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**Persistent Organic Pollutants Review Committee**  
**Fifth meeting**  
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**Report of the Persistent Organic Pollutants Review Committee  
on the work of its fifth meeting**

**Addendum**

**General guidance on considerations related to alternatives and  
substitutes for listed persistent organic pollutants and candidate  
chemicals**

At its fifth meeting, the Persistent Organic Pollutants Review Committee adopted general guidance on considerations related to alternatives and substitutes for listed persistent organic pollutants and candidate chemicals, on the basis of the draft guidance contained in document UNEP/POPS/POPRC.5/6 as amended during the meeting. The text of the guidance as adopted is set out below.

# **General guidance on considerations related to alternatives and substitutes for listed persistent organic pollutants and candidate chemicals**

Prepared by the ad hoc working group on  
substitution and alternatives  
of the Persistent Organic Pollutants Review Committee  
of the Stockholm Convention

**October 2009**

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## Terminology

1. The term “listed persistent organic pollutants” as used in the present document refers to chemicals listed in the annexes to the Stockholm Convention on Persistent Organic Pollutants. The term “candidate chemicals” refers to chemicals that have been proposed for inclusion in the annexes in accordance with article 8 of the Convention.
2. In the Convention, and in the present document, the term “alternative” is used to denote a chemical, material, product, product design, system, production process or strategy that can replace listed persistent organic pollutants or candidate chemicals, or materials, products, product designs, systems, production processes or strategies that rely on listed persistent organic pollutants or candidate chemicals, while maintaining an acceptable level of efficacy.<sup>1</sup>
3. “Technical feasibility” is the practicability of applying an alternative technology that currently exists or is expected to be developed in the foreseeable future. “Efficacy” is how well an alternative performs, including any potential limitations. “Availability” is the extent to which an alternative is on the market or is ready for immediate use. “Accessibility” is the ease with which an alternative can be obtained and used, given geographic, legal or other limitations.

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<sup>1</sup> The word “substitute” appears once in the Convention (in paragraph (c) of article 5) and both “substitute” and the word “replacement” appear in various other relevant documents and instruments. Both words as so used have substantially the same meaning as the word “alternative” as defined above.

## 1. Background and objectives

4. The present document is intended to provide general guidance on the identification and evaluation of alternatives to the chemicals listed in the annexes to the Stockholm Convention or proposed for listing in the annexes.

5. The Persistent Organic Pollutants Review Committee agreed at its fourth meeting that a guidance document should be prepared that would describe the issues relating to alternatives and indicate the considerations related to persistence, bioaccumulation, potential for long-range environmental transport and adverse effects that should be taken into account when dealing with possible alternatives. The Committee established an intersessional working group on alternatives and substitution, which took up the task of preparing such a document.

6. At its fifth meeting, the Committee adopted the present document on the basis of the draft contained in document UNEP/POPS/POPRC.5/6, which had been developed by the intersessional working group.

### 1.1 Evaluation of alternatives to chemicals proposed for listing in the annexes to the Stockholm Convention

7. Under the Stockholm Convention any Party may submit a proposal for listing a new chemical in Annexes A, B or C to the Convention. It is the task of the Persistent Organic Pollutants Review Committee to determine whether a chemical proposed for listing satisfies the screening criteria for inclusion listed in Annex D to the Convention (persistence, bioaccumulation, potential for long-range environmental transport and adverse effects). If the Committee concludes that the chemical does satisfy those criteria it must then consider the proposal further and prepare a recommendation, for the consideration of the Conference of the Parties, on whether the chemical should be listed in the annexes to the Convention. Its next step in developing that recommendation is to prepare a document known as a "risk profile". The risk profile contains information, as specified in Annex E to the Convention, on whether a candidate chemical has the characteristics of a persistent organic pollutant such that global action is warranted. If the Committee determines that the chemical does have those characteristics, it then prepares a "risk management evaluation", a document containing information, as specified in Annex F to the Convention, on social and economic considerations associated with possible control measures (technical feasibility and environmental and health costs of possible control measures, alternatives, social and economic impacts, waste and disposal implications, etc.).

8. During the risk management evaluation phase, Parties and observers are invited to provide, among other things, information on alternatives (including products and processes), including information relating to technical feasibility; cost, including environmental and health costs; efficacy; risk; availability; and accessibility.

9. Based on the information received, the Committee may recommend that the Conference of the Parties should consider listing the candidate chemical in Annexes A, B or C to the Convention. The Committee may also recommend control measures for the chemical, such as prohibition of production and use or reporting requirements.

10. The Convention also contains additional provisions on information related to alternatives:

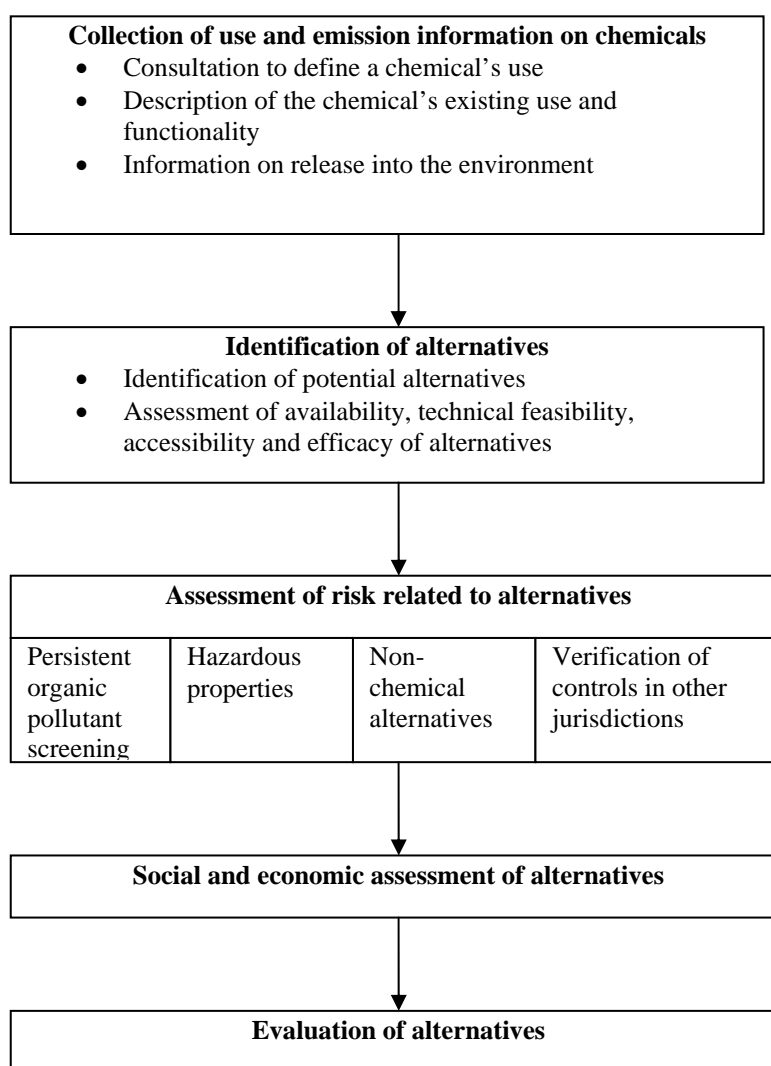
- Pursuant to article 9 each Party to the Convention is to facilitate or undertake the exchange of information relevant to "alternatives to persistent organic pollutants, including information relating to their risks as well as to their economic and social costs";
- Under article 10 each Party, within its capabilities, is to promote and facilitate "development and implementation, especially for women, children and the least educated, of educational and public awareness programmes on persistent organic pollutants ... and on their alternatives". Such programmes may include the use of safety data sheets, reports, mass media and other means of communication, and may establish information centres at the national and regional levels;
- According to article 11 Parties, within their capabilities, are to "encourage and/or undertake appropriate research, development, monitoring and cooperation pertaining to persistent organic pollutants and, where relevant, to their alternatives and to candidate persistent organic pollutants".

## 1.2 Objectives of the guidance

11. The aim of the present guidance document is to assist in the analysis of products and processes that could serve as alternatives to listed persistent organic pollutants or candidate chemicals. The guidance focuses primarily on the chemicals listed in Annexes A or B, i.e., intentionally produced substances. It may, however, also be applied in identifying and evaluating techniques that could reduce releases of unintentionally produced persistent organic pollutants (Annex C). Moreover, the guidance may be useful in the consideration of specific exemptions or other measures to eliminate or restrict persistent organic pollutants, or more generally in the consideration by Parties of policies to reduce the risk to human health and the environment posed by hazardous substances.

12. The guidance provides a general description of the issues to be considered in identifying and evaluating alternatives to listed persistent organic pollutants and candidate chemicals. It is not intended as a determination of the feasibility or availability of alternatives to specific substances. Neither is it intended to overrule any national or regional guidelines or criteria. It is intended for use by the Persistent Organic Pollutants Review Committee and by Parties when considering the listing of new persistent organic pollutants. It may also be useful for manufacturers or users of listed persistent organic pollutants and candidate chemicals in identifying and deploying alternatives.

13. The steps in the identification and evaluation of alternatives are shown in the figure below.



**Figure: Steps in the identification and evaluation of alternatives**

14. It must be recognized that developing countries and countries with economies in transition may often require financial and technical assistance to participate effectively in the collection of information relating to the use, identification, evaluation and deployment of alternatives as described above.

## 2. Collection of use and emission information

### 2.1 Consultations for defining the use of listed persistent organic pollutants and candidate chemicals

15. The first step in identifying and evaluating alternatives is to collect information on the use categories<sup>2</sup> for listed persistent organic pollutants and candidate chemicals. Without a full picture of the life cycle of these chemicals, it would be impossible to discuss their alternatives. Consultations aimed at collecting such information should be undertaken, preferably during the development of the risk profile (collection of Annex E information). If the information in the risk profile is insufficient, information on social and economic considerations should be collected during the preparation of the risk management evaluation (collection of Annex F information). If possible, the percentage of the total use of the chemicals should be identified for each use category.

16. National or, where appropriate, international consultation is needed to collect information on:

- Production and import of chemicals and products that contain them;
- Ways in which chemicals and products containing them are used in industrial processes or other practices, including the functions and features of the chemicals that render their use necessary (including technical, economic and social considerations);
- Potential emission of chemicals into the environment (including during the waste and recycling stages in their life cycles).

17. Consultations should be undertaken with, among others, manufacturers, importers, industrial users (downstream users) and waste collection and disposal firms. Sending a questionnaire to companies and industrial associations is a good means of consultation (see box below for an example). Successful consultations require that those from whom information is being sought be given a clear explanation of why and how urgently requested information is needed and what use will be made of it, including by the Persistent Organic Pollutants Review Committee, the Conference of the Parties and national authorities. Interviews with experts in industrial sectors, academic institutions and Governments may also contribute to a better understanding of a chemical's use.

18. More guidance on how to collect information on the production and use of chemicals is included in the handbook for effective participation in the work of the Persistent Organic Pollutants Review Committee, which is available on the Stockholm Convention website.

19. Information on uses and releases of any chemical that is under review by the Committee may be found in the risk profile and risk management evaluation for the chemical.

#### **Example of consultation arrangements: survey by the expert committee of the Government of Japan**

The Government of Japan established an expert committee, chaired by the Japanese member of the Persistent Organic Pollutants Review Committee, to review information on candidate chemicals, to develop a national submission to the Committee and to perform other preparatory work for the Committee's discussions on alternatives. The expert committee conducted a survey among users and producers of candidate chemicals with regard to:

- Use, application and function of candidate chemicals;
- Emission to the environment and its management;
- Availability of potential alternatives;
- Specification of essential use and its purpose (e.g., results from the consideration of social and economic impacts).

In preparing Japan's submission on alternatives the expert committee considered only the information provided through this survey and existing information.

<sup>2</sup> A use category is a grouping individual uses of a proposed chemical based upon similarity of function and application. For example, flame-retardant polyurethane foam cushioning is a use category for pentabromodiphenyl ether (pentaBDE). Since flame-retardant polyurethane is used as a flame retardant in many products (e.g., chairs, sofas and mattresses), all those uses fit within a single use category: "flame-retardant polyurethane foam".

## 2.2 Description of the existing use of listed persistent organic pollutants and candidate chemicals

20. It is important to describe the use and functionality of listed persistent organic pollutants and candidate chemicals as specifically as possible. The Persistent Organic Pollutants Review Committee needs information on specific uses for its consideration of the social and economic implications of the listing of chemicals in the annexes to the Convention. In addition, without such specific information, it would be impossible to describe the specific exemptions in Annexes A or B to the Convention.

## 2.3 Information on releases into the environment

21. Information on releases of listed persistent organic pollutants and candidate chemicals into the environment is important when evaluating the need for alternatives. Although it may be difficult to estimate the quantity of environmental releases, at least qualitative consideration should be given to whether significant quantities of a chemical are released into the environment.

22. A first qualitative consideration may be to determine whether chemicals are used, or can be used, in a closed industrial process. If they are used in closed systems and do not remain in the final product, there is less concern about releases into the environment than there would otherwise be, except for accidental releases. In contrast, if they are contained in final products intended for dispersive use (such as paints, detergents, adhesives and pesticides), it should be assumed that all or most of them may be released into the environment. If they remain in products not intended for dispersive use, such as industrial lubricants and insulators, it should be assumed that some environmental releases will occur at the use, recycling and waste disposal stages.

23. Quantitative information on estimated releases from point sources may be obtained from pollutant release and transfer registers or emission inventories. Existing risk assessment documents may also contain such information. If such data are unavailable, releases of a given chemical may be estimated by applying emission factors to the volume of that chemical produced or imported or performing a mass balance on the amount of the chemical produced or bought and sold.<sup>3</sup>

24. Environmental monitoring data, human biomonitoring<sup>4</sup> data and emission measurement data are also good sources of information. Environmental monitoring and human biomonitoring may be used to identify unknown releases into the environment and to evaluate the accuracy of emissions estimates through a comparison of concentrations estimated by exposure models with measured data. Emission measurements contribute to a more precise estimation of releases from point sources.

## 3. Identification of alternatives

### 3.1 Identification of potential alternatives

25. The second step in the identification and evaluation of alternatives is to compile a list of potential alternatives that can perform a function equivalent to that of the listed persistent organic pollutant or candidate chemical to be replaced. The list should include not only alternative chemicals that can be used without major changes in products or processes in which they are used, but also innovative changes in the design of products, industrial processes and other practices that do not require the use of listed persistent organic pollutants or candidate chemicals.

26. Information useful for the identification of alternatives may be collected through consultations with relevant industry constituencies, including manufacturers, industrial users and end-users, in a way similar to that described in subsection 2.1. End-users of products that contain listed persistent organic pollutants or candidate chemicals are essential sources of information on alternatives because they are in the best position to select alternatives that do not contain those chemicals. End-users constitute a broader category than industrial users and include farmers, hospitals, retailers, Governments and original equipment manufacturers.<sup>5</sup> In these consultations, care should be taken to handle confidential business information appropriately, since disclosure of such information may result in a loss of

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3 Emission scenario documents produced by the Organization for Economic Cooperation and Development provide quantitative information for estimating releases of chemicals (see reference list, OECDa).

4 "Biomonitoring is the measurement of a chemical, the products it makes after it has broken down, or the products that might result from interactions in the body. These measurements are usually taken in blood and urine and sometimes in other tissues such as hair, saliva and breast milk." (Health Canada 2007).

5 Information from general consumers could be collected through retailers, consumer groups or Governments.



competitiveness and thus hinder innovation in the development of alternatives. Parties are encouraged to address confidential business information restrictions when they prevent end-users from choosing products that do not contain listed persistent organic pollutants or candidate chemicals and hinder the selection of safer alternatives. Information from literature and experience from regulation may be useful in identifying possible alternatives. Consultation meetings involving experts from industry, academics and regulatory authorities may be a good means of identifying possible alternatives.

27. Non-chemical alternatives, i.e., measures that do not rely on the use of chemicals, are also included among potential alternatives. Non-chemical alternatives include alternative industrial processes and innovative practices. An example from agriculture is integrated pest management, whereby physical, mechanical and biological methods are used as alternatives to pesticides. Identification of alternatives to pesticides could include consideration of the potential development of pest, pathogen or weed resistance to an alternative chemical or practice.

### **3.2 Assessment of the availability, technical feasibility, accessibility and efficacy of alternatives**

28. Alternatives need to be available, technically feasible, accessible and efficient. In consideration of chemicals for inclusion in the annexes to the Convention and in the identification of specific exemptions, the availability, technical feasibility, accessibility and efficacy of potential alternatives should be assessed.

29. The commercial availability of an alternative is an important indicator of technical feasibility. If alternatives are used by some companies there is a good prospect that they are available and technically feasible for others. It may not always be feasible, however, for some companies to adopt such alternatives for technical reasons or owing to lack of awareness, including in cases of confidential business information, intellectual property rights, or other reasons. Chemicals or processes used in a given type of products or industrial sector may be suitable alternatives in another; in such cases, however, there may be technical and other challenges that require time to surmount. Some potential alternatives may be less feasible in the short term, for example when they are at the research and development stage.

30. Information on the availability and technical feasibility of alternatives can be collected during stakeholder consultations, as described in subsection 3.1.

### **3.3 Stimulation of innovation in the development of new and safer alternatives**

31. Efforts to replace listed persistent organic pollutants and candidate chemical should not stop at the identification of existing alternatives, but should also stimulate innovation in the development of new and safer alternatives. To foster an environment conducive to such innovation, national and international policies should send a clear message that alternatives are strongly needed for the protection of human health and the global environment; intellectual property rights should be properly protected to maintain the incentives needed for the development of alternatives; obstructions to innovation, such as delays in regulatory procedures, should be minimized; and international and cross-sectoral cooperation should be promoted.

## **4. Assessment of risks related to alternatives**

32. The objective of promoting the use of alternatives under the Convention is to protect human health and the environment. Simply replacing persistent organic pollutants with other hazardous chemicals should therefore be avoided and safer alternatives should be pursued. What is termed a “safer alternative” is an alternative that either reduces the potential for harm to human health or the environment or that has not been shown to meet the Annex D screening criteria for listing a chemical under the Convention as a persistent organic pollutant. To ensure that a potential alternative leads to the protection of human health and the environment, a risk profile for the chemical being considered should be developed to assess whether it is safer than persistent organic pollutants. Although a comprehensive risk assessment may be impossible if there is a lack of information on its hazardous properties or exposure data, a simple analysis of risk should be performed, taking into account the weight of available evidence.

#### **4.1 Application of persistent organic pollutant screening criteria**

33. First, it should be confirmed that an alternative does not lead to the use of other chemicals that have the properties of a persistent organic pollutant. Therefore an alternative should not meet the Annex D screening criteria for listing a chemical under the Convention as a persistent organic pollutant (persistence, bioaccumulation, potential for long-range environmental transport and adverse effects).

#### **4.2 Further considerations**

34. Even if the alternative does not contain, use or lead to the formation of other chemicals with the characteristics of a persistent organic pollutant, it may lead to increased risk to human health and the environment, depending on its hazardous properties and exposure conditions.

35. Ideally, human health and environmental risks should be quantitatively assessed, using hazard data and an estimate of exposure, including a comparison of toxicity or ecotoxicity data with detected or predicted levels of a chemical resulting or anticipated to result from its long-range environmental transport, as stated in paragraph 2 of Annex D to the Convention. Such a full risk assessment may be impossible, however. Where that is the case, efforts should be made to collect information to ensure that:

- The alternative chemical does not have hazardous properties that raise serious concern, such as mutagenicity, carcinogenicity or adverse effects on the reproductive, developmental, endocrine, immune or nervous systems;
- The risk resulting from the use of the alternative is considerably lower than that resulting from the use of persistent organic pollutants, in view of its known hazardous properties and exposure conditions.

36. Attention should be paid to the potential for harm under actual conditions of use by consumers and indications that the processing or manufacturing conditions of the alternative might increase health risks of factory workers.

#### **4.3 Development of safer alternative products and processes**

37. The previous subsections describe the issues to be considered in the assessment of existing alternatives. The same issues, however, should be considered in the development of new alternatives. It is therefore recommended that the hazardous properties (especially persistent organic pollutant properties) of possible alternatives be assessed at the development stage, taking into account varying exposure conditions.

#### **4.4 Qualitative and quantitative structure–activity relationship models**

38. Qualitative and quantitative structure–activity relationship (QSAR) modelling is a method of estimating the physical and chemical properties of a substance, including toxicity, from its molecular structure. Using QSAR techniques, chemical hazard information can be obtained relatively quickly and cheaply. Models employing QSAR techniques can be used for screening hazardous chemicals and aiding in the prioritization of potential alternative chemicals through a review of their risks. General guidance documents on QSAR, and guidance and training materials for the QSAR application toolbox, have been developed by the Organization for Economic Cooperation and Development and are available on that organization's website (see reference list, OECDb).

39. QSAR models are especially apt for:

- Pre-selection and selection of chemicals to be used in original innovation processes (operational product and process development);
- Synthesis and development of chemicals;
- Sustainable design and selection of sustainable uses of chemicals.

40. QSAR modelling is already used by large industrial enterprises as a screening instrument in product development, demonstrating its potential as a methodology for screening alternatives. Although currently available QSAR information on sustainable design and selection of alternative products and processes for small and medium enterprises is lacking, such information is valuable in that it can lead to an immediate reduction in costs.

## 5. Social and economic assessment of alternatives

41. Alternative products and processes may lead to human health and environmental economic benefits, but may also result in increased costs. The economic impacts of alternatives, in terms of costs and benefits, should therefore be considered in social and economic assessments.

42. Characterizing the social and economic implications of an alternative varies according to whether the chemical to be replaced has already been largely phased out or remains in use. For those that have been phased out, alternative chemicals, products or processes are presumably already in use. This implies that they are available, accessible and economically feasible. Any assessment of availability and accessibility should investigate not only the current market situation, but also whether future availability and accessibility will remain the same. Future demand for and supply of an alternative need to be assessed to determine whether the chemical remains a viable alternative in terms of availability and accessibility.

43. Any constituents within a Party, such as regulatory authorities, local governments, academics or industry groups may conduct a social and economic assessment of alternatives for the elimination or restriction of persistent organic pollutants. Any such assessment should be carried out for entities that directly and indirectly run risks and receive benefits, such as manufacturers, processors and end-users. Characterizing the social and economic implications of prohibiting listed persistent organic pollutants and candidate chemicals should take into account the following factors if relevant information is available: the incremental cost to users of replacing a listed persistent organic pollutant or candidate chemical with an alternative (including, where applicable, the redesign of a product to eliminate the need to use a listed persistent organic pollutant or candidate chemical; the cost of waste handling and management; and the cost incurred by national Governments related to regulation, enforcement and compliance activities. While the overall impact on society of switching from a chemical in use to an alternative may be economically beneficial or neutral, some variation in individual impacts is likely, with some stakeholders experiencing positive, and others negative, economic impacts.

### 5.1 Cost analysis

44. Ideally, cost assessments should be performed to estimate quantitatively the cost of the adoption of alternative products or processes. This includes the costs to both manufacturers and users. Manufacturers may incur additional costs through increased raw material prices, capital investment and changes to manufacturing processes. This may manifest as the difference in price between a listed persistent organic pollutant or candidate chemical and the alternative. The cost to users may include, in addition to the extra production costs reflected in the higher price of an alternative, capital investment and operational costs resulting from any necessary changes in processes. Furthermore, if the performance of the alternative is lower than that of the listed persistent organic pollutant or candidate chemical, this may result in additional costs to the user. Assessments of cost should also take into account costs related to the application of the chemicals, for example waste disposal costs, the cost of remediating contaminated sites, health costs and any other social costs.

45. Where a quantitative cost assessment is not possible, cost should be assessed qualitatively. For example, stakeholder consultations may reveal that the cost of a chemical is negligible, minimal, considerable or prohibitive or that costs can be reduced by the adoption of alternatives. It should be noted that consumers can play a role in the adoption of alternatives if they are made aware of the presence of persistent organic pollutants, for example through product labelling. When alternatives become widely adopted, for example through informed consumer choice, the costs of alternatives are likely to decline as a result of economies of scale and increased market size. It is important to recognize that such costs decline relative to the cost comparisons applied at the moment of research.

### 5.2 Benefit assessments

46. Social and economic analysis is a tool for making a well-reasoned choice between various alternatives. This part of alternative assessment is complex and requires more than a simple consideration and comparison of costs related to replacing a chemical with an alternative. An adequate social and economic assessment should not only account for the costs of switching to an alternative, but also the benefits. "Benefits" are defined here primarily as benefits to human health and the environment. Benefits can, however, also arise from increased technical performance or reduced cost. Although it tends to focus more on "costs" rather than "benefits", social and economic analysis should be a general approach to analysing all relevant effects. Therefore the concept of "impact" could be used here to include both positive and negative changes achieved by using an alternative.

### 5.3 Comprehensive approach to social and economic assessment

47. The main difficulties encountered when undertaking a social and economic analysis lie in defining the relevant scenarios, particularly in relation to the likely response of relevant actors (including manufacturers and downstream users) and where each alternative identified is to be implemented. There is a further challenge in finding and using the most suitable data to estimate the impacts.
48. Social and economic analysis includes the following steps:
- Setting the scope of the analysis;
  - Assessing impacts;
  - Comparing impacts.
49. There are various types of impacts to be considered:
- Economic impacts: These include the cost difference (whether an increase or a decrease) between the chemical or specific use to be replaced and each alternative. There could be cost differences associated with each link in the supply chain; if so they should all be taken into account;
  - Human health and environmental impacts;
  - Social impacts: These are in many cases limited to possible employment effects. The potential adverse effects on some social groups should be considered, including in developing countries;
  - Wider economic impacts: These types of effects follow from the distribution of the economic effects and how the relevant markets function. For example, additional demand for safer alternatives could foster the development of new and innovative technologies, products and companies. Additional costs could also mean that some businesses or industries would face trade or competition issues that would reduce their activity.
50. Economic, human health and environmental impacts are likely to be the most significant and should therefore be assessed first. Analysis of social and wider economic impacts should follow on from the assessment of economic impacts, as the economic data gathered will provide the starting point for further analysis of employment, trade, competition and wider economic impacts.
51. It is important for all relevant impacts identified to be included, if not quantitatively then at least qualitatively. There should be no bias towards impacts that are quantitatively described simply because of the quantification (as impacts that cannot be described quantitatively may be of equal or greater importance). Impacts will ideally be described by quantitative data where suitable data sources exist and where such an analysis is proportionate. For impacts that are difficult to quantify and to monetize, for example, environmental and human health risks, this guidance includes suggestions on how to take the analysis of those elements as far as possible. There are references and links to possible external sources of data and valuations that can be applied.
52. In many cases impact will have to be assessed by using expert judgement. The very nature of expert judgement is such that it is difficult to provide guidance on how to exercise such judgement. What is important is transparency (for example with regard to what is included in the range of relevant information). If judgements are made, the assumptions behind them should be clearly stated.

## 6. Evaluation of alternatives

53. Parties providing information on alternatives to the Persistent Organic Pollutants Review Committee for its preparation of risk management evaluations in accordance with Annex F should present such information in a concise manner. The Committee will take such information into account in considering the feasibility and availability of identified alternatives as part of the process of deciding whether to recommend the listing of a chemical in the annexes to the Convention and whether to recommend any specific exemptions. An example of the evaluation of substitution is shown in the annex to this guidance.

54. Furthermore, after the Conference of the Parties makes its decision on listing chemicals in Annexes A, B or C, each Party will use such information on the potential alternatives in deciding whether it needs to register specific exemptions. When providing information<sup>6</sup> specified in Annex F, a Party requesting exemption for essential applications must ensure that the following information is supplied:

- A description of the functionality and use of the listed persistent organic pollutant or candidate chemical and clear identification of the use category;
- An explanation of why the exemption is technically or scientifically necessary and why potential alternatives are not technically or scientifically viable. This should include how the proposed use is distinct from other examples of alternatives for similar uses. If known, an assessment of what is in the research pipeline for alternatives should be provided;
- A description of potential alternative processes, products, materials or systems that eliminate the need for the chemical. The research should have a broader focus than simply chemical substitutes, and include alternative processes and products;
- A list of sources researched, which could include research and government institutions, relevant technical journals, patent searches, equivalent end-users, non-governmental organizations familiar with the proposed chemical and its end uses, and indigenous groups with traditional knowledge that may have alternative solutions;
- If possible a substitution plan should be provided, including steps that need to be taken to develop a viable substitute.

55. If a chemical is listed under the Convention with a time-limited exemption, Parties would benefit from being aware of new advances in the development of alternatives. Article 9 of the Convention encourages Parties to share information on alternatives to persistent organic pollutants, including information relating to their risks and their economic and social costs.

56. When collecting information for presentation to the Persistent Organic Pollutants Review Committee, Parties may take into account the following points, in addition to the information on the technical feasibility, costs, efficacy, risk, availability and accessibility of the alternatives, as outlined above:

- Human health and environmental benefits achieved by substitution through alternatives;
- Benefits deriving from the chemical, including consideration of whether it performs an essential function for human health and safety;
- Requirement of a transition period for adjusting downstream production processes to the alternative;
- Requirement of sound environmental management of waste arising from replacement of chemicals by alternatives;
- Application of the precautionary principle where scientific evidence is incomplete.

## 7. Conclusions and recommendations

57. The key messages of this guidance are summarized as follows:

- It is essential to identify the precise use and functionality of listed persistent organic pollutants and candidate chemicals, which requires information to be collected from various sources, mainly through consultations with industry and other stakeholders. The availability of alternative chemicals, products or processes can be determined by conducting a survey on which specific alternatives are feasible for what use;
- Although it may be difficult to implement fully risk assessment on alternatives, Parties should at least confirm that persistent organic pollutants are not substituted by others or by chemicals with concern of significant risk;

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<sup>6</sup> In principle, each Party needs to handle information provided by companies and other entities as confidential business information, but it should be noted that appropriate information disclosure to the public may be required, for example when a candidate chemical is used in a manner that poses a potential risk to public health.

- Although it is difficult to estimate precisely costs and benefits of alternatives, Parties should make every effort to collect information on social and economic impacts to evaluate cost-effectiveness for a particular use;
- Cooperative efforts are helpful to facilitate further dissemination of better and safer alternatives worldwide. The development of the present guidance under the auspices of the Persistent Organic Pollutants Review Committee is in itself one such cooperative effort.

## Annex

### Evaluation of alternatives

#### A. Example: Evaluation of the substitution of alternatives to hazardous chemicals in products and processes

Lohse et al. (2003) conducted 10 case studies on substitution of alternatives to hazardous chemicals, involving private sector organizations, authorities and other stakeholders, including trade unions, environmental non-governmental organizations and mass media. As a first step, all influence factors identified as important for the evaluation of case studies were classified into five main analytical categories with several subcategories, as shown in table A.1. Subsequently, the possible alternatives to a given chemical were narrowed down to the one considered the most important, to enable a direct comparison of the case studies.

**Table A.1: Analytical categories for evaluation of case studies**

Main category	Subcategories
Economy	<ul style="list-style-type: none"> <li>• Costs</li> <li>• Liability</li> <li>• Resources</li> <li>• Competition</li> </ul>
Technical functionality	<ul style="list-style-type: none"> <li>• Performance</li> <li>• Process integration and product quality</li> </ul>
Social factors	<ul style="list-style-type: none"> <li>• Public awareness</li> <li>• Business-to-business communication</li> </ul>
Risk information	<ul style="list-style-type: none"> <li>• Risk information on chemicals or product</li> <li>• Risk information on alternative</li> <li>• Shift of risks</li> </ul>
Regulatory framework	<ul style="list-style-type: none"> <li>• Legislation/regulation</li> <li>• Standardization</li> </ul>

In principle, the case studies were analysed assuming that substitution was a reasonable approach for reducing the risk posed by a chemical. The relevant factors influencing substitution were then characterized by + and – symbols according to their observed effect as either a promoting factor or as a barrier to substitution (table A.2).

**Table A 2. Definition of characterizing factors**

--	Strong hindering effect
-	Hindering effect
O	Neutral effect
+	Promotional effect
++	Strong promotional effect

For each case study, some factors exerted a stronger influence than others. The key influence factors are graded and indicated by grey shades, as shown in table A.3.

Table A.3. Key influence factors promoting or hindering substitution

Category	Case study									
	1 MPC	2 CF	3 TC	4 MAF	5 WP	6 FR	7 LL	8 MR	9 RB	10 PT
<b>Economy</b>										
-Costs	-	-	-	--	O	--	-	-	-	-
-Liability	-	O	-	-	O	O	-	-	O	O
-Resources	O	O	O	O	O	O	O	O	++	O
-Competition	O	O	O	-	O	O	O	O	+/-	O
<b>Technical function</b>										
-Performance	++	O	--	-	-	o	+	+	+	+
-Process integration and product quality	-	-	O	-	+	-	+	-	+	O
<b>Social factors</b>										
-Awareness (public)	+	O	+	++	++	+	-	-	+	++
-Communication (business to business)	+	-	O	O	+	-	+	O	O	O
<b>Risk information (RI)</b>										
-RI re chemical/product	++	O	+	++	++	+	+	O	++	+
-RI re alternative	-	+	-	-	-	-	+	+	+	O
-Shift of risks	-	-	+	-	-	-	+	O	+	O
<b>Regulative frame</b>										
-Legislation/regulation	+	+	O	++	++	+	O	+	++	+
-Standardization	O	O	O	+	-	--	-	O	O	O

<b>MPC</b>	Metal parts cleaning	<b>CF</b>	Cleaning of facades
<b>TC</b>	Textiles cleaning in laundries	<b>MAF</b>	Marine anti-fouling coatings
<b>WP</b>	Wood preservation	<b>FR</b>	Flame retardants
<b>LL</b>	Loss lubrication in inland water	<b>MR</b>	Mould release agents
<b>RB</b>	Rechargeable batteries	<b>PT</b>	Plastics/phthalates in toys

Note: The + and – symbols indicate the direction of the relevant influence factors promoting or hindering substitution. Neutral or non-existent effects (symbol “o”) are not further considered except for case study 2, facade cleaning. In this case the complete absence of public awareness makes it considerably more difficult to promote substitution.

## B. Example: Summarizing the information on potential alternatives

It would be useful to summarize the available information on alternatives as an overall assessment. This should give an overview of the knowledge on the risks to human health and the environment and on the economic feasibility of alternatives that are technically feasible and that deliver the same functionality as the chemical of concern. The authority may consider summarizing the available information in table form, as in table A.4.



**Table B.1. Example of a table for the evaluation of potential alternatives to [substance name] in [use] (Reference: European Chemicals Agency 2007)**

Parameter		Questions to be answered	Alt 1	Alt 2	Alt 3
Technical feasibility		Can the alternative perform the same functions as the substance in question?			
		Will the alternative require changes (in processes, equipment, storage facilities, training, etc.)?			
Availability	Current and future availability	Is it available in the required tonnage/amount in the European Union/worldwide?			
	Time frame	How fast could enterprises make the switch? What would be the down time, if any?			
Risk assessment	Human health	Information on the hazards, i.e., properties causing concern about the substance, to be restricted/other properties			
		Information on risks posed by properties causing concern about the substance to be restricted/other properties. Information on risks posed by the alternatives			
	Risk to the environment	Information on the hazards, i.e., properties causing concern about the substance to be restricted/other properties			
		Information on risks posed by properties causing concern about the substance to be restricted/other properties. Information on risks posed by the alternatives			
	Assessment of net risk	Would the alternative result in a sufficient reduction in the net risk? Are there new risks associated with the alternative?			
	Economic feasibility	Net costs	Net compliance and other costs (taking into account both increases and decreases in costs) faced by actors in each link of the supply chain		
Financial viability of the alternatives					
Ability of the different actors to pass costs down the supply chain					
Trade and wider economic and employment effects					
Uncertainties: what is the level of uncertainty in the assessment of the feasibility, risks and economic viability of alternatives?					

Note: The analysis presented in section A, "Example: Evaluation of the substitution of alternatives to hazardous chemicals in products and processes", could be summarized in this table with the use of crosses and minuses or "low-medium-high" or, in the case of costs and benefits, by providing the estimated monetary costs and benefits for each alternative, if such information is available. For the assessment of the overall uncertainty, "low-medium-high" indications may be provided for each alternative; a detailed discussion on uncertainty in the main text should also be provided.

Reference: European Chemicals Agency 2007.

## References and other sources

### References

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### Other useful information sources

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There are many references and tools on substitution and alternatives available on the website of the Intergovernmental Forum on Chemical Safety (IFCS).

Special references: [http://www.who.int/ifcs/documents/standingcommittee/substitution\\_references/en/index.html](http://www.who.int/ifcs/documents/standingcommittee/substitution_references/en/index.html).

Tools: [http://www.who.int/ifcs/documents/standingcommittee/substitution\\_tools/en/index.html](http://www.who.int/ifcs/documents/standingcommittee/substitution_tools/en/index.html).