Indies, Martinique and Guadeloupe. Since 2003 the local authorities in Guadeloupe have restricted the cultivation of crops due to the contamination of soil by chlordecone. A study reported a significant increase in the risk of prostate cancer with increasing plasma chlordecone concentration (Multigner et al., 2010), and Guadeloupe has one of the highest prostate cancer rates in the world (Mallick et al., 2005).

2. Information gaps in respect of chlordecone

19. The risk management evaluation for chlordecone indicates that the substance might still be produced or used as an agricultural pesticide in some developing countries, although there have been no reports of such production or use.

20. Information on sites contaminated with chlordecone is limited.

C. Hexabromobiphenyl

1. Key findings relevant to hexabromobiphenyl

21. No information on hexabromobiphenyl was provided by parties or observers.

22. The risk management evaluation on hexabromobiphenyl[18] indicates that it was produced in the United States from 1970 to 1976, and was used mainly in polyurethane foam in cars, bus seats and roof-linings. Polyurethane foam is currently recycled in some countries.

2. Information gaps in respect of hexabromobiphenyl

23. The number of articles containing hexabromobiphenyl in polyurethane foam, including car seats, currently in use or being recycled is unknown.

D. Pentachlorobenzene

1. Key findings relevant to pentachlorobenzene

24. Three countries responded to the request for information on pentachlorobenzene (the Czech Republic, Honduras and Lithuania). The Czech Republic reported that sites contaminated with pentachlorobenzene had been taken into account in its inventory process. Honduras reported that pentachlorobenzene had not been produced or used and that there was no inventory of the chemical or related products. Lithuania reported that there was no data on the presence of pentachlorobenzene in articles, stockpiles or contaminated sites in the country.

25. Additional information on unintentional releases of pentachlorobenzene was provided at the sixth meeting of the Persistent Organic Pollutants Review Committee.[19] A study suggested that the degradation of pentachloronitrobenzene, also known as quintozene, in soil resulted in the formation of pentachlorobenzene at a yield of approximately 3 per cent (Beck et al., 1974). Another study reported releases of pentachlorobenzene from residuals of production of solvents such as tetrachloromethane, tetrachloroethene, trichloroethene, and ethylene dichloride.

17 UNEP/POPS/POPRC.3/20/Add.2.

18 UNEP/POPS/POPRC.3/20/Add.3.

19 UNEP/POPS/POPRC.6/INF/21.

2. Information gaps in respect of pentachlorobenzene

26. Information on potential sources of unintentional releases of pentachlorobenzene, such as degradation of pentachloronitrobenzene in soil and production of specific chlorinated solvents, is limited. Furthermore, little is known about the global use and production of pentachloronitrobenzene, quantities of wastes that may contain pentachlorobenzene generated from solvent production, disposal practices in respect of such wastes, levels of contamination in environments surrounding manufacturing sites, and the effect of such wastes on the environment and human health.

References

Abhilash, P. C., and Singh, N. Seasonal variation of HCH isomers in open soil and plant-rhizospheric soil system of a contaminated environment. *Environmental Science and Pollution Research*, vol. 16 (2009), pp. 727–740.

Apelberg, B. J., and others. (2007) Cord serum concentrations of perfluorooctane sulfonate (PFOS) and perfluorooctanoate (PFOA) in relation to weight and size at birth. *Environ Health Perspect* 115 (11): 1670-1676.

Beck, J., and Hansen, K. E. The degradation of quintozene, pentachlorobenzene, hexachlorobenzene and pentachloroaniline in soil. *Pesticide Science*, vol. 5 (1974), pp. 41–48.

Fei, C., and others. (2009). Maternal levels of perfluorinated chemicals and subfecundity. *Hum Reprod* 24 (5): 1200-1205.

Fricke, M., and Lahl, U. Risikobewertung von Perfluortensiden als Beitrag zur aktuellen Diskussion zum REACH-Dossier der EU-Kommission (2004).

Herbstman, J. B., and others. Prenatal exposure to PBDEs and neurodevelopment. *Environmental Health Perspectives*, vol. 118 (2010), pp. 712–719.

Hoffman, K., and others. (2010). Exposure to polyfluoroalkyl chemicals and attention deficit hyperactivity disorder in U.S. Children aged 12-15 years. *Environ Health Perspect*.

Jit, S., and others. Evaluation of hexachlorocyclohexane contamination from the last lindane production plant operating in India. *Environmental Science Pollution Research* (2010), DOI: 10.1007/s11356-010-0401-4.

Joensen, U. N., and others. (2009). Do perfluoroalkyl compounds impair human semen quality? *Environ Health Perspect* 117(6): 923-927.

Mallick S., Blanchet, P., and Multigner, L. Prostate cancer incidence in Guadeloupe, a French Caribbean Archipelago. *European Urology*, vol. 47 (2005), pp. 769–772.

Multigner, L., and others. Chlordecone exposure and risk of prostate cancer. *Journal of Clinical Oncology*, vol. 28 (2010), pp. 3457–3462.

Vijgen, J., and others. Hexachlorocyclohexane (HCH) as new Stockholm Convention POPs – a global perspective on the management of Lindane and its waste isomers. *Environmental Science Pollution Research*(2010). DOI: 10.1007/s1 1356-010-0417-9.

Vijgen, J. The legacy of lindane HCH isomer production, main report. (International HCH and Pesticides Association 2006), available at http://ew.eea.europa.eu/Agriculture/Agreports/obsolete_pesticides/lindane_production.pdf

Washino, N., and others. (2009). Correlations between prenatal exposure to perfluorinated chemicals and reduced fetal growth. *Environ Health Perspect* 117(4): 660-667.

Weber, R., and others. Persistent organic pollutants and landfills – a review of past experiences and future challenges. *Waste Management & Research* (2010 a) DOI: 10.1177/0734242X10390730.

Weber, R., and others. PFOS and PFC pollution from use of fire fighting foam in a major fire in Düsseldorf/Germany – human exposure and regulatory actions. *Organohalogen Compounds*, vol. 72 (2010 b).

Weber, R., and others. Dioxin- and POP-contaminated sites, contemporary and future relevance and challenges. *Environmental Science and Pollution Research*, vol. 15 (2008), pp. 363–393.