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Stockholm Convention on Persistent Organic Pollutants

Persistent Organic Pollutants Review Committee Ninth meeting

Rome, 14-18 October 2013

Report of the Persistent Organic Pollutants Review Committee on the work of its ninth meeting

Addendum

Risk management evaluation on chlorinated naphthalenes

At its ninth meeting, by its decision POPRC-9/1, the Persistent Organic Pollutants Review Committee adopted a risk management evaluation for chlorinated naphthalenes on the basis of the draft contained in document UNEP/POPS/POPRC.9/4. The text of the risk management evaluation, as amended, is set out in the annex to the present addendum. It has not been formally edited.

Annex

CHLORINATED NAPHTHALENES

RISK MANAGEMENT EVALUATION

Prepared by the ad hoc working group on chlorinated naphthalenes Persistent Organic Pollutants Review Committee

18 October 2013

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Executive summary

- 1. The European Union and its Member States submitted a proposal to list chlorinated naphthalenes (CNs) in Annex A, B and/or C to the Stockholm Convention pursuant to paragraph 1 of Article 8 of the Convention. The risk profile on CNs was adopted by the eighth meeting of the Persistent Organic Pollutants Review Committee in October 2012. The Committee decided (1) that 73 polychlorinated naphthalenes (PCN) i.e. dichlorinated naphthalenes, trichlorinated naphthalenes, tetrachlorinated naphthalenes, pentachlorinated naphthalenes, hexachlorinated naphthalenes, heptachlorinated naphthalenes and octachlorinated naphthalene (di to octa chlorinated naphthalenes = polychlorinated naphthalenes (PCN)), are likely, as a result of their long-range environmental transport, to lead to significant adverse human health and environmental effects such that global action is warranted, (2) to prepare a risk management evaluation that includes an analysis of possible control measures for chlorinated naphthalenes and (3) to invite parties and observers to submit to the Secretariat the information specified in Annex F before 11 January 2013, as well as additional information relevant to Annex E in particular data on sources of emissions such as the production of chlorinated naphthalenes and/or unintentional releases.
- 2. Chlorinated naphthalenes (CNs) comprise 75 possible congeners in eight homologue groups with one to eight chlorine atoms substituted around the planar aromatic naphthalene molecule. As mono chlorinated naphthalenes are not considered persistent organic pollutants, this document addresses PCN.
- 3. PCN have historically been used in many applications including: use as wood preservative, as additive to paints and engine oils, and for cable insulation and in capacitors. To date, intentional production of PCN is assumed to have ended¹. To limit possible remaining uses and to prevent re-introduction of other uses, listing of PCN in Annex A without any specific exemptions could be the primary control measure for intentional sources under the Convention. As a consequence, PCN would be subject to the provisions of Article 3 of the Convention with the objective to eliminate their production, use, import and export. Health and the environment could benefit from listing PCN in Annex A, as the re-introduction of PCN and related risks would be prevented. A beneficial effect could be expected as any currently unidentified production and use around the world should also end. Relevant negative impacts on health, environment and society are not expected from the listing of PCN.
- 4. PCN are unintentionally generated during high-temperature industrial processes in the presence of chlorine. Of the known releases, combustion (primarily waste incineration) is considered the most significant current source. PCN are also unintentionally generated with similar mechanisms as polychlorinated dibenzo-*p*-dioxins and dibenzofurans (PCDD/PCDF) during other industrial processes such as smelting in the secondary non-ferrous metal industry, cement and magnesia production, aluminium refining and coking. Listing of PCN in Annex C would subject this substance group to the measures under Article 5 of the Convention and establish the goal of continuing minimization and, where feasible, ultimate elimination of unintentional releases of PCN. This would include an obligation to promote best available techniques (BAT) and best environmental practices (BEP) for PCN sources. Measures that reduce the releases of PCDD/PCDF will also reduce PCN emissions. BAT and BEP relevant to reduce unintentionally produced PCDD/PCDF for various types of incinerators are available and already widely applied. Measures to reduce unintentional releases of PCN through listing in Annex C would positively impact human health and the environment. Monitoring of PCN will induce additional costs. Additional costs for implementation of measures to reduce releases of PCN, enforcement and supervision are considered low as the control measures for other unintentional POPs such as PCDD/PCDF are already applied. Monitoring capacity for PCN is needed in developing countries and countries with economies in transition.
- 5. Since the main production and use of PCN ceased, PCN can be expected to be released mostly from past uses and products not yet disposed, and from thermal processes namely waste incineration and polychlorinated biphenyls (PCB) containing devices still in use. Finally it might be released from landfills or old appliances as well as from possible ongoing uses. Listing of PCN in Annex A or C would subject PCN to the measures under Article 6 of the Convention and establish the goal of identifying stockpiles consisting of or containing PCN and managing them in a safe, efficient and environmentally sound manner. Stocks of PCN occurring in conjunction with PCB are already covered by existing measures. Stocks of PCN in old appliances and materials are addressed in the EU since 2012. In other regions of the world inventories will need to be made. Parties to the convention have already introduced measures to identify and manage PCB stockpiles. Measures in place with respect of PCB stockpiles will also efficiently reduce releases of PCN from stockpiles. Health and the environment would benefit from reduced releases. Additional costs would not arise.
- 6. Having prepared a risk management evaluation and considered the management options, in accordance with paragraph 9 of Article 8 of the Convention, the Committee recommends the Conference of the Parties to the Stockholm Convention to consider listing and specifying the related control measures for PCN in Annexes A and C.

¹ UNEP/POPS/POPRC.8/16/Add.1.

1. Introduction

1.1 Chemical identity of the proposed substance²

- 7. The European Union and its Member States submitted a proposal to list chlorinated naphthalenes (PCN) in Annex A, B and/or C to the Stockholm Convention on 10 May 2011 (UNEP/POPS/POPRC.7/2), together with a detailed dossier to support the proposal (UNEP/POPS/POPRC.7/INF/3).
- 8. Chlorinated naphthalenes (CNs) comprise 75 possible congeners in eight homologue groups with one to eight chlorine atoms substituted around the planar aromatic naphthalene molecule. The homologue groups considered in this report are 73 polychlorinated naphthalenes (PCN) i.e. dichlorinated naphthalenes (di-CNs), trichlorinated naphthalenes (tri-CNs), tetrachlorinated naphthalenes (tetra-CNs), pentachlorinated naphthalenes (penta-CNs), hexachlorinated naphthalenes (hexa-CNs), heptachlorinated naphthalenes (hepta-CNs), octachlorinated naphthalene (octa-CN). They are structurally similar to the polychlorinated biphenyls (PCB), which were listed in the Stockholm Convention upon its adoption in 2001. As monochlorinated naphthalenes are not considered as persistent organic pollutants, this document addresses PCN.
- 9. PCN have historically been used as wood preservatives, paints and engine oils additives, heat exchange fluids, high-boiling point specialty solvents, engine crank case additives and ingredients in motor tune-up compounds, in capacitors and for cable insulation, chemical-resistant gauge fluids, instrument seals and colour dispersions. While the use of PCN has ceased, they are also present in PCB formulations and are unintentionally produced during combustion processes and in industrial installations.

Name and registry number

Common name:	Polychlorinated naphthalenes
IUPAC names and numbers and CAS	See UNEP/POPS/POPRC.8/16/Add.1, annex 1.
registry numbers of the 73 congeners:	
Synonyms:	PCN, CNs, naphthalene chloro- derivatives ^{3,4}

- 10. The system of nomenclature for PCN is similar to that of PCB. Most of the industrially produced PCN are mixtures of several congeners. Table A2-1 in annex 2 of UNEP/POPS/POPRC.8/16/Add.1displays the composition of several Halowaxes according to analytical measurements (data adapted from Environment Canada, 2011 and Falandysz et al., 2008). Other commercial mixtures and trade names are Basileum SP-70, Nibren wax D88, Nibren wax D116N, Nibren wax D130, Seekay wax R68, Seekay wax R93, Seekay wax R123, Seekay wax R700, Seekay wax RC93, Seekay wax RC123, Chlonacire wax 115, Chlonacire wax 95, Chlonacire wax 130 (Jakobsson and Asplund, 2000) and Cerifal Materials (Falandysz, 1998). There may be other trade names for PCN containing commercial mixtures. The physical state ranges from thin liquids to hard waxes (IPCS, 2001).
- 11. While several analytical challenges are associated with the exact determination of PCN, the current methods are similar to analytical methods used for PCB. It is based on carbon clean-up (from matrices) and fractionation followed by high-resolution gas chromatography/high-resolution mass spectrometry (HRGC/HRMS) for low levels PCN/high selectivity. However, fewer than half of the possible congeners are commercially available and isotopically labelled PCN are available for only a few congeners, e.g. no 13C-labeled tri-CNs are available (Kucklick and Helm, 2006).

Structures

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² UNEP/POPS/POPRC.8/16/Add.1.

³ UNEP/POPS/POPRC.7/INF/3.

⁴ ACToR (2012).

Physical and chemical properties of different homologue groups

- 12. Physico-chemical properties vary considerable due to the degree of chlorine substitution. Tri- to octa-CNs are very lipophilic with high log Kow (>5). Log Kow values in Table 1 are experimentally determined, whereas annex 1 to document UNEP/POPS/POPRC.8/16/Add.1 contains Quantitative Structure—Property Relationship (QSPR) modelled values (Puzyn and Falandysz, 2007). Modelled values were lower for the more chlorinated congeners.
- 13. Water solubility and vapour pressure decrease with the degree of chlorination. Di-CNs are slightly soluble in water while the higher chlorinated naphthalenes have a water solubility of few µg/L. For chemicals with low water solubility, measured values have a higher uncertainty (Environment Canada, 2011) (cf. Table 1, values in brackets are estimated values with WSKOWWIN version1.41, EPISUITE). Puzyn et al. (2009) developed a QSPR model to estimate the water solubility, log Kow, Koa, Kaw and the Henry's Law Constant for all 75 congeners. The estimates for water solubility are lower than the values given in Table 1. Values of these modelled endpoints are listed in annex 1 to document UNEP/POPS/POPRC.8/16/Add.1. The range of log Koa and log Kaw are summarized for the different homolog groups in Table 1.
- 14. PCN in the gas phase are attached to particles due to their semi-volatility. Based on the Henry's Law constant, volatilization from moist soil surfaces and water is expected for di-CNs to hexa-CNs (HSDB, 2012). The UV spectra of PCN show strong absorbance maxima between 220 and 275 nm and weaker maxima between 275 and 345 nm. The absorption maxima are shifted towards longer wavelengths as the chlorine degree increases (according to Brinkman and Reymer, 1976 as referenced in Jakobsson and Asplund, 2000).
- 15. Pure chlorinated naphthalenes are colourless, crystalline compounds (Indian Institute of Science, 2011, submitted Annex E information by Thailand).

Table 1: Selected physical and chemical property (table modified from Environment Canada, 2011)

Congeners	Molecular weight (g/mol)	Solubility (μg/L) ^a	Vapour pressure (Pa)b (sub- cooled liquid, 25°C)	Henry's law constant (Pa·m³/m ol, 25°C) ^c	Log K _{ow} ^d	Log K _{oa} c	Log K _{aw} ^e	Melting point (°C)	Boiling point (°C)
Di-CNs	197.00	137–862 (2713)	0.198–0.352	3.7–29.2	4.2–4.9	6.55 to 7.02	-2.83 to - 1.98	37–138	287– 298
Tri-CNs	231.50	16.7–65 (709)	0.0678-0.114	1.11–51.2	5.1–5.6	7.19 to 7.94	-3.35 to - 2.01	68–133	274*
Tetra-CNs	266.00	3.7–8.3 (177)	0.0108-0.0415	0.9–40.7	5.8–6.4	7.88 to 8.79	-3.54 to - 2.02	111–198	Unkno wn
Penta-CNs	300.40	7.30 (44)	0.00275- 0.00789	0.5–12.5	6.8 - 7.0	8.79 to 9.40	-3.73 to - 2.3	147–171	313*
Hexa-CNs	335.00	0.11* (11)	0.00157- 0.000734	0.3–2.3	7.5 - 7.7	9.62 to 10.17	-4.13 to - 3.04	194	331*
Hepta-CNs	369.50	0.04* (2.60)	2.78 x 10-4, 2.46 x 10-4	0.1-0.2	8.2	10.68 to 10.81	-4.34 to - 4.11	194	348*
Octa-CN	404.00	0.08 (0.63)	1.5 x 10-6	0.02	6.42–8.50	11.64	-5.21	198	365*

Data source: IPCS (2001), unless otherwise noted.

1.2 Conclusions of the POPs Review Committee regarding Annex E information

- 16. The Committee has conducted and evaluated a risk profile in accordance with Annex E at its eighth meeting held in Geneva from 15 to 19 October 2012. The Committee, by its decision POPRC-8/1, adopted the risk profile of chlorinated naphthalenes (UNEP/POPS/POPRC.8/16/Add.1) and:
- (a) Decided, in accordance with paragraph 7 (a) of Article 8 of the Convention, that dichlorinated naphthalenes, trichlorinated naphthalenes, tetrachlorinated naphthalenes, pentachlorinated naphthalenes, hexachlorinated naphthalenes, heptachlorinated naphthalenes and octachlorinated naphthalene, are likely, as a result

a) Values outside of brackets were experimentally determined by aqueous saturation method (Opperhuizen et al. 1985) for the solid congeners; values in brackets are predicted using WSKOWWIN 2000.

b) Source: Lei et al. (1999).

c) Values obtained from Puzyn and Falandysz (2007).

d) Measured Kow sources: Opperhuizen (1987), Opperhuizen et al. (1985) (shake flask method, Bruggeman et al. (1982)), Lei et al. (2000) (reversed phase HPLC method).

e) Estimates from Puzyn et al. (2009)

^{*}Estimated value, using methodologies laid out in Lyman et al. (1982).

of their long-range environmental transport, to lead to significant adverse human health and environmental effects such that global action is warranted;

- (b) Also decided, in accordance with paragraph 7 (a) of Article 8 of the Convention and paragraph 29 of decision SC-1/7 of the Conference of the Parties, to establish an ad hoc working group to prepare a risk management evaluation that includes an analysis of possible control measures for chlorinated naphthalenes in accordance with Annex F to the Convention;
- (c) Invited, in accordance with paragraph 7 (a) of Article 8 of the Convention, parties and observers to submit to the Secretariat the information specified in Annex F before 11 January 2013, as well as additional information relevant to Annex E in particular data on sources of emissions such as the production of chlorinated naphthalenes and/or unintentional releases.

1.3 Data sources

- 17. The risk management evaluation is primarily based on:
- (a) Information that has been provided by Parties and observers. Responses regarding the information specified in Annex F to the Stockholm Convention have been provided by the following Parties and observers⁵:
 - (i) Parties: Croatia, Estonia, Nigeria, Romania, Slovakia, Sri Lanka;
 - (ii) Observers: no information submitted;
- (b) Comments from parties and observers provided during the drafting process of the Risk Management Evaluation;
 - (c) Decision POPRC-8/1 (UNEP/POPS/POPRC.8/16);
 - (d) The risk profile on chlorinated naphthalenes (UNEP/POPS/POPRC.8/16/Add.1);
 - (e) The exploration of management options for PCN (UNECE 2007).
- 18. In addition to the above-mentioned sources, information has been gathered from other open information sources and literature. Such information sources are listed in the reference section.

1.4 Status of the chemical under international conventions

- 19. Chlorinated naphthalenes are subject to a number of international treaties and conventions:
- (a) In December 2009, PCN were proposed for inclusion in Annex I (prohibition of production and use) to the Aarhus Protocol on Persistent Organic Pollutants under the United Nations Economic Commission for Europe (UNECE) Convention on Long-Range Transboundary Air Pollution (CLRTAP), according to Decision 2009/2. The amendment will come into force when two thirds of the Parties have adopted the amendment.
- (b) The OSPAR Commission has included PCN in the List of Chemicals for Priority Action. Further information can be found at http://www.ospar.org/.
- (c) Waste containing PCN is characterized as hazardous waste under Annex VIII of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal.
- 20. Additional information on the status of the chemical under international conventions has not been provided by parties or observers who submitted Annex F information.

1.5 Any national or regional control actions taken

- 21. Information on PCN considered in regional and national substance lists is scarce. Additional information on national or regional control actions has not been provided by parties or observers who submitted Annex F information.
- 22. Canada has prohibited the manufacture, use, sale, offer for sale and import of PCN under the *Prohibition of Certain Toxic Substances Regulations*, 2012 (Canada, 2012)⁶. No actions have been undertaken in the United States as the production of PCN ceased in the 1980s. The import and manufacture of PCN has been banned in Japan since 1979. All halogenated naphthalenes, including PCN, are legally banned in Switzerland. Within the European Union, the Netherlands reported that PCN were listed as a National Priority Substance for possible future regulatory control. In the European Union, the production, placing on the market and use of PCN is prohibited since the substance has

⁵ Annex F information provided by parties and observers is available at the SC website (see http://chm.pops.int/Convention/POPsReviewCommittee/LatestMeeting/POPRC8/POPRC8Followup/SubmissionCN/tabid/3068/Default.aspx); status evaluated for the present document: 19.02.2013.

⁶ Source: http://www.gazette.gc.ca/rp-pr/p2/2013/2013-01-02/html/sor-dors285-eng.html

been incorporated in the EU POPs Regulation in 2012 (Regulation (EC) No 850/2004 as amended by Regulation (EC) No 519/2012).

23. In Japan, tri-CNs and more chlorinated congeners are designated as Class I Specified Chemical Substances under the Chemical Substances Control Law (CSCL). A person who intends to operate a business of manufacturing, import or use of a Class I Specified Chemical Substance shall obtain permission (the manufacture, import or use of these chemical substances is prohibited in principle).

2. Summary information relevant to the risk management evaluation

2.1 Additional relevant information on sources, releases and measures

Production

24. Sources of PCN include anthropogenic activities: (1) intentional production, (2) unintentional production and (3) stockpiles and wastes (for details see document UNEP/POPS/POPRC.8/16/Add.1, section 2.1 on sources) as explained in the following:

(1) Intentional production:

- 25. Estimates of the total global PCN production so far vary between 200,000–400,000 tonnes (AMAP, 2004) and 150,000 tonnes (about one tenth of the PCB ever produced (Brinkman & De Kok, 1980 as cited in: Falandysz, 1998). Within the UNECE region, PCN are not intentionally produced anymore. However, a number of UNECE countries have not yet organised legal prohibition. Therefore, production is still possible even within UNECE as well⁷. Specific information on ongoing production is not available. Production and use data outside of the UNECE region are very scarce and largely unknown.
- 26. Document UNEP/POPS/POPRC.8/16/Add.1 states that global production has been virtually stopped in many countries, having drastically decreased already in the 1970s. Hayward (1998) estimates a total of between 50,000 and 150,000 tonnes PCN having been produced in the US from 1910 until 1960. In the US, PCN production decreased significantly after 1977 (Koppers Company Inc. in the US (Halowax)), down to an annual output of 320 tonnes in 1978 (IPCS, 2001). The production of PCN in the US stopped in 1980. The prohibition in Canada for production and use came into force in 2013.⁸
- 27. In Europe, Bayer produced PCN in a range of 100 to 200 tonnes per year between 1980 and 1983 and ceased PCN production in 1983. In the UK, the production stopped in the mid 60s, although it was reported that in 1970 small amounts of PCN were still being produced. In Germany, around 300 tonnes were produced in 1984, mainly for use as dye intermediates. Slovakia reported that there is no production of PCN (Annex F, Slovakia 2013). According to a comment from the Netherlands, production was possible in the European Union until 2012 when PCN were incorporated in the EU POP regulation.
- 28. PCN have never been produced in Nigeria (Annex F, Nigeria, 2013). Also, Sri Lanka and China reported that there is no production of PCN (Annex F, China, Sri Lanka, 2013). Additional information on the intentional production of the chemical has not been provided by parties or observers who submitted Annex F information. PCN
- 29. Cases of illegal trade of Halowax-like PCN formulations were reported in 2002, and recent publications still publish experiments with Halowax. Contaminated products were still found on the market in 2003 (Yamashita et al., 2003 as cited in: Bidleman et al., 2010). According to Yamashita et al., 2003, illegal imports to Japan around 2000 were of about 18 tons of a PCN mixture (Halowax 1001) from the UK used to manufacture a wide spectrum of industrial materials and commercial goods including sealants, putty, shock absorbing materials, adhesive materials, insulating materials and rubber belts and another 40 kg of PCN contained in 54 tons of PCN contaminated raw rubber which was imported for industrial use.

(2) Unintentional production:

- 30. PCN are unintentionally generated during thermal processes. Of the known releases, waste incineration is considered the most significant current source. Other sources are smelting in the secondary non-ferrous metallurgical industry (e.g. copper), and aluminium refining. Cement and magnesia production have been reported as further sources. Also, coking can release PCN and there have also been indications of PCN formation in chlor-alkali plants (graphite sludge). Although one older study reported that di-CNs are formed at low concentrations as by-products in the chlorination of drinking water (Shiraishi et al. 1985 in Environment Canada, 2011), no evidence has been found in the recent literature to support this finding (Environment Canada, 2011).
- 31. According to UNECE (2007), waste incineration contributed by 74% to total PCN emissions. In addition, 10% were attributed to residential combustion attributed, 11% to industrial processes, and 6% to solvent and product use.

⁷ Comment by the Netherlands on the first draft risk management evaluation.

⁸ Source: http://www.gazette.gc.ca/rp-pr/p2/2013/2013-01-02/html/sor-dors285-eng.html

Falandysz (1998) concluded that unintentional PCN releases do not exceed polychlorinated dibenzo-*p*-dioxins and dibenzofurans (PCDD/PCDF) levels and estimated them to be below 10-100 kg per year worldwide.

32. PCN are suspected to be unintentionally produced via similar mechanisms as PCDD/PCDF.

(3) Stockpiles and wastes:

33. Commercial PCBs also contained traces of PCN (0.01-0.09%; Falandysz, 1998, Kannan et al., 2000, Yamashita et al., 2000). UNEP/POPS/POPRC.7/INF/3 states that, based on these calculations, overall quantities of PCN contained in PCB-containing fluids can be estimated to have ranged between 100-169 tonnes.

Use

- 34. PCN have been used mainly for their chemical stability, including low flammability, their (electrically) insulating properties and recalcitrance, including resistance to biodegradation and biocidal function; they share these properties and their scope of application with PCB, by which they were gradually replaced after World War II.
- 35. Less chlorinated congeners (mono-CN and mixtures of mono- and di-CNs) have been used for chemical-resistant gauge fluids and instrument seals, as heat exchange fluids, as high boiling specialty solvents, for colour dispersions, as engine crankcase additives, and as ingredients in motor tune-up compounds. Mono-CN has also been used as a raw material for dyes and as a wood preservative with fungicidal and insecticidal properties (IPCS, 2001).
- 36. Higher chlorinated congeners have been used mostly, in terms of volume, for cable insulation and flame-proofing, wood preservation, engine and gear oil additives, electroplating masking compounds, feedstock for dye production, dye carriers, dielectric impregnates for capacitors/condensers, and refractive index testing oils.
- 37. The use of PCN as wood preservatives was popular in the 1940s and 1950s, but they are no longer used for this purpose in the US. Further uses were dipping encapsulating compounds in electronic and automotive applications, temporary binders in paper coating and impregnation, binders for ceramic components, casting materials for alloys, grinding and cutting lubricants, separators in batteries, moisture proofing sealant (NICNAS 2002). In the US, only very small amounts of PCN (about 15 tonnes/year in 1981) were still being used, mainly as refractive index testing oils and as capacitor dielectrics. The most likely possible new uses for PCN would be as intermediates for polymers and as flame retardants in plastics (IPCS, 2001).
- 38. In the UNECE region, their application in wood preservation, as additive in paints and engine oils, for cable insulation and in capacitors have been the most important ones (UNECE 2007).
- 39. PCN were mainly used between 1920 (annual production of 9000 tonnes worldwide in the 1920s (Jakobsson and Asplund, 2000 as cited in AMAP, 2004) and 1950, but remained high volume chemicals until the 1970s (AMAP, 2004). After 1980, their use declined considerably. In Europe, the most recent available data on use have been reported for Germany and former Yugoslavia, where small amounts were used as casting material until 1989 (ESWI 2011). In addition PCN have been used in pyrotechnic applications. It cannot be excluded that such use is still ongoing⁹.
- 40. The European Chemicals Agency (ECHA) classification and labelling (C&L) inventory indicates that there are notifiers for a limited number of specific CN congeners ¹⁰ (CN congeners 1, 2, 5, 9, 27 and 75). Specific congeners are furthermore listed in the ECHA inventory of pre-registered substances (CN congeners 1 to 5, 7 to 12, and 75 with envisaged registration deadlines in 2010 or 2013). So far, no registration has been submitted to ECHA. This suggests that there are no EU companies which produce or import PCN in high volumes. The entries in the C&L inventory and the fact that pre-registrations have been submitted to ECHA at least indicates that PCN are of certain interest for EU companies, although pre-registrations could also have been submitted due to strategic reasons instead of real registration obligations.
- 41. Within the Annex F submissions, Nigeria reported that there are documented uses ¹¹ of PCN as cable insulation, capacitor fluids, casting material for alloys, dye carriers, electroplating masking compounds, engine oil additives, feedstock for dye production, flame proofing, lubricants, moisture proofing sealant, preservatives, refractive index testing oils, temporary binders for ceramic component manufacture and wood preservatives (Annex F, Nigeria, 2013). Additional relevant information on uses has not been provided by parties or observers who submitted Annex F information.
- 42. Halowax can still be purchased via internet. e.g. octa-CN (Halowax 1051) can be bought from several global suppliers. The website does not provide information on the amounts available for sale. 12

⁹ Comment from the Netherlands, 2013.

¹⁰ http://echa.europa.eu/web/guest

¹¹ Note: It is assumed that Nigeria has reported here documented historic uses.

¹² Comment from the Netherlands, 2013. Internet source: <u>http://www.chemicalbook.com/Search_EN.aspx?keyword=HALOWAX</u>

Releases

- 43. The total PCN production was roughly assessed to be 10% of the PCB produced (i.e. 150000 metric tonnes from 1920 1980) (Brinkman and De Kok, 1980) and quantities of PCN in total technical PCB were estimated at 100 metric tonnes. In addition, it is estimated that 10–100 kg PCN are formed during combustion annually worldwide, with an overall total (ever released) volume of 1–10 tonnes PCN (Falandysz, 1998).
- 44. PCN are not mentioned in the European Pollutant Release and Transfer Register (PRTR), indicating low releases today¹³. Hexa- and octa-chloronaphthalenes are mentioned in the Toxics Release Inventory (TRI) database in the US, but no releases have been reported.¹⁴
- 45. IPCS considered waste incineration and disposal of PCN-containing items as the major current sources of PCN releases to the environment (IPCS, 2001). Bolscher et al. (2005) conclude on the combustion of clinical, municipal and industrial waste as a key source of PCN releases to the environment. For the UNECE region, unintentional CN releases from waste disposal through incineration were assumed to be the most important current source (UNECE 2007). It was estimated that 74% of total PCN releases in Europe are caused by waste combustion. Denier Van der Gon et al. (2007) report one tonne annual PCN emissions from UNECE-Europe back in 2000, but the track B review asked for further information on the sampling methodology.
- 46. In the UK, PCN commercially produced more than 30 years ago are thought to be the most important source of PPCN in the atmosphere, with the disposal routes of capacitors and engine oils considered as the most important routes. Other source sectors are thermal sources, other industrial processes and contamination in industrially-produced PCB mixtures (Dore et al. 2008). In urban sites, emissions of suggested historically used technical PCN have been reported (Harner et al., 2006 cited from UNEP/POPS/POPRC.8/16/Add.1).
- 47. Due to common practices in medical waste incineration to be performed under uncontrolled conditions, it is likely that in developing countries significant PCN releases from clinical waste incineration are produced.¹⁵
- 48. Liu et al. (2012) provide emissions for ore sintering. A quick estimation shows an annual emission in China due to ore sintering of 60 kg annually. The calculated emission factor for releases from thermal production processes in the metal industry is 428.4 ng TEQ per tonne secondary copper (aluminium: 142.8; zinc: 125.7; lead: 20.1; Ba et al., 2010). PCN releases from coking were reported as 0.77–1.24 TEQ per tonne coke (Liu et al., 2010). For UNECE, PCN releases from industrial combustion and other processes were considered to be 11% of the calculated 1 tonne. (Denier van der Gon et al., 2007).
- 49. There are potential releases from former uses (PCN or impurities of technical PCB) contained in landfills or old appliances, but their contribution to current PCN releases are difficult to assess (UNEP/POPS/POPRC.8/16/Add.1). Since the development of safe technologies of disposal or recycling of used technical PCB formulations as well as wastes with high concentrations of PCB, the amount of PCN potentially escaping into the environment can be expected to be much lower than could be predicted from their residual concentrations in technical chlorobiphenyl mixtures.
- 50. Although official release data are lacking, there is literature available on releases of PPCN from various industries, specifically on unintentional releases. A report by Brack et al (2003) on historical industrial contamination in the former German Democratic Republic (GDR) identified the chlor-alkali industry as the major source of PCN contamination. There have also been signs of PCN formation in the mercury cell chlor-alkali process (characteristic congener profiles), indicated by the high concentrations of PCN in fish collected near a former chlor-alkali plant (Kannan et al., 1998). The authors of another study (Järnberg et al., 1997) identified mostly hepta-CNs (65%) and hexa-CNs (-20%) in the graphite sludge of a chloro-alkali plant. No data on octa-CN were given. According to Falandysz (1998), the highly chlorinated pattern of PCN in graphite sludge can be related to the highly chlorinated technical PCB formulation used in the chloro-alkali process, such as Aroclor 1268 (Kannan et al., 1997), or possible use of technical PCN formulation (Halowax 1051) as a lubricant for the graphite electrodes, and less to the formation due to reactions of the chlorine released.
- 51. One older study reported that di-CNs are formed at low concentrations as by-products in the chlorination of drinking water (Shiraishi et al. 1985 in Environment Canada, 2011), however no evidence has been found in the recent literature to support this finding (Environment Canada, 2011).
- 52. Nie et al. (2012) also reported on PCN emissions from thermal wire reclamation at industrial scrap metal parks in China.

¹³ E-PRTR database: http://prtr.ec.europa.eu/TimeSeriesPollutantReleases.aspx

¹⁴ Comment from the Netherlands, 2013.

¹⁵ Comment from NCRRTE (National Center for Radiation Research and Technology, Egypt), 2013.

- 53. Another unintentional source is the release of PCN-traces from technical PCB production which was roughly estimated at 0.1 kt present in all Arochlor and Clophen ever produced worldwide (Falandysz, 1998). PCN formation during PCB production was reported as a potential source (Denier van der Gon et al., 2007).
- 54. Nigeria reported that no coordinated survey has been conducted in the country, however, considering the use pattern of PCN, unintentional formation of PCN may be linked to metal refining, waste incineration, wood combustion, open municipal waste dump, historical use of PCN, contaminated sites, abandoned stockpiles, old formulation facilities, historical and present use of PCBs, open burning practices, etc. (Annex F, Nigeria, 2013). Additional information on releases has not been provided by parties or observers who submitted Annex F information.
- 55. Air monitoring data provide some additional information on potential source. A passive sampling campaign across Europe in summer 2002 identified congeners no. CN 23, 24, 57 and 59 as the PCN species with the highest measured reported ranges (Jaward et al., 2004a). Congeners number 24 and 59 were part in commercial Halowax mixtures. However, CN 24 is also regarded as a marker congener for combustion.
- 56. High concentrations at urban sites (up to 52 pg/m³) at the Laurentian Great Lakes were attributed to continued emissions of historically used technical PCN. Contributions from combustion-derived PCN seemed to be more important at rural locations, where releases of CN 24 and 50, associated with wood and coal burning, were elevated (Harner et al. 2006).
- 57. A nationwide monitoring of atmospheric POPs in Ghana between May and July 2010 observed that the percentage composition of the lower-chlorinated homologues increased northwards, probably because of their transportation in the direction of the prevailing winds. From the congener profile analysis, CN 45/36 is proposed as a possible source marker for emissions pre-empted by uncontrolled waste burning activities (Hogarh et al., 2012). Data on markers in soil or sediment cores may indicate the importance of the various sources. E.g. data presented in Meijer et al (2001) show significant increasing trends for several congeners associated with combustion sources suggesting that combustion related sources are more important than they were in the past. This indicates that the relative importance of combustion sources may increase.
- 58. A similar conclusion was taken by Hogarh et al. (2012b). From the principal component analysis, combustion emerged as highly responsible for the contemporary emissions of both PCB and PCN across the East Asian subregion. Another factor derived as important to air concentrations of PCB was re-emissions/volatilization. Signals from PCB formulations were also picked, but their general importance was virtually consigned to the re-emissions/volatilization tendencies. On the contrary, counterpart PCN formulations did not appear to contribute much to air concentrations of PCN (Hogarh et al., 2012b).
- 59. Data on concentrations in sediment cores presented by Gevao et al. (2000) indicate that the peak production of PCN precede that of PCB by 20-30 years. A summary of concentration patterns in sediment cores is provided in Gewurtz et al. (2009), which suggest that peak concentrations of PCN were reached about 20 years earlier in the UK than in Japan, in the late 1950s to mid-1960s and in the 1980s respectively.
- 60. PCN release measurements from municipal waste incineration plants in Europe resulted in Toxic Equivalent (TEQ) levels below the European emission limit of 0.1 ng I-TEQ/Nm³ set for all incineration plants (UNEP/POPS/POPRC.7/INF/3).
- 61. Measurements in Canada showed low levels of PCN in fly ash samples from municipal solid waste incineration, cement kiln and iron sintering (sum PCN concentrations ranged from 1.8 to 2.7 ng/g) but higher levels (more than 1,000 times higher) were measured in fly ash from medical waste incineration (5.4 μ g/g) (see Helm et al., 2003).
- 62. Data on PCN concentrations related to landfills are scarce. The only data are from a Dutch municipal waste disposal site, showing PCN concentrations in contaminated soils of 31-38 mg/kg dw and 1180-1290 mg/kg dw; in a third soil sample, PCN were not detected (De Kok et al, 1983 in Howe et al. 2001).
- 63. In conclusion, the information available indicates that the largest amount of PCN was present in products, which may still be partly in use or have been discarded as waste. The most important potential for releases results from (1) past intentional production of PCN and remaining products, stockpiles and wastes (estimates for global production range between 150,000 and 400,000 tonnes); (2) unintentional production during uncontrolled waste combustion, waste incineration (e.g. municipal, clinical and industrial waste); and (3) other thermal (domestic and industrial) processes (e.g., non-ferrous metal industry, coke production, and metal reclamation, industrial solvent production and use, domestic combustion, public heat and power, chlor-alkali industry, and cement industry) which can be considered sources for ongoing small release quantities. Assuming that PCN in PCB are properly removed through the measures taken for PCB, PCN production and use (current and past), as well as unintentional releases from thermal processes (if uncontrolled) remain as the most important categories.

Possible measures

64. Possible measures can be directed at the relevant anthropogenic sources of PCN: (1) intentional production, (2) unintentional production and (3) stockpiles and wastes. Figure 1 illustrates relevant sources and possible control measures for PCN.

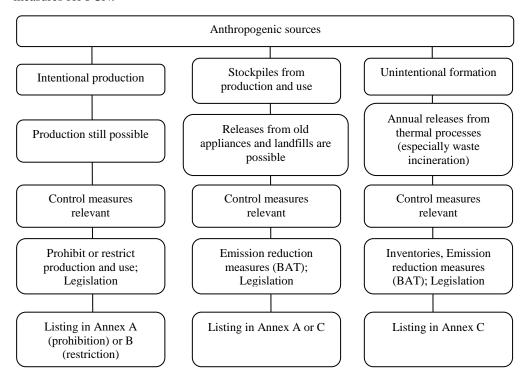


Figure 1: Relevant sources and possible control measures for PCN

(Note: use for laboratory-scale research or as a reference standard is not considered; such use is excluded from the Convention according to Article 3, paragraph 5)

2.2 Identification of possible control measures

Control measures for releases from intentional production

- 65. The global PCN industrial production has virtually stopped. The use of PCN has been substituted by the use of other chemicals (UNECE 2007).
- 66. To limit possible remaining uses and to prevent re-introduction of other uses, listing of PCN in Annex A without any specific exemptions could be the primary control measure for intentional sources under the Convention. As a consequence, PCN would be submitted to the provisions of Article 3 of the Convention and the requirement to eliminate their production, use, import and export, to register stockpiles and to eliminate wastes.

Control measures for releases from unintentional production

- 67. With PCB uses largely reduced, unintentional releases from thermal processes in waste incineration, domestic combustion and metal industry may be considered to be the most important remaining sources of unintentional releases of PCNPCN if emission abatement is not put in place. Possible measures to control such releases include measures for PCB outlined in Annex A, Part II of the Stockholm Convention and measures to reduce releases of PCB and PCDD/PCDF from incineration (see UNECE 2007 and the Stockholm Convention Best Available Techniques (BAT) and Best Environmental Practices (BEP) Guidelines (UNEP 2007)).
- 68. Annex V of the UNECE POP protocol contains BAT to control emissions of POPs from major stationary sources including waste incinerators. Further thermal processes covered are thermal metallurgic processes and combustion plants providing energy. As these installations have to reduce the emissions of PCDD/PCDF by using BAT included in Annex V, this will also lead to a reduction of the emissions of PCN from waste incineration. PCN emissions from these sources are expected to be reduced by ~70% upon full implementation of the POP protocol. However, cement kilns can be a source of PCN that is not listed in Annex V of the UNECE POP protocol (UNECE 2007).
- 69. Corresponding BAT and BEP are also described in the Stockholm Convention BAT and BEP Guidelines (UNEP 2007), in Section V on guidance/guidelines by source categories in Part II of Annex C. Relevant BAT for various types of incinerators (including waste incinerators in section V.A and cement kilns firing hazardous waste in

section V.B) and other thermal sources (including thermal processes in the non-ferrous metal sector in section V.D) are specified in the BAT and BEP guidelines. In addition, the relevant EU BAT reference documents (BREFs) also include such information particularly on waste incineration (EC BREF WI 2006) and on non-ferrous metal industries (EC BREF NFM 2009).

- 70. The application of the corresponding BAT under the Stockholm Convention is a control measure to reduce PCN releases.
- 71. The listing of PCN in Annex C of the Stockholm Convention would subject this substance group to the measures under Article 5 of the Convention, and establish the goal of continuing minimization and, where feasible, ultimate elimination of PCN releases. This would include an obligation to promote BAT and BEP for PCN sources.

Control measures for releases from stockpiles and wastes

- 72. Releases from former uses (PCN or impurities of technical PCB) contained in landfills or old appliances (stockpiles) are plausible. Based on production figures, PCN in old appliances and products from former use are considered as the most important reservoir for releases through their quantity. Products and articles upon becoming waste should be handled, stored and disposed in an environmentally sound manner. Releases from remaining PCB containing devices are another potential source, but less important in size and already covered by management and elimination measures. In addition, there is some potential for releases from waste disposal sites if not engineered. Possible measures to control releases from stockpiles and wastes should be consistent with Article 6 paragraph 1 of the Convention
- 73. For engineering standards of landfills, including management of leachate, and further information on sustainable waste management, the technical guidelines under the Basel Convention are recommended (technical guidelines: on specially engineered landfill (D5); (BC 1997)). As there is a direct relation between the occurrence of PCB and PCN in old appliances, the stocks of PCN in old appliances are particularly occurring in PCB stockpiles (waste disposal and PCB containing equipment).
- 74. Listing of PCN in Annex A and/or C would subject PCN to the measures under Article 6 of the Convention and establish the goal of identifying stockpiles consisting of or containing the chemicals listed in Annex A and/or C, and of managing them in a safe, efficient and environmentally sound manner.

2.3 Efficacy and efficiency of possible control measures in meeting risk reduction goals

Intentional production

- 75. On a global scale intentional production of PCN is assumed to have ended, , but their use is still possible. Furthermore, there may be remaining products and stocks in a number of countries. PCN can be captured with the same methods that are used to capture PCB and other intentionally produced POPs, and will require the same measures.
- 76. Nigeria reported that there are no additional costs for eliminating the production and use of PCN, since the industry has already substituted this use (Annex F, Nigeria, 2013). Additional costs for eliminating the production and use of PCN are not expected, as alternative chemicals for the same uses are readily available and in use. Costs, however, will arise for setting up of inventories and for appropriate classification and management of PCN-containing products and wastes, including costs for measurements in articles. Health and the environment would benefit from a ban of PCN, as their re-introduction and related risks would be prevented. A beneficial effect could be expected as any currently unidentified production and use around the world should end. Negative impacts on health, environment and society are not expected from a ban of PCN.

Releases from unintentional production

- PCN are unintentionally released from the same sources as PCDD/PCDF. Therefore, measures that reduce the release of PCDD/PCDF will also reduce PCN releases. BAT and BEP relevant for unintentionally produced POPs for various types of incinerators and other thermal sources are very well documented in the Stockholm Convention BAT and BEP Guidelines (UNEP 2007) and the relevant BREFs and are widely applied. In the UNECE region, it was expected that the full implementation of the POP Protocol would reduce PCN emissions by 75% (UNECE 2007). There are no extra costs for the industry in the UNECE region for controlling unintentional releases. Price increases are not expected since the alternatives are already in use, and the measures against unintentional releases have to be taken to reduce other emissions (PCDD/PCDF, HCB, etc). There will, however, be additional costs for monitoring, namely for chemical analysis, even if monitoring programmes for PCDD/PCDF, HCB and PCB are already established.
- 78. The measures implemented to minimize and ultimately eliminate releases of PCDD/PCDF could be efficient to address PCN releases as well. Monitoring of PCN will induce additional costs. Monitoring capacity for PCN is needed in developing countries and countries with economies in transition. In addition, emission factors for PCN releases from unintentional production should be developed and included in a revised Toolkit for identification and quantification of PCDD/PCDF releases. As noted by Nigeria (Annex F, Nigeria, 2013), costs for the state are

considered to be negligible; they may consist of additional costs for measuring PCN content in products or from unintentional releases which includes monitoring and preparation of emission inventory. According to Mexico, costs may arise from monitoring emissions of PCN and for monitoring environmental levels in order to demonstrate that levels decrease as a consequence of taking control measures. Moreover, it will also be necessary to adjust legislation in order to enable the control of PCN. ¹⁶

Stockpiles and wastes

- 79. Stockpiles of PCN in remaining products are considered to be the most important potential source for release. Given the similar nature and use pattern, measures similar to those for PCB could be expected to be the most effective for this category.
- 80. As a consequence of listing PCN in Annex A and/or C, parties to the convention would have to identify, to the extent practicable, existing stockpiles of PCN (including both relevant waste disposals and old appliances), and to manage them in a safe, efficient and environmentally sound manner.
- 81. There is a specific relation between the occurrence of PCB and PCN (see above). According to Article 6 of the Convention, Parties are already obliged to identify, to the extent practicable, existing stockpiles consisting of or containing PCB, and to manage these in a safe, efficient and environmentally sound manner. Provisions on the elimination of PCB in equipment, and measures to reduce exposure and risk to control the use of PCB and several further specifications, including determined efforts designed to lead to environmentally sound waste management of liquids containing PCB and equipment contaminated with PCB, are laid down in Annex A, part II of the Convention. As a consequence, PCN stockpiles which are part of the PCB stockpiles are likely to be already identified and managed in an environmentally sound manner together with any remaining PCB stockpiles. Additional costs for PCN contained in PCB stockpiles will not arise.

2.4 Information on alternatives (products and processes) where relevant

- 82. Within the UNECE region, the information on substitution and alternatives is extremely limited, as PCN are not in use anymore. The only available information is that, since the production of PCN has stopped in the 1970s and 1980s, PCN have been substituted by other chemicals. These chemicals have not been identified and described (UNECE 2007).
- 83. Hayward (1998) reports that production of PCN began to decline with the advent of plastic substitutes for insulation and the use of PCB for dielectrics in transformers (Hayward 1998). This indicates that PCN have been replaced by PCB as dielectrics and by plastics as insulating material. PCBs are nowadays largely substituted by other alternatives.
- 84. No requests have been received, nor particular needs identified for specific exemptions on PCN. No additional information on alternative chemicals being used to substitute PCN was provided by parties within the Annex F questionnaire.

2.5 Summary of information on impacts on society of implementing possible control measures

Intentional production

85. No negative impacts on society have been reported from prohibition or phasing-out PCN within the UNECE region (UNECE 2007). Most uses seem to have stopped worldwide. Health and the environment could benefit from listing PCN in Annex A, as the re-introduction of PCN and related risks would be prevented. A beneficial effect on health, environment and society could be expected as any currently unidentified production and use around the world should end and new production would not begin. Negative impacts are not expected.

Unintentional production

86. PCN are unintentionally released from the same sources as PCDD/PCDF. Measures that reduce the release of PCDD/PCDF will also reduce PCN emissions. BAT and BEP relevant to unintentionally produced PCDD/PCDF for various types of incinerators are already available and widely applied. Measures to reduce unintentional releases of PCN through listing in Annex C would positively impact human health and the environment. Monitoring of PCN will induce additional costs. Monitoring capacity for PCN is needed in developing countries and countries with economies in transition. Compared to developed countries, costs may be different in developing countries and countries with economies in transition.

Stockpiles and wastes

87. PCN are unintentionally released from existing stockpiles (waste disposal sites and old appliances). Listing of PCN in Annex A and/or C would require developing strategies to identify existing stockpiles and to manage them in an environmentally sound manner. Parties to the convention have already introduced such measures to manage PCB

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¹⁶ Comment Mexico on the second version of the draft risk management evaluation.

stockpiles. Measures which are in place with respect to PCB stockpiles will also efficiently reduce releases of PCN from stockpiles. Health and the environment would benefit from reduced releases. Additional costs would not arise.

2.6 Other considerations

88. Specific relevant information on information and public education and on the status of the control and monitoring capacity has not been provided by parties or observers who submitted Annex F information.

3. Synthesis of information

Risks and need for action

89. According to the risk profile, PCN meet all screening criteria, i.e. long-range environmental transport, bioaccumulation, persistence and toxicity. The POPs Review Committee decided that PCN are likely, as a result of their long-range environmental transport, to lead to significant adverse human health and environmental effects such that global action is warranted.

Sources

- 90. PCN have been used mainly for their chemical stability, including low flammability, their (electrically) insulating properties and recalcitrance, including resistance to biodegradation and biocidal function. They share these properties and their scope of application with PCB, by which they were gradually replaced since the 1950s. They have been used for several technical applications and as a wood preservative. To date, the intentional production of PCN is assumed to have ended; however, remaining use is still possible.
- 91. PCN are still unintentionally generated during high-temperature industrial processes. Of the known releases, combustion (primarily waste incineration) is considered the most significant current source. PCN are also generated in industrial processes with similar mechanisms as PCDD/PCDF; they are formed during smelting in the secondary nonferrous metallurgical industry (where production conditions include heat, chlorine-containing recyclates and the catalytic function of metals such as copper), cement and magnesia production, aluminium refining and coking have been reported as unintentional PCN sources. There have also been indications of PCN formation at manufacturing sites producing chlorine by use of graphite anodes in mercury cell within the chlor-alkali process.
- 92. Commercial PCB contained traces of PCN. PCN were unintentionally released as contaminants in PCB. Releases from former uses (PCN or impurities of technical PCB) contained in landfills or old appliances (stockpiles) are plausible but difficult to assess.

Existing control

93. In 2009, PCN were proposed to amend Annex I (prohibition of production and use) of the Aarhus Protocol on POPs under the UNECE Convention on Long-Range Transboundary Air Pollution. The amendment will come into force when two thirds of the parties have adopted the amendment. The OSPAR Commission has included PCN in the List of Chemicals for Priority Action (by June 2003) and waste containing PCN is characterized as hazardous waste under Annex VIII of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal.

Releases and control measures and their efficacy and efficiency

94. In the present document, an overview of the sources of releases of PCN from current activities and the related possible control measures is given. Possible release sources are (1) intentional production (which seems to have ceased), (2) unintentional production (particularly from waste incineration and other activities potentially generating PCDD/PCDF) and (3) release from stockpiles and wastes (particularly waste disposal sites and old appliances).

(1) Intentional production:

- 95. To date, intentional production of PCN is assumed to have ended; however, remaining use is still possible. To limit possibly remaining uses and to prevent re-introduction of other uses, listing of PCN in Annex A without any specific exemptions could be the primary control measure for intentional sources under the Convention. As a consequence, PCN would be submitted to the provisions of Article 3 of the Convention, and the objective requirement to eliminate their production, use, import and export.
- 96. Additional costs for eliminating the production and use of PCN are not expected, as alternative chemicals for the same uses are already available and in use. Health and the environment could benefit from a ban of PCN as their re-introduction and related risks would be prevented. A beneficial effect on health, environment and society could be expected as any currently unidentified production and use around the world should end. Negative impacts are not expected from a ban of PCN.

(2) Unintentional production:

97. PCN are unintentionally generated during high-temperature industrial processes. Of the known releases, combustion (primarily waste incineration) is considered the most significant current source. PCN are generated

unintentionally with similar mechanisms as PCDD/PCDF during other industrial processes such as smelting in the secondary non-ferrous metal industry, cement and magnesia production, aluminium refining and coking. Listing of PCN in Annex C would subject this substance group to the measures under Article 5 of the Convention and establish the goal of continuing minimization and, where feasible, ultimate elimination of PCN releases. This would include an obligation to promote BAT and BEP for PCN sources.

98. Measures that reduce the release of PCDD/PCDF releases will also reduce PCN releases. BAT and BEP relevant to unintentionally produced PCDD/PCDF for various types of incinerators are already available and widely applied. Measures to reduce unintentional releases of PCN through listing in Annex C would positively impact human health and the environment. Monitoring of PCN will induce additional costs. Monitoring capacity for PCN is needed in developing countries and countries with economies in transition..

(3) Release from stockpiles and wastes:

- 99. PCN can be unintentionally released from landfills or old appliances (stockpiles). Possible measures to control releases from stockpiles are (1) to establish inventories of relevant landfills, control and sound management of releases (particularly leachate) from relevant waste disposal sites or restoration/decontamination of waste disposal sites, and (2) to establish inventories of stocks of relevant old appliances and their sound management. Listing of PCN in Annex A and/or C would subject PCN to the measures under Article 6 of the Convention and establish the goal of identifying, to the extent practicable, stockpiles consisting of or containing PCN and managing them in a safe, efficient and environmentally sound manner.
- 100. Commercial PCBs contain traces of PCN, and therefore PCN can be unintentionally released as contaminants in PCB. As there is a direct relation between the occurrence of PCB and PCN in old appliances, stocks of PCN are particularly occurring in conjunction with PCB (i.e. in PCB containing waste disposal sites and PCB containing equipment). Parties to the convention have already introduced measures to identify and manage PCB stockpiles. Measures in place with respect to PCB stockpiles will also efficiently reduce releases of PCN from stockpiles. Health and the environment would benefit from reduced releases. Additional costs would not arise.

4. Concluding statement

- 101. Having evaluated the risk profile on PCN, the POPs Review Committee concludes that these chemicals are likely, as a result of long-range environmental transport, to lead to significant adverse effects on human health and/or the environment, such that global action is warranted.
- 102. The Committee prepared the present risk management evaluation, and concluded that, although PCN are not known to be currently intentionally produced or used, it is important to limit possible remaining uses and to prevent the re-introduction of PCN.
- 103. PCN are unintentionally generated during high-temperature industrial processes (particularly waste incineration, but also in other processes known to generate PCDD/PCDF). Measures that reduce the release of PCDD/PCDF will also reduce PCN releases. Monitoring of PCN will induce additional costs. Monitoring capacity for PCN is needed in developing countries and countries with economies in transition.
- 104. PCN are released to an unknown extent from waste disposal sites and stocks of old appliances. PCN in stockpiles are particularly occurring in conjunction with PCB (i.e. in PCB containing waste disposal sites and in PCB containing equipment). Parties to the Stockholm Convention have already introduced measures to identify and manage PCB stockpiles. Measures that are in place with respect to PCB stockpiles will also efficiently reduce releases of PCN from stockpiles.
- 105. The Stockholm Convention, through the POPs Review Committee aims to protect human health and the environment from POPs, while being mindful of the precautionary approach as set forth in Principle 15 of the Rio Declaration on Environment and Development. It seeks to adopt measures to eliminate releases from intentional production and use of POPs, to reduce or eliminate releases of unintentionally produced POPs, and to reduce or eliminate POPs releases from stockpiles and wastes, in support of the goal agreed at the 2002 Johannesburg World Summit on Sustainable Development, ensuring that by the year 2020, chemicals are produced and used in ways that minimize significant adverse impacts on the environment and human health.
- 106. Having prepared a risk management evaluation and considered the management options, in accordance with paragraph 9 of Article 8 of the Convention, the Committee recommends the Conference of the Parties to the Stockholm Convention to consider listing and specifying the related control measures for PCN in Annexes A and C.

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