

About Nordic Ecolabelling of

Imaging Equipment



Version 6.6

Background for ecolabelling

Adopted in May 2013

Nordic Ecolabelling - Background

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1 Summary

The criteria revision towards version 6.0 was executed during the autumn of 2012 and spring of 2013. The criteria were revised for the 5th time. The same product group definition as in version 5.0 continued to version 6.0.

The objective for the revision was to revise the energy consumption requirement and the requirements for heavy metals and flame retardants, propose requirements for additives in plastic parts, examine the possibility to propose requirements on re-cycled/re-used plastics and bio-plastics, update the packaging requirements and propose electrical safety requirements.

The Relevance/Potential/Steerability (RPS) analysis for this product group shows a high score in energy consumption during the user-phase, flame retardants in plastics, double-sided (duplex) copying and consumables coupled to printers, specifically laser-printers. Medium/high score was found for other additives in plastic parts (phthalates for instance) and packaging material. All of these topics have requirements coupled to them.

The most important requirements revised from version 5.0 were the requirement for energy consumption, flame retardants, re-used plastic and double-sided copying. The energy consumption refers to the Blue Angel revised criteria for Office equipment with printing function RAL-UZ 171 and/or the Energy Star specifications for imaging equipment v. 2.0. The flame retardant requirement was sharpened with two additional eco-toxicity risk-phrases and with fewer exceptions.

New requirements added to version 6.0 of the criteria were requirements for phthalates in the imaging equipment's external cables, recycled material used in packaging material, consumables (consumption of toner cartridges in relation to page printing) and code of conduct. Removed requirements from version 5.0 and later modifications, included the harmonization with the Eco Mark, heavy metals, labelling of plastic parts and labelling of plastic packaging, subassemblies and requirements for batteries. Evaluated requirements but not proposed requirements were re-cycled/re-used plastics and bio-based plastics, electrical safety and halogen-free flame retardants.

During the revision process, future requirements and areas in need to be revised in upcoming revision processes were identified. Example of focus areas suggested for upcoming revisions were regulations to minimize the risk of use of "conflict metals" (minerals/metals mined in conditions of armed conflict and human rights abuses) in electronics, emissions of ultra-fine particles, substances in toner powder and ink and software to lower paper use.

2 Basic facts about the criteria

2.1 Products which can be labelled

Nordic Ecolabelling has developed a common criteria document for copiers, printers, fax machines, multifunctional devices and scanners i.e. imaging equipment, because the structures of these products are similar. The foundation for the development of the criteria for imaging equipment has many features in common with the Nordic Ecolabelling criteria for personal computers. The requirements are also in many ways similar to the

requirements developed by other ecolabelling organizations, i.e. TCO, Blue Angel, and Eco Mark, though the levels of the requirements differ.

The name of the criteria, Imaging Equipment, is the same as Energy Star has for this product group but Nordic Swan exclude Mailing Machine in this group. The machines may be equipped with external or internal scanners. Detailed descriptions of the individual products are found below.

Copier

A commercially-available imaging product whose sole function is the production of hard copy duplicates from graphic hard copy originals. The unit must be capable of being powered from a wall outlet or from a data or network connection. This definition is intended to cover products that are marketed as copiers or upgradeable digital copiers (UDCs).

Digital Duplicator

A commercially-available imaging product that is sold in the market as a fully-automated duplicator system through the method of stencil duplicating with digital reproduction functionality. The unit must be capable of being powered from a wall outlet or from a data or network connection. This definition is intended to cover products that are marketed as digital duplicators.

Facsimile Machine (Fax Machine)

A commercially-available imaging product whose primary functions are scanning hard copy originals for electronic transmission to remote units and receiving similar electronic transmissions to produce hard copy output. Electronic transmission is primarily over a public telephone system, but also may be via computer network or the Internet. The product also may be capable of producing hard copy duplicates. The unit must be capable of being powered from a wall outlet or from a data or network connection. This definition is intended to cover products that are marketed as fax machines.

Multifunction Device (MFD)

A commercially-available imaging product, which is a physically-integrated device or a combination of functionally-integrated components, that performs two or more of the core functions of copying, printing, scanning, or faxing. The copy functionality as addressed in this definition is considered to be distinct from single sheet copying offered by fax machines. The unit must be capable of being powered from a wall outlet or from a data or network connection. This definition is intended to cover products that are marketed as MFDs or multifunction products (MFPs).

Note: If the MFD is not a single integrated unit but a set of functionally integrated components, then the manufacturer must certify that when installed correctly in the field, the sum of all energy or power use for all MFD components comprising the base unit will achieve the energy or power levels provided in Section 3 to qualify as an Energy Star MFD.

Printer

A commercially-available imaging product that serves as a hard copy output device, and is capable of receiving information from single-user or networked computers, or other input devices (e.g., digital cameras). The unit must be capable of being powered from a wall outlet or from a data or network connection. This definition is intended to cover products that are marketed as printers, including printers that can be upgraded into MFDs in the field.

Scanner

A commercially-available imaging product that functions as an electro-optical device for converting information into electronic images that can be stored, edited, converted, or transmitted, primarily in a personal computing environment. The unit must be capable of being powered from a wall outlet or from a data or network connection. This definition is intended to cover products that are marketed as scanners

Extra equipment

The above products also include various consumer durables, such as OPC (Optical Photosensitive Conductor) kits, drums, toner powder and residual toner cartridges.

If extra equipment such as desks, sorters, feeder and units for double-sided printing are to be included, the individual parts must meet the requirements as to design, materials, chemical requirements during production, requirements as to packaging and requirements as to recycling.

2.2 Motives for Nordic Ecolabelling, RPS

Relevance

This relevance, potential and steerability (RPS) section is mainly based on the work by European Commission's Joint Resource Centre and its Institute for Prospective Technological Studies (JRC/IPTS) in the project on developing EU Ecolabel criteria for Imaging Equipment. The LCA information is mainly deriving from the Ecodesign study on imaging equipment.

These studies identified three areas of environmental significance¹:

- Paper consumption,
- Energy efficiency in the user-phase, and
- Consumption of toner and inks

¹ JRC/IPTS – Background Report Technical analysis - “Development of European Ecolabel and Green Public Procurement Criteria for Imaging Equipment”, December 2011, <http://susproc.jrc.ec.europa.eu/imaging-equipment/stakeholders.html>

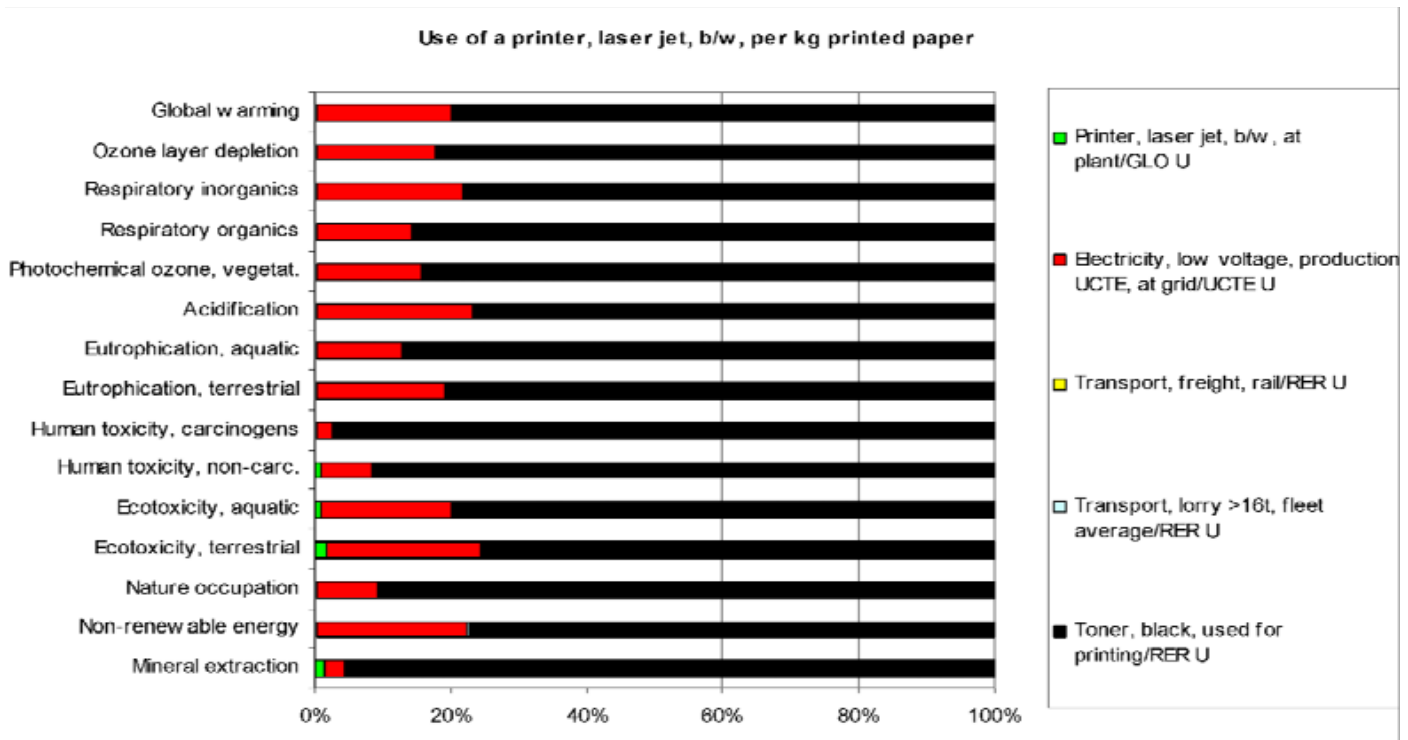


Figure 1 - Impacts on 15 different midpoint environmental indicators of a laser jet printer.¹

Figure 1 show the impact on 15 different midpoint environmental indicators. Paper consumption is not included in this figure. It should also be noted that the laser jet printer is taken as an example for all imaging equipment in the LCA-study.

Besides the above shown environmental indicators, there are areas that are not necessarily picked up in LCA-studies although they contribute to environmental and health concerns. These are:

- Indoor air emissions, and
- Noise

Paper consumption

The requirement as to double-sided copying for printing devices is an important means of reducing the volume of paper used in printing and consequently also the energy consumption in printing. This is because a significant part of the energy consumption involved in making one print is connected to the manufacturing of the paper. Using double-sided printing will therefore reduce the total energy consumption involved in printing.

Energy consumption

Energy consumption is an important property of the device from an environmental point of view, see figure 1, showing a significant contribution of electricity from the user phase on all environmental impact categories¹.

Consumption of toner and inks

As shown in figure 1, the contribution of black ink used for printing on all environmental impact categories, is significant. The impact from the production of toner mainly comes from the production of the toner module, the toner (powder), the production of aluminium and the electricity for manufacturing the toner¹.

During a printing machines life-cycle significant amount of toner cartridges and other consumables are used. These volumes create a number of environmental problems, such as greenhouse gases emitted during transport from manufacturing sites often located in Asia to the Nordic marked and considerable amount of waste after its end use.

The re-use of toner printer cartridges can save 25-40% of the environmental impact, expressed in CO₂-equivalents².

Design and lifetime extension

Discarded printing equipment represents a considerable waste problem. Large amounts of waste is generated containing hazardous substances such as flame-retardants and heavy metals. Requirements as to re-cycling and re-using parts and materials increase material re-cycling and re-use, thus allowing natural resources to be conserved and the quantity of waste sent to landfill sites or incineration to be reduced. The end of life-treatment is regulated in detail by the Waste electrical electronic equipment Directive (WEEE-Directive, 2012/19/EC). Here the collection, dismantling and the final disposal of electronic waste is regulated.

The ability to re-cycle and re-use parts (remanufacturing) of a printing device is known to reduce negative environmental effects from the manufacturing phase of the toner cartridges. Here the design of a printer/copier is very important. Below is a comparison of two cases, showing the importance of design in an imaging equipment when it comes to environmental impact. The comparison is between a product life-cycle with remanufacturing compared to a product life-cycle without remanufacturing but with the ability of refilling empty cartridges.

Table 1 – Comparison of two different product life-cycles environmental impact aspect¹

| Environmental impact aspect | Photocopier non-modular design (refilling) | Photocopier modular design (remanufacturing) |
|-----------------------------|--|--|
| | Environmental savings in percent | |
| Materials consumption (kg) | 25 | 49 |
| Energy consumption (MJ) | 27 | 68 |

The table above shows that remanufacturing and refilling is lowering the environmental impact in general, but the energy/material saving is much higher if the photocopier has a modular, or remanufactured design¹. However, these figures are sometimes ambiguous as they can contradict results from other LCA-studies showing for instance a lowering of printing quality of remanufactured toner cartridges.

² Development of EU Ecolabel Criteria for Imaging Equipment, JRC presentation at 1st AHWG meeting, April 2011, <http://susproc.jrc.ec.europa.eu/imaging-equipment/stakeholders.html>

Chemicals

Components in electronic waste can contain a large number of hazardous substances, including heavy metals (mercury, cadmium and lead) and substances used as flame retardants like polybrominated diphenyl ethers (PBDE's) and tetrabromobiphenol-A (TBBPA).

There is also use of phthalates in plastic components in Imaging equipment. Phthalates are used in a large variety of products, from enteric coatings of pharmaceutical tablets and nutritional supplements to viscosity control agents, gelling agents, film formers, stabilizers, dispersants, lubricants, binders, emulsifying agents, and suspending agents. Many phthalates are classified as carcinogen, endocrine disruptor, developmental and reproductive toxicant.

Heavy metals

A large proportion of the above stated stabilizers are persistent, bio-accumulative and toxic to waterborne organisms, carcinogenic, harmful to the reproductive system or have immunotoxic properties. Heavy metals are used as stabilizers e.g. in PVC and are primarily used in cables or other plastic materials. Lead stabilizers account for approximately 60 % of all stabilizer consumption and are used especially in plastic compounds requiring heat stability and tensile strength, as in electrical insulation.³ Although cadmium stabilizers are being phased out, cadmium is still found in "old" products. Organic tin compounds are used in some applications of stiff PVC.

Flame retardants

PBB, PBDE or chlorinated paraffins (with a certain chain length) have are well documented hazardous effects on health and the external environment. Plastic containing brominated substances have to be separated from other types of plastic because of specific requirements in the WEEE-directive.

A large proportion of the brominated materials are combusted. Depending on the temperature of combustion, high levels of brominated dioxins and furans can be formed and released during incineration as a result of the dioxin precursor properties of aromatic brominated flame retardants¹.

The prohibition of the flame retardant deca-BDE in the RoHS-directive (in line with PBB) is still questioned. Interestingly, there exist data supporting that deca-BDE can degrade to shorter chained brominated biphenyls having high toxicity i.e. giving effects like the chlorinated dioxins and PCB. Many chlorinated paraffins are, similar to heavy metals, persistent and bio accumulative. The use of some flame-retardant are regulated by Restriction of hazardous substances Directive (RoHS-Directive, 2011/65/EU). However, many flame retardants, not regulated by the RoHS-Directive are of environmental concern and are relevant to regulate further.

³ Environmental and Occupational Medicine, 4th Ed. Philadelphia: Lippincott Williams & Wilkins, 2007.

Chlorine based plastics

The presence of chlorine atoms in materials affords a number of technically desirable properties, but also the formation of dioxin and other persistent organic pollutants during production and disposal.

Emissions/indoor air quality

Imaging equipment is a source of indoor air pollutants, especially ozone, particulate matter, volatile organic compounds (VOC), and semi-volatile organic compounds (SVOC).

Imaging equipment generate ozone in varying amounts while toner and paper dust from printing devices may become airborne, generating respirable particles that include ultra-fine aerosols. Also VOC's are emitted which is at least partly derived from the toner that is heated during printing. Toxicological effects or potentially significant consequences due to these emission is widely described in literature¹, e.g. ozone and particulate matter have been associated with occupational symptoms such as eye, nose or throat irritation, headache and fatigue.

Noise/Sound Power

It is well known that noise pollution can affect health. Some of the effects are:

- Loss of productivity,
- Physiological effects, and
- Annoyance

See further relevance of noise as an environmental problem under Chapter 5 – Motivation of the requirements, and “sound effect”.

Potential

Copiers are the most energy intensive type of office equipment. Because they waste energy sitting idle for several hours each day, there is potential to improve their energy efficiency. Printers are typically left on 24 hours a day, but are active only a small percent of the time, meaning that they waste a lot of energy. Power down can cut a printers electricity use by over 65%. Interestingly, all Energy Star compliant copiers automatically turn off after a period of inactivity⁴.

Copiers automatically set to make double sided copies saves energy and paper. Easy and reliable duplex operations will encourage users to copy on both sides.

Likewise, the potential to pose strict requirements for flame retardants used as additives in plastic parts is considered possible and important. Today there are substitutes to brominated flame retardants for many applications within the product group. Moreover,

⁴Imaging equipment: copiers, faxes, printers, scanners, multifunctional devices (Lot 4), European Commission,
http://www2.mst.dk/common/Udgivramme/Frame.asp?http://www2.mst.dk/udgiv/publications/2009/978-87-92617-03-3/html/kap06_eng.htm

there is a potential to pose requirement on so called consumables (toner cartridges, collecting cartridges etc.) identified as an important environmental load in figure 1.

Improvement options regarding life-time extension are important. Design for re-use of components and re-cycling of materials from imaging equipment's should be highly prioritized. The end-of-life of offices machines will be influenced by the WEEE directive (updated 2011) which set requirements of the handling of products and also on the possibility to identify and remove hazardous substances.

The potential for additives to plastics such us flame retardants and phtalates are high for ecolabelling. It is possible to produce plastic parts for imaging equipment with no additives. When it is necessary it is possible to use less harmful additives.

There is a large variety of imaging equipment with different effect of the work environment. The noise/sound effect and emissions from imaging equipment effect people who work close to the machines.

Nordic Ecolabelling find it important to consider packaging although their overall environmental impact is relatively low for imaging equipment . Mostly because it is manageable for procurers to put simple requirements in place when tendering packaging products, and thereby make reasonable environmental improvements in their production/packaging of their products. Important parameters which can be influenced are for instance quantity, type of packaging and opportunities for re-cycling.

IT equipment have a clear interest to use re-cycled material in their packaging. Regarding cardboard the optimum level of re-cycled content in a packaging box has not been possible to find. Re-cycling cardboard requires only 75% of the energy required to make new cardboard.

Steerability

The steerability of the most significant environmental parameter, energy consumption in the user-phase, is very high since this is technically achievable and can be communicated to manufacturers in contrast to difficulties related to raw materials such as metals etc. Technological innovation of printing devices also continually pushes the user-phase energy consumption. Moreover, energy consumption is a parameter regulated by several by the industry accepted schemes such as the Energy Star.

Experience from handling applications shows that information on flame retardants used in different components has been challenging to extract. There can be a long chain of involved companies between the producer of imaging equipment to the producer of flame retardant. However information from the supplier of flame retardant has been collected. It is important that ecolabelling gets the correct information about the additives in plastics. It is an important requirement. It has been clear that there is an advantage in having standardized declarations, in order to enhance the dialogue between applicant and sub-supplier. Generally, the steerability for flame retardants in plastics is considered to be lower than that for energy consumption, due to abovementioned reasons. Flame retardants are also products more difficult to substitute while preserving same desired technical functionality as is the case with other chemical products, due to that the flame retardant is added to achieve a certain protection against fire. This can be stipulated by a certain standard for electronic equipment and if you have a plastic with flame retardant that fulfils the standard it can be hard to replace it.

The steerability for noise (sound effect), emissions and consumables improvements is considered to be good. It is possible to reduce the sound effect and emissions from the imaging equipment. It is also possible to have consumables that can be changed by the consumer.

It is also quite easy to use packaging with low environmental impact. The possibilities to use recycled fibre in cardboard boxes is good.

Toner cartridge is not included in this product group. It has a large environmental impact if it is included in the life cycle of imaging equipment. Nordic Ecolabelling has specific criteria for toner cartridges.

The steerability for design for imaging equipment is good. It is important that the imaging equipment can change toner cartridge. There are examples when the imaging equipment is designed so it is difficult for the consumer to change toner cartridge for example. It is also important that the imaging equipment is possible to repair or to change parts that are used.

Table 2 – RPS-analysis of individual environmental parameters

| Environmental parameter | Relevance | Potential | Steerability | Assessment of RPS |
|--|--------------------|--------------------|---------------------------|-------------------|
| Energy consumption | Very high | High ¹⁾ | High | +++ |
| Plastics | Low | High ²⁾ | Good | + |
| Flame retardants in plastics | Very high | High ²⁾ | Low | ++ |
| Other additives in plastics | High | High ²⁾ | Good | ++ |
| Heavy metals | High | Indifferent | Indifferent ³⁾ | 0 |
| Double-sided copying and consumables | Very high | High ⁴⁾ | High | +++ |
| Indoor air emissions | High ⁵⁾ | High | Good | ++ |
| Sound power | High ⁵⁾ | Good | Good | + |
| Environmental impact of production (use of raw materials and energy, transport) | High | High | Poor ⁶⁾ | 0 |
| Design | High | High | Good | ++ |
| Packaging | Low ⁷⁾ | High | High | ++ |

¹⁾ Power consumption per unit decreases as product development continues

²⁾ Alternatives are available

³⁾ Controlling the chain of suppliers is difficult. RoHS restricts the use of heavy metals

⁴⁾ Different patented techniques available for consumables.

⁵⁾ Continued and/or increasing public awareness and concern. Multiple health responses of noise and combination-effects of air emissions relevant

⁶⁾ Poor controllability so far down the production chain

⁷⁾ Low relevance in relation to the final products overall environmental impact

Based on the above RPS-analysis the product requirement for imaging devices focus on:

- Energy consumption during use
- Plastic parts and their characteristics
- Flame retardants and other additives in plastic parts
- Design as to combined toner cartridges
- Packaging
- Supply of spare parts,
- double-sided copying and on consumables, and
- Emissions to indoor air and sound effect

Criteria version and validity

The first criteria document for this product group was adopted in 1993, set only for copiers. Version 2 of the criteria was adopted in 1997. The criteria document for copiers, printers, fax machines and multifunctional devices version 3.3 (June 6th 2001-January 7th 2007) was a merger of two criteria documents: Copiers, version 2.2 and Printers/Fax Machines, version 2.1.

During version 3, the Board of Nordic Ecolabelling and Japan Environmental Association decided to develop the so called core criteria following a harmonization program. For the license applicant that meant that a product approved by the Japan Environmental Association and awarded the Eco Mark, needed no further documentation regarding requirements encompassed by the cooperation agreement

Version 4, set criteria for the same type of products as version 3, but the document had a new structure and simpler criteria while still maintaining a strict focus on environmental improvements. In version 4 the harmonization ambition embraced also the Blue Angel. This ambition continued throughout version 5.0 of the criteria in 2007.

The Nordic market

Nearly all manufacturing of products within this product group takes place outside the Nordic region. The product group encompasses two market segments: products sold as office equipment and products sold for home use through home electronics stores. The quality of the machines manufactured for office use is higher than those designed for the consumer market. For business users, factors such as low energy consumption, print speed, cost per page, and working environment requirements are important. For the consumer market, purchase price is the decisive factor.

The Nordic Swan Ecolabelled products cover both printers and copiers and other types of imaging equipment. All designed for offices, professionals and regular consumers.

Nordic Swan Ecolabelling licences

When the revision to version 6.0 of the criteria was undertaken there were four producers having licenses for Imaging Equipment for over 80 products. In the business market, the Nordic Ecolabelling has had a larger impact than on the consumer market where there are not any licenses.

Other labels

Table 3 – Listings of different Ecolabel organizations and their characteristics within this product group

| Type 1 labels | |
|---|---|
| Eco Mark, www.ecomark.jp/english/ | The Eco Mark is the Japanese third-party certificate corresponding to the Nordic Swan Ecolabel. Eco Mark has criteria for Copiers Multifunctional devices and Printers. Type-1 label. |
| The Blue Angel www.Blauer-Engel.de | The Blue Angel ecolabel is the German third-party certificate corresponding to the Nordic Swan. Blue Angel has criteria for Copiers, Multifunctional devices and Printers. Type-1 label |
| TCO www.tcodevelopment.com | The TCO label is a third-party certificate. TCO has issued criteria for Printers only. The requirements cover the external environment and work environment. Type-1 label |
| EU Ecolabel www.eco-label.com | The Ecolabel Flower is the EU third party certificate corresponding to the Nordic Swan. They have until yet no criteria for Copiers and printers. Type-1 label. |
| Other type of labels | |
| GEEA www.efficient-appliances.org | GEEA is a collaborative project between the energy authorities in France, Switzerland, Sweden, Denmark, Finland, Germany and the Netherlands. The GEEA label is a self-declaration scheme. The organization has the right to withdraw a license if it is revealed that the criteria are not fulfilled. Denmark is the only Nordic country that actively markets the GEEA label. |
| IT Ecodeclaration www.itecodeclaration.org | IT Ecodeclaration is a collaborative initiative between IT enterprises in Denmark, Norway and Sweden. IT Ecodeclaration is a self-declaration scheme that covers external environmental and working environment parameters. |
| Energy Star www.energystar.gov | Energy Star is third party scheme run by the US Environmental Protection Agency with the aim of promoting energy-efficient products. Virtually all companies on the market are affiliated to Energy Star. |

There is an ongoing work for ecodesign for imaging equipment (Lot 4). So far there is only a final draft for “Industry voluntary agreement of Imaging Equipment placed on the European market”.⁵

⁵ <http://www.energimyndigheten.se/sv/Foretag/Ekodesign/Produktgrupper1/Utrustning-for-bildbehandling/>

3 About the revision

Objectives with Criteria/revision

The objective for this criteria development was to revise the criteria for Imaging equipment version 5.4, and construct a proposal for a new criteria document. The goals were specifically to:

- investigate the possibility to sharpen the energy, material, emission and noise requirements through a harmonization ambition,
- investigate the possibility to form a requirement for consumption of toner cartridges during a set period of an Imaging equipment's life-time,
- revise the requirements for heavy metals and flame retardants,
- pose requirements for additives in plastic parts,
- examine the possibility to pose requirements on re-cycled/re-used plastics and bio-plastics,
- update the packaging requirements, and
- propose electrical safety requirements.

In order to investigate the possibility for a revision of the energy, material, emission and noise requirements the EU Ecolabel, Eco Mark and Blue Angel were benchmarked. Requirements for flame retardants, additives in plastic parts, re-cycled/re-used/bio-plastic parts, packaging and electrical safety were predominately assessed in a parallel revision project within Nordic Ecolabelling, that of Computers to version 7.0.

About this criteria development/revision

The revision for criteria version 6.0 was undertaken during the autumn of 2012 and spring of 2013. During the process of the criteria revision license holders as well as other stakeholders such as other environmental label organizations, environmental organizations, producers, retailers and industrial organizations were consulted.

The referral period was set from December 2012 – February 2013 during which the proposal for the new criteria document version 6.0 was published in the website of the Nordic Ecolabelling.

The project team for this revision in the Nordic Ecolabelling was the following:

| | |
|-----------------|---------------------------|
| Project leader: | Jimmy Yoler/Anders Moberg |
| Denmark: | Jacob Wegener Waidløw |
| Norway: | Marianne B Eskeland |
| Sweden: | Ove Jansson |

4 Motivation for the requirements

Harmonization with Blue Angel

During the revision to version 5.0, the structure of the criteria was simplified, which made it easier for manufacturers or distributors to apply for the Nordic Swan Ecolabel if they already held an ecolabel issued by Eco Mark or Blue Angel.

The harmonization ambition was also prioritized during the revision to version 6.0 of the criteria. However, it was concluded that Blue Angel was a more relevant ecolabelling scheme to harmonize with than Eco Mark. The Blue Angel had drafts for new criteria proposals during the time Nordic Ecolabelling revised version 5.0 with later modifications to version 6.0 (see further motivation under 5-Changes from previous version, and removed requirements), which Eco Mark had not. Therefore, the revision to version 6.0 implied such major changes with corresponding criteria document at Eco Mark that the harmonization ambition was not able to uphold with the Japanese eco-label.

The additional requirements a manufacturer must comply with to receive a Nordic Swan Ecolabel, if the manufacturer holds a valid Blue Angel label, are listed in R1 in the criteria document.

R1 Valid Blue Angel license

If the product has a valid Blue Angel license (RAL-UZ 171 (valid until 2017-12-31), RAL-UZ 205 or later versions), the following requirements need to be fulfilled:

- Re-used plastic, R4
- Disassembly, R5
- Flameretardants, R11
- Phthalates in external power cable, R12
- Re-cycled material in packaging, R15
- Double-sided copying, R18
- Consumables, R18
- Code of conduct, R21
- Chapter 5, Quality and regulatory requirements
- Appendix 2

☒ Description as specified above.

Environmental requirements

General description

The intention with this requirement is to see if the product is possible to license, i.e. it is included in the product definition.

R2 Description of the product

Describe the product and how it fulfils the definition of a product eligible to carry the Nordic Swan Ecolabel.

☒ Description as specified above.

Energy consumption

Energy consumption is a very important property of the device from an environmental point of view, see more details in 2.2 – RPS-analysis. Also, in the closely related Nordic Ecolabelling product groups, “computers” and “audiovisual equipment”, there are clear indications that energy consumption during the user-phase is the most important environmental parameter when considering entire product life cycles.

Nordic Ecolabelling has through the years tried to harmonize its requirements as much as possible with worldwide well known standards as for example Energy Star. During the revision process for criteria version 5.0, the Nordic Ecolabelling proposed an energy requirement where the applicant should comply either with Blue Angel criteria (at the time being the most stringent requirement RAL-UZ 122, June 2006) or Energy Star criteria (at the time being version 1.0 May 3 2006).

The harmonization ambition continued throughout version 6.0 of the criteria. During the criteria revision, both Blue Angel and Energy Star had drafts for new criteria – RAL-UZ-171 (from July 2012) and Imaging Equipment version 2.0 respectively. The formulation of requirement R3 was decided to be unchanged in relation to version 5.0 with later modifications concerning the reference to Blue Angel and Energy Star. The difference between the two ecolabelling organizations sharpness for this product group and specific requirement was also valid during the revision for version 6.0 as it was during the revision to version 5.0.

For more detail information regarding the energy consumption calculations in the respective labelling organization, Nordic Ecolabelling refers to Blue Angel and Energy Stars respective webpages. Imaging equipment that meet these requirements will provide significant energy savings. If all imaging equipment in the United States met these new ENERGY STAR requirements, the savings in energy costs would grow to more than \$178 million each year and 2.6 billion pounds of annual greenhouse gas emissions would be prevented, equivalent to the emissions from more than 240,000 vehicles. With this specification, the Energy Star label will recognize products that use, on average, between 40 to 55% less energy than standard models, depending on product type and print speed.⁶ Energy Star version 2 was finalized in April 2013.

R3 Energy consumption

The energy consumption of the product must fulfil the energy requirement in Blue Angel criteria for a corresponding product. Energy consumption must be measured in accordance with the requirements described in the criteria for Blue Angel: (RAL-UZ 171 (valid until 2017-12-31), RAL-UZ 205 or later versions)⁷.

Or

The energy consumption of the product must fulfil the energy requirement in Energy Star criteria for imaging equipment. Energy consumption must be measured in

⁶ Final Version 2.0 Imaging Equipment Program Requirements, <https://energystar.gov>

⁷ Blue Angel, RAL-UZ 171 (valid until 2017-12-31) or RAL-UZ 205, Basic Criteria for Award of the Environmental Label, Office Equipment with Printing Function (2012)
http://www.blauer-engel.de/de/produkte_marken/vergabegrundlage.php?id=259

accordance with the requirements described in the Energy Star criteria for “Imaging Equipment version 2.0”⁸ or later versions.

- ☒ A test report documenting that the product(s) is in compliance with either RAL-UZ 171 (valid until 2017-12-31), RAL-UZ 205 or later versions, or Energy Star criteria for “Imaging Equipment version 2.0”, or later versions.

Design and materials

Discarded printing equipment represents a considerable waste problem. Large amount of waste is generated containing hazardous substances such as flame-retardants and heavy metals.

According to Sweden’s business sectors service company for the collection and recycling of electrical and electronic products (El-kretsen), “office equipment and other IT and telecommunication equipment”, in which printing equipment is a part, where recycled with 26 846 tons in 2009, 28 690 tons in 2010 and 28 355 tons in 2011⁹. According to the Swedish Environmental Protection Agency, Sweden has a good frequency of re-cycling. In 2009, 94% of the same abovementioned category was re-cycled, of which 91% was either re-used or material re-cycled¹⁰. El-kretsen show in their statistics that “miscellaneous” electronic waste (excluded are TV-sets and monitors) lead to an extraction of approximately 17% plastics.

Requirements as to re-cycling and re-using parts and materials increase material re-cycling and re-use. The background for the requirement that at least one part >25g shall be made of re-used or post-consumer and pre-consumer plastic is derived from Eco Mark. The intention of Eco Mark was to initiate a process to use re-used or re-cycled plastics. The formulation of the requirement has during the revision phases been altered so that a re-used plastic part can be accepted as well as a post or pre-consumer re-cycled plastic. The Nordic Ecolabelling recognizes that there is a challenge in the availability of post-consumer plastics with good enough quality, therefore pre-consumer plastics are allowed in the revision towards version 6.0 of the criteria.

Post-Consumer Material:

Material generated by households or by commercial, industrial, and institutional facilities in their role as end-users of the product that can no longer be used for its intended purpose. This includes returns of materials from the distribution chain.

Pre-Consumer Material:

Material diverted from the waste stream during the manufacturing process. Excluded is the reutilization of materials such as rework, regrind or scrap generated in a process and

⁸ Energy Star, Product Specification for Imaging Equipment, Final Draft Version 2.0 (2012)
<http://energystar.gov/products/specs/sites/products/files/Final%20Draft%20Version%202%200%20Imaging%20Equipment%20Specification.pdf>

⁹ El-kretsen, Sweden’s business sectors service company for the collection and recycling of electrical and electronic products, Annual report 2011 – In Swedish http://www.el-kretsen.se/sitespecific/elkretsen/files/arsrapport2011/elk_0066_arsrapport_2011_webb.pdf

¹⁰ Swedish Environmental Protection Agency, report 6482 (2012), ”Collect, re-cycle!, a follow-up of the producer responsibility” – in Swedish
<http://www.naturvardsverket.se/Documents/publikationer6400/978-91-620-6482-2.pdf>

capable of being reclaimed within the same process that generated it.
(Source: ISO 14021:1999)

They are therefore steering natural resources to be conserved and waste sent to landfill sites or incineration to be reduced meanwhile speeding up the trend towards increased plastic re-cycling. This requirement supports the Waste Electrical and Electronic Equipment Directive (WEEE-Directive), 2012/19/EU, and also provides a scope for up-grading and ease of re-pair. Another advantage of these criteria is that they can be used for product development purposes by manufacturers. This requirement is partly harmonized with Blue Angel and Eco Mark.

In general, the requirements focus on plastic casing parts >25 g as the significant level for material re-use or re-cycling. The imaging product must have an environmentally friendly design, using few plastics materials (e.g. homo-polymer, co-polymer or polymer blends), which are separable. To promote post-consumer re-cycling at least one part >25g must be made of re-used or re-cycled plastic.

R4 Re-used plastic

List the plastic materials used.

At least one part > 25 g must contain re-used plastic part or post-consumer and pre-consumer re-cycled plastic.

- A list from the manufacturer of the imaging equipment showing the plastic materials used, by filling out Appendix 5.
- Declaration from the manufacturer of the imaging equipment, showing that the requirement is fulfilled by filling out Appendix 4.
- Description from the manufacturer of the imaging equipment of all plastic part comprising of re-cycled (post-consumer/post-industrial)* or re-used plastic parts.

Disassembly

The total amount of products for recycling covered by WEEE (the European Waste Electrical and Electronic Equipment Directive) collected in 2011 in Sweden was 154 000 tons, in Norway about the same and in Denmark 80 000 tons according to information from Elkretsen (the business sector's service company for the collection and recycling of electrical and electronic products implementing the producer responsibility solution). Historical products are heavier than new products. The historical flow is still significant even if the WEEE was established already 2001 according to Elkretsen.

An imaging equipment consists of a number of different raw materials of which many are classified as being particularly significant and critical by the European Union (EC 2010)¹¹. Many of the critical metals, especially the rare earth metals, show a total end-of-life recycling rate of less than 1 % according to a study carried out by the German institute Oeko-Institut e.V.¹². The recycling situation for precious metals (platinum, palladium, gold and silver) and cobalt is significantly better with rates above 50% according to the study. It is difficult for Nordic Ecolabelling to influence this phase of the recycling process. However there are requirements for disassembly which makes it easier for

¹¹ WEEE directive: <http://eur-lex.europa.eu/JOHtml.do?uri=OJ:L:2012:197:SOM:EN:HTML>

¹² <http://www.oeko.de/oekodoc/1375/2012-010-en.pdf>

recycling. Nordic Ecolabelling believes that this has an effect of the amount of recycled metals and other materials that can be recycled.

With these figures in mind Nordic Ecolabelling find the requirement on disassembly to facilitate recycling important.

R5 Disassembly

Imaging Equipment must be designed in such a way that disassembly is possible. The requirement consists of the following individual requirements:

- A qualified person, working alone, must be able to disassemble the product.
- The manufacturer must ensure that disassembly of the unit is possible and compile disassembly instructions demonstrating that:
 - connections are easy to locate and access and easily separable with generally available tools.
 - connections are, where possible, standardized.
- It must be possible to separate the substances, preparations and components listed in ANNEX VII of the WEEE Directive (2012/19/EU).
- If labels are required they shall be easily removable or integrated. This does not apply to safety labels according to CENELEC safety standard EN 60850 §1.7.2.
- Plastic parts heavier than 25 g must be composed of one polymer or compatible polymers.
- Plastic parts heavier than 25 g may contain metallic inlays provided that these can easily be separated without the use of special tools.
- 90% by weight of plastics and metals in the enclosure and chassis must be technically suitable for material recovery.

☒ Disassembly instructions and a declaration from the manufacturer of the product showing that the requirements are met (Appendix 3, Design, can be used).

The ecolabelling organization may request a demonstration of disassembly, if this is considered necessary. The demonstration may take the form of a video film or an inspection visit by the ecolabelling organization. The licence applicant may also choose to arrange for a third party to verify that the product fulfils the requirements. The products that are checked must be selected randomly. The licence applicant will bear the cost of verification.

Products with combined toner cartridge

Some printing devices use a combined toner cartridge (drum, developer and toner in one unit) instead of one separate and removable unit. These combined toner cartridges may be accepted if the cartridges have been designed for re-use. Products must also accept remanufactured cartridges.

R6 Special requirements as to products with combined toner cartridges

Products with combined toner cartridge may be accepted if the cartridge is not designed to prevent re-use.

Products must accept re-manufactured toner cartridges.

In order to ensure that the toner cartridges are returned for re-use, a return system must be offered for re-cycling combined toner cartridges and information to user about the return system must be provided.

Combined toner cartridge = Drum, developer and toner in one unit.

- Declaration from the manufacturer of the imaging equipment showing that the requirement is fulfilled by filling out Appendix 4.
- The applicant/manufacturer must document the existence of a functional return system and describe the structure of this system.

Plastics in casings and their components

The requirement in this and the following chapter, i.e. chlorine-based plastics, flame retardants, phthalates in the external cable in plastic parts and chemicals during production are intended to stimulate the phasing out, or a substitution of environmentally dangerous substances and products.

Numerous and complicated process stages are required to produce the electronic parts for an imaging equipment product, such as a printing device. Large volumes of chemicals are used and the volume of waste generated often is significant in volume and complexity.

The following requirements are partly harmonized with the Blue Angel.

R7 Marking of Plastics

Plastic parts > 25 g and with a plane surface of at least 200 square millimetres, must be permanently marked according to ISO 11469:2000 while taking ISO 1043, part 1-4, into consideration.

- Declaration from the manufacturer of the imaging equipment showing that the requirement is fulfilled by filling out Appendix 4.

Single and combined plastic casing parts

R8 Single plastic casing parts

Single plastic casing parts > 25 g must be made of a homopolymer or copolymer. Polymer blends (polymer alloy) are permitted.

- Declaration from the manufacturer of the imaging equipment showing that the requirement is fulfilled by filling out Appendix 4.

R9 Combined plastic casing parts

Combined plastic casing parts > 25 g must be made of four or fewer types of mutually separable polymers or polymer blends.

- Declaration from the manufacturer of the imaging equipment showing that the requirement is fulfilled by filling out Appendix 4.

Chlorine-based plastics

PVC plastic parts >25g are excluded from use in imaging equipment. The presence of chlorine atoms in materials affords a number of technically desirable properties, but there are adverse environmental impacts coupled to the disposal of PVC plastics as they usually contain additives with undesirable health effects. When PVC ends up in the waste stream for incineration, this means effectively more chlorine in the waste stream.

Chlorine is a prerequisite for the formation of the highly toxic dioxins in the flue gas, but

since there are several other sources of chlorine than PVC, an increased incineration of PVC will not necessarily lead to an increased amount of dioxin, as chlorine is not the limiting factor for the formation of dioxins in incinerator^{13,14}. The extra amount of PVC will, however, increase the formation of acidic gases and consequently will increase the need for gas cleaning with gas cleaning equipment.

Combustion of 1 kg of PVC produces up to 1.7 kg of salt in flue gas cleaning⁸. In practice, it means that more waste is generated than the amount of waste that was sent into the incinerator. This is due to the neutralizing process carried out in order to avoid hydrochloric acid to be formed and create a corrosive environment in the incinerator. Not all waste incineration facilities are able to incinerate PVC-products in the Nordic region. Old fractions of PVC have a high probability of containing hazardous additives such as lead and cadmium creating rest materials that need to be taken care of. In the case of incinerators that cannot incinerate such PVC waste, the stream is usually landfilled. In the case of incinerators being able of incinerating such PVC waste, the rest products (the fly ash and bottom slag) are treated specially; the fly ash being landfilled in special landfills, and the bottom slag also landfilled or used as construction material for landfills.

During the revision to version 6.0 it was decided to remove the exception in previous versions of the criteria for re-used/re-cycled chlorinated polymers. The motivation for this is that producers do not tend to re-use/re-cycled chlorine-based plastics, due to a set of reasons such as availability and content. The modified requirement for chlorine-based plastics requirement, without the exception for re-used/re-cycled chlorinated plastics became therefore more like equal requirements for close related product groups of audiovisual equipment and computers.

R10 Chlorine-based plastics

Plastic parts >25g must not contain chlorinated polymers.

- Declaration from the manufacturer of the imaging equipment, showing that the requirement has been met.

Constituent substance

The term constituent substance refers to all substances in the product, including additives in the ingredients (such as preservatives and stabilizers), with the exception of impurities from primary production. Impurities are defined as residual products from primary production that can be found in the product in concentrations below 0.010% (100 ppm). Substances that are actively added to an ingredient or product for a particular purpose are not considered to be impurities, irrespective of quantity. Impurities of over 1.0% concentration in the primary product are regarded as constituent substances. Substances/products known to be liberated by a constituent substance (e.g. formaldehyde and arylamine) are also themselves considered to be constituent substances.

¹³ Hjelmar, 2002: Forbrænding af PVC: Påvirkning af massestrømmene gennem et forbrændingsanlæg. DHI – Institut for Vand og Miljø

¹⁴ Erichsen & Hauschild, 2000: Technical data for waste incineration – background for modelling of product specific emissions in a life cycle assessment context. Department of manufacturing engineering, Technical University of Denmark, 2000

Flame retardants

All electrical and electronic products carry a risk of fire. Various flame retardants are used to minimise this risk. The choice of flame retardant is governed by various factors, including the material to be protected, fire safety standards and price. The flame retardant must also not impinge on the product's intended technical functions.

It is intended that flame retardants will provide protection throughout a product's life cycle. They are therefore intentionally designed not to break down easily, which means that the substances may not be readily degradable when they enter the environment. A great deal of attention has been focused on *brominated* flame retardants, not least because they have been detected in breast milk and in blood.

Of the flame retardants that are not brominated, the most common are metal compounds, organic phosphorus and nitrogen compounds or inorganic salts.

There are around 70 brominated flame retardants on the market and knowledge regarding their effect on health and the environment varies. Table 10 gives a summary of the different flame retardants, along with their risks and usage restrictions. The five brominated flame retardants that have been used most and about which there is a great deal of knowledge are¹⁵:

- pentabromodiphenyl ether
- octabromodiphenyl ether
- decabromodiphenyl ether
- hexabromocyclododecane (HBCDD)
- tetrabromobisphenol A (TBBP-A)

The three top chemicals fall into the group of polybrominated diphenyl ethers (PBDE). Under the EU's Restriction of Hazardous Substances (RoHS) Directive, polybrominated diphenyl ethers and polybrominated biphenyls (PBB) have been prohibited in new electrical and electronic equipment since July 2006. The European Commission decided in October 2005 that the flame retardant decaBDE¹⁶ should generally be excluded from the ban in the RoHS Directive. However, on 1 April 2008, the European Court of Justice ruled that the Commission's decision on such an exemption was invalid. As a consequence decaBDE was also banned in electrical and electronic products from 1 July 2008.

No new substances have been banned in the recently revised RoHS Directive (which entered into force in June 2011). The flame retardants that the Commission was tasked with working into the RoHS Directive were the brominated flame retardants HBCDD and TBBP-A.

Sweden was rapporteur for the risk assessment of HBCDD under the EU's Existing Substances Programme. The conclusions in the report are that the substance is persistent, bioaccumulating and highly toxic to aquatic organisms, and may cause damaging long-term effects in an aquatic environment. In animal tests, HBCDD has

¹⁵ <http://www.kemi.se/sv/Innehall/Fragor-i-fokus/Flamskyddsmedel/>

¹⁶ Penta-, octa- and decabromodiphenyl ethers belong to the same chemical group, polybrominated diphenyl ethers, which is abbreviated to PBDE. These have different numbers of bromine atoms in their structure. All three are non-readily degradable and persistent substances, but their bioaccumulation and toxicity varies.

been shown to affect the liver and thyroid and be toxic for reproduction. The EU's risk assessment of HBCDD has been completed. HBCDD has been identified as a Substance of Very High Concern (SVHC), and has been entered on the Candidate List (REACH). HBCDD has also been included on the Authorisation List, Annex XIV, in REACH.

TBBP-A has also been risk assessed under the EU's Existing Substances Programme. As a result, the substance has been classified as highly toxic to aquatic organisms, and may cause damaging long-term effects in an aquatic environment. TBBP-A is considered non-readily degradable and may bioaccumulate. Alternatives to TBBP-A as a flame retardant have been developed and their use is increasing.

TBBP-A is the most widely used brominated flame retardant in global terms. It is used primarily in printed circuit boards. Since it is chemically bonded to the material in the printed circuit board and is thus not as easily spread into the surrounding environment, the EU has judged that it poses no risk to human health in this application.

Chloroparaffins, which can also be used as a flame retardant, are stable and non-readily degradable substances that can bioaccumulate in the environment. Short and medium chain chloroparaffins are highly toxic to aquatic organisms, and may cause damaging long-term effects in an aquatic environment. Short chain chloroparaffins have been identified as Substances of Very High Concern (SVHC), and have been entered on the Candidate List.

Table 10 Summary of flame retardants, their risks and usage restrictions

| Flame retardant | Rule | Risk assessment | Nordic Ecolabelling stipulation |
|---------------------------------------|--|---|--|
| Polybrominated biphenyls (PBB) | Banned in new electrical and electronic equipment since July 2006 under RoHS Directive | PBB was the first brominated flame retardant that proved to be harmful. The substance has been well studied and as far as we know PBB is no longer made. | Must not be present |
| Polybrominated diphenyl ethers (PBDE) | Banned in new electrical and electronic equipment since July 2006 under RoHS Directive (since July 2008 for decaBDE) | <u>pentaBDE</u> : persistent, harmful to health and environment. POP substance (UNEP) <u>octaBDE</u> : endocrine disruptor, persistent and bioaccumulating. POP substance <u>decaBDE</u> : suspected to be harmful but risk assessment pending. | Must not be present |
| Hexabromocyclododecane (HBCDD) | Use permitted | Classed as SVHC. Included on Candidate List. | Must not be present |
| Tetrabromobisphenol A (TBBP-A) | Use permitted | Highly toxic to aquatic organisms. May cause damaging long-term effects in an aquatic environment. | Must not be present (exceptions for printed circuit boards) |
| Short chain chloroparaffins | Use permitted | Classed as SVHC. Included on Candidate List. | Chain length of 10-13 carbon atoms and chlorine content > 50 must not be present |
| Medium chain chloroparaffins | Use permitted | Highly toxic to aquatic organisms. May cause damaging long-term effects in an aquatic environment. | Current criteria: No requirement Revised criteria: Must not be present |

Table 11 below shows a list of the brominated flame retardants used in commonly occurring polymers.¹⁷

Table 11 List of brominated flame retardants used in commonly occurring polymers

| Polymer | Content (%) | Substance(s) |
|----------------------------------|-------------|--|
| Polystyrene foam | 0.8-4 | HBCDD |
| High-impact polystyrene | 11-15 | decaBDE, brominated polystyrene |
| Epoxy resin | 19-33 | TBBP-A |
| Polyamides | 13-16 | decaBDE, brominated polystyrene |
| Polyolefins | 5-8 | decaBDE, propylene dibromostyrene |
| Polyurethanes | n/a | no brominated flame retardants available |
| Polyethylene terephthalate (PET) | 8-11 | brominated polystyrene |
| Unsaturated polyesters | 13-28 | TBBP-A |
| Polycarbonate | 4-6 | brominated polystyrene |
| Styrene copolymers | 12-15 | brominated polystyrene |

Against this background, particularly the credible risk assessment, the following is proposed:

1. A continued ban on polybrominated diphenyl ethers (PBDE) and polybrominated biphenyls (PBB), under which the requirements in RoHS must be met. RoHS now also includes a ban on decaBDE, which is not incorporated into the current criteria.
2. The revised criteria should be toughened to include a ban on high chlorine short chain and high chlorine medium chain chloroparaffins.
3. The revised criteria should be toughened to include a ban on hexabromocyclododecane (HBCDD), tris(2-chloroethyl)phosphate (TCEP) and tetrabromobisphenol A (TBBP-A). Exceptions are made for TBBP-A for printed circuit boards.
4. As is the case today, flame retardants used in constituent plastic and rubber parts must not, at the time of the ecolabel application, have been given or have the potential to be given the following risk phrases:
 - H350 (may cause cancer)
 - H350i (may cause cancer by inhalation)
 - H340 (may cause heritable genetic damage)
 - H360F (may impair fertility)
 - H360D (may cause harm to the unborn child)
 - H360Fd (Suspected of damaging the unborn child)
 - H360Df (Suspected of damaging fertility)

¹⁷ Pedro Arias, Brominated flame retardants – an overview. 2nd International Workshop on BFR, Stockholm, 2001

Exception from 4 may be acceptable where this is necessary for electrical or fire safety reasons under the Low Voltage Directive 73/23/EEC or standard EN 60335-1 (electrical appliances for household use). Printed circuit boards and plastic/rubber parts weighing < 25 grams that are integral to electronic parts are exempted from the requirement.

Nordic Ecolabelling has found that licensees have great difficulty in providing CAS-numbers for all the flame retardants used, as is required. There are several links back down the chain between the manufacturer of the end product and the manufacturer of the components (plastic parts)/chemicals. It is therefore proposed that CAS-numbers should not be included as part of the required documentation.

Today TBBP-A is the most used flame retardants in printed circuit boards. TBBP-A has been assessed by EU and found “acceptable“ regarding human health. Regarding aquatic and terrestrial ecosystems EU has concluded that there is a need for further investigation¹⁸. TBBP-A is currently used in over 90 % of the printed circuit boards on the market according to a report from US Environmental Protection Agency¹⁹. The market situation when revising these criteria motivated the exception for printed circuit boards from the halogenated flame retardant TBBP-A prohibition requirement. One reason for using TBBP-A is that the printed circuit boards have to meet the fire safety requirement standard UL 94 V0 which is achieved by using TBBP-A. With TBBP-A as flame retardant it has also been possible to meet performance specifications. The specifications can be difficult to meet due to the layered structure of the printed circuit board, etc. One problem has been that the boards, for example, tend to delaminate at higher temperatures. Halogen-free alternatives to TBBP-A are, however, becoming more available on the market now. However TBBP-A is still the dominating flame retardant in printed circuits boards on the market and therefore the steerability (possibility to choose other products) is not good enough to exact requirements for printed circuit boards. Printed circuit boards are thereby exempted from this requirement.

The use of TBBP-A is not restricted today but TBBP-A is on many priority lists of chemicals that are risks to the environment. For example Norway's list to eliminate or substantially reduce releases of priority substances²⁰.

During the revision of the criteria Nordic Ecolabelling have been in contact with producers of white goods, computers, TVs and image equipment and asked them what kind of printed circuit boards and flame retardants they used. Most of the printed circuit boards contained TBBP-A. There were one example where one producer used printed circuit board treated with alternative DOPO (9,10-dihydro-9-oxa-10-phosphaphenanthrene-10-oxide) but that was for one printed circuit board in a product that is containing other printed circuit board. The other were treated with TBBP-A. According to European Brominated Flame Retardant Industry Panel over 95% of printed circuit

¹⁸ Communication from the Commission on the results of the risk evaluation and the risk reduction strategies for the substances: sodium chromate, sodium dichromate and 2,2',6,6'-tetrabromo-4,4'-isopropylidenediphenol (tetrabromobisphenol A), (2008/C 152/02) <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2008:152:0011:0020:EN:PDF>

¹⁹ Design for the Environment, An EPA Partnership Program, “Flame retardants in Printed Circuit Boards”, (2007) <http://www.epa.gov/dfe/pubs/projects/pcb/index.htm>

²⁰ <http://www.environment.no/Tema/Kjemikalier/Kjemikalielister/Prioritetslisten/>

boards are treated with TBBP-A, where it contributes to the fire safety²¹. This makes it necessary with an exemption for TBBP-A in printed circuit boards today.

Normally TBBP-A is being chemically bound to the polymer as a reactive flame retardant in printed circuit board and does not emigrate from the plastic easily. It is a different situation for flame retardant that is an additive in plastic components (such as plastic for casings etc.) when TBBP-A is used as flame retardant²².

Nordic Ecolabelling will review the requirement for flame retardant in coming revision and will try to exclude also TBBP-A from printed circuit boards.

There is also an exception for plastic parts <25 g and special plastic components installed in direct vicinity of heating and fusing units due to extreme heat development on those particular parts in the device. However, above mentioned parts that are exempted from the flame retardant requirement shall not be treated with PBB, PBDE, HBCDD, TCEP, TBBP-A or chlorinated paraffins.

R11 Flame retardants in plastic and rubber

- a) The flame retardants Hexabromocyclododekan (HBCDD), tris(2-chloro-ethyl)phosphate (TCEP) and high chlorinated short chain and high chlorinated medium chain chloro paraffines must not be added.
- b) The flame retardant Tetrabromobisphenol-A (TBBP-A) must not be added,
- c) Other organic halogenated flame retardants and other flame retardants assigned one or more of the following risk phrases, or combinations, must not be added:
 - H350 (may cause cancer)
 - H350i (may cause cancer by inhalation)
 - H340 (may cause heritable genetic damage)
 - H360F (may impair fertility)
 - H360D (may cause harm to the unborn child).
 - H360Fd (Suspected of damaging the unborn child)
 - H360Df (Suspected of damaging fertility)

Exceptions from b) are made for printed circuit board

Exceptions from c) are made for flame retardants

- In cases where there is demand for safety reason with reference to low voltage directive 73/23/EG or standard EN 60335-1
- Printed circuit board, PCB
- Plastic and rubber parts that weight less than 25 gram and are parts of electric components.

Exceptions are not made for flame retardants in a) or that are regulated according to RoHS-directive (2011/65/ EG).

²¹ <http://www.ebfrip.org/main-nav/our-substances/tbbpa>

²² SWEDISH ENVIRONMENTAL PROTECTION AGENCY REPORT 6417, Recycling and disposal of electronic waste. 2011.

- ☒ The manufacturer of the imaging equipment must provide a list of plastics and rubber used in the product signed by filling out Appendix 5 – Plastics in imaging equipment, Manufacturer’s Declaration.

The plastic and rubber manufacturer must provide a list with flame retardants used in plastic and rubber parts, by filling out Appendix 6 – Flame retardants in plastics and rubber, Plastic and rubber manufacturer’s declaration.

The manufacturer of flame retardants, used in plastic parts, must certify that the requirements are fulfilled by filling out Appendix 7 – Flame retardant manufacturer’s declaration and submit an MSDS for each flame retardant.

Confidential information can be sent directly to Nordic Ecolabelling.

Phthalates in external power cable

This requirement is new in this version. There has not been any requirement for phthalates for this product before. Phthalates are commonly used in cables. Power cables, and cables as part of the AC-adaptor of the imaging equipment, are cables that the user gets in contact with.

Phthalates are used chiefly as plasticisers in plastic and rubber and may account for up to 40% of the finished product. A particular focus is placed on the use of DEHP, (di-2-ethylhexyl phthalate), which is a plasticiser in PVC. Plasticisers are not firmly bound to the PVC polymer and therefore phthalates are secreted from plastic products throughout their lifetime. This diffuse dissemination means that phthalates are found almost everywhere in the environment²³.

DEHP, dibutyl phthalate (DBP) and butyl benzyl phthalate (BBP) are classified as toxic and specifically toxic to reproduction, which means that they may impair fertility and may cause harm to the unborn child. DBP is also classified as environmentally harmful and highly toxic to aquatic organisms. These three most harmful phthalates (DEHP, DBP and BBP) are totally banned²⁴ in toys and childcare items. The three less harmful substances (DINP, DIDP and DNOP) are banned in toys and childcare items that can be put in the mouth.

It is proposed that the revised criteria should have a new requirement banning those phthalates that are shown or may be shown to be harmful. This means those that comprise linear medium, linear long or branched carbon chains.

About 25 per cent of all softened PVC²⁵ is used by the wire, cable and electrical industries. PVC's ability to be bent and twisted without cracking is a safety feature which makes it suitable for a wide range of applications.

When it comes to the computing market for instance, not all suppliers to computer manufacturers and not all computer manufacturers seem to yet have started to plan for the future restriction regarding phthalates. Nordic Ecolabelling assesses therefore the steerability in this area to be relatively low at the moment. However, Nordic Ecolabelling reasons that the effect of a limited requirement on the use of phthalates would be

²³ Swedish Chemicals Agency, http://www.kemi.se/templates/Page____3283.aspx

²⁴ If the level of the product exceeds 0.1%.

²⁵ Initiative of the European Council for plasticisers and intermediates, <http://www.dehp-facts.com/cables>

valuable in order to set focus on the problems associated with the use of phthalates. The suggestion here therefore is to only focus on the power cable used to connect the imaging equipment to the mains. Only cables with male/female connector to connect to the imaging equipment set or AC-adaptor are addressed, not cables that are hardwired to the equipment. Blau Engel has no requirement for phthalates.

The motivation for the requirement is that the volume of the plastic in a "normal" power cable to for instance a printer is considerably high in relation to the volume of the plastic in other cables inside the printer, making the requirement relevant. Cables used internally in a printer are limited to short distances and are of a lower diameter compared to external power cables due to the lower voltage levels inside the printer. The power cable is also exposed more for human contact and mechanical stress.

Alternatives such as halogen-free cables are available on the market today. If not halogen free alternatives would be preferred phthalates, others than those listed in the REACH candidate list still can be used in cables, such as PINP and DIDP. In the coming revisions we will evaluate if a more comprehensive requirement will be possible to introduce.

In November 2012 there was a law suggested in Denmark that the phthalates DEHP, DBP, DIBP and BBP must not be used.

There has been discussion about the Danish ban against phthalates should be implemented in this version of the criteria. The consequence for the Danish law against phthalates is not certain. Therefore Nordic Ecolabelling decided to keep the exclusion for printed circuit boards and parts smaller than 25 gram from the requirement. In May 2013 the Danish environmental minister decided to postpone the law two years and consider changes of the law before it is in force.

There will be an analysis of the consequence of the Danish law for phthalates if it will have consequences for this product group. Nordic Ecolabelling will contact licence holders and suppliers of plastic parts so there will be a good background for the next revision of the criteria.

R12 Phthalates in external power cable

The external power cable delivered with the product must not contain following substances:

- Diethyl hexyl phthalat (DEHP)
- Dibuthyl phthalat (DBP/DnBP)
- Butyl bensyl phthalat (BBP)
- Dicyclo hexyl phthalat (DCHP)
- Diiso buthyl phthalat (DIBP)
- Diiso nonyl phthalat(DINP)
- Diiso decyl phthalat (DIDP)
- Di-n-octhyl phthalat (DNOP)
- Dihexyl phthalat (DHP)
- Diethyl phthalat (DEP)
- Diiso hepthyl phthalat (DIHP)
- Bis (2-methoxyethyl) phthalat
- Diiso penthyl phthalat
- N-penthyl-isopenthyl phthalat

Ingoing substances are defined as all substances in the product – including additives, but not residuals from production. Residuals are defined as residuals, pollutants and contaminants derived from the production, which are present in the final product in amounts less than 1000 ppm (0,1 w-%, 1000 mg/kg), but not substances added to the raw materials or product intentionally and with a purpose – regardless of amount. Known substances realised from the raw materials are also regarded as ingoing substances.

- Declaration from the cable manufacturer, Appendix 11, can be used.

Chemicals and materials during production

Chemicals used in production

To prevent emissions to the atmosphere of ozone depleting substances during production, a prohibition of emissions during production for the specific substances CFCs (five types), other CFCs, carbon tetrachloride, 1,1,1-trichloroethane, and HCFCs is defined. This is based on the Law concerning the Protection of the Ozone Layer through the Regulation of Specified Substances and Other Measures, which is a Japanese regulation, ratified from the Montreal Protocol of ozone depleting substances. Though it is assumed that none of these substances are used in the manufacture of copiers at present, in view of the fact that certain countries and regions where copiers are manufactured may not have laws and regulations or have moratoriums on these substances, it was decided that this item should remain as a criteria to ensure that the use of ozone layer depleting substances are prohibited.

R13 Chemicals used during production

Chemicals containing the following substances regulated in the Montreal Protocol must not be used in the end production of the machines or in the production of circuit boards: CFCs, HCFCs, 1.1.1 trichloro-ethane or carbon-tetrachloride.

- Declaration from the manufacturer of the imaging equipment and the direct suppliers (suppliers during the final stages of the supplier chain) showing that the requirement is fulfilled by filling out Appendix 9.

Packaging

Packaging constitutes for some products a significant part of the volume and weight. For other products, the packaging is secondary. Packaging components may consist of materials that have harmful effects on the environment and/or health such as PVC or other halogenated plastics, which can cause environmental problems during disposal. Another important aspect is the recycling of the materials used in the packaging. For imaging equipment the major packaging material consists of cardboard boxes, plastic films, expanded polystyrene. Re-cycling of the packaging material is mandatory in the Nordic countries. Producers and retailers have to be joined to a recycling solution. In Sweden producers have joined REPA to fulfil their obligations regarding the recycling of packaging material. Corresponding systems in Norway and Finland are Grønt Punkt and PYR. In Denmark the Danish Ministry of the Environment is managing the producer responsibility for packaging waste.

According to the European Commission Green Public Procurement Training Toolkit, module 3 of Purchasing Recommendations, a brief environmental life cycle of packaging equipment includes resource consumption, primary energy consumption whilst making the packaging, environmental effects of chemicals used in the packaging (particularly chlorinated plastics), the process of making it and waste generation²⁶. In the same Green Public Procurement Toolkit it is assessed that packaging material contribute little of the total environmental impact of, in the report, office IT equipment.

However Nordic Ecolabelling find it important to consider packaging although their overall environmental impact is relatively low for the one imaging equipment as such. Mostly because it is manageable for procurers to put simple requirements in place when tendering packaging products, and thereby make reasonable environmental improvements in their production/packaging of their products. Important parameters which can be influenced are for instance quantity, type of packaging and opportunities for re-cycling.

During the revision project of the parallel Nordic Ecolabelling's revision project of the computer criteria document during 2012 it was concluded that manufacturers of IT equipment have a clear interest to use re-cycled material in their packaging. Regarding cardboard the optimum level of re-cycled content in a packaging box has not been possible to find. Re-cycling cardboard requires only 75% of the energy required to make new cardboard²⁷. One producer required the usage of more than 50% re-cycled material in the cardboard box. Another manufacturer claimed that the quality/function of the box deteriorates when that portion of re-cycled cardboard becomes too high lowering the stability and strength quality of the packaging. Weak packaging can also result in damaged products which in turn can lead to production of replacement products. The optimum level of re-cycled material depends on the weight and volume of the good contained in the packaging.

New packaging solutions are clearly available and are also being developed. Some of these solutions will surely be adopted in a large scale in the future. The traditional packaging materials will still be very much used and is actually increasing more in volume in relation to the global economic growth according to EC Nova Institute on behalf of EU²⁸. The expansion depends mostly on plastic material packaging.

Nordic Ecolabelling finds it most reasonable according to the context of packaging materials described above, to focus on cardboard material regarding re-cycled content and limit the use of halogenated plastics. An introduction of a new requirement on the use of re-cycled material was therefore suggested to version 6.0 of the criteria. The requirement as to halogenated organic substances in packaging is intended to prevent the use of chlorinated plastic materials in packaging and consequently the formation of dioxins and other persistent organic pollutants in their production and disposal phase, a requirement title modification in relation to the criteria version 5.0.

²⁶ European Commission Green Public Procurement (GPP) Training Toolkit – Module 3: Purchasing Recommendations – Office IT Equipment, Background Product Report (2008)
http://ec.europa.eu/environment/gpp/pdf/toolkit/office_IT_equipment_GPP_background_report.pdf

²⁷ Bureau of International Recycling – The Industry, Paper <http://www.bir.org/industry/paper/>

²⁸ European Commission, Community Research – Material Change, the world is looking for new materials: industrial crops (2006)
http://ec.europa.eu/research/energy/pdf/gp/gp_events/biorefinery/bs4_05_gahle_en.pdf

These two requirements, along with the requirement on labelling of plastic parts to facilitate re-cycling, comprise the packaging requirements in this criteria document.

R14 Plastic materials in packaging

Plastic material used as packaging material must not consist of, or contain, halogenated organic substances.

- Declaration from the manufacturer of the imaging equipment showing that the requirement is fulfilled, by filling out Appendix 8.
- Description of the packaging materials used.

R15 Re-cycled material in packaging

When cardboard boxes are used, they shall be made of at least 50% post-consumer re-cycled material. Only primary packaging, as defined in Directive 2005/20/EC, is subject to the requirement.

- Declaration from the manufacturer of the imaging equipment showing that the requirement is fulfilled.

Other environmental requirements

Supply of spare parts

This requirement is included to secure the supply of spare parts for repairs in order to extend the commercial life of the product. This requirement contributes to a reduction in resource consumption per unit produced.

R16 Supply of spare parts

The availability of spare parts must be guaranteed for at least five years after production of the specified ecolabelled machine comes to an end.

- Declaration from the manufacturer of the imaging equipment showing that the requirement is fulfilled by filling out Appendix 10.

Double-sided copying

The requirement for double-sided copying for printing devices is an important means of reducing the volume of paper used in printing. A significant part of the energy consumption involved in making one print is connected to the manufacturing of the paper. Using double-sided printing will therefore reduce the total energy consumption involved in printing.

This requirement was revised during the revision to version 6.0 in correlation with the suggested criteria proposal from the EU Ecolabel for duplex printing. The requirement was revised from 45 sheets per minute for A4 size paper to 19 sheets per minute. Also, the formulation for appliances with an operating speed of 20 to 44 sheets per minute was removed. In this requirement the draft for Blue Angel criteria, RAL-171 and the draft for Imaging Equipment EU Ecolabel criteria differ, and Nordic Ecolabelling chooses to harmonize with the EU Ecolabels more stringent requirement.

R17 Double-sided copying

Appliances with a maximum operating speed of >19 sheets per minute for A4 size paper must be equipped with automatic double-side copying (a duplex-unit).

- ☒ Declaration from the manufacturer of the imaging equipment showing that the requirement is fulfilled by filling out Appendix 10.

Consumables

There are currently a number of different technologies to print text and images on paper. These techniques create different volumes of consumables, such as toner cartridges and waste toner boxes. The largest amount today is traditional toner cartridges for xerographic printing. One technique that lowers the volume of consumables is inkjet, but during the revision to version 6.0 of these criteria, such technology could not produce printouts to the same quality and price as laser toner technology.

The market indicates that different manufacturers have developed different technologies, some of which reduces the volume of consumables for imaging equipment. However, such technologies are often protected by patents, making it difficult for the Nordic Ecolabelling to develop requirements for specific technologies.

Conventional printers use an imaging cartridge which contains drum, developer and toner into a single, disposable unit. When the toner has depleted, the entire cartridge must be disposed of or sent to re-cycling and replaced with a new or re-cycled unit. In some imaging equipment the drum and developer is separate from the toner. This is often common in larger imaging equipment, used in business office environments. Some manufacturer has developed solutions for smaller xerographic printers²⁹ with the advantage of creating less waste and volume of consumables needed to be transported to the Nordic market.

Nordic Ecolabelling reasons that the potential to develop some limit values for the amount of consumables, used for xerographic imaging equipment in order to lower the environmental impact from the transportation volumes of consumables and to create less end-of-product waste, is relatively high. During the revision of these criteria to version 6.0, none ecolabelling organisation had any similar requirement, making Nordic Ecolabelling first to develop such a requirement.

Nordic Ecolabelling collected some data from license holder and non-license holders within the product group Imaging Equipment and developed a first suggestion of limit values.

It is important to differentiate the limit values for the different types of equipment depending on the different technologies used for different categories of users. It is important that a private consumer has the possibility to purchase a Nordic Swan Ecolabelled Imaging Equipment for home office purposes. A limit value of Images Per Minute (IPM) ≤ 19 was set, corresponding to the same level as for duplex printing, see R15.

The limit values are expressed as maximum values, which the devices' consumables must fall beneath. The proposed limits are not very strict, around 80% of the printers can fulfil

²⁹ Kyocera, Ecosys (2012) – ”Kyocera Document Solutions’ banbrytande tekniska genombrott” (in Swedish), http://www.kyoceradocumentsolutions.se/index/om_oss/ecosys.html

the requirement, however it is assessed that not every device is able to fulfil the requirement. This is particular relevant for some small colour/monochrome laser printers for consumers or small/medium sized companies that have a higher challenge in fulfilling the requirement. The requirement is steering towards toner cartridges with higher content of toner, otherwise expressed as more prints per kg of toner cartridges which in turn lowers the environmental load created during a printer's life-time.

R18 Consumables

All consumables* that the end user can exchange by themselves for the Nordic Swan Ecolabelled Imaging Equipment must meet set maximum limits below.

For each consumable, if several variants can be used in Nordic Swan Ecolabelled Imaging Equipment, the one with the highest index for weight/1000 pages must meet set limits below.

** For instance toner cartridges, waste toner box and residual toner container.*

| Images Per Minute (IPM) | Monochrome application (Kg/1000 pages according to ISO/IEC 19752) | Color application (Kg/1000 pages according to ISO/IEC19798) |
|-------------------------|---|---|
| IPM > 19 | ≤ 0,65 | ≤ 2 |
| IPM ≤ 19 | ≤ 1 | ≤ 3 |

Products that use Ink-Jet technology are exempted.

- ☒ Declaration from the manufacturer of the imaging equipment showing that the requirement is fulfilled.
- ☒ All consumables that the end user can exchange by themselves shall be listed with gross weight (Kg) including packaging and number of pages according to ISO/IEC 19752 and ISO/IEC19798.

Performance properties

Emissions

Imaging equipment used in office environments are known for many years to be a source of ozone, volatile organic compounds (VOC) and semi-volatile organic compounds (SVOCs). Effects of such emitted substances include for instance eye, nose and throat irritation, headache and fatigue. It is interesting that common LCA constructed for imaging equipment usually do not cover indoor air emission, nevertheless, these emissions are important to monitor. According to previously mentioned review¹, VOC levels were highest from laser printers in “on” mode.

During the revision to version 5.0 of these criteria, The Federal Institute for Materials Research and Testing (BAM) in Germany, improved their new test method for determining emissions from hardcopy devices. The test method was then broadened with Total Volatile Organic Compounds (TVOC) and benzene. The broadening of the scope in relation to previous emission requirements was to meet the growing focus on the indoor environment.

During the revision for version 6.0 of these criteria, the draft from Blue Angel RAL-171 suggested a limit value for so called Ultra-Fine Particles (UFP), suspected to emit from printing devices. RAL has also developed measuring procedures and tested them in test

laboratories for detecting the emission of such particles. Simultaneously, in the EU, Green Public Procurement work for Imaging Equipment, and also the draft for the EU Ecolabel decided not to pose a similar requirement mostly due to the fact that a direct link between UFP and health impacts could not be proved¹. The definition according to RAL and BAM for UFP, is particles having a particle diameter less than or equal to $0.1\mu\text{m}$ ³⁰.

Due to the fact that the Blue Angel criteria draft RAL-171 finalization date was uncertain during the time of revision for these criteria to version 6.0, Nordic Ecolabelling chose in the area of UFP to harmonize with the EU Ecolabel. Also, significant uncertainties related to the strictness of the proposed requirement for UFP and for test laboratories to adhere to the test standards developed by BAM are relevant for harmonizing with the EU Ecolabel.

However, Nordic Ecolabelling chose in the criteria document version 6.0 to harmonize with the Blue Angel in the requirement for emissions with the additional parameter “not identified single substances VOC”. The Nordic Ecolabelling assess that the parameter is capturing residual VOC not included in TVOC, making the requirement more holistic in terms of volatile organic compound identification and regulation.

R19 Emissions

The product must fulfil the maximum limit values expressed in the table below and the emission rates must be measured in accordance with the requirements described in Blue Angel: RAL-UZ 171 (valid until 2017-12-31) or RAL-UZ 205.

| Substance | Emission rate Print phase (mg/h) | | Emission rate Ready phase (mg/h) | |
|---|---|---|-------------------------------------|--|
| | Colour Printing Total in ready + print phase | Monochrome printing Total in ready + print phase | Desktop products | Floor-mounted equipment (volume > 250 litres) |
| TVOC | 18 | 10 | 1 | 2 |
| Not identified single substances VOC | 0.9 | 0.9 | | |
| Benzene | < 0.05 | <0.05 | | |
| Styrene | 1.8 | 1.0 | | |
| Ozone | 3.0 | 1.5 | | |
| Dust | 4.0 | 4.0 | | |

Table with limited values of emission according to Blue Angel RAL-UZ 205.

- ☒ Test report containing the results of the emission test according to the methods specified in RAL-UZ 171 (valid until 2017-12-31) or RAL-UZ 205.

³⁰ BAM.De, Test Method for the Determination of Emissions from Hardcopy Devices, within the Award of the Blue Angel Ecolabel, for Equipment with Printing Function according to RAL-UZ-171

Sound power

Regarding noise Nordic Ecolabelling would like to refer to the background work made by the EU Ecolabel³¹ in 2011-2012.

Noise pollution is an environmental impact category which, similar to the case of indoor air pollution, cannot be captured by a product environmental assessment based on a life-cycle assessment. The sources of noise, as well as the modelling of noise pollution, is currently not sufficient enough and therefore considered non-operational in the context of LCA methodology. Noise is often an underestimated threat that can cause a number of short and long term health problems.

In common use, the word noise means any unwanted sound³². Noise pollution can affect health, yet the effects are very difficult to quantify. Some of the potential adverse effects can be summarized as:

- Annoyance – it creates annoyance to the receptors due to sound level fluctuations
- Physiological effects – the physiological features like breathing amplitude, blood pressure, heart-beat rate, pulse rate, blood cholesterol are affected
- Loss of productivity – noise has negative impacts on cognitive performance. For attention and memory, a 5 dB(A) reduction in average noise level results in approximately a 2 – 3 % improvement in performance
- Nervous system – it causes pain, ringing in the ears, feeling of tiredness, thereby effecting the functioning of human system

Of the abovementioned potential adverse effects, annoyance is considered to be the most widespread problem caused by environmental noise. Annoyance reflects the way that noise affects daily activities. It has been estimated by the WHO that 20 % of the population is exposed to levels exceeding 65 dB(A) during the daytime which is a value close to the noise levels caused by operating printers and/or copiers. The noise exposure time is also a significant parameter which becomes even more important if we consider working environments with many imaging devices operating at the same time, e.g. copy/print centres as then the overall effective sound level is higher.

Although noise impacts are very difficult to quantify, in many ecolabel schemes, one of the environmental impact categories addressed is noise. For instance in the EU Ecolabel criteria for the product group of personal computers one criterion refers to noise requirements during operation. Blue Angel and Japanese EcoMark criteria for imaging equipment also include noise as an environmental impact category area.

Moreover, imaging equipment manufacturers have focused on reducing unwanted noise, e.g. by introducing a feature that allows users to adjust the sound level of the printer. Some printers have the option of quiet mode in which the operating noise level of printers can be additionally lowered by three decibels. Other alternatives are to avoid beep sounds while typing hard-on buttons.

³¹ JRC, Jiannis Kougoulis, Oliver Wolf. Development of European Ecolabel and Green Public Procurement Criteria for Imaging Equipment, Working Document Input to 1st AHWG on 21st March 2011 page 29-31.

³² Noise, Wikipedia the free encyclopedia, <http://en.wikipedia.org/wiki/Noise>

A comparison between the Blue Angel and EU Ecolabel limits gives the following data, calculated from a device with 19 IPMs and 44 IPMs. Detailed noise equations from Blue Angel and EU Ecolabel are found in appendix 3

Table 5 – Comparison between Blue Angel and EU Ecolabels result of permitted noise values for devices with different copier speed.

| IPM | EU Ecolabel(dB) | | Blue Angel(dB) | | Nordic Ecolabelling version 5.0 with later modifications |
|-----|-----------------|--------|----------------|--------|--|
| | Monochrome | Colour | Monochrome | Colour | Both monochrome and colour |
| 19 | 65,6 | 66,6 | 65,7 | 66,7 | 65,6 |
| 44 | 71,3 | 72,3 | 74,4 | 74,2 | 74,4 |

The comparison shows that the EU Ecolabel has slightly tougher requirements on sound effect limit values than Blue Angel, however, in the line with Nordic Ecolabellings harmonization ambition it was accepted to refer to both system.

The modification of this requirement to version 6.0 serves partly as sharpness and easing. In the case of a colour printer with 44 IPM, the modification of the requirement from version 5.0 and later modifications imply a stricter sound effect level, meanwhile for a colour printer with 19 IPM, the modification of the requirement from version 5.0 and later modifications imply an eased sound effect level, see table 5. In the criteria version of the Blue Angels requirement for imaging equipment, only section 3.5.1 is relevant as 3.5.2 is a section comprising new ways of measuring and expressing sound effect levels, lacking any data at the moment³³.

For the sound effect requirement, Nordic Ecolabelling referred to EU Ecolabels ecological draft criteria for the award of the EU Ecolabel for imaging equipment. The EU Ecolabel revision had a time plan with a finalization in March 2013. Nordic Ecolabelling assumed that the original EU Ecolabel time-plan would be followed. Therefore, during the external review of the criteria for version 6.0, Nordic Ecolabelling referred to the EU Ecolabel draft criteria, available in the webpage for EU Ecolabel and Green Public Procurement. If the time-plan will not be followed, or any major modifications will be done during the EU Ecolabel revision, necessary measures will be taken by the Nordic Ecolabelling.

R20 Sound power

The product shall comply with the requirements for Noise in The Blue Angel RAL-UZ 171 (valid until 2017-12-31), RAL-UZ 205 (section 3.5) or the noise requirement in EU Ecolabel for Imaging equipment³⁴.

- Test report containing the results of the sound power according to the methods specified in RAL-UZ 171 (valid until 2017-12-31), RAL-UZ 205 (section 3.5) or EU Ecolabel for Imaging equipment, or their respective later versions.

³³ Contact with Mr. Buttner, RAL 2012-12-07

³⁴ Revised EU Ecolabel criteria (2012)
<http://susproc.jrc.ec.europa.eu/imaging-equipment/stakeholders.html>

Working Conditions - Code of Conduct

In certain parts of the world the production of components essential for imaging equipment involves heavy manual labour. Some of the constituent substances in imaging equipment are very harmful to health and are handled manually. Working conditions must accordingly be good in order to avert permanent damage to the health of the workers as a result of this work. At the same time, however, companies using a high proportion of manual labour are often located in countries in which the scope for securing good working conditions and freedom of speech is limited. There are for instance examples of strikes amongst battery factory workers who have been exposed to high concentrations of toxic substances and whose working conditions are also poor in other respects³⁵.

Nordic Ecolabelling believes that ecolabelled products should not only be the best choice in terms of the environment, but also in terms of working conditions. For this reason, in the version 6.0 of the criteria, Nordic Ecolabelling chose to impose the requirement that licence holders must have a code of conduct in place and that this code should be communicated to suppliers/subcontractors.

Nordic Ecolabelling recognizes that it may be very difficult to ensure that the working environment at all sub-contractors in all parts of the imaging equipment production chain is satisfactory. Nevertheless, Nordic Ecolabelling is confident that the more production facilities and raw material suppliers are confronted with a requirement/signal from their customers that a code of conduct must be met, the more likely it will become that such conditions in fact will be improved. The licence holder shall communicate its code of conduct to its supplier. The licence holder must not guarantee that it is followed by its supplier.

R21 Working Conditions

The license holder must have a code of conduct in place in accordance with the ten principles provided for in the United Nations Global Compact.

The license holder must ensure that the code of conduct is communicated to all suppliers/subcontractors together with a wish that these should also comply with a code of conduct that follows the ten principles provided for in the United Nations Global Compact.

NB: The principles embodied in the United Nations Global Compact include the following: human rights, employee rights, environmental protection and anti-corruption safeguards. Further information can be found at <http://www.unglobalcompact.org>.

If the licensee violates this code of conduct, Nordic Ecolabelling may revoke their licence.

- Copy of the license holder's "Code of Conduct".
- Description of the way in which subcontractors and producers are notified of the licence holder's code of conduct and of the licence holder's wish that they have a code of conduct in place that follows the ten principles in the United Nations Global Compact.

³⁵ International Network on Human Rights and Sustainability in Electronics – JOIN GoodElectronics in its urgent appeal to Gold Peak (2010)
<http://goodelectronics.org/news-en/chinese-battery-producer-fails-to-be-a-decent-employer/>

Quality and regulatory requirements

Information to consumers

It is important that consumers are given instructions on how to reduce the environmental impact of the printing device by for example utilizing the available energy saving setting or using the double-sided function to minimize the paper use. Important environmental benefits from this requirement are lower energy consumption from printing, recycling of toner cartridge, handling of used toner etc.

Producers/local distributors may adjust the national instruction manual to fulfil the requirement as to how to minimize the environmental impact associated with using the machine. Requirements in accordance with Nordic Ecolabelling should be implemented in the instruction manual.

R22 Information to consumers

The following information must be specified in user information:

- Maximum power consumption during operation, stand by-, low energy- and off-modes.
- Information on the function of the energy management system.
- Recommendation that the machine be turned off when not in use for a long time.
- Information on the use of double-sided copying, the presence of a duplex unit or its availability as an upgrade and information that double-sided copying will save the environment and money.
- Instructions on the positioning of the machine.
- Information about where used products and packaging can be deposited in accordance with local legislation.
- Information about the return system for re-cycling combined toner cartridges.
- Information on disposal of used OPC kit/photosensitive drums, toner containers and containers for used toner.
- Information that used batteries should be disposed of in accordance with local legislation.
- Print capacity (copies per minute and copying volume per year or month).
- Recommendation that ecolabelled paper be used.
- Maximum sound effect level during operation and stand by-modes. In the case of machines with a sound effect level of more than 63 dB L_{wad} during operation and 40 dB L_{wad} in stand-by, the manufacturer should recommend that the machine be located in a room in which no employee has his/her regular work station.
- Maximum value of emission rate of TVOC in printing phase, benzene, styrene, ozone and dust. For colour printer the values must be shown for colour and monochrome printing.
- Warranty period. For products sold to private consumers. For products only sold to companies conditions of guarantee should be stated in the contract.
- Information that offers supply of spare parts for 5 years.

The following technical information must be specified in the service manual:

- A specification of how frequently ozone filters (if such exists in current product) require replacement.
- The applicant must submit copies of all relevant pages of the user manual/service manual with information as specified in the requirement. Information on webpage is valid.

Re-cycling and re-use of consumer durables and parts that wear out

Waste is also generated as a result of the replacement of parts that wear out, e.g. combined toner cartridges. As a consequence, enhanced re-cycling of waste electrical and electronic equipment should be a major factor in preserving resources, in particular energy.

The requirement provides information for the user or service personnel about the procurement of spare parts and that scrapped parts must be taken back by the applicant or distributor to ensure re-use and re-cycling.

R23 Re-cycling and re-use of consumer durables and parts that wear out

The license applicant and/or the local representative of the license applicant must have a system in place for ensuring that consumer durables and parts that wear out as far as possible are sorted and re-covered/re-used.

Consumer durables and parts that wear out are those parts that service personnel replace when the machine is serviced or that can be replaced by the consumer after reading the instructions for use.

Collected toner cartridges, drum kits, light-sensitive drums and residual toner containers collected by the license applicant or the representative of the license applicant must be re-used or re-cycled.

- The applicant must prepare information material to the service personal and the users informing about how parts wear out and how these parts shall be re-cycled or re-used.

Service and support

In order to ensure good quality and a high service feeling when consumers or businesses purchase labelled imaging equipment, service and support must be offered by the producer. The service must be in the official Nordic language in the country where the product will be sold.

R24 Service and support

The license holder must offer service and support in the official Nordic language in the country in which the Nordic Swan Ecolabelled product is on sale.

- Description of service and support organization.

Quality system

The requirements for the quality system are intended to ensure that the license holder fulfills the criteria and that the requirements are verifiable during the period of validity of the license, including the possibility to trace the products. To complement this system, Nordic Ecolabelling needs also to have an appointed contact person at the license holder ensuring that the criteria are fulfilled during the period of validity of the license. The contact person is also responsible to inform Nordic Ecolabelling in case of planned changes or unplanned non-conformities affecting the licenses products. Following requirements are found in all Nordic Ecolabelling criteria document.

R25 The quality of the product

The license holder must guarantee that the quality (at the time of application) of the Nordic Swan Ecolabelled products leaving the production is maintained throughout the validity period of the license.

- Procedures for collating and, where necessary, dealing with claims and complaints regarding the quality of the Nordic Swan Ecolabelled product.
Documentation to guarantee the above.

R26 Nordic Swan Ecolabel licence contact

The company must appoint a person responsible for ensuring that Nordic Ecolabelling requirements are fulfilled, and a contact person for communications with Nordic Ecolabelling.

- A chart of the company's organizational structure detailing who is responsible for the above.

R27 Documentation

The license holder must be able to present a copy of the application, as well as the facts and calculation data on which the documents submitted in the application are based (including test reports, documents from suppliers and suchlike).

- ☺ Checked on site.

R28 Planned changes

Written notice must be given to Nordic Ecolabelling of planned changes in products and markets that have a bearing on Nordic Ecolabelling requirements.

- Procedures detailing how planned changes in products and markets are handled.

R29 Unplanned nonconformities

Unplanned nonconformities that have a bearing on Nordic Ecolabelling requirements must be reported to Nordic Ecolabelling in writing and also journal led.

- Procedures detailing how unplanned nonconformities are handled.

R30 Traceability

The license holder must have a traceability system for the production of the Nordic Swan Ecolabelled product.

- Description of/procedures for the fulfilment of the requirement, relevant for the whole corporate chain.

R31 Take-back system

Relevant national regulations, legislation and/or agreements within the sector regarding the recycling systems for products and packaging shall be met in the Nordic countries in which the Nordic Swan Ecolabelled Imaging Equipment are marketed.

- Declaration from the applicant regarding adherence to existing recycling/take-back agreements.

Legislation and regulations

The license holder must guarantee adherence to safety regulations, working environment legislation, environmental legislation and conditions/concessions specific to the operations at all sites where the Nordic Swan Ecolabelled product is manufactured. No documentation is required when the license is granted, but Nordic Ecolabelling may revoke the license if the requirement is not fulfilled.

R32 Legislation and regulations

The license holder must guarantee adherence to safety regulations in force, working environment legislation, environmental legislation and conditions/concessions specific to the operations at all sites where the Nordic Swan Ecolabelled product is manufactured. In addition the license holder must guarantee adherence to product specific regulations in all the Nordic countries where the product is on sale.

No documentation is required, but Nordic Ecolabelling may revoke the license if the requirement is not fulfilled.

Marketing

The requirement as to marketing has been set to ensure that that the ecolabelling criteria are fulfilled and that they are verifiable during the period of validity of the license. The requirement is common to all Nordic Ecolabelling criteria documents.

R33 Marketing

The requirement is removed as decided by the Board of Directors 17 November 2014.

5 Changes from previous version

All modification of the requirements from version 5.0 with later modifications to version 6.0 is summarized in the following table. The most important ones are considered to be requirements for energy consumption, flame retardants and packaging.

New requirements, removed requirements and evaluated requirements are described further down.

Table 6 – Summary over modification of the requirements from criteria version 5.0 with later modification to version 6.0

| Requirement Title in version 5.0 | Chapter in version 5.0 | Correspond with chapter in version 6.0 | Change |
|--|-------------------------------|---|---|
| Valid Blue Engel license | R2 | R1 | Revised referred criteria document at Blue Engel and with a bulled list over additional requirements need to be fulfilled for the Nordic Ecolabelling |
| Energy consumption | R4 | R3 | Revised energy requirement referring to revised criteria documents of Blue Engel and Energy Star versions. |
| Re-used plastics | R5 | R4 | Revised formulation for pre-consumer/ post-industrial re-cycled plastics. They are allowed, as long as they are not derived from internal production. |
| Chlorine-based plastics | R11 | R9 | Exception for re-used/re-cycled chlorine-based plastic parts removed. |
| Additives | R12 | R10-R12 | Requirement title changed to "Flame retardants". New requirements for flame retardants an phthalates. |
| Chlorine-based packaging materials | R15 | R13 | Requirement title change into: "Plastic materials in packaging". |
| Supply of spare parts | R17 | R15 | - |
| Double-sided copying | R18 | R16 | The limit value for duplex copying revised to 19 sheets per minute. |
| Emissions | R21 | R18 | Revised with additional parameter "not identified single substance VOC", harmonization with Blue Angel |
| Sound effect | R22 | R19 | Reformulated requirement. Reference directly to EU Ecolabel and Blue Angel schemes for sound effect requirement. |
| Information to consumers | R23 | R21 | - |
| Re-cycling and re-use of consumer durables and parts that wear out | R24 | R22 | - |
| Quality and regulatory requirements | R23 – R32 | R24 – R32 | Revised order of requirements. Traceability requirement stricter including compliance to the requirement for the whole corporate chain. |
| Marketing | R33 | R33 | - |

Removed requirements from version 5.0 and later modifications

Harmonization with Eco Mark

During the revision to version 6.0 of the criteria, the harmonization towards Blue Angel and EU Ecolabel was more constructive in terms of energy requirements, material requirements and requirements for emissions and sound effect. This had to do with the fact that both Blue Angel and EU Ecolabel had, at the time of the revision to version 6.0 of the criteria, constructed drafts for new criteria proposals, in contrast with Eco Mark which had modified their criteria without extensive revisions.

This fact motivated Nordic Ecolabelling to temporarily lift Eco Mark out from the initial requirement, granting products licensed with Eco Mark licenses the Nordic Ecolabel so long the quality system requirements were fulfilled.

However, such a requirement is not impossible to be re-formulated in later modifications or revisions.

Labelling of plastic parts and plastic packaging

European waste legislation, such as the WEEE-Directive, and legislation for packaging (97/129/EC) ensures that plastic parts and plastic packaging are labelled in accordance with standardized procedures stipulated in abovementioned legislations. Moreover, when dealing with certification, no problems or uncertainties have come up in relation to labelling of plastic parts and plastic packaging, which indicates that all manufacturers have procedures for labelling in place.

Subassemblies

The recycling industry has developed their recycling equipment, making the requirement for subassemblies irrelevant. The requirement for subassemblies wanted to insure that products were not produced in such a way that incompatible materials were impossible to separate. Today the recycling industries machinery is able to demolish extract and separate incompatible material. The requirement for subassemblies is also catered by the requirement for single and combined plastic casing parts, R6 and R7 respectively.

Heavy metals

The scope of the requirement for heavy metals covered all parts, also plastic parts < limit 25 grams. The main reason was that cadmium could be found in for instance "old" products PVC-products and that lead stabilizers represent approximately 70% of total stabilizer use in Europe. The stabilizers are for instance persistence and bio accumulative. Their effects are toxic to waterborne organisms, harmful to reproductive systems, toxic to the immune system and carcinogen.

The requirement on heavy metals was removed for version 6.0 of the requirement with the motivation that the directive RoHS (2002/95/EC) captures the problem with use of heavy metals in electrical and electronic equipment. The RoHS-directive poses both absolute requirements, points out limit values and exceptions of use in certain areas. As such legislation works effectively, making producers generally to comply with its

requirement, the motivation for Nordic Ecolabelling having own requirements in this area is not supported by relevance.

Batteries

The requirement for batteries (R13 in version 5.0 with later modifications) aimed are the phasing out of batteries containing heavy metals cadmium, mercury, lead, and their compounds, with the exception of technically unavoidable impurities. Such impurities could not exceed the limit values specified in the previous EU Battery Directives (91/157/EG and 98/101/EG).

Considering the entire life-cycle of a printing device from an environmental perspective, the impact from batteries is not very significant. It is important to prevent the use of nickel-cadmium batteries to prevent the environmental effects coupled to the disposal of the battery and its content of cadmium. This aim will be achieved by setting the limits provided for in the Battery Directives.

New requirements that have been added to the criteria document version 6.0

New requirements in version 6.0 of the criteria are:

- Design for disassembly , R5
- Flame retardants in plastic and rubber, R10
- Phthalates in external power cable, R11
- Re-cycled material in packaging, R14
- Consumables, R17
- Code of conduct, R20

Evaluated requirements that were considered to the criteria document version 5.0

Re-cycled/Re-used plastics and bio-based plastics

Positive initiatives from related computer manufactures can be seen regarding use of post-consumer re-cycled plastic, for instance monitors with 65 % recycled content. Also TV-sets are found to contain an environmentally interesting plastic produced from re-cycled DVDs and TV screens with an efficient sodium sulphate based flame retardant which has led to a 80% lower CO₂-emission than for conventional plastics in the manufacturing phase, according to this manufacturer.

Although the development is positive, and is in line with Nordic Ecolabellings ambition to promote post-consumer re-cycled plastic, there are two central challenges connected with post-consumer plastics. The first challenge is the content of post-consumer plastic parts and the second challenge is the availability of post-consumer plastic parts with good enough quality aspects. The low availability of good enough post-consumer re-cycled plastic parts has a consequence that manufacturers demanded volumes of such plastic

parts cannot always be guaranteed, making volume-products vulnerable for large-scale production due to raw material insufficiency.

When it comes to bio-based plastics, The Nordic Ecolabel is looking very positive on the development of using more bio-plastics in manufacturing, but is also aware of some problem connected with the use of bio-based plastics that have to be investigated further. These are for instance health and safety hazards in production, land-use and GMO as well as cultivation methods. Similarly with the use of re-cycled plastic we see that the availability to use bio-based plastic in products is limited for only some niche products.

According to recent research at EU level³⁶, there are also questions that bio-based plastics are not as sustainable as they seem. Although in some aspects bio-based plastics are more sustainable than traditional plastics, the analysis identified several environmental and occupational health and safety hazards in their respective production. Some bio-based plastics are preferable from a health and safety perspective. These include polyhydroxy-alkanoates (PHAs), poly-lactic acid (PLA) and starch. However, also they have some potential hazards. For instance, the production of PHA may expose workers to chemicals that are possibly carcinogenic, and PLA production uses a tin-based chemical that could have toxic effects on the hormonal system. Some bio-based plastics are preferable from an environmental perspective, such as starch, PHA and soy protein. However, all bio-based plastics require land for production, which may compete with land needed for food. In addition the feedstock for bio-based plastics may be genetically modified or grown using toxic pesticides, polluting the environment.

Therefore, in this criteria revision Nordic Ecolabelling is not ready to introduce a general requirement posing a certain level of post-consumer or bio-based plastic parts. The consequence of doing so would be that only some few niche products would be able to acquire a license. However, developing this kind of requirements to increase the use of post-consumer plastic is something that Nordic Ecolabelling would like to do in the future.

Electrical safety

Electrical safety concerns the electrical design of apparatus with respect to its electrical insulation and other arrangements that are intended to prevent accidents resulting from contact with live components, and the risk of fire or explosion as a result of electrical flash-over due to inadequate or faulty electrical insulation.

It is the manufacturer who is responsible for ensuring that a product is safe. In order to assess the safety of products, the authorities together with the industry have compiled standards for different product groups. The manufacturer always has the possibility to use an independent test body to test the product. A number of test bodies are accredited to certify products.

In the Nordic countries there are governmental organizations conducting inspections of electrical safety, especially in the form of market surveillance. In Sweden the Swedish National Electrical Safety Board has this responsibility.

³⁶ Alvarez-Chavez, C.R., Edwards, S., Moure-Eraso, R. & Geiser, K. (2012) Sustainability of bio-based plastics: general comparative analysis and recommendations for improvement. *Journal of Cleaner Production*. 23:47-56.

The Nordic Ecolabelling does not find any reasons to develop a new requirement for electronic safety. Nordic Ecolabelling has been in contact with the Swedish National Electrical Safety Board. They agree that there are no reasons to have specific requirements for electric safety. The CE-label still covers electrical safety and there are well-developed market controls done by governmental organizations in the Nordic countries and the EU. Nordic Ecolabelling concludes therefore that there is no need of requirements of electrical safety in the criteria document.

Flame retardants

Halogen-free alternatives are becoming more available on the market. However, our knowledge about the properties of the new flame retardants used in printed circuit boards is very limited so it is not possible for the Nordic Ecolabelling at this revision to sharpen the requirement when it comes to halogen-free flame retardants.

6 New requirements

In the next revision process for Imaging Equipment, Nordic Ecolabelling will be focus on the following areas:

- Energy use (production and use phase.
- Additives in plastic (flame retardants and phthalates)

The next coming revision will focus on:

- Ultra-fine particles
- Use of recycled plastic
- Substances in toner powder and ink
- Software to lower the use of paper
- Regulations to minimize the risk of use of “conflict metals” in electronics
- Additives in plastic parts. Flame retardants, phthalates and other chemicals.