

Labelling of products or articles that contain POPs – Initial considerations

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Aim of the Document

This document aims to provide some considerations on how to select and implement a national label system. It describes approaches to the labelling of POPs, whether as substances, mixtures or in articles, based on a range of voluntary or legally binding instruments. The target audiences are policy makers responsible for developing regulations for the management of POPs and authorities involved in the collection of information on POPs.

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Table of contents

Abbreviations and acronyms.....	4
1 Overview of the document.....	5
2 Available labelling systems.....	7
2.1 Systems to avoid the use of chemicals in mixtures and articles.....	7
2.1.1 EU restriction on the use of hazardous substances.....	7
2.1.2 Joint industry guide for material composition declaration for electronic products.....	7
2.1.3 Ecolabels.....	8
2.1.4 Other approaches.....	8
2.2 Labelling systems for chemicals and mixtures.....	9
2.2.1 Globally Harmonized System of Classification and Labelling of Chemicals.....	9
2.3 Labelling systems for chemicals in articles.....	10
2.3.1 Labelling of flame retardants in plastic materials used in articles.....	10
2.3.2 Labelling requirements for certain articles containing crocidolite asbestos in the European Community.....	10
2.4 Labelling systems for chemicals in a national inventory.....	11
2.4.1 Stockholm Convention labelling of PCBs.....	11
3 Development and implementation of labelling systems for POPs.....	12
3.1 Systems to avoid the use of POPs in mixtures and articles.....	13
3.1.1 EU RoHS Directive and the JIG.....	13
3.1.2 Ecolabelling.....	14
3.1.3 Other approaches.....	15
3.1.4 Summary.....	15
3.2 Labelling systems for POPs as chemicals and in mixtures.....	15
3.2.1 Globally Harmonized System of Classification and Labelling of Chemicals.....	15
3.3 Labelling systems for POPs in articles.....	17
3.3.1 Information through article number.....	18
3.3.2 Labelling of an article or component of an article.....	18
3.3.3 Provisions of ISO.....	19
3.4 Labelling/identification systems for POPs in a national POPs inventory.....	20
4 Conclusions.....	21

Abbreviations and acronyms

BFR	brominated flame retardant
CAS	Chemical Abstract Service
COP	Conference of the Parties
EEE	electrical and electronic equipment
ESM	environmentally sound management
FR	flame retardant
GEN	Global Ecolabelling Network
GHS	Globally Harmonized System of Classification and Labelling of Chemicals
ISO	International Organization for Standards
IUPAC	International Union of Pure and Applied Chemistry
JIG	Joint Industry Guide
PBB	polybrominated biphenyls
PCBs	polychlorinated biphenyls
PFOS	perfluorooctane sulfonic acid
PFOSF	perfluorooctane sulfonyl fluoride
POPs	persistent organic pollutants
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals (EU)
RoHS	Restrictions of the use of certain hazardous substances in electrical and electronic equipment
SAICM	Strategic Approach to International Chemicals Management
SDS	safety data sheet
UNRTDG	United Nations Recommendations on the Transport of Dangerous Goods – Model Regulations
WEEE	waste electrical and electronic equipment
WHO	World Health Organization
XRF	x-ray fluorescence

1 Overview of the document

The identification of products and articles that contain new POPs is a prerequisite for their environmentally sound management (ESM). The labelling of such products and articles represents an option for ensuring that information on their POPs content is clearly indicated and disseminated along the supply chain to stakeholders who can then implement appropriate management measures. Such labelling should take into account that stakeholders may be located in different countries due to the globalized nature of the supply chains of products and articles.

Although the Stockholm Convention mentions the need to label polychlorinated biphenyls (PCBs) in equipment (Annex A, Part II, para. a (i and ii)), suggests the use of safety data sheets (SDS) (Article 10, para. 4), and addresses hazard assessment (Annex E, para. (b)), it does not address a particular classification and labelling scheme for persistent organic pollutants (POPs).

Many countries have regulatory systems in place designed to protect human health and the environment from exposure to hazardous chemicals. These systems, however, are known to vary in content and approach across countries and regulatory authorities within a country (e.g. ministries of environment, labour, industry, agriculture, and consumer goods). Such differences may result in inconsistent application of guidelines, legislation, or voluntary approaches to labelling that offer variable protection for human health and the environment. A number of useful documents that address the question of how to communicate information on chemicals in products and articles to protect human health and the environment have been developed for the Chemicals in Products project — activities led by the United Nations Environment Programme (UNEP) in support of the corresponding Strategic Approach to International Chemicals Management (SAICM) emerging issue.¹

The wide number and variety of published classification and labelling systems that exist today have led to a range of national and international schemes with which industries producing chemicals may have to comply for export purposes. The elaboration of a harmonized hazard classification and labelling system was agreed on in Agenda 21 (UN, 1992, Chapter 19, area B, 19.29); after thorough discussion and debate, it was finally implemented as the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) by the United Nations Sub-Committee of Experts on the GHS (UN, 2003).² In its Overarching Policy Strategy, SAICM also refers to the need for the labelling of chemicals and a hazard communication mechanism that makes full use of the GHS.

Any system for classifying and labelling chemicals, whether as substances, mixtures, or in articles, could be based on and consider the following descriptive components:

- The aim, objective, content, and basis for the system including how it will be internationally harmonized and implemented.
- Whether the system is voluntary or legally binding.
- What will be labelled, how it will be undertaken, and, if legally binding, how it will be enforced?
- If the system is flexible enough to allow for the inclusion of chemicals under international treaties e.g. POPs.
- If training and awareness raising are a component of the system described.

The objective of this document is to provide Parties with some considerations on how to select and implement a national label system for products and articles that contain POPs by enhancing

¹ <http://www.unep.org/hazardoussubstances/UNEPsWork/ChemicalsInProductsproject/tabid/56141/Default.aspx>

² Globally Harmonized System of Classification and Labelling of Chemicals (GHS), *Fourth revised edition*, United Nations, New York and Geneva, 2011: http://www.unece.org/trans/danger/publi/ghs/ghs_welcome_e.html

understanding of the essential elements of different schemes and their value in facilitating management of POPs. The document includes elements on how to adapt existing international labelling schemes for use in labelling of products containing POPs.

Chapter 2 provides summaries of available classification and labelling systems around the world and addresses their relevancy to POPs. These systems are grouped under the following categories:

- Systems to avoid the use of chemicals in mixtures and articles (section 2.1)
- Labelling systems for chemicals and mixtures (section 2.2)
- Labelling systems for chemicals in articles (section 2.3)
- Labelling system for chemicals in a national inventory (section 2.4)

Chapter 3 provides specific considerations for the development of labelling systems for POPs and a set of elements to Parties and/or companies for their implementation, with specific reference to the systems outlined in chapter 2.

Chapter 4 outlines key conclusions and presents a checklist for classification and labelling approaches.

2 Available labelling systems

2.1 Systems to avoid the use of chemicals in mixtures and articles

2.1.1 EU restriction on the use of hazardous substances

The Restriction of Hazardous Substances (RoHS) Directive is a major piece of legislation (2002/95/EC) that came into force in 2006.³ It restricts the use and import into European Union (EU) member states of six hazardous substances in articles, such as new electrical or electronic equipment (EEE) incorporating a flame retardant. Since 2006, a series of Commission Decision amendments have been promulgated. The six restricted substances are lead (Pb), mercury (Hg), cadmium (Cd), hexavalent chromium (Cr), polybrominated biphenyls (PBB), and polybrominated diphenyl ethers (PBDE). Three new POPs are within this category, namely, hexabromodiphenyl and commercial pentabromodiphenyl ether (c-PentaBDE) and commercial octabromo-diphenyl ether (c-OctaBDE).

The EU has adopted the RoHS Directive to protect the employees of manufacturers and recyclers from exposure to these substances throughout the product life cycle.

Key elements of the RoHS Directive include:

- **An article with maximum allowable concentration value in homogeneous articles of 0.1% by weight (1000ppm) for PBB and PBDEs:** if this concentration is exceeded, the articles are not in compliance with the EU Directive, will not be permitted to be imported into the EU, and are placed on a register of non-conforming products.
- **Standard reference materials:** developed for analytical testing of articles and materials in the supply chain.
- **An EU Declaration of Conformity:** assured through the fixing of a legible and indelible “CE” mark; governments can take action if the label is awarded improperly.

Some countries, other than those supplying articles to the EU, have adopted the concepts of the RoHS for their own national markets.

The RoHS, which places the burden of proof on manufacturers inside and outside the EU, could form the basis for further development of compliance with import/export and transport regulations for additional POPs.

2.1.2 Joint industry guide for material composition declaration for electronic products

The Joint Industry Guide (JIG), a voluntary scheme⁴ organized through members of the Consumer Electronics Association, is implemented by approximately 2,000 companies in the United States (US) consumer technology industry. Its aim is to inform electrotechnical manufacturers within the global supply chain of the material composition of products, thus enabling companies to comply with requirements of the EU RoHS Directive and EU regulations on Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).⁵ A total of 58 problematic materials and substances, including several POPs (PFOS, PBDEs, and PCBs), are listed worldwide. Key elements of the JIG include:

³ Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment: <http://eur-lex.europa.eu/Notice.do?val=576071:cs&lang=en&list=576071:cs,&pos=1&page=1&nbl=1&pgs=10&hwords=&checktexte=checkbox&visu=#texte>

⁴ <http://www.ce.org/Standards/Standard-Listings/Joint-Industry-Guide/JIG-101-Ed-4-1.aspx>

⁵ Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93

- Suppliers are required to report the presence of problematic materials and substances
- The aim is to provide consistent and standardized material declarations across the supply chain
- Threshold limits of the problematic materials, or their absence, are declared
- Regulatory requirements by countries can be readily provided
- As the JIG is a voluntary scheme, governments are not involved

Although additional costs for inclusion of further POPs would be relatively small, the JIG only addresses one industrial sector and one step in the supply chain. Thus, while the potential for enforcement exists, it can only be compared with other voluntary industrial approaches.

2.1.3 Ecolabels

A variety of ecolabels, designed to be included on articles, have been developed by many countries that cooperate through the Global Ecolabelling Network (GEN)⁶, in part to compensate for the lack of internationally standardized information systems. Key elements include:

- Ecolabels are a voluntary approach to labelling
- There is no international standardization of the labels
- The labels are usually self-declared by industry
- The labels are awarded to products and services
- The labels are designed especially to indicate protection of environmental resources

Ecolabels typically do not contain specific information on the chemical content of a product, but might indicate what the article does not contain.

POPs are not usually specifically addressed in ecolabels, but the GEN could be asked to promote ecolabels that indicate an absence of POPs in a product.

2.1.4 Other approaches

POPs-free products and processes is a voluntary initiative initiated by the Secretariat of the Stockholm Convention⁷ to assist parties in meeting the obligations of Articles 9 and 10, which call for exchange of information on POPs substitutes and alternatives and on provision of POPs information to the public. The approach targets uses by industry and the public, and uses the concept of “POPs-free” in both the product and the product life cycle. The limit set for POPs-free products is 0.5mg/kg or 0.5 ppm for POPs, except for polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans where the detection limit is 0.1µg/kg or 0.1 ppb.

Key elements of this initiative are:

- The promotion of POPs-free products provides powerful incentives for sales of such goods.
- Alternatives to brominated flame retardants (BFRs) have been identified (Paxymer™)
- Alternative to pharmaceutical applications for lindane (LieMeister® comb) have been identified

and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC:

http://ec.europa.eu/environment/chemicals/reach/legislation_en.htm

⁶ <http://www.globalecolabelling.net/>

⁷ <http://chm.pops.int/Implementation/POPsfreeinitiative/tabid/2194/language/en-US/Default.aspx>

2.2 Labelling systems for chemicals and mixtures

2.2.1 Globally Harmonized System of Classification and Labelling of Chemicals

To unify the variety of international and national regulatory systems, the United Nations has developed the voluntary Globally Harmonized System of Classification and Labelling of Chemicals (GHS) (in its Third Revised Edition, 2009) for implementation in 2011-2012. This revised edition of the GHS has been harmonized with the United Nations Recommendations on the Transport of Dangerous Goods – Model Regulations (UNRTDG) (in its 16th Revised Edition, 2009), also for implementation in 2011-2012. The current Fourth Revised Edition of the GHS and the Seventeenth Revised Edition of the Transport of Dangerous Goods Regulations will be implemented in 2012-2014. The original GHS (2003) and its revised editions in 2005, 2007, and 2009 have provided guidance on the classification and hazard communication of substances and mixtures based on agreed definitions for all terms used in the system.

The GHS is an international harmonized standard for classification and labelling of chemicals and mixtures and hazard communication via safety data sheets but excluding articles. It is the predominant system for classification and labelling of chemicals as substances and mixtures and includes all POPs chemicals.

The classification system is based on 28 hazard classes comprising physical hazards (16 classes), human health classes (10 classes), and environmental hazards (2 classes: aquatic hazards, and recently hazards to the ozone layer). Divisions within the hazard classes constitute hazard categories. Both classes and categories constitute what are known as building blocks.

Countries adopt the number of hazard categories for each hazard class advanced in detail by the GHS according to their own chemical uses and regulatory requirements. The approach also includes standard hazard warning pictograms and “signal words” such as “danger” or “warning”. To assist with the classification process, the GHS provides a decision logic, or decision tree, for hazard classes and categories. When implementing the GHS, countries have the flexibility to determine which of the building blocks will be applied in different parts of their systems. Building blocks are, for example, hazard classes like acute toxicity, carcinogenicity, and hazard categories.

Once a substance has been classified, its hazards need to be communicated to the target audience, which may include industrial workers, farmers, consumers, first-response personnel, etc. The list of elements through the label for each hazard class includes:

- Allocation of label elements.
- Reproduction of the hazard pictogram, signal word, and hazard statement.
- Precautionary statements and pictograms.
- Product supplier information, International Union of Pure and Applied Chemistry (IUPAC) name, and Chemical Abstract Service (CAS) registry number.
- Multiple hazards and precedence of information, supplied as appropriate along with any special labelling elements.

Although implementation of the GHS is voluntary, it is increasingly being adopted for pesticides and less so for consumer chemicals (although some countries have trialled its use for specific consumer chemicals).

The World Health Organization (WHO) has been updating the Recommended Classification of Pesticides by Hazard in Accordance with GHS Criteria. The 2009 edition of The WHO Recommended Classification of Pesticides by Hazard⁸ aligns the classification of pesticides to that of the GHS,

⁸ http://www.inchem.org/documents/pds/pdsother/class_2009.pdf

especially the GHS classification for acute oral toxicity. When implementing the GHS for pesticides, Parties can take this WHO classification into account.

In many countries the GHS is implemented by legislation. Most countries that have not yet done so are determined to implement the GHS for hazardous chemicals in the future as it is the basis for sound chemicals management; however, they may lack the resources to do so. For example, the United Nations Institute for Training and Research/International Labour Organization (UNITAR/ILO) is supporting national GHS implementation and capacity-building projects in various countries.⁹ The GHS, as an international harmonized standard, could be the basis for a classification and labelling system for POPs as substances and in mixtures to control marketing and trade of POPs.

2.3 Labelling systems for chemicals in articles

2.3.1 Labelling of flame retardants in plastic materials used in articles

This labelling approach (ISO 1043-4, 1999)¹⁰ provides uniform symbols for flame retardants added to plastic materials throughout the supply chain. It is especially relevant for recycling of plastics that could contain commercial pentaBDE and commercial octaBDE. Key elements include:

- It provides voluntary industrial guidelines harmonized for industry worldwide through the International Organization for Standards (ISO) standard.
- It is a preventive system informing recyclers, in particular, of the composition of the plastic based on specific markings on the materials.
- It involves industry markings (in effect a “label”) with the use of code numbers, e.g. code-18 is pentaBDE and octaBDE; code-20 is polybrominated biphenyls (hexabromodiphenyl).
- Code markings apply to chemical contents >1% for flame retardant (FR) 18.
- The government is not involved.

The ISO standard, while based on an international approach by industry, applies only to specific flame retardants in plastic materials used for specific purposes.

2.3.2 Labelling requirements for certain articles containing crocidolite asbestos in the European Community

The European Community (EC) directive on the ban and restriction of asbestos¹¹ is an example of a labelling requirement for articles containing the chemical asbestos – crocidolite. Key elements include:

- It was implemented in EC member states from 1983 till 1999, when the use of crocidolite was totally banned in the EC.
- It is a preventive system that requires that an article placed on the market/imported must be labelled if it contains the regulated chemical crocidolite.
- It provides information on the presence of crocidolite on the label. This allows the user of the article and end-of-product life management to protect human health and the environment from the unwanted impacts of crocidolite. This also facilitates control of the import/export and transport of crocidolite by government and industry, and enforcement of compliance with the crocidolite legislation within countries.

⁹ <http://www.unitar.org/cwm/ghs>

¹⁰ Plastics – Symbols and abbreviated terms, Part 4: Flame retardants, (ISO 1043-4 : 1998) English version of DIN EN ISO 1043-4.

¹¹ Council Directive 83/478/EEC of 19 September 1983 amending for the fifth time (asbestos) Directive 76/769/EEC on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:1983:263:0033:0036:EN:PDF>

- It regulates articles containing crocidolite-like asbestos: cement pipes, acid and temperature-resisting seals, gaskets, gland packing, and flexible compensators and torque converters. All other uses of crocidolite are banned.
- The regulated articles, when marketed by the manufacturer, have to bear a specific label of a minimum size.
- It does not address POPs, but is in principle applicable to all articles containing a regulated chemical.

The allowed articles containing crocidolite were produced in the EU and imported. The labelling system required efficient monitoring by customs to identify unlabelled imported articles and the control of manufacturers in the EU producing the regulated articles. The system could be applied to POPs by labelling articles with allowed uses for POPs and adapting the labelling procedure, content and practicalities for POPs.

2.4 Labelling systems for chemicals in a national inventory

2.4.1 Stockholm Convention labelling of PCBs

The labelling requirements for PCBs are stipulated in Annex A, Part II of the Convention, which provides a management plan and inventory designed to keep track of appliances (equipment) containing PCBs so that important information is not lost. Parties to the Convention are required to identify and remove from use equipment containing PCBs, as well as to attach labels indicating the presence of PCBs in appliances. The label states its % in accordance with three stated concentrations, volumes and in accordance with priorities established in the Convention.

This requirement is in place only for PCBs. Parties could consider addressing other articles that contain a POP, e.g. POP-PBDEs and PFOS establishing requirements or setting references.

3 Development and implementation of labelling systems for POPs

Labelling systems could be useful for products and articles that use POPs – like DDT, lindane, endosulfan, PFOS, its salts, perfluorooctane sulfonyl fluoride (PFOSF) and PFOS-related chemicals – during manufacture as allowed by the Stockholm Convention in Annexes A and B for specific exemptions and/or acceptable purposes. This includes substances that are manufactured POPs, mixtures that are manufactured by intentionally adding a POP (i.e. substances), and articles that are manufactured by intentionally adding a POP.

Labelling systems for products and articles that contain Tetrabromodiphenyl ether and Pentabromodiphenyl ether or Hexabromodiphenyl ether and heptabromodiphenyl ether¹² could be useful for identifying these POPs in material from recycling of articles containing them and to facilitate the use and final disposal of articles manufactured from such recycled articles allowed under Annex A of the Convention.

A label attached to the product for POPs as substances, in mixtures, and in articles would enable identification of these POPs, their suppliers, and their hazards when they are marketed and traded. This would facilitate the control of POPs and the implementation of the Convention through the supply chain.

Any proposed labelling system for POPs could address the following questions:

- What is the aim, objective, and content of the system?
- What will be labelled?
- How will the POPs be labelled (what information is required on the label, for whom is it labelled, how is it done technically)?
- How can the system be enforced?
- What resources are needed for implementation by the producer, user, and government?

Based on the above analysis, the following labelling considerations could be subject to attention:

- **POPs as substances and in mixtures:** Parties and companies implement and adapt the GHS, which would also apply to products (substances and mixtures) that contain impurities of these POPs.
- **POPs in articles:** the system could include different options including a combination of legally binding obligations to label certain articles and voluntary activities by industry.

Activities to avoid the use of POPs in mixtures and articles would be more efficient than labelling the presence of POPs. These activities could also be implemented by Parties and companies. The proposed labelling systems would require different actors to implement different parts of the systems: for example, manufacturing industry; user industry; Parties with manufacturing industry, user industry, consumers, and exporting Parties; as well as importing Parties with user industry and consumers. Exporting Parties could either avoid the use of POPs during manufacture or implement a labelling system that informs users and importing Parties about the presence of the POPs in mixtures and articles. Importing Parties could implement the same labelling systems as the exporting Party,

¹² For Stockholm Convention “Hexabromodiphenyl ether and heptabromodiphenyl ether” means 2,2',4,4',5,5'-hexabromodiphenyl ether (BDE-153, CAS No: 68631-49-2), 2,2',4,4',5,6'-hexabromodiphenyl ether (BDE-154, CAS No: 207122-15-4), 2,2',3,3',4,5',6-heptabromodiphenyl ether (BDE-175, CAS No: 446255-22-7), 2,2',3,4,4',5',6-heptabromodiphenyl ether (BDE-183, CAS No:207122-16-5) and other hexa- and heptabromodiphenyl ethers present in commercial octabromodiphenyl ether. “Tetrabromodiphenyl ether and pentabromodiphenyl ether” means 2,2',4,4'-tetrabromodiphenyl ether (BDE-47, CAS No: 5436-43-1) and 2,2',4,4',5-pentabromodiphenyl ether (BDE-99, CAS No: 60348-60-9) and other tetra- and pentabromodiphenyl ethers present in commercial pentabromodiphenyl ether.

raise awareness among users, and enforce the labelling system. The labelling system would allow for the identification of POPs in mixtures and articles along the whole supply chain.

The first step in a national process to develop a labelling system is to analyse the situation in the country:

- Is the country a producer of POPs or an importer?
- What labelling systems are already in place for chemicals, mixtures, and articles, and can they be adapted to include POPs?
- Has the GHS been implemented or is its implementation planned? Are the POPs already classified and labelled, or is support needed to classify and label them?
- Does the country have the resources to develop and implement a national labelling system?

The second step is to design and implement a labelling system adapted to a country's needs and resources. This includes consideration of:

- The national economic situation
- National human and environmental health issues related to POPs
- Status of public awareness on negative impacts of POPs

The labelling system must be practical, effective, enforceable, and easy to implement, and consider the socio-economic impact on companies. Monitoring and enforcement could be facilitated by monitoring a company's self-inspection scheme, through a liability scheme in cases of fatalities, or through the use of financial incentives. High-level political will is a prerequisite for implementation of a POPs labelling system. The implementation could proceed on a step-by-step basis with easy to implement solutions. It could target "low hanging fruits" first and identify short-, medium- (5 years), and long-term (10 years) goals.

The best approach may be to gain experience by first selecting one labelling system option and implementing it on a provisional basis. If this proves successful, legislation and the administrative system could then be adapted, as appropriate. Harmonizing the labelling systems for POPs at the international level, using the Conference of the Parties of the Stockholm Convention as a platform, could be considered.

3.1 Systems to avoid the use of POPs in mixtures and articles

Activities to avoid the use of POPs in mixtures and articles would be most efficient, since, in the absence of POPs, POPs management along the supply chain would be unnecessary. Examples of these activities include elements/components of regulatory and voluntary systems to prevent the presence of certain chemicals in articles.

3.1.1 EU RoHS Directive and the JIG

The EU RoHS Directive is an example of an activity that assures that certain chemicals are not contained in an article. The knowledge of what is contained in an article facilitates the otherwise onerous task of ensuring that each new chemical of concern is not contained in an article along the entire value chain. The Directive consists of a harmonized list of banned substances that are only allowed to be contained below certain threshold levels.

As stated in section 2.1.1, PBB and PBDEs, are not allowed in EEE if the maximum concentration values by weight in homogeneous materials is equal or higher than 0.1% or 1000 ppm. This system could be expanded to include POPs, like PFOS, that could be expected to be contained in EEE. A system like the RoHS Directive allows companies to protect their proprietary information.

Resources and requirements for implementation of such a system for POPs could include:

- **Manufacturers:** do not use restricted substances or contaminated material, draw up a declaration of conformity, label EEE products, and keep a register of non-conforming EEE.
- **Importers:** only import EEE in conformity, ensure that the manufacturer has assessed conformity with the relevant documentation and put the “CE” label (specific to this legislation) on the EE, and keep a register of non-conforming EEE and inform the distributor.
- **Distributors:** verify that the EEE bears the “CE” marking and only distribute EEE in conformity; in cases of non-conformity inform the manufacturer or importer as well as the market surveillance authority.
- **Governments:** use existing mechanisms to ensure the correct application of the regime governing the “CE” marking and take appropriate action in the event of improper use of the “CE” marking.

The EU Directive puts the main burden of proof on the manufacturer both inside and outside the EU, affects other countries, while also giving responsibilities to importers and distributors.

The impact of the EU Directive on manufacturers of EEE in other countries has led to the development and implementation of the “JIG (see section 2.1.2).

POPs which are not yet listed in table A of the JIG that are contained in EEE articles could be added to the EU RoHS system, but each addition would increase the resources required from manufacturers, importers, distributors, and government while facilitating the control of POPs in producing countries and importing countries. Surveillance/enforcement authorities also need to monitor the conformity of manufactured imported EEE by selecting high-risk products based on criteria of concern and conducting first indicative non-destructive testing (e.g. x-ray fluorescence analyser), eventually followed by more sophisticated testing. This might not always be possible and/or sustainable in many developing countries.

Parties with industries that manufacture EEE could consider developing and implementing national legislation addressing all relevant POPs based on the RoHS Directive. As an alternative, national industry could be asked to apply and adapt systems as the JIG to meet national needs, either a voluntarily or based on legislation.

Industry in other sectors also conducts a variety of voluntary activities to avoid the use of certain chemicals and to communicate the use of certain chemicals in the supply chain. It would be preferable to have one voluntary system for industry for information in the supply chain, so as to avoid confusion about what information to provide and which lists to follow.

3.1.2 Ecolabelling

National organizations for ecolabels work together through the Global Ecolabelling Network, which serves as a platform for exchange of information and knowledge. It assists newly established ecolabelling organizations in developing structures and in matters of organization and quality assurance of processes.

One specific example of an ecolabel relevant to POPs is the German Blue Angel Label.¹³ Based on the experience of Germany, the resources and requirements for implementation of such a system that includes POPs could include:

- **Industry:** proposes new ecolabels with technical documentation.
- **User industry and the public:** use the information to select products.
- **Government** (e.g. German EPA): develops the technical criteria, organize expert hearings involving representatives from industry and other expert groups, and prepare proposals for the technical criteria to be met by the product.

¹³ <http://www.blauer-engel.de/en/index.php>

- **Environmental Label Jury:** decides on the award of an ecolabel (e.g. Blue Angel in Germany).

Industry could also propose further products not containing POPs for an ecolabel. (POPs are not specifically addressed, but could be covered, for example, for wooden toys, composite wood panels, and mobile phone plastic cases.) Parties could directly contact their national ecolabel organizations, or the Global Ecolabelling Network, to promote no POPs in the products as one of the priorities of new eco-label proposals by industry.

3.1.3 Other approaches

Resources and requirements for implementation of initiatives such as POPs-free initiative could include:

- Industry: substitutes a product with a POPs-free product, verified by an independent analysis, and uses "POPs-free" as a sales argument for the substitute product.
- User industry, public, and end of product life management: use the system.
- Governments: promote voluntary measures on this direction.
- Secretariat: receives mandate from the Conference of the Parties.

Ways to continue looking for opportunities for the promotion of exchanges and alternatives to POPs and related industry best practices in specific sectors and applications are being explored by those participating in the initiative. Initial research on several industry sectors, and the phase-out of POPs in products, is being undertaken. The initiative currently has limited coverage. Parties and industry could consider expanding the initiative.

3.1.4 Summary

It is more efficient for Parties with industry that manufactures the chemical products or articles with the POPs to try to avoid these POPs and use substitutes for them. Guidance on alternatives for POP-PBDEs and PFOS is available on the website of the Stockholm Convention.¹⁴ The implementation could be by legislation encouraging the substitution or even banning the POPs in certain articles, for example, in electronic equipment like the EU RoHS Directive. Parties could also encourage industry to voluntarily apply relevant international guidance on how to support the RoHS Directive, like, for example, with the JIG. National or regional ecolabel systems could be encouraged to expand their coverage to articles containing POPs. With support from industry, the POPs-free initiative could be expanded to cover more articles by substituting safer non-POPs alternatives for POPs.

3.2 Labelling systems for POPs as chemicals and in mixtures

3.2.1 Globally Harmonized System of Classification and Labelling of Chemicals

The GHS covers all POPs as hazardous chemicals. Impurities, additives, or individual constituents of a substance or mixture that have been identified and are themselves classified should be taken into account during classification if they exceed the cut-off value/concentration limit for a given hazard class. That means that known unintentional trace contaminants of products containing POPs also have to be labelled if the GHS is implemented voluntarily.

POPs in mixtures have to be identified on the label in countries that have implemented the GHS if they are in the mixture in concentrations greater or equal than the cut-off value.

The generic cut-off values are normally $\geq 1.0\%$ with $\geq 0.1\%$ for the more severe effects like sensitization, carcinogenicity, mutagenicity, reproductive toxicity, and acute/chronic category 1

¹⁴ <http://chm.pops.int/Convention/POPs%20Review%20Committee/Publications/tabid/345/Default.aspx>

hazardous for the aquatic environment. The cut-off values can be reduced if the classifier has information that the hazard of an ingredient will be evident below the generic cut-off values/concentration limits; the mixture containing that ingredient should be classified accordingly. Adequate documentation supporting the use of any values other than the generic cut-off values/concentration limits should be retained and made available for review on request.

Since implementing the GHS in 2008, the EU has classified and labelled certain POPs and assigned cut-off values. Most POPs have cut-off values of 0.1% or 1000 ppm except for lindane, which due to high aquatic toxicity, has a value of 0.01% or 100 ppm.¹⁵ That means that in principle in the EU, these POPs in mixtures have to be identified on the label if they are in concentrations greater than or equal to the cut-off value.

The value of 0.1% as a cut-off level may be too high for POPs in the light of cut-off values used in national and regional legislation: with 10 ppm in the EU POPs regulation or 100 ppm for lindane in the EU GHS implementation regulation applying the M factor of 10 due to the high aquatic toxicity of lindane.¹⁶ Countries could reduce the cut-off levels based on the principles of the GHS: "The cut-off values can be reduced if the classifier has information that the hazard of an ingredient will be evident below the generic cut-off values/concentration limits, the mixture containing that ingredient should be classified accordingly". A first step to facilitate international harmonization of POPs classifications and cut-off levels could be an exchange of this information between Parties when implementing the GHS.

For a mixture, the chemical identity, identification number, and concentration or concentration ranges of all hazardous ingredients, which are hazardous to human health or the environment within the meaning of the GHS, and are present above their cut-off levels, are provided. The name, address, and telephone number of the manufacturer or supplier of the substance or mixture are also provided. The identity information on hazardous chemicals as substances and in mixtures on the label can be used to control certain chemicals throughout the supply chain.

When implementing the GHS for industrial chemicals and pesticides in exporting Parties where POPs as substances and in mixtures are manufactured, it is important that all hazard classes be considered. This would have the effect that all known hazards of the POPs, as industrial chemicals and pesticides allowed on the market and allowed to be exported, would be communicated to the user within the Party and in importing Parties.

The label has to be fixed to the container of the chemicals or mixture or its packaging and should include the chemical identity of the POP; for example, by the CAS name, CAS number, or IUPAC name. For a mixture, the chemical identity, identification number, and concentration or concentration ranges of POPs, which are hazardous to human health or the environment within the meaning of the GHS, and are present above their cut-off levels, would be provided. The name, address, and telephone number of the manufacturer or supplier of the substance or mixture would also be provided. The identity information for POPs as substances and in mixtures on the label can be used to control these chemicals throughout the supply chain. This would apply to the pesticides lindane and endosulfan with specific exemptions in Annex A of the Convention and the pesticide DDT with an acceptable purpose in Annex B of the Convention. The industrial chemicals PFOS, its salts, PFOSF and PFOS-related chemicals listed with specific exemption and/or acceptable purpose in Annex B of the Convention as substances or in mixtures would also be covered. Any POP that is contained in another chemical above the cut-off level would also appear on the label of the chemical, thus allowing tracing of these chemicals that are not allowed to be marketed, used, exported, and imported under the Convention.

¹⁵ GHS classification and labelling of Chlordecone, DDT, Endosulfan, Lindane, OctaBDE, PentaBDE, Pentachlorobenzene, PFOS and its salts by the European Community

¹⁶ Information on POPs-free/unintentional trace contaminants, and low POPs content for waste.

Importing Parties that do not manufacture POPs or mixtures containing POPs could, as a first step, implement the GHS for some hazard classes as legally binding and for other hazard classes as voluntary, or make the whole system voluntary. Whatever the implementation strategy, it can be useful for Parties to allow POPs to be imported with a label showing the full information on all human health and environmental hazards.

Resources and requirements for implementation could include:

- **Industry:** classify and label chemicals and mixtures.
- **(User) industry, poison control centres, emergency responder, and transport companies:** use the information provided through the GHS to protect human health and the environment.
- **Workers, farmers, and public:** use the information provided through the GHS to protect human health and the environment.
- **Government:** support the implementation by awareness-raising campaigns, provide/support training for applying and using the GHS, and monitor and enforce the system during import and within the country.

When countries have already implemented the GHS and industry, user, and government resources have been made available, the POPs, which comprise a very small fraction of the traded hazardous chemicals and mixtures, would be automatically covered with negligible additional resources needed for implementation and enforcement.

3.3 Labelling systems for POPs in articles

Articles containing POPs still allowed to be manufactured and marketed include:

- Articles manufactured with and containing PFOS, its salts, PFOSF or PFOS-related chemicals.
- Articles manufactured using recycled materials from articles containing hexabromodiphenyl ether and heptabromodiphenyl ether and tetrabromodiphenyl ether and pentabromodiphenyl ether that are still in use by Parties.

For articles manufactured using PFOS, its salts, PFOSF or PFOS-related chemicals, the manufacturer is aware of the POPs used and the content of the POPs in the article or in the components of the article. If the manufacturer of the article uses a component manufactured by another company, the original manufacturer knows the POPs content of the component. For these articles, Parties could request the manufacturer of the component and/or the article to inform the user in the supply chain about the POPs content of the component or of the article.

For articles or components manufactured using recycled materials from articles containing hexabromodiphenyl ether and heptabromodiphenyl ether and tetrabromodiphenyl ether and pentabromodiphenyl ether that are still in use in Parties, the manufacturer would also inform the user in the supply chain about the POPs content of the component or of the article. In this situation, the manufacturer using the recycled plastics needs to know the POPs content of the recycled material, if this is known to the recycling company. This is currently difficult for companies in developed country Parties and even more so in developing country Parties. Therefore, the fifth Conference of the Parties (COP-5) agreed (decision SC-5/5) on a work program on brominated diphenyl ethers to improve, inter alia, the ability of Parties to identify POP-PBDEs in plastics during recycling. If the information on POP-PBDEs content is available for articles produced from recycled material, it is proposed that Parties could request that the manufacturer of the component and/or of the article inform the user in the supply chain about the POPs content of the component or of the article. Articles containing a POP that are still in use in a Party are allowed if the Party has notified the Secretariat of the type of use. Identification of these articles before they become waste would allow for ESM of the POPs-containing waste.

The following three options, which may help identify POPs in newly manufactured articles, are proposed for consideration by manufacturing Parties:

- Information through article number
- Labelling of an article or component of an article
- Provisions of ISO

3.3.1 Information through article number

When articles like electronics or cars or their components are produced, normally the production year/date, name of the manufacturer and brand of the article/component are known. The articles normally contain an article number that uniquely identifies them. The manufacturer could inform the user in the supply chain through a list on the Internet or upon request, by letter or email, about the POPs content of the article/component for a given article number.

3.3.2 Labelling of an article or component of an article

Another option that requires more resources from the manufacturer is to label the article or the components of the article and give information on:

- Manufacturer
- Name of the POP
- POPs content
- Information relevant for recycling or final disposal

An example of this system is the requirement for labelling of articles containing crocidolite asbestos in the EC from 1983 until 1999 when the use of crocidolite was totally banned in the EC (see section 2.3.2). The system could be adapted for POPs. The requirement could be for regulated articles, when marketed by the manufacturer, to bear a specific label. The content of the label could be as follows:

- **Minimum label size:** for example, 5 cm high and 2.5 cm wide.
- **Top part of label abbreviation:** "POP" in white on a black background.
- **Bottom part of label text:** "Warning: contains x.x % of [name of the POP], a persistent organic pollutant; and indicates the measures to reduce releases from waste: "Requires environmentally sound waste management" as well as "Follow waste treatment instructions" in white and/or black on a red background. If labelling takes the form of direct printing on the products, a single colour contrasting with the background colour could be sufficient.
- **Label on package:** a label firmly affixed to the packaging, or a (tie-on) label securely attached to the package, or direct printing of the packaging.

Label of unpacked products: a label firmly affixed to the product containing a POP, or a (tie-on) label securely attached to such product or direct printing on the products.

If this is not reasonable, for example, due to smallness of size of the product, the unsuitable nature of the product's properties, or certain technical difficulties, the labelling requirement could be fulfilled by means of a hand-out with the required information.

Resources and requirements for implementation of this approach could include:

- **Manufacturer:** identifies the POPs and labels the article.
- **User industry, poison control centres, workers, farmers, and the public:** use the information to protect human health and the environment.
- **Government:** provides awareness raising and training, and monitors the obligation to label. The system requires efficient monitoring by customs to identify unlabelled imported articles and the control of manufacturers in manufacturing Parties producing the regulated articles.

All manufactured articles that contain a regulated POP could, in principle, use this approach.

3.3.3 Provisions of ISO

The provisions of ISO 1034-4 (see section 2.3.1) to identify flame retardants added to plastic material could form the basis for a labelling system of POPs in plastic components of articles. This is of interest as plastics containing hexabromodiphenyl ether and heptabromodiphenyl ether and tetrabromodiphenyl ether and pentabromodiphenyl ether are allowed to be recycled under the Stockholm Convention; and labelling the plastic material could facilitate the separation of plastic materials containing POPs from those plastic materials not containing POPs. The following modification for ISO 1034-4 could enable the identification of all POPs added to plastic components of articles in the supply chain or included in plastic from waste electrical and electronic equipment (WEEE) destined to be recycled to new articles (recyclate):

- Industry prepares a list of all POPs that could be contained in plastics, and the ISO norm is added. The list could be based on Table A of the JIG.
- Each POP gets a code number and the POP identifier is “POP and code number”. The cut-off concentration of the POP below which no label is necessary could be 0.1%.
- Marking is as visible as possible, and performed by moulding on to the product. “POP0” with “0” placed after the POP means “no POP”; marking is not necessary for mass concentrations of 0.1% or less (cut-off level).
- The content of POP in recycled materials could be marked by adding the concentration value in % to the POP identifier, e.g. “POP and code number 10%”.

Resources and requirements for implementation could include:

- Manufacturer of plastic material: marks the material.
- All actors in the supply chain: use the information, from the manufacturer of products using the plastic material to the users of the products, including end-of-life management and reuse of recycled plastic material.
- Government: is not involved, which saves the costs of monitoring and enforcement.

The system is only applicable to POPs that are added to plastics.

When recycling plastics from articles, the plastic materials are usually separated from the article and then collected. At this stage, the marks in those materials could be used to set apart the portion of plastics containing POPs and handle them through ESM. If the collected plastics marked as containing POPs are shredded before using them in recycling, the information provided by the marking disappears. In such a situation, the company that shreds the plastic material could be required to inform customers about the types and contents of POPs present in the shredded plastic material. Indeed, the main recycled plastic flow of concern comes from WEEE, which is often a mixture of plastics that may contain POP-PBDEs (often in the 0.1%); a range of other critical chemicals like other BFRs; phosphorous flame retardants; antimony trioxide; and possibly other heavy metals like lead or cadmium.

It is proposed that such recycled material is not used for any sensitive uses, such as toys, food contact material, refrigerators, water tanks, and water pipes, where there is the chance of direct or indirect contact via food and water to humans. To recognize and manage plastic from WEEE requires labelling the recycled material. In addition to a negative list of applications in which such recycled materials should not be used, a positive list could be developed specifying applications where recycled materials from WEEE might be used.

Manufacturing Parties could initiate discussions with national and international industry organizations on the willingness to modify ISO 1034-4 or to develop a new ISO norm for identifying all POPs added to plastic materials.

3.4 Labelling/identification systems for POPs in a national POPs inventory

When setting up an inventory at the national level, POPs identified as substances, in mixtures, or in articles could be labelled to keep the information on identified POPs, especially in articles, readily available and accessible so that the information linked to the article does not get lost. An example of this is the labelling requirement of PCBs in equipment in Annex A Part II of the Stockholm Convention (see section 2.4.1). This management system allows Parties to keep track of equipment – articles in use – containing PCBs. The building of an inventory would be facilitated if the equipment containing PCBs had been properly labelled by a previous preventive system.

Determining what type of information is provided, how it is used, and how the information on identified articles is kept readily available and accessible, (so it does not disappear), depends on the nature and the specific properties of the articles identified when setting up an inventory.

Possible challenges for articles identified as containing POP-BDEs could include:

- **Cars/trucks/buses:** It might be possible to label them individually if information is available on the extent of the use of PentaBDE by the different producers and the time periods involved. The most efficient way could be to collect information from producers that have used POP-PBDEs, in which models, from when to when, and to what extent (concentration). This could indicate where to find POP-PBDEs by car producer, model, and year of production.
- **Electronics:** Theoretically, information on producers and use of POP-PBDEs could be provided by producers depending on their former use. Due to the wide range of producers and products, this approach could prove rather complicated. Also single electronics cannot be analysed for POP-PBDEs for an inventory. It would be more appropriate to screen for bromine in plastics at the end of the life cycle and then label the fractions of BFR-free and BFR-containing plastics. This information would be kept and managed for administrative and policy purposes.
- **Furniture and mattresses:** The same concept, as for electronics, could be applied.

Possible challenges for articles identified to contain PFOS, its salts, PFOSF or PFOS-related chemicals could include:

- **Fire fighting foams:** The identification and labelling of PFOS for fire fighting foams in private use and those from local fire fighting services could be very demanding. There could also be stocks (in case of fire accidents) at large factories (refineries, oil production, military installation, etc.), which have not been used for years. These should be labelled after being identified for the inventory.
- **Carpets:** The same challenge exists for identification and analysis due to the mobility of carpets in private households. If, PFOS determined in carpets in large hotels, for example, information on these hotels could be kept in a national database.
- **Textiles:** A large percentage of PFOS has been used for the treatment of textiles. Since the measurement of single textile items is not practical, companies could be approached to provide information on any former uses of PFOS.
- **Sewage sludge/biosolids:** Sewage sludge is a sink of PFOS. Since it is relevant to the total flow of PFOS into the environment, it could be appropriate to address this material here. Depending on the industries and inflow from deposits, certain sewage treatment plants might have particularly high concentration levels of PFOS or PFOS-related chemicals¹⁷ and they could be labelled so that the sludge originating from such a facility is not used as biosolid.

¹⁷ Oliaei F, Kriens D, Weber R. 2010. Discovery and investigation of PFOS/PFCs contamination from a PFC manufacturing facility in Minnesota – environmental releases and exposure risks. *Organohalogen Compounds* 72, 1338-1341. <http://www.dioxin20xx.org/pdfs/2010/10-1507.pdf>

4 Conclusions

A variety of approaches have been advanced by various organizations for the classification and labelling of substances, mixtures, and articles. Some are voluntary while others are mandated by legislation. Some of the approaches address all chemicals, others address all POPs, and still others address only some POPs (such as flame retardants or PCBs). Some of the approaches are industry-based while others are based on international agreements or regulations (see table 4-1).

Table 4-1: Summary of some characteristics of classification and labelling schemes

Scheme	Voluntary/Legislation	Substances/Mixtures	Articles
GHS	Voluntary	Yes/Yes	No
RoHS	Legislation	No/No	Yes
JIG	Voluntary	No/No	Yes
Ecolabel	Voluntary	No/Yes	Yes
POPs-free	Voluntary	No/Yes	Yes
ISO-1043-4	Voluntary	No/No	Yes
EU asbestos	Legislation	No/No	Yes
PCB	Convention ¹	No/No	Yes

¹ Stockholm Convention Annex A, Part II.

The GHS, the best-known systematic labelling approach for chemicals, including POPs, is being implemented more and more throughout the world. Although it is a voluntary system, many governments have integrated its principles into national legislation, at least for industrial chemicals and, in some countries, for pesticides. Application of the basic concepts of the GHS within the EU Member State regulations is legally binding. A number of useful approaches for labelling of specific POPs in articles based on specific compositions have been advanced.

Table 4-2: Elements to be considered for classification and labelling approaches

- Which of the approaches outlined in this document are already implemented nationally?
- Which of the approaches adopted nationally are voluntary and which are regulated by legal instruments?
- Are there moves nationally to legalize any voluntary scheme?
- Are industrial chemicals, consumer chemicals, pesticides, and articles classified and labelled following the same approach (e.g. the GHS)?
- Which industries or manufacturers have adopted any voluntary POPs labelling?
- Has the RoHS been adopted on articles for sale and in use nationally, as well as implemented for export to the EU? If not, why not?
- What methods have been adopted for classification and labelling of specific or all uses of plastics? Have they been adopted for named POPs in articles that may be recycled?

A number of elements that may be considered for classification and labelling are in Table 4-2.