



**Rotterdam Convention on the Prior
Informed Consent Procedure for
Certain Hazardous Chemicals and
Pesticides in International Trade**

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Technical work: review of notifications of final regulatory

action: pentachlorobenzene

**Additional information on pentachlorobenzene from the
Persistent Organic Pollutants Review Committee of the
Stockholm Convention**

Note by the Secretariat

1. At its third meeting, in October 2006, the Conference of the Parties to the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade endorsed two approaches recommended in a note by the Secretariat on risk evaluations under other multilateral environment agreements and their relevance to candidate chemicals (UNEP/FAO/RC/COP.3/10).
2. One of those approaches was that the Committee should consider risk evaluations under the Stockholm Convention on Persistent Organic Pollutants and the Montreal Protocol on Substances that Deplete the Ozone Layer as adequate support for meeting criteria (b) (i) and (b) (ii) of Annex II to the Rotterdam Convention and that, in order for criterion (b) (iii) to be met, bridging information providing evidence of the prevailing conditions in the notifying country would have to be submitted.
3. In the annex to the present note, the Secretariat has the honour to provide a risk management evaluation for pentachlorobenzene that was adopted by the Persistent Organic Pollutants Review Committee of the Stockholm Convention at its fourth meeting. The document was originally issued under the symbol UNEP/POPS/POPRC.4/15/Add.2 and has been reproduced without change and without formal editing. It serves as additional information that can be used by the Chemical Review Committee in reviewing the notifications of final regulatory action for pentachlorobenzene.

* UNEP/FAO/RC/CRC.7/1.

Annex

**Document UNEP/POPS/POPRC.4/15/Add.2: risk management
evaluation for pentachlorobenzene**

PENTACHLOROBENZENE

RISK MANAGEMENT EVALUATION

Prepared by the ad hoc working group on
Pentachlorobenzene
under the Persistent Organic Pollutants Review Committee
of the Stockholm Convention

October 2008

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Executive Summary

The European Community and its Member States being Parties to the Stockholm Convention have proposed pentachlorobenzene (PeCB) to be listed in Annex A, B and/or C to the Convention pursuant to paragraph 1 of Article 8 of the Convention. The risk profile of PeCB was adopted on the third meeting of the Persistent Organic Pollutants Review Committee in November 2007. The Committee decided, in accordance with paragraph 4 (a) of Article 8 of the Convention, that the screening criteria have been fulfilled for PeCB. The Committee recommended to make an additional effort in order to distinguish between the environmental burden caused by intentional use and the burden caused by unintentional production in order to support the risk management evaluation.

Past uses mentioned in the risk profile concern PeCB as a component in PCB products, in dyestuff carriers, as a fungicide and a flame retardant and as a chemical intermediate e.g. for the production of quintozone. There is no quantitative information available on historic production and use. PeCB is presently only produced and used in relatively small amounts of analytical grade PeCB by laboratories for the preparation of standard solutions used for analytical purposes. Furthermore, the use in the worldwide production of quintozone can not be excluded. The information indicating that PeCB is not used anymore for the production of quintozone only covers the UNECE region¹.

The most efficient control measure would be the prohibition of all production and uses of PeCB and PeCB containing products. As no remaining production or uses of PeCB have been identified except the use in laboratories and the possibility that some use for quintozone production takes place, listing of PeCB in Annex A would be the primary control measure under the Convention. Listing of PeCB in Annex A would also ensure that the provisions of Article 3 on export and import and of Article 6 on identification and sound disposal of stockpiles and waste would apply. As the production of PeCB has ceased some decades ago in the main producing countries, there are now alternatives available with comparable efficacy, and without cost implications. Based on this background, significant negative impact on society of listing PeCB in Annex A is expected to be very limited. No requests have been received nor particular needs identified for specific exemptions on PeCB. A beneficial effect could be expected as any currently unidentified production and use around the world should end. Also re-introduction of PeCB is effectively excluded if listed in Annex A.

Unintentional anthropogenic sources can be divided into point sources and diffuse sources.

As regards point sources, combustion and thermal processes and industrial processes are most important and releases are controlled by abatement and substitution techniques and/or legislation. For PeCB formed as by-product in combustion processes there is a clear relation to PCDD/F releases formed by combustion. Most measures taken to reduce PCDD/F releases, as described in the Stockholm Convention's BAT/BEP guidelines for incinerators and other thermal processes, will lead to a significant reduction of the releases of PeCB. The most relevant diffuse sources are impurities in products such as, solvents, pesticides and wood preservative products, and barrel burning, open fire places, accidental fires and forest burning for agricultural purposes. For these sources abatement techniques are not feasible and release reduction measures can only be enacted by legislation and/or providing information and education by the national and local authorities.

An Annex C listing would subject PeCB to the measures under Article 5 of the Convention and establish the goal of continuing minimization and, where feasible, ultimate elimination of PeCB releases. This would include an obligation to promote best available techniques and best environmental practices for PeCB sources. Countries already have obligations to take these control measures for other unintentionally produced POPs (PCDD/Fs, PCBs and HCB) under the Convention.

1 United Nations Economic Commission for Europe:
http://www.unece.org/oes/member_countries/member_countries.htm

1. Introduction

1.1 Chemical identity of the proposed substance

Background

The European Community and its Member States being Parties to the Stockholm Convention have proposed pentachlorobenzene (PeCB) to be listed in Annex A, B and/or C to the Convention pursuant to paragraph 1 of Article 8 of the Convention. The complete original proposal is contained in document UNEP/POPS/POPRC.2/INF/5. A summary of the proposal prepared by the Secretariat was provided in document UNEP/POPS/POPRC.2/13. The risk profile of PeCB was adopted on the third meeting of the Persistent Organic Pollutants Review Committee in November 2007 (UNEP/POPS/POPRC.3/20/Add.7).

Chemical identity of the proposed substance

PeCB belongs to the group of chlorobenzenes, which are characterised by a benzene ring in which the hydrogen atoms are substituted by one or more chlorines. The chlorobenzenes are neutral, thermally stable compounds with increasing stability and higher melting and boiling points with increasing chlorine substitution. PeCB has a very low solubility in water.

IUPAC Name: pentachlorobenzene

CAS Chemical Name: benzene, pentachloro-

Synonyms: 1,2,3,4,5-pentachlorobenzene; Pentachlorobenzene; PCB; PeCB; QCB; quintochlorobenzene

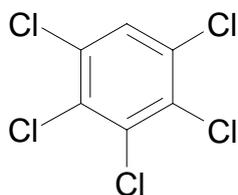
CAS Registry Number: 608-93-5

EINECS Number: 210-172-0

Trade names: None

Structure

1,2,3,4,5-Pentachlorobenzene



1.2 Conclusion of the Review Committee, Annex E information

The Committee has conducted and evaluated the risk profile in accordance with Annex E at the third meeting in Geneva 19-23 November 2007 (UNEP, 2007). The Committee decided, in accordance with paragraph 4 (a) of Article 8 of the Convention, that it is satisfied that the screening criteria have been fulfilled for pentachlorobenzene.

PeCB is persistent in the environment and is bioaccumulative. The small spatial variability in the ranges of air concentrations across the Northern Hemisphere indicates that PeCB has a very long atmospheric residence time and is widely distributed in the global hemisphere. There are monitoring data from remote areas, backed up by modelling results that suggest that PeCB can be transported over long distances. PeCB is moderately toxic to humans, but is very toxic to aquatic organisms.

As a result of the long range transport of PeCB, neither a single country nor a group of countries alone can abate the pollution caused by this substance. Unintentional release of PeCB as a byproduct of incomplete combustion appears to be the largest current source. Measures to reduce these releases can only be taken at a global scale. Although the production and use of PeCB has ceased in most countries, its reintroduction remains possible. This reintroduction could lead to increased releases and levels in the environment. Based on the available evidence, PeCB is likely, as a result of its long range environmental transport, to lead to significant adverse human health and/or environment effects, such that global action is warranted.

As the distinction between the environmental burden caused by intentional use and the burden caused by unintentional production could support the preparation of the risk management evaluation and making the final recommendation, the Committee considers that an additional effort should be made to fill this gap.

1.3 Data sources

The draft Risk Management Evaluation is based on information that has been provided by Parties to the Convention and observers. The following parties and observers have answered the request for information specified in Annex F of the Stockholm Convention (risk management): Armenia, Canada, Croatia, Czech Republic, International POPs Elimination Network (IPEN), Moldova, Monaco, Mozambique, Myanmar, Netherlands, Qatar, United States and World Chlorine Council (WCC). During the process of drafting the RME additional information was received from Australia, Germany, the Republic of Korea, Mauritius and Slovakia.

In addition, information is gathered from the open literature. Relating to the UN-ECE region also additional information is obtained from a paper 'Exploration of management option for Pentachlorobenzene (PeCB)' prepared for the 6th meeting of the UNECE CLRTAP Task Force on Persistent Organic Pollutants (4-7 June 2007) (UNECE, 2007) and papers produced within the UNECE framework (UNECE, 2008).

1.4 Status of the chemical under international conventions

PeCB is not included in any international convention. The European Commission has submitted a proposal to include PeCB to the Protocol on Persistent Organic Pollutants to the 1979 Convention on Long Range Transboundary Air Pollution (LRTAP) to the Executive Secretariat of the United Nations Economic Commission for Europe (UNECE) in 2006 (European Commission, 2007). The objective of the LRTAP POPs protocol is to control, reduce or eliminate discharges, emissions and losses of persistent organic pollutants. The UNECE Task Force on POPs identified the following options for possible inclusion of PeCB into the Protocol:

- (a) Listing of PeCB in annex I to the Protocol in order to prevent production and use;
- (b) Listing of PeCB in annex I and annex III to the Protocol.

The conclusions of the Task Force have been discussed at the 40th session of the Working Group of Strategies and Review (WGSR) under the UNECE POP protocol. The WGSR took note of the Task Force conclusions on PeCB and agreed to submit it to the Executive Body for consideration. In their meeting of December 2007 the Executive Body mandated the WGSR to negotiate draft amendments to the Protocol on POPs for presentation to the twenty-sixth session of the Executive Body in 2008 that covers inclusion of PeCB and six other POPs in the Protocol Annexes (UNECE, 2008).

1.5 Any national or regional control actions taken

Canada

In Canada PeCB is included under the *Prohibition of Certain Toxic Substances Regulations, 2005* (hereinafter referred to as the Regulations) under the Prohibited Toxic Substances List in Schedule 2, Part 2 of the Regulations. These regulations enacted a ban on the manufacture, use, sale, offer for sale and import of PeCB or any mixture or product containing these substances, but allows exemptions where they are used with PCBs. PCBs are regulated under the *Chlorobiphenyls Regulations* and *Storage of PCB Material Regulations*.

Various other initiatives also contribute to reductions in PeCB emissions in Canada, such as:

- the Canada-wide Standards for dioxins and furans;
- the regulatory approaches in other Canadian jurisdictions to either prohibit open burning, or permit it only under pre-approved conditions;
- proposed revisions to the PCB regulatory framework;
- the Wood Preservation Strategic Options Process; and
- the regulations for the control of tetrachloroethylene from the dry-cleaning sector.

Czech Republic

In the Czech Republic, PeCB is part of an integrated monitoring program on POPs. This program will provide information on the Central European levels of POPs, the long-term trends in those levels and the impact of various sources and the effectiveness of measures applied to reduce the impact.

European Union

In the EU quintozene is not included as an active substance in Annex I to Directive 91/414/EEC, which means that Member States shall ensure that authorizations for plant protection products containing quintozene are withdrawn and that no authorizations will be granted or renewed (the use of quintozene has stopped after June 2002).

The EU has identified a number of priority substances within the European Water Framework Directive (2000/60/EC). Within the list of these priority substances so-called priority hazardous substances are identified which are of particular concern for the freshwater, coastal and marine environment. These substances will be subject to cessation or phasing out of discharges, emissions and losses within 20 years after adoption of the Directive. The European Commission has proposed to include pentachlorobenzene as a priority hazardous substance. PeCB is listed on the OSPAR 1998 List of Candidate Substances (UNEP, 2007).

Republic of Korea

Pentachlorobenzene is not regulated under the Hazardous Chemicals Management Act. According to a survey conducted in 2006, the chemical was not manufactured nor imported in the Republic of Korea.

Mauritius

PeCB is neither produced nor used in the Republic of Mauritius.

Moldova

PeCB is not included in the official register of permitted substances for importation and use in agriculture, including individual farms, forestry and household. This substance will be banned in Moldova by the new National Chemicals Management Law, which now is under development. Quintozene was banned in former Soviet Union on 21 March 1986. This prohibition is in force in the Republic of Moldova before approval of the new National Chemicals Management Law.

Mozambique

Pentachlorobenzene (proposed by the European Community and the Members States that are Parties to the Stockholm Convention) has been never used in Mozambique.

United States

PeCB is subject to a US Toxic Substances Control Act (TSCA) Significant New Use Rule, requiring notification to EPA prior to manufacture, import or processing of 10,000 pounds (4,536 kg) or more of PeCB per year per facility for any use subject to TSCA. No such notification has been received.

The other countries who submitted information did not provide information on specific actions taken to control PeCB. In the submission from IPEN a list of countries is given in which the use of quintozene, endosulfan, chlorpyrifos-methyl, atrazine and clopyralid, which may contain PeCB, is prohibited.

2. Summary information relevant to the risk management evaluation

2.1 Additional information

2.1.1 General information on sources, releases and measures

At the third meeting of the POPs Review Committee, it was noted that there were information gaps in the risk profile regarding environmental burden caused by intentional use and un-intentional releases of PeCB. Because the releases of PeCB in the past from several sources, such as waste burning and pesticide use, are not known and changed over time, it is not possible to distinguish the environmental burden from intentional use and unintentional releases.

Assuming that historical contamination in sediments and soils are already controlled by national and international legislation, contaminated sites are not covered in this document. In the past PeCB was used in PCB applications, which are still in use worldwide. But since PCBs are listed on Annex A of the Stockholm Convention, this potential PeCB source will be addressed in countries that are Parties to the Convention. The focus will be, therefore, on the actual intentional and unintentional sources, processes and possible measures. A concise overview of the various current release sources and related reduction measures is given in Figure 1.

Anthropogenic sources can be divided into intentional and unintentional sources.

In the risk profile past uses mentioned are PeCB as a component in PCB products, in dyestuff carriers, as a fungicide and a flame retardant and as a chemical intermediate e.g. for the production of quintozene. There is no quantitative information available on historic production and use. Based on the information from the risk profile, from the Annex F submissions from parties and observers and from an internet search, there is no indication that (large scale) production or intentional use of PeCB still takes place. However, the use in the production of quintozene cannot be excluded. The information indicating that PeCB is not used anymore for the production of quintozene only covers the UNECE region. PeCB is presently only produced and used in relatively small amounts of analytical grade PeCB by laboratories for the preparation of standard solutions used for analytical purposes. According to article 3.5 of the Stockholm convention such an application is not included in the Convention.

Unintentional anthropogenic sources can be divided into point sources and diffuse sources.

As regards point sources, large scale combustion processes and industrial processes are most important and releases are controlled by abatement techniques and/or legislation.

The most relevant diffuse sources are;

- as an impurity in products such as, solvents, pesticides and wood preservative products,
- uncontrolled combustion such as barrel burning an open fire places,
- accidental fires and
- forest burning for agricultural purposes.

For these sources abatement techniques are not likely and release reduction measures might be obtained by legislation and/or providing information and education by the national and local authorities.

Forest and bush fires can be expected to be a source of PeCB, but no data are available to quantify possible releases. However, there is good correlation between the releases of PCDD/F and PeCBs during the open burning of household wastes (Lemieux et al., 2004; EPA 2002), and the information of PCDD/F releases from forest fire simulations (Gullett and Touati, 2003). Article 5 of the Stockholm Convention states that measures shall be taken for chemicals listed on Annex C to reduce or eliminate release from unintentional production by anthropogenic sources. Therefore, natural sources are excluded from the Convention and forest fires are not further discussed.

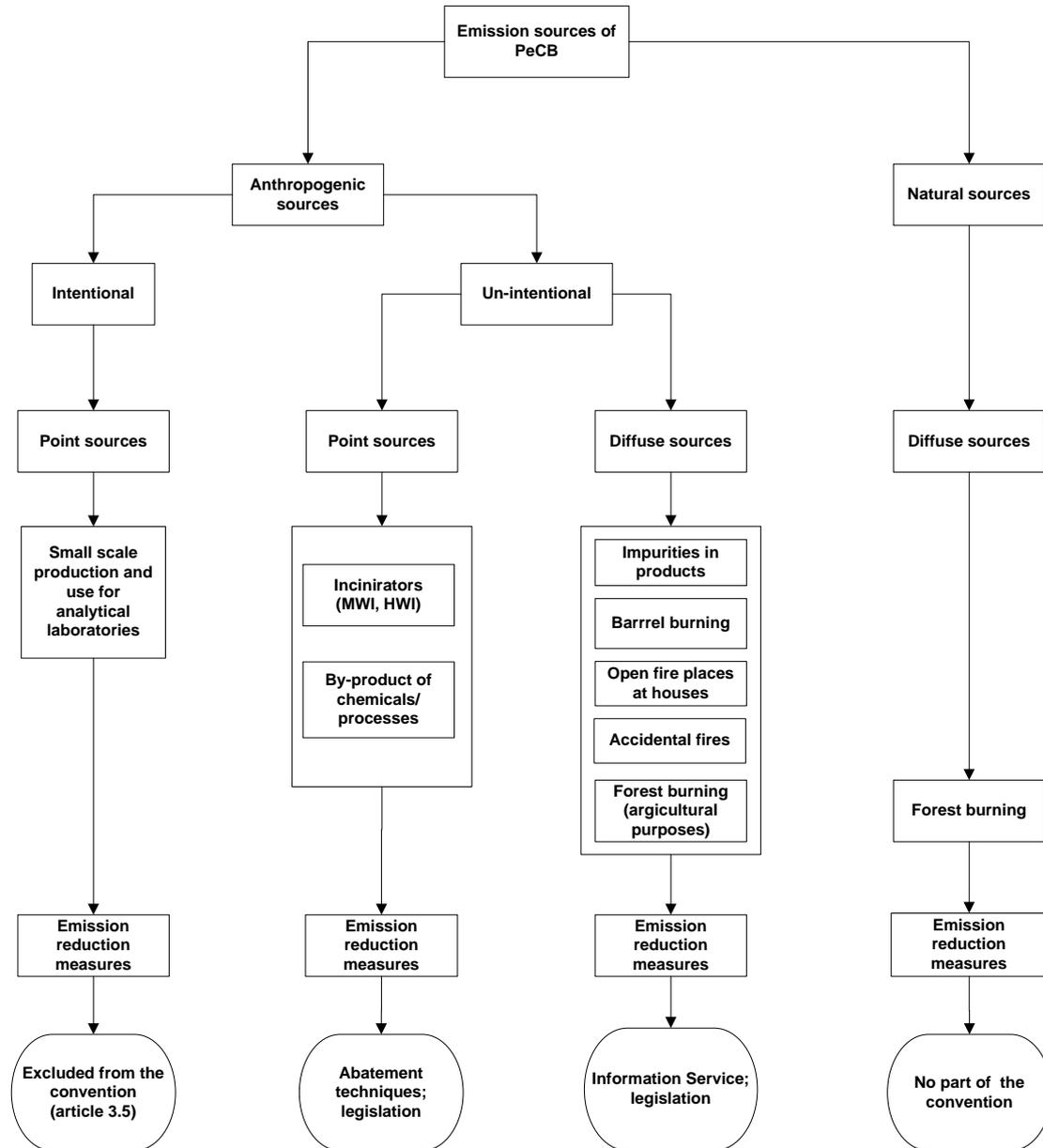


Figure 1. Emission sources of PeCB of current activities and related possible release reduction measures

Since natural sources and the remaining intentional use (laboratories) are excluded from the Stockholm Convention, this risk management evaluation will mainly focus on possible measures relating to unintentional anthropogenic emission sources of PeCB.

Total releases for the US between 2000 and 2004 as reported in the TRI varied between 763 and 1512 kg/year (UNEP, 2007). Global releases of PeCB, including natural sources, are estimated to be 85,000 kg (Bailey, 2007). Data on other sources are provided in the risk profile for Pentachlorobenzene.

2.1.2 Pentachlorobenzene production and use

Pentachlorobenzene can be used as an intermediate in the production of quintozene. Major U.S. and European manufacturers of quintozene have changed their manufacturing process to eliminate this use of PeCB. Also the use of quintozene has been stopped in most UNECE countries. The situation outside the UNECE region on production and use at this stage is unknown.

The annex F submissions did not contain much information on quintozene except for the submissions of Canada, Moldova, US, IPEN and World Chlorine Council. Canada reports that PeCB is present as an impurity in this fungicide. Quintozene is currently used, but not produced, in Canada. Moldova reports that quintozene was banned from the USSR in 1986. The US reports that PeCB was formerly used for producing quintozene, but the submission does not report on quintozene production and use in the US. IPEN reports that quintozene was banned in the EU in 1991 and that it is not registered for use in Burkina Faso, Cameroon, Cape Verde, Chad, Gambia, Madagascar, Niger, Tanzania, Uganda, India, Sri Lanka, and Belize. Quintozene is registered for use in 13 products in Australia against fungal diseases in turf, cotton, horticulture and ornamentals (comment Australia 14-05-08). Bailey (2007) reports that PeCB has been used as an intermediate in the production of quintozene, and that there is an alternative production procedure without PeCB. The available information at this stage does not allow to draw a general conclusion on PeCB content of quintozene and the worldwide production and use of quintozene.

Production of quintozene in the US was estimated to be 1,300,000 kg in 1972 of which 30-40% was exported (ICPS, 1984). Other data on sales could not be traced back. The Government of British Columbia in Canada reported sales for quintozene to be 15,581 kg in 1995 (Government of British Columbia, 2008).

Combining the quintozene sales data for the US and the percentage of PeCB reported by the US-EPA (1998) (<0.01% PeCB) results in a maximum potential total release of PeCB through application of quintozene in the US of 1,300,000 kg x 0,6 x 0.0001 = 78 kg. Total releases for the US between 2000 and 2004 as reported in the TRI varied between 763 and 1512 kg/year (UNEP, 2007). The data indicate that compared to unintentional releases, pesticide use is of minor importance, but it still may be a relevant source to achieve for reduction.

PeCB might still be present as an impurity in quintozene stockpiles (UNECE 2007). Canada reports that PeCB can be found as impurity in several herbicides, pesticides and fungicides currently in use in Canada. The US reports in their Annex F submission that PeCB can be found in the quintozene process waste stream as an untreated intermediate. US EPA reported between 93.000 and 140.000 kg of quintozene as waste in 2000 – 2004 (US EPA, 2007). There is no further information available on quintozene and/or PeCB present in stockpiles.

PeCB can still be ordered on the internet. In most cases these sales are related to analytical standards of 100 or 200 ug/ml in various solvents (methylene choride, methanol, isooctane) and sold in quantities of 1 – 1.2 ml. Although laboratory use is not included in the Convention this source is addressed here to indicate that the total releases through laboratory use are negligible compared to the releases mentioned in the risk profile for unintentional releases (between 763 and 1512 kg/year for the US and roughly estimated by Bailey (2007) to be 85,000 kg worldwide) and the use of pesticides containing PeCB (see estimations below). No remaining intentional use of PeCB above laboratory scale has been identified. This observation is based on the information provided in the risk profile, and a limited number of questionnaires received in reply to the Annex F information request.

2.1.3 Pentachlorobenzene within the scope of the UNECE Protocol

The Executive Body of the UNECE LRTAP Convention mandated that draft amendments to the POPs protocol to be negotiated including the options of listing PeCB in either Annex I or Annexes I and III². The decision to negotiate for either Annex I or Annexes I and III was based on the fact that commercial production of PeCB within the UNECE region had stopped many years ago. It was concluded that quintozene was still used worldwide, but that it was unclear if PeCB was used in the manufacturing process. It was expected that:

1. inclusion of PeCB in Annex I would not require additional management actions nor additional cost as industry had already replaced PeCB,
2. PeCB releases related to quintozene would phase out with time, and
3. releases from PCB containing equipment were already covered by the measures taken for PCBs.

No additional management actions for by-product formation in thermal processes were expected as the measures to control PCDD/Fs would also lead to a reduction in the releases of PeCB. The UNECE indicated that no information was available on costs and impacts of emission reduction addressing residential/domestic combustions sources such as barrel burning. Costs within the UNECE region for State budgets were expected to be negligible and no price increases for consumers were expected (UNECE 2008).

² These are comparable to Annexes A and C of the Stockholm Convention.

2.2 Intentional point sources

2.2.1 Identification of possible control measures

Intentional anthropogenic sources mentioned in the risk profile are PeCB as a component in PCB products, in dyestuff carriers, as a fungicide and a flame retardant and as a chemical intermediate e.g. for the production of quintozone. Most applications seem to have ceased. The applications in dye carriers have been discontinued in Canada (Environment Canada, 2005). PeCB may have been used in the past as a fungicide and as a flame retardant. There is no indication that PeCB is still used for these applications. The use in PCB-applications (dielectric fluids, heat transfer equipment) declined considerably in the last decades. PeCB nowadays is not used anymore for this purpose. Release from historical use, stockpiles and waste is unknown. Actions taken to eliminate the use of PCBs will subsequently eliminate any related PeCB releases (UNEP, 2007).

To limit the possible application for the production of quintozone and prevent re-introduction of other intentional uses, and to reduce or eliminate releases from stockpiles and wastes, listing of PeCB in Annex A without any specific exemptions could be the primary control measure for intentional sources under the Convention.

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

Except for quintozone production for which the information does not allow a straightforward conclusion to be drawn on a global scale, no remaining uses have been identified.

The control measure may limit the use of PeCB in the production of quintozone if still in use and prevents re-introduction of other intentional uses.

2.2.3 Information on alternatives (products and processes)

As there is no current commercial demand for PeCB, no alternatives have been identified or developed. For the production of quintozone, an alternative process using the chlorination of nitrobenzene is available.

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

No discernible negative impacts on society have been reported from prohibition or phasing-out PeCB within the UNECE region. Most uses seem to be phased out world wide, except possibly for quintozone production and use. The information provided does not allow a conclusion to be drawn on PeCB use in producing quintozone worldwide. A listing in Annex A would phase out that potential use and prevent future production. This would therefore prevent negative impacts on public, environmental and occupational health that would accrue from any future production or use of PeCB. Costs could arise from elimination of unknown production, use and potential disposal of remaining stocks of quintozone. The costs are expected to be limited based on the data in the UNECE management options (UNECE, 2007), and the information provided by the various countries, IPEN and the World Chlorine Council in the Annex F information request. However, at present it is not possible to provide a quantitative estimate on these costs.

2.3 Un-intentional point sources

2.3.1 Identification of possible control measures

PeCB is formed as an unintentional by-product of large scale combustion processes and industrial processes and its formation and release can be reduced by abatement techniques and legislation. An Annex C listing would subject PeCB to the measures under Article 5 of the Convention and establish the goal of continuing minimization and, where feasible, ultimate elimination of PeCB releases. This would include an obligation to promote best available techniques and best environmental practices for PeCB sources.

For PeCB formed as a by-product in combustion processes, there is a clear relation to HCB and PCDD/F releases formed by combustion. Most measures taken to reduce PCDD/F releases will undoubtedly lead to a significant reduction of the releases of PeCB. There is no specific information available on measures taken to reduce HCB releases.

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

Comprehensive data on releases of PeCB from incineration and thermal processes and on the effectiveness of control are not (yet) available. Best available techniques (BATs) and Best Environmental Practices (BEP) relevant to unintentionally produced POPs for various types of incinerators and other thermal sources are very well documented in the Stockholm Convention BAT/BEP Guidelines (2006) and the reference document (BREF) of the EU (EC, 2006).

In state-of-the-art incineration and other combustions processes good combustion is determined by the so-called '3-T criteria': high Temperature, good Turbulence and sufficient residence Time. Incinerators complying with the EU legal requirement of the limit value for PCDD/Fs (0.1 ng/m³) apply optimal combustion conditions in combination with abatement techniques. Under such optimal combustion conditions and with optimal abatement techniques, releases in stack gases of organic compounds can be minimised. Hence, incinerators complying with the demand of the low PCDD/F releases will undoubtedly minimize the releases of PeCB. Efficiencies similar to that of dioxins (> 99.9%)

can be obtained, e.g. in the case of catalytic destructions above 300° C (Sakurai and Weber, 1998) or the use of carbonaceous adsorbents as cleanup of flue gases (EC, 2006).

However, different releases of PCDD/Fs and PeCB formed in *de novo* synthesis in the flue gas might still be possible and will depend on the type of the abatement technology, applied for the specific emission reduction of PCDD/Fs. A variation between the correlation of releases of PeCB and PCDD/Fs from various incinerators has been observed (Lavric et al., 2005) and there is conflicting information about effectiveness for various abatement techniques (Liljelind et al., 2001). In addition, due to the relatively high volatility of PeCB in comparison to PCDD/Fs the adsorption to particles will be distinctly less, and, therefore PeCB will be more present in the gas phase in comparison to PCDD/Fs (Chen et al., 2007). Hence, abatement techniques focused at the elimination of dust might have a somewhat lower efficiency for the removal of PeCB formed *de novo* in the flue gas.

In conclusion, waste incinerators fulfilling the conditions for PCDD/Fs described above will usually have a comparable low emission level for PeCB. Hence, the use of state-of-the-art waste incinerators and inherent abatement technologies can be recommended in order to reduce the emission of PeCB during combustion in incinerators.

2.3.3 Information on alternatives (products and processes)

Alternatives and methods to reduce persistent organic pollutants when formed and released unintentionally from anthropogenic sources are dealt with under UNEP guidelines (2006).

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

Countries already have obligations to implement control measures for other un-intentionally produced POPs (HCB, PCBs, PCDD/F) under the Convention. These may for a large part be similar to those for PeCB. Measures to reduce un-intentional releases of PeCB through listing in Annex C would positively impact human health and the environment.

2.4 Un-intentional diffuse sources

2.4.1 Identification of possible control measures

For these sources abatement techniques are not feasible and emission reduction measures could consist of legislation and providing information and public education by national and local authorities.

PeCB can be found as an impurity in several biocides and pesticides currently in use. The relative contribution of PeCB as an impurity in quintozone to total releases has been provided in 2.1.2. The other pesticides reported to contain PeCB are expected to have a much smaller impact. HCB products, which could contain up to 1.8% PeCB are already in the Convention and efforts to reduce and eliminate HCB may also reduce PeCB from this source. PeCB has been detected as an impurity in technical grades of endosulfan, chlorpyrifos-methyl, atrazine, and clopyrilid at concentrations of 0.25 to 6 ppm (US EPA, 1998). The source of the PeCB is not clear, since it is chemically unrelated to the other substances. If endosulfan is added to the Convention, actions taken to eliminate or restrict its use will subsequently affect the related PeCB releases. In cases where PeCB is found as an impurity of biocides and pesticides whose use is continuing further legislative measures could be taken to reduce the amounts of impurities.

An Annex C listing would subject PeCB to the measures under Article 5 of the Convention and establish the goal of continuing minimization and, where feasible, ultimate elimination of PeCB releases. This would include an obligation to promote best available techniques and best environmental practices for PeCB sources, including municipal solid waste incineration, hazardous waste incineration, magnesium production, wood treatment plants, barrel burning, open fire places and forest burning for agricultural purposes. For example open burning can be prohibited or permitted only under pre-approved conditions (see Annex F submission of Canada).

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

The PeCB emission as a result of impurities in several biocides is very small and restriction and control of these biocides have the effect of reducing PeCB releases. Control measures to reduce the amount of PeCB in these biocides may also be an effective measure. However, considering the amount of PeCB present as impurity, these additional measures are not likely to have a significant impact.

Listing PeCB in Annex C will involve control measures that are familiar to countries since they already have obligations for unintentionally-produced POPs under the Convention and will not lead to additional cost.

2.4.3 Information on alternatives (products and processes)

Biocides or pesticides without PeCB impurities can be used as alternatives. Non-chemical alternatives may also be available. For the production of quintozone another process without PeCB is already available and implemented by quintozone producers. This example shows that other production techniques can be a good alternative. An assessment of other biocides and pesticides and non-chemical techniques goes beyond the scope of the risk management evaluation and is not needed because additional measures are not considered.

Alternatives and methods to reduce persistent organic pollutants when formed and released unintentionally from anthropogenic sources are dealt with under the Stockholm Convention BAT/BEP guidelines of the UNEP (2006) and BREFs (BAT reference documents) of the EU (EC, 2006).

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

Listing in Annex C would mean that PeCB would become subject to measures that prevent, reduce or eliminate its formation and release. The control measures under the Convention for other unintentionally produced POPs (PCDD/F, HCB, and PCBs) could be applied also to unintentionally released PeCB. Monitoring, enforcement and supervision could lead to additional costs.

2.5 Other considerations

Information on public information, control and monitoring capacity has been provided by Armenia, Canada, the Czech Republic and Moldova.

In Armenia information to the public is provided through a national electronic database on legislative documents (IRTEC), through the journal "Official bulletin" where relevant normative-legislative documents are published by the Centre for Monitoring of Environmental Impacts, as well as through annual statistical reports.

In Canada public access to risk management information on PeCB is available on Environment Canada's Management of Toxic Substances Web Site at http://www.ec.gc.ca/TOXICS/EN/detail.cfm?par_substanceID=188&par_actn=s1. Links are provided regarding sources of the substance, risk assessments, and the risk management strategy, tools, and activities.

Various initiatives that indirectly contribute to reductions in the PeCB emissions in Canada are:

- the Canada-wide Standards for dioxins and furans;
- the regulatory approaches in other Canadian jurisdictions to either prohibit open burning, or permit it only under pre-approved conditions;
- proposed revisions to the PCB regulatory framework;
- the Wood Preservation Strategic Options Process; and
- the regulations for the control of tetrachloroethylene from the dry-cleaning sector.

Further details on measures by Canada can be found in the information on unintentional release submitted by Parties and observers during the intersessional period between the 3rd and 4th session of the POPRC, as contained in the annex to the risk profile.

In the Czech Republic information on PeCB is part of the SC/UNECE CRLTAP³ education and awareness raising campaign under the national implementation plan.

PeCB is not monitored for in Moldova. Access to information and public education is part of the national strategy on the reduction and elimination of POPs and the national implementation plan of the Stockholm Convention.

3. Synthesis of information

According to the risk profile, PeCB meets all screening criteria, i.e. long-range environmental transport, bioaccumulation, persistence and toxicity. Generally, environmental concentrations seem to be decreasing. In the past, PeCB was used in PCB products employed for heat transfer, in dyestuff carriers, as an intermediate for the manufacture of quintozene, as a fungicide and as a flame retardant. Based on all available information, there is no indication that production or intentional use of PeCB still takes place.

PeCB is currently not included in any international convention. The European Commission has submitted a proposal to include PeCB to the Protocol to the 1979 Convention on Long Range Transboundary Air Pollution (LRTAP). The manufacture, use, sale, offer for sale and import of PeCB is banned in Canada. International actions taken to eliminate the use of PCBs will subsequently eliminate the use of PeCB for this application. Also the use of quintozene is prohibited in many countries.

In this risk management evaluation an overview of emission sources of PeCB of current activities and related possible emission reduction measures is given. Nowadays PeCB is only intentionally used in laboratory applications. According to Article 3.5, laboratory use is excluded from the Stockholm Convention. Unintentional release of PeCB as a by-product of incomplete combustion appears to be the largest current source. Unintentional anthropogenic sources can be divided into point sources and diffuse sources. As regards point sources, combustion processes and industrial processes are probably the most relevant. Releases from these sources can be controlled by abatement and

substitution techniques and/or legislation. The most relevant diffuse sources are (a) as an impurity in products such as, solvents, pesticides and wood preservative products, (b) small scale combustion such as barrel burning and open fire places, (c) accidental fires and (d) forest burning (for example for agricultural purposes). For these sources abatement techniques are not feasible and emission reduction measures can only be enacted by legislation and/or providing information and education by national and local authorities. Natural sources (forest fires) might contribute to the worldwide emission of PeCB. Note that natural sources are excluded from the Convention.

PeCB and HCB have many similarities. Both chemicals have intentionally been used in the past for example as biocide and both chemicals are un-intentionally formed as by-products of combustion. HCB is already listed on Annex A and Annex C of the Stockholm convention.

To prevent present use and re-introduction of intentional use, listing PeCB in Annex A without any specific exemptions could be the primary control measure for intentional sources under the Convention. As the current information sources do not suggest large scale production and use of PeCB, limited discernible negative impact on society is expected. A listing in Annex A would prevent future production and integration into products. This would therefore prevent negative impacts on public, environmental and occupational health that would accrue from any future production or use of PeCB.

Listing in Annex C would mean that PeCB would become subject to measures that prevent, reduce or eliminate its formation and release. This would include an obligation to develop an action plan and to promote best available techniques and best environmental practices for PeCB sources, applying the guidelines on BAT&BEP developed under the Convention.

Countries already have obligations under the Convention to take these control measures for other unintentionally produced POPs (PCDD/F, HCB, and PCBs). For PeCB formed as unintentional by-products in combustion processes, there is a clear relation to HCB and PCDD/F releases formed by combustion. Most measures taken to reduce PCDD/F releases will lead to significant reduction of the PeCB releases. The action plans developed under Article 5 of the Convention to minimize and where feasible eliminate releases of these substances would therefore also address PeCB.

Listing of PeCB in Annex C would oblige Parties to include PeCB in their report of unintentional releases submitted pursuant to Article 15. This could be facilitated by inclusion of PeCB emission factors in the Standardized Toolkit for Identifying and Quantifying Releases of Dioxins and Furans if these factors can be developed for the various source categories.

4. Concluding statement

Having evaluated the risk profile for PeCB the Committee concludes that this chemical is 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.

The Committee prepared this risk management evaluation and concluded that although PeCB is not known to be currently produced or used, it is important to prevent its re-introduction into commerce and use. Like HCB, PCBs and dioxins/furans, PeCB is formed as an unintentional by-product of combustion and other thermal processes and industrial processes. Most measures to reduce unintentional releases of dioxins will lead to significant reduction of the PeCB releases.

Therefore, 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 of PeCB in Annexes A and C.

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