About Nordic Swan Ecolabelled

Packaging for Liquid Foods



Version 1.4

Background to Nordic Swan Ecolabelling
17 December 2020

Nordic Ecolabelling

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Addresses

In 1989, the Nordic Council of Ministers decided to introduce a voluntary official ecolabel, the Swan. The following organisations/companies are responsible for the official "Swan" Nordic Ecolabel on behalf of their own country's government. For more information, see the websites:

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1 Summary

Nordic Swan Ecolabelling has developed criteria for packaging for liquid food products. A Nordic Swan Ecolabelled packaging shall consist of a high proportion of bio-based materials or recycled materials or a combination of these. The packaging can therefore consist of different materials - glass, aluminium, plastic or board - which is approved into contact with food. Exceptions are PVC and recycled paper that are forbidden in the Criteria.

The criteria are intended to stimulate the development of sustainable produced renewable materials and use of recycled materials in the packaging. Environmental benefits can be expected with regard to non-renewable materials reused or recycled infinitely or renewable material replacing products from a fossil source. This will conserve non-renewable resources and reduce emissions of greenhouse gases. The criteria therefore focus on sustainably produced raw materials, chemicals and packaging that can be recycled in the existing recycling systems.

Requirements are also set for packaging design to promote recyclability and on ensuring that environmental benefits are not achieved at the expense of the packaging's primary function, which is to protect and contain the food product. The focus of the criteria is thus on where there is relevance, potential and steerability to achieve environmental benefits. The criteria are the first generation of criteria for Nordic Swan Ecolabelled packaging. The structure and level of requirements will be reviewed in the next version of the criteria.

Nordic Swan Ecolabelled packaging in contact with liquid foods:

- Consists of minimum 90% sustainability sourced renewable materials or minimum 80% recycled material, in order to conserve the Earth's resources and reduce emissions of greenhouse gases.
- fulfils the high requirements for chemicals, for the benefit of health aspects, as well as opportunities for recycling;
- can be recycled, which promotes the circular economy.

Packaging for liquid foods is not a traditional Nordic Swan Ecolabelled product, since here it is the actual packaging that is Nordic Swan Ecolabelled, and not the product inside the packaging. To make this clear to the consumers, a special label for Nordic Swan Ecolabelled packaging for liquid foods must be used. Guidelines for the use and placement of the label have also been developed. For example, the label should not be placed on the front side (shelf-facing side) of the product.

2 Basic facts about the criteria

Justification for Nordic Swan Ecolabelling

Nordic Ecolabelling's mission is to contribute to sustainable consumption. Our objective is therefore to recognise products with low environmental impacts and high functionality. Since packaging for foods plays an important role in reducing environmental impacts during a food product's life cycle, it is relevant for Nordic Ecolabelling to also have criteria for the packaging.

Packaging of foods is used extensively in our society. Often, packaging is considered to be unnecessary and adverse for the environment, while also generating large amounts of refuse at home for consumers. Yet packaging is necessary, to contain and protect the food in a secure way. Nordic Ecolabelling therefore wishes to promote the important positive significance of packaging in preserving food quality. Packaging serves as important protection from spoiling the food and effectively prevents food waste. Large volumes of food products are thrown out every year[1] and without appropriate packaging, these volumes, and their environmental impact, would be even greater. Packaging thus reduces environmental impacts during the food product's life cycle and contributes to sustainable solutions.[2]

Products that can be labelled

Nordic Ecolabelling's criteria for packaging for liquid food products are focused on the packaging being produced with a high ratio of renewable material or recycled material or combination of these. The packaging can therefore consist of different materials - glass, aluminium, plastic or board - which is approved into contact with food. Exceptions are PVC and recycled paper that shall not be used in the packaging. Due to the requirements, primarily packaging made from high proportion of recycled non-renewable materials, bio-based polymers and comprising carton packaging can be Nordic Ecolabelled under the first generation of these criteria.

The definition of the product group in the criteria is as follows:

"The product group consists of primary packaging for liquid pre-packaged food products. The actual content, i.e. the liquid food product, is not included in the product group.

Packaging intended to be in contact with a liquid food product for a short time, e.g. take away coffee cups and pizza packs, cannot be Nordic Swan Ecolabelled according to these criteria. These products can be Nordic Swan Ecolabelled according to Nordic Ecolabelling's Criteria for Disposables for Food."

The brand owner of a pre-packaged food product may apply for a licence for its primary packaging. This hereby refers to e.g. breweries, dairies and other food producers, as well as brand owners such as various retail chains for which food companies manufacture products under their own names. Packaging manufacturers may also be licensed provided that the packaging manufacturer has full control over the manufacture of the primary packaging covered by the Nordic Ecolabelling requirements. In the case of plastic bottles this means, for example, that the packaging manufacturer is responsible for ensuring that all accessories included in the primary packaging such as labels, stoppers etc. comply with Nordic Ecolabelling requirements.

Nordic Swan Ecolabelling of packaging

As background material for the criteria development of packaging for liquid foods, several consumer researches have been conducted. The surveys aimed to find out e.g. how aware the Nordic consumers are of the environmental impact of food packaging and to what extent they consider Nordic Swan Ecolabel as a relevant guide to environmentally friendly packaging.

[1] http://www.fao.org/docrep/018/i3347e/i3347e.pdf (accessed 2017-06-15)
[2] https://www.researchgate.net/publication/301776599_Williams_H_2011_Food_packaging_for_sustainable_development (accessed 2017-06-15)

The studies showed that more and more of today's consumers are aware of the packaging's environmental impact and therefore consider the Nordic Swan Label on a packaging as a relevant tool. Seven out of 10 consumers found it positive to buy food in Nordic Ecolabelled packaging, while only 3 percent of the survey respondents were against. The Nordic Swan Ecolabel on a packaging also adds value for the food manufacturers. The studies showed that half of the consumers would gain a more positive impression of a food product if the packaging was Nordic Swan Ecolabelled [and 1 out of 3 were also willing to pay more for the food product if the packaging is Nordic Swan Ecolabelled.]

The Nordic Swan Ecolabel can only be found on non-food products and services, so food cannot be ecolabelled. Therefore, it is important for Nordic Ecolabelling that it is clear that here it is the actual packaging that is Nordic Swan Ecolabelled, and not the product inside the packaging. To make this clear to the consumers, a special label for Nordic Ecolabelled packaging for liquid foods must be used. Guidelines for the use and placement of the label have also been developed. For example, the label should not be placed on the front side (shelf-facing side) of the product. The consumer surveys showed that the label that clearly indicates that it is the packaging which is ecolabelled and not the content will prevent misunderstandings.

Label to be used on Swan Ecolabelled packaging for liquid foods can be seen in Image 1:

Version A without explanatory text



Version B with explanatory text



Image 1. The label to be used on the Nordic Swan Ecolabelled packaging.

3 The Nordic market

This section considers short packaging for liquid foods in general and then focuses on certain materials such as biopolymers due to the growing market during the recent years. The labelling on packaging is considered in section 4.

Packaging of food

Out of the total global packaging market from the beginning of 2000, paper and paperboard packaging accounted for the largest share of the market, at 38%.[3] Plastic packaging accounted for 30% of revenue, and the share of rigid plastic was the fastest growing element of the packaging market. This development has been driven by several factors, such as increased demand for soft drinks in PET bottles, and for bottled water.[4] In Europe, the demand for plastic was 49 million tonnes in 2015, of which 40% as packaging material. Most of the plastic packaging was intended for one-off use.[5] The plastic packaging volume is

[3] Market Statistics and Future Trends in Global Packaging, WPO – World Packaging Organisation 2008.http://www.worldpackaging.org/i4a/doclibrary/index.cfm?category_id=4
[4] Market Statistics and Future Trends in Global Packaging, WPO – World Packaging Organisation 2008. http://www.worldpackaging.org/i4a/doclibrary/index.cfm?category_id=4
[5] Naturskyddsföreningen 2017, Rätt plast på rätt plats – om svårnedbrytbar plast i naturen och plastens roll I den cirkulära ekonomin (Right plastic in the right place – about slowly degradable plastic in nature and plastic's role in the circular economy).

expected to double in the next 15 years, with a fourfold increase up to 2050 of 318 million tonnes per year – which is more than the current overall plastic industry's production.[6] Traditional packaging material such as metal, glass and also paper-based material has also been replaced with rigid plastic in the market for food products. The global consumption of beverage packaging accounted for approximately 14% of all packaging in 2005.[7] From 2006 to 2015, paper and cardboard was the main packaging waste material in the EU (34.8 million tonnes in 2015) followed by plastic and glass (15.9 and 15.8 million tonnes)[8].

Packaging for liquid foods comprises B2B products whereby the packaging manufacturer markets its products to foodsuppliers. Besides food producers and suppliers, the large everyday commodities chains also play an important role in the markets, due to their control of the most important sales channels. Most of these also have their own brands of e.g. juice or milk products. The product naturally plays the most important role in the marketing of foods. Environmental characteristics are primarily marketed with segmented product ranges, e.g. organic products.

Bio-based polymers

Today, bioplastics already play an important role e.g. in the field of packaging[9]. Development of bio-based polymers is dynamic, global production of bio-based polymers is expected to grow during the next five years[10]. Considering the global production of bio-based polymers, worldwide share of bio-based polymers in market segments of packaging is assumed to grow from 24% to 46% between years 2013-2020[11].

As an example of the development of bio-based polymers, global companies, such as Coca-Cola, PepsiCo, Nestlé and Danone have attempted to sidestep the traditional petrochemical route and create bio-PET[12] [13] [14]. PET bottles can now also be created from sugar cane molasses, an organic agricultural by-product in sugar production[15]. Bio-PET can be used with both virgin and recycled PET to make the so-called 'Mixed PET'. It is also fully compatible with standard PET recycling processes. According to Coca-Colas sustainability commitments 2020, the company is committed to Use PlantBottle™ packaging for all PET plastic bottles (up to 30% plant material)[16].

[6] Ellen MacArthur Foundation, The new plastics economy – rethink the future of plastics, January 2016. https://www.ellenmacarthurfoundation.org/assets/downloads/EllenMacArthurFoundation_TheNewPlasticsEconomy_15-3-16.pdf

[7] Market Statistics and Future Trends in Global Packaging, WPO – World Packaging Organisation 2008. http://www.worldpackaging.org/i4a/doclibrary/index.cfm?category_id=4

[8] http://ec.europa.eu/eurostat/statistics-explained/index.php/Packaging_waste_statistics

[9] Michael Carus & nova-Team, Jan Ravenstijn, Wolfgang Baltus, Dirk Carrez, Harald Kaeb, Stefan Zepnik:2013. Bio-based Polymers in the World Capacities, Production and Applications: Status Quo and Trends towards 2020 available at http://bio-based.eu/markets/

[10] Michael Carus & nova-Team, Jan Ravenstijn, Wolfgang Baltus, Dirk Carrez, Harald Kaeb, Stefan Zepnik:2013. Bio-based Polymers in the World Capacities, Production and Applications: Status Quo and Trends towards 2020 available at http://bio-based.eu/markets/

[11] Market study on bio-based building blocks and polymers in the world - Capacities, production and applications: status quo and trends toward 2020. Presentation given by Michael Carus, Florence Aeschelmann nova-Institut GmbH, Hürth (Cologne), Germany. 24 February 2015, Oslo.

[12] http://www.pepsico.com/live/pressrelease/PepsiCo-Develops-Worlds-First-100-Percent-Plant-Based-Renewably-Sourced-PET-Bott03152011

[13] http://www.coca-colacompany.com/press-center/press-releases/coca-cola-produces-worlds-first-pet-bottle-made-entirely-from-plants

[14] http://www.nestle-waters.com/media/featuredstories/danone-and-nestle-waters-launch-naturall-bottle-alliance-with-california-startup-to-develop-100-bio-based-bottles

[15] www.sidel.com/about-sidel/sustainability/pet/recycling-and-reusing-pet

[16] Coca-Cola, sustainability report 2013/2014, http://www.coca-colacompany.com/packaging-recovery

The development of biopolymers can also be seen in the markets of the Nordic countries. The Swedish juice manufacturer Brämhult and the Danish brand Valsølille, that are part of the juicer group Ecked-Granini, began in 2016 with juice bottles of Braskem's bio-based PE[17]. Coca Cola has, as mentioned in previous paragraph, has developed its PlantBottle of PET. Dairies such as Arla[18] and Tine[19] together with Tetra Pak launched bio-based screw caps in their products. In the products of Elopak, second generation renewable PE is used, made of European-sourced biomass that is not in competition with food supply[20].

There is a great deal of innovation going on in the world of packaging, and new materials are being brought to market, including nanocellulose[21]. There are also products that are edible, such as "Ooho, the edible water bottle" or plastic made from the milk protein casein[22]. See also biopolymers in the section 6.2.

4 Other labels

One of the functions of food packaging is to intermediate information about the food product contained in the packaging. While some information must be presented due to provisions in existing legislation, other information may have been added voluntarily by the food producer. The following section focuses on labelling and expressions which mainly concern packaging or other related environmental aspects. The introduction also gives a brief description of product labelling and other types of printed information concerning food products.

Labelling concerning food products (labels, symbols and expressions)

Pre-packaged food products must be labelled with various information such as a list of ingredients and constituent substances, as well as the best-before date or expiry date. These labels are governed by legislation. The general labelling rules are stated in EU Regulation 1169/2011 concerning food product information to consumers.[23]

The EU symbol **the Leaf** must be found on packaging of organic food products and these should adhere to the EU regulations for organic production. There are also a number of national organic labels, such as state-controlled organic in Denmark, **the Ø label** (Norway), **KRAV** (Sweden) and **Luomu** (Finland).

There are also other voluntary raw materials labelling schemes, such as **Rainforest Alliance Certified**[24] for agricultural products, and various nutritional and health claims that may be used by food producers. If the manufacturer wishes to make nutritional or health claims, they must adhere to the relevant regulations in food safety legislation.[25] One example is the

[17] http://www.packnews.se/default.asp?id=10336&show=more 2017-06-16
[18] http://www.arla.se/vara-produkter/vara-forpackningar/var-forpackning-med-skruvkork/
[19] http://www.tine.no/presserom/nyheter/f%C3%B8rst-med-biokork-p%C3%A5-melkekartonger
[20] http://www.elopak.com/news-media/news/news/bio-based-pe-moves-elopak-closer-to-100-renewable-vision
[21] Abstract from the article "Nanocellulose in bio-based food packaging applications", Azeredo et al, 2016, Industrial Crops and Products: http://www.sciencedirect.com/science/article/pii/S092666901630156X (accessed 06.10.2016)
[22] https://www.acs.org/content/acs/en/pressroom/newsreleases/2016/august/edible-food-packaging-made-from-milk-proteins-video.html (accessed 06.10.2016)
[23] http://www.livsmedelsverket.se/produktion-handel--kontroll/livsmedelsinformation-markning-och-pastaenden/regler-om-livsmedelsinformation-och-markning/
[24] http://www.rainforest-alliance.org/business/agriculture/certification
[25] http://www.livsmedelsverket.se/livsmedel-och-innehall/text-pa-forpackning-markning/narings--och-halsopastaenden-pa-livsmedel/

Keyhole[26] label, which is the symbol of a number of approved nutritional claims in Sweden, Norway and Denmark. There are also a number of other labels, such as **Fairtrade**-labelled[27] products, which aim to improve the working and living conditions of farmers and workers in countries with widespread poverty.

Labelling which concerns packaging (labels, symbols and expressions)

There are many different labels, symbols and expressions related to packaging in different ways. The results of consumer surveys show, however, that consumers' level of knowledge of what the various labels stand for can be very low. FSC is probably the best-established label for packaging in the Nordic countries. Even though it is very common, it seems that still only very few people know and understand what the label stands for.[28]

The following sections consider various labelling, symbols and expressions intended to give consumers information concerning packaging.

Glass and fork symbol

Material and articles which are not yet in contact with food when placed on the market shall be accompanied by the words "for food contact" or **glass and fork symbol** in accordance with Article 15 of EU Regulation 1935/2004/EC. Labelling with the symbol is not, however, mandatory for products which, because of their characteristics, are clearly intended to come into contact with foodstuffs such as e.g. cup.

Life-cycle-analysis based labelling

Nordic Swan Ecolabelling is the system which makes it easiest for consumers to choose the products which are a good choice for the environment. The products are approved on the basis of established environmental requirements and the organisations administering the system make all the complex assessments relating to the products' environmental impacts. The system excludes products that fail to meet the requirements and compliance is monitored by an independent third party.

Other environmental labels besides the Nordic Swan Ecolabel have criteria for packaging of food, but not so many criteria include packaging for liquid food products. The GEN (Global Ecolabelling Network) website[29] e.g. presents China's CEC for Disposable Food & Drink Containers, Green Seal in America for Food Service Packaging,[30] Green Label Singapore for Food Packaging, Crockery and Cutlery,[31] and Green Label in Hong Kong for Degradable Food/Drink Containers and Bags.[32] The New Zealand Ecolabelling Trust has criteria for Packaging and Paperboard Products,[33] which e.g. include egg cartons and fruit trays.

The Sustainable Packaging Coalition (SPC)

The Sustainable Packaging Coalition (SPC) has created a framework for the assessment of sustainable packaging (based on how it is defined by SPC). The SPC definition has criteria for materials use, energy use, water consumption, clean production and transport, costs and

[26] http://www.livsmedelsverket.se/om-oss/press/nyheter/pressmeddelanden/nyckelhalet-gor-skillnad/
[27] http://www.fairtrade.net/
[28] Nordic Swan Ecolabelling and FSC in a Nordic consumer survey commissioned by Nordic Ecolabelling (YouGov 2015).
[29] http://www.globalecolabelling.net/
[30] http://www.greenseal.org/GreenBusiness/Standards.aspx?vid=StandardCategory&cid=0&search=GS_35
[31] http://sgls.pixart.com.sg/categoryinfo.php?cid=34
[32] http://www.greencouncil.org/eng/greenlabel/cert.asp
[33] http://www.environmentalchoice.org.nz/specifications/published_specifications/index.htm

performance, and impacts on society and working conditions[34]. This is all based on a life cycle analysis perspective and to some extent includes the relationship between product and packaging system.[35]

KRAV's packaging pilot

In May 2016, KRAV in Sweden published its *Förpackningslots* (Packaging Pilot) for KRAV-labelled companies[36]. Here, KRAV summarises its food packaging rules. KRAV-labelled packaging must comply with three aspects:

- Give the product maximum protection and sustainability
- Be non-toxic
- Be resource- and climate-efficient

KRAV-labelled companies must be able to show clearly how they work systematically to continuously environmentally optimise their packaging. KRAV performs annual controls to assess whether the company has worked in line with KRAV's packaging rules.

Labelling of raw materials

Today, paper products can be labelled with the **FSC** (Forest Stewardship Council) or **PEFC** (Programme for Endorsement of Forest Certification) raw material labels. FSC and PEFC were originally certification systems for sustainable forestry and traceability (Chain of Custody), but this label is now being used more and more on various products and packaging. To include this label on a product, the product's raw fibres must originate from sustainable forestry and contain a given amount of FSC/PEFC-labelled timber. FSC/PEFC labelling is, however, solely intended for certified wood raw material in the product and does not describe the environmental impacts of later phases in the product's life cycle. There are similar labelling systems for bio-based plastic, such as labelling related to the renewable raw material used. This may be Bonsucro-labelled sugar cane**, RSPO** (Roundtable of Sustainable Palm Oil)-labelled palm oil, or **RTRS** (Roundtable of Responsible Soy) or **ProTerra**-labelled soya. Like FSC and PEFC, these labelling systems solely concern the actual production of the raw material, and not its environmental impact in later stages of the production chain.

Labelling concerning bio-based origin, composting and degradability

There are also other systems for labelling of bio-based raw materials, such as **ISCC Plus**[37] (International Sustainability and Carbon Certification) and **RSB**[38] (Roundtable on Sustainable Biomaterials). These are global labelling schemes concerning sustainability and ethics. The ISCC system also concerns greenhouse gas emissions. The European Commission has, among other things, recognised ISCC as one of the labelling systems to show compliance with the EU Directive on Renewable Energy (RED). ISCC PLUS has also been developed e.g. for food, feed, bioplastics and other bioenergy applications. ISCC also makes it possible to label the end-products. Based on the type of product (whether it is bio-based or partly bio-based), various labels and claims can be used on the end-products.

[34] http://sustainablepackaging.org/uploads/Documents/Definition%20of%20Sustainable%20Packaging.pdf
[35] Daniel Hellström och Annika Olsson; Managing packaging design for sustainable development - a compass for strategic directions, first edition, John Wiley and Sons Ltd. 2017
[36] http://www.krav.se/nyhet/kravs-forpackninglots
[37] http://www.iscc-system.org/en/iscc-system
https://www.scsglobalservices.com/roundtable-on-sustainable-biomaterials-rsb (accessed 2017_0615)

Braskem, a polymerproducer from Brazil has also registered the **I'm green** trademark with related symbols. The expression "I'm green" and the alternative symbols can both be used for products made from the bio-based polyethylene which the company markets.[39] Coca Cola's **PlantBottle**™ with related symbol is another example of a company choosing to communicate based on the packaging material's raw material source.[40]

A number of standards and labels are used to show that products are bio-based and biodegradable.[41] Some the standards, such as EN 16640, use radiocarbon (isotope C14) as the analysis method to show the origin of the material in a specific product, while others focus on the degree of degradability of a product in various conditions.

The EN 13432 standard applies to composting in industrial facilities, and certain national standards, such as NF T 51-800, and Vinçotte's certification, also consider domestic composting.[42] Labelling schemes for composting in industrial conditions and which are also found in the Nordic markets are the Seedling logo[43] or OK Compost[44].

In addition to the aforementioned labelling, there are also several other environmental statements (environmental claims), such as "bioplastic", "bio-based" and "biodegradable", which are often used for products without referring to any particular label or standard. Currently there is no mandatory labelling scheme requiring producers to disclose the amount of bio-based material in their products.[45] Yet producers may give this information to consumers and thereby confirm their marketing claims. Evidence that the producer fulfils bio-based requirements should be matched to the EU's CEN/TS 16137 standard: 2011 Plastics – Determination of bio-based carbon content. The standard specifies calculation methods for the content of bio-based carbon and is based on measurement of the C14 concentration.

Recycling symbols

Various different recycling symbols can be found on different packaging. The aim is to help consumers to identify how the various types of packaging can/shall be recycled. According to EU Directive 94/62 /EC on packaging and packaging waste, to facilitate recycling, packaging should be provided with information on the nature of the packaging materials used. Materials can be identified by numbering or abbreviations[46].

The **universal recycling symbol** (three arrows travelling in a continuous direction to form a Mobius loop) is often seen on packaging. This is a public recycling symbol, rather than a trademark. The symbol indicates that the packaging is recyclable, or contains recycled fibres. But it does not guarantee that recycling is organised.

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39 http://www.braskem.com.br/Portal/Principal/Arquivos/ModuloHTML/Documentos/1069/I_m_green_Communication_Guide.pdf (accessed 2017-06-15)

40 http://www.coca-colacompany.com/stories/great-things-come-in-innovative-packaging-an-introduction-to-plantbottle-packaging 2017-06-13

41 http://docs.european-bioplastics.org/2016/publications/fs/EUBP_fs_standards.pdf

42 http://www.okcompost.be/en/recognising-ok-environment-logos/ok-compost-amp-ok-compost-home/

43 http://en.european-bioplastics.org/standards/labelling/compostability-label/

44 http://www.okcompost.be/en/vincotte-amp-en-13432/

45 https://www.scsglobalservices.com/roundtable-on-sustainable-biomaterials-rsb http://en.european-bioplastics.org/standards/labelling/bio-based-label/

46 http://eur-lex.europa.eu/legal-content/SV/TXT/PDF/?uri=CELEX:31997D0129&from=DE

The **Green Dot** symbol is also often seen on packaging. It is a symbol to show that the packaging charge has been paid in the country in which the packaging/packaged item is marketed.[47] The Green Dot is used in Norway and Sweden. In Finland the equivalent

Rinki label is used.[48] Recycling companies have also developed detailed packaging labelling to make it easier for consumers to recycle correctly.[49] [50] An example is text with the pictogram "Beverage cartons must be recycled" in Norway (see image 2). Another example is the Swedish Förpackings- och Tidningsinsamlingen's (FTI) various pictograms to use on packaging.[51]

The **Tidyman** symbol is also often found on packaging. The origins of Tidyman[52] are rather unclear, but it is widely used and the symbol is still one of the most globally recognised symbols. The symbol does not concern recycling, but is a reminder to consumers that a good citizen does not litter the countryside with rubbish, but disposes of packaging waste in an appropriate way.



Image 2. Various recycling symbols on packaging. Tidyman, the universal recycling symbol and the Green Dot, together with the pictogram (to the left of the Green Dot) showing that beverage cartons must be recycled. Furthest to the right is FTI's pictogram that can be used as a guide for sorting plastic packaging.

Other instruments

Environmental product declarations (EPDs)

Environmental product declarations provide detailed environmental information without making any absolute requirements of the products. There are thus no predetermined requirement levels. The value of a declaration depends on the buyer's knowledge of which environmental factors are important for the product. There is no international system for environmental product declarations, but work is under way in this area within ISO. To create an environmental product declaration (**EPD,** Environmental Product Declaration) product-specific rules (**PCR**, product category rules) must exist or be created. These product-specific rules set requirements of the EPDs for a given product category.

An example of an environmental product declaration is the international EPD® system,[53] which describes the environmental performance of goods or a service based on a life cycle analysis (**LCA**, Life Cycle Analysis). Today there are 48 EPD categories within wood and paper products. There are also product-specific rules for beverage cartons.

[47] http://www.grontpunkt.no/emballasjemerking/
[48] http://rinkiin.fi/for-hushall/rinki-market/
[49] https://www.grontpunkt.no/emballasjemerking/
[50] http://www.ftiab.se/394.html
[51] http://www.ftiab.se/download/18.319a52e515ad8a9a7e97d3/1490879760135/Anvisningar+2017-03-31.pdf accessed 2017-06-04
[52] https://tidymanlogo.wordpress.com/history-of-the-tidyman/¨
[53] http://www.environdec.com/en/

Green Public Procurement (GPP) requirements

The EU's Green Public Procurement (GPP) has set joint criteria for public procurement. This has been done in order to have verifiable environmental criteria for products and services that are based on scientific data and a life-cycle approach. There are currently no GPP or national procurement documents for packaging for liquid food products.

Environmental management

Environmental management systems bring order to a company's own operations and produce improvements based on the company's own objectives in the environmental field. However, an environmental management system does not contain any specific requirement levels (threshold values) for the products or their production. The most important systems are **ISO 14001**, which is an international standard, and **EMAS**, which has been developed within the EU. These are generally applied by packaging manufacturers.

Product Environmental Footprint

Within the EU, an ongoing project is the Product Environmental Footprint (**PEF**), which aims to develop a method to calculate the environmental impacts of products and organisations.[54] The project is currently in a pilot phase. Under the project, product- and sector-specific rules will be developed for environmental footprints and various verification methods, as well as opportunities to communicate environmental performance to business partners, consumers and other stakeholders. Dairy products and bottled water are examples of pilot projects in this work, which is expected to be completed at the end of 2017.

5 The criteria development process

Purpose of developing the criteria

The overall objective of the criteria development is to submit a proposal for Nordic Swan Ecolabelling's new criteria for packaging for liquid foods. The project was running in parallel with the revision of the Nordic Swan Ecolabelling Criteria for Disposables for Food, since the criteria are partly similar to each other. The criteria are intended to promote renewable raw materials and recycyled material in the packaging. The focus is also on sustainably produced raw materials, chemicals and packaging recycling, based on the circular economy.

Packaging for liquid foods is not a traditional Nordic Swan Ecolabelled product in the sense that only the actual packaging is Nordic Swan Ecolabelled, and not the product inside the packaging. The conclusion drawn in the preliminary study was that to minimise the risk of confusion about what is Nordic Swan Ecolabelled, the packaging or its contents, a Nordic Swan Ecolabel with the sub-text that the ecolabelling concerns the packaging must be used. During the criteria development, rules and guidelines were also developed for the design, placement, etc. of the Nordic Swan Ecolabel on the packaging. See also section 2.

About the development of these criteria

The work was performed as an internal criteria development project within Nordic Ecolabelling. The working group was in contact with various operators in the industry, such as food producers and suppliers, packaging manufacturers, materials producers, the waste industry, research institutes and public authorities. During the criteria development, Nordic Ecolabelling's communication and market group developed rules and guidelines for the

[54] http://ec.europa.eu/environment/eussd/smgp/dev_methods.htm

design, placement, etc. of a modified Nordic Swan Ecolabel on packaging. The modified Nordic Swan Ecolabel was also tested among consumers.

6 Food packaging and sustainable development

Section 6 describes the sustainable development of food packaging in further detail, thereby justifying the requirements made in the criteria.

6.1 RPS analysis

Nordic Ecolabelling assesses a product's environmental impact throughout its life cycle. In order to achieve environmental benefits, Nordic Ecolabelling must be able to set requirements that are relevant for the environment. It must also be possible to distinguish between environment-friendly and other products. Finally, it must be possible for the producer to manage an environmental problem via the Nordic Swan Ecolabelling requirements. These three parameters should be considered together, and are called RPS (Relevance – Potential – Steerability).

Packaging's most important function is to contain and protect the packaged product.[55] This includes various phases of a product's life cycle, such as transport, storage and distribution to and in shops, and use after purchase (such as storage and possible emptying by the consumer at home). Packaging that does not fulfil any of its basic functions (to preserve and protect the product, etc.) will probably lead to a lot of waste of the packaged food, which is not desirable from an environmental viewpoint. Large volumes of food products are thrown out every year and without appropriate packaging, these volumes, and thereby the environmental impact, would be even greater.

Since the packaging is considered to be part of the packaged product, often the packaging's environmental impact is investigated together with the product. These investigations show that the environmental impacts of packaging and the material in them generally only account for a few per cent of the packaged products' environmental impacts.[56] [57] In case of beer and soft drinks, the packaging can contribute with 40 percent of the CO_2 emissions for the product[58] [59]. The investigations also show that there can be an environmental justification for allowing a higher environmental impact related to packaging. This is subject to the condition that the volume of product (food waste) can be reduced. The reason is that the benefits of reducing food waste exceed the environmental impacts from the production or optimisation of packaging. This applies especially to food products with a high environmental impact, such as meat and dairy products.[60]

[55] http://eur-lex.europa.eu/legal-content/SV/TXT/PDF/?uri=CELEX:01994L0062-20150526&from=EN (accessed 2016-12-20)
[56] http://denkstatt.at/files/How_Packaging_Contributes_to_Food_Waste_Prevention_V1.2.pdf (2015-060-14)
[57] Katajajuuri J-M, 2007. i boken Järvi-Kääriäinen, T. ja Ollila. M. Toimiva pakkaus. Pakkaustutkimus (Association of Packaging Technology and Research) - PTR ry. pp. 16-23.
[58] https://sinebrychoff.fi/media/22509/carlsberg-group-sustainability-report-2017.pdf
[59] https://www.vinbudin.is/Portaldata/1/Resources/um_atvr/umhverfid/Environmental_impacts_of_alcoholic_beverages_as_distributed_by_the_Nordic_Alcohol_Monopolies_2014_final_report_20161230_3.pdf
https://www.vinbudin.is/Portaldata/1/Resources/um_atvr/umhverfid/Environmental_impacts_of_alcoholic_beverages_as_distributed_by_the_Nordic_Alcohol_Monopolies_2014_final_report_20161230_3.pdf
[60] http://kau.diva-portal.org/smash/get/diva2:413913/FULLTEXT01.pdf (accessed 2017-06-14)

From an environmental viewpoint, it would therefore be relevant to develop function-based criteria for packaging whereby the product and its packaging are considered together, but this is highly complex. There is no potential or steerability to cover every area. Since packaging plays an important role in reducing environmental impacts during a food product's life cycle, it is relevant for Nordic Ecolabelling to have criteria for this packaging. Nordic Ecolabelling wishes to promote the important positive significance of packaging in preserving food quality and guide to material choices with a low environmental impact, low consumption of resources, and high functionality.

On investigating packaging excluding the product, the production of the packaging's constituent materials is of greatest environmental significance (glass, polymers, aluminium, paperboard). According to the LCA analyses, the transport and conversion of packaging, including filling and distribution to shops, are of less significance.[61] The waste phase, and thereby consumer behaviour, is decisive in the final phase of the packaging's life cycle. Packaging can either be discarded or sorted to existing recycling systems, provided that these recycling systems exist.

The preliminary study of packaging for liquid foods showed that it is clearly relevant to assess the environmental benefits of each individual material, but the potential and steerability is generally considered to be very low, especially for glass, fossil-fuel plastic sand aluminium. Manufacturing these non-renewable materials is energy-intensive and thereby related to high CO_2 emissions. Besides greenhouse gas emissions, there is also the major challenge related to pollution of natural habitats: in the case of aluminium, for example, the bauxite mining industry affects the environment, and in the case of polymers, there is the effect of the production of fossil raw materials, such as oil drilling. Leakage of plastic to the marine environment is also emphasised as a major challenge in our time.[62] Even though there are relevant environmental problems related to these materials, it can be difficult to determine the materials' traceability and thereby their sustainability. However, if these non-renewable materials can be reused or recycled, environmental impact will be significantly less.

There are well-established recycling systems for glass and PET bottles, as well as aluminium cans, in the Nordic region, with the deposit system driving the take-back system. In this deposit system, take-back levels of almost 90% are not unusual.[63] [64] [65] [66] Packaging recycled via the deposit system is also considered desirable material in recycling because food contact material meets food legislation and is thus considered valuable raw material from recycling perspective.The potential environmental benefits in the final phase of the life cycle for the products included in the deposit system are therefore deemed to be high. From a CO_2 perspective, there is an environmental benefit in packaging products made from recycled materials and which can also be recycled in existing recycling systems.it is therefore assessed that packaging made of non-renewable material containing recycled material that can be recycled or reused is included in the first generation of Nordic Ecolabelling criteria for liquid food packaging.

[61] Falkenstein, Wellenreuther & Detzel, 2010. LCA studies comparing beverage cartons and alternative packaging: can overall conclusions be drawn? Int J Life Cycle Assess DOI 10.1007/s11367-010-0218-x
http://www.ace.be/uploads/Modules/Publications/lca_studies_article_published_1_july_2010.pdf
[62] http://www3.weforum.org/docs/WEF_The_New_Plastics_Economy.pdf
[63] http://www.palpa.fi/yritys/palautusasteet-1
[64] http://infinitum.no/infinitum/english/deposit-facts-of-2013
[65] http://www.dansk-retursystem.dk/content/dk/om_dansk_retursystem/nogletal_arsrapporter
[66] http://www.pantamera.nu/sv/v%C3%A4lkommen-till-returpack

The driving force behind Nordic Ecolabelling's criteria is also to promote renewable raw materials in order to reduce dependence on fossil raw materials. Since, according to the LCA analyses, the manufacture of packaging material (polymers, paperboard, etc.)[67] [68] [69] has the greatest environmental impact, the emphasis of the RPS analysis is on the constituent materials. RPS for pulp and paper manufacturing is presented in further detail in the Background Document to Nordic Swan Ecolabelling of Paper Products, Basic and Chemical Modules, version 2 (2011). Environmental problems concerning paperboard manufacture are related to forestry and actual pulp and paperboard production, in the form of energy consumption, emissions to air and water, and the chemicals used.

Nordic Ecolabelling has assessed that there is relevance (R), potential (P) and steerability (S) for environmental benefits if the focus of the criteria for packaging for liquid food products

- Consists of minimum 90% sustainability sourced renewable materials or minimum 80% recycled material, in order to conserve the Earth's resources and reduce emissions of greenhouse gases.
- fulfils the high requirements for chemicals, for the benefit of health aspects, as well as opportunities for recycling;
- can be recycled, which promotes the circular economy.

Below, these aspects are considered in further detail.

High element of bio-based material

The criteria are intended to stimulate the development of renewable material. Environmental benefits can be expected with regard to renewable material replacing products from a fossil source. This will conserve fossil resources and reduce emissions of greenhouse gases.[70] Renewable resources as such do not contribute to increased emissions of greenhouse gases, since the CO_2 released in the waste phase is considered to be biogenetic and is part of the natural CO_2 cycle. In World Economic Forum's "The New Plastic Economy" renewable resources are highlighted as an alternative to reduce the negative environmental impacts of plastic.[71] Bio-based products and biomass are also one of the prioritised areas which the EU has identified in its action plan.[72]

Sustainably produced raw materials

Environmental benefits of the criteria are also related to the opportunities to promote sustainable production of renewable raw materials. When bio-based materials are promoted to replace other materials (such as fossil-fuel plastic or aluminium) it is vital that the bio-based material is produced sustainably without creating environmental problems in other areas (called a burden shift). One example of this is land use change, which can lead to increased CO_2 emissions and reduced biodiversity, due to increased cultivation of raw

[67] http://www.billerudkorsnas.com/PageFiles/20097/LCA_report_BillerudKorsnas2015_Final.pdf
[68] https://endpoint895270.azureedge.net/static/se/documents/sustainability-downloads/lca%20nordic%20final%20report.pdf
[69] http://www.environdec.com/en/EPD-Search/?query=elopak
[70] Wolf O. Crank M. Patel M. Marscheider-Weidemann F. Schleich J. Hüsing B. Angerer G. 2005, Techno-economic feasibility of large-scale production of bio-based polymers in Europe, Joint Research Centre, Institute for Prospective Technological Studies, Technical report EUR 22103 EN
[71] http://www3.weforum.org/docs/WEF_The_New_Plastics_Economy.pdf
[72] https://ec.europa.eu/research/bioeconomy/index.cfm?pg=policy&lib=strategy

materials for biopolymer manufacture. It is difficult to predict the consequences of changes in land use, but it is important not to consider renewable raw materials solely as an unlimited resource.[73] [74]

Sustainable raw materials production entails using e.g. various certification schemes to ensure the traceability of the raw material and its origins. Certification systems protect e.g. forests from illegal felling and fulfil a number of different environmental interests and social aspects. For some time, Nordic Ecolabelling has set requirements for sustainable forestry in products which include fibre raw materials (FSC and PEFC certification). It is also possible to promote the sustainable production of bio-based raw materials and use of secondary raw materials (residual products from other production), so as not to compete with food production. Consumption of first-generation bio-based polymers (food crops primarily used for food production) has dominated in the first generation of polymers, but it is even more important to promote second-generation biopolymers (non-food crops, residual products from e.g. farming or forestry), or even third-generation biopolymers (algae) in the production of biopolymers. Nordic Ecolabelling would rather promote the use of second- and third-generation bio-based polymers than first-generation, but as yet these are in short supply. Most second- and third-generation products are still at the trial stage. For this reason, with certain limitations, Nordic Ecolabelling also approves first-generation biopolymers in the first generation of the criteria for packaging of liquid food products. See also the background text for requirement O14.

Energy efficiency in production

Environmental benefits are also related to the opportunities to promote energy and resource efficiency in the production of bio-based polymers, and thereby also contribute to measures to reduce the climate impact. Several LCA studies of packaging show that one of the most important factors regarding the packaging's environmental impacts is the energy used to manufacture constituent materials, such as polymers and paperboard. The energy sources used are difficult to control, however, and are often related to external factors, such as the country where production is located and which energy sources are available there, and whether the power source is hydropower, coal or nuclear power, etc. How efficiently energy is used at the production site is also important. Efficient production which uses less energy than other equivalent production will generally have lower energy consumption and thereby climate emissions. Since many biopolymer materials are relatively new, there should also be potential to optimise the production processes. It is therefore relevant to set requirements concerning the energy used in the production of renewable raw materials, including bio-based polymers. Energy consumption requirements are considered to be an indirect requirement to reduce the climate impact.

Other significant environmental impacts are related to the consumption of resources. The theoretically simplest way to limit the energy and climate impact of packaging is to ensure that it does not comprise unnecessary amounts of material. The manufacturer often focuses on resource efficiency for economic reasons, and the opportunities to set relevant requirements for these materials are therefore considered to be insignificant.

More stringent requirements of chemicals

The Nordic Swan Ecolabel is primarily an environmental label, but in addition to environmental aspects, there is also focus on health aspects for product groups where this is

[73] UNEP (2009): Towards sustainable production and use of resources: Assessing Biofuels. International Panel for Sustainable Resource Management, United Nations Environment Programme
[74] Memo from Force Technology "The land use aspect" 2010

relevant. Health-related issues are also related to environmental issues, since impacts on human beings also affect the environment. Packaginging in contact with food are a product group for which requirements of chemicals are being scrutinised more closely, due to the health-related aspects.

The criteria focus on setting requirement of the chemicals used in the production of constituent materials and conversion. Chemicals used may have problematic environmental and health-related characteristics. They may be persistent, bioaccumulative and toxic, or have carcinogenic and endocrine-disrupting effects. Bisphenol A (BPA), isocyanates and certain phthalates used as plasticisers are examples of substances that have negative effects on human health and the environment.

Studies indicate that food contact materials can be an underestimated source of chemical food contamination[75]. Contamination may occur in several ways. Non-inert materials, like paperboard or plastics, can be a direct source of migrants. Chemicals may also migrate from the outside through the packaging. A special case of migration is “off-set migration”: the printed, outside layer of a food packaging can transfer chemicals to the inside, direct food contact layer when both layers are in direct contact with each other. Off-set migration may occur when e.g. paperboard is stored in rolls, or when paper cups are stacked into each other[76].

Substances which migrate easily are usually low-molecular and volatile, e.g. additives such as antioxidants, non-intentionally added substances (NIAS), or residual monomers from production. One example is polyurethane glue (PUR), which is used for the lamination of polymers in food packaging. PUR glue may contain pre-polymer isocyanates and thereby free diisocyanate monomers. Isocyanates have been upgraded to Carc 2 H351. If the lamination has not hardened before the food is packaged, there is a risk that isocyanates migrate to the food product, giving rise to primary aromatic amines (PAA). Some of them may be carcinogenic. The isocyanate example shows that not only constituent substances and materials in contact with food, but also process conditions, can affect migration to food. Any migration will generally depend on various different factors, such as the physical chemical characteristics of the migrating substances, the packaging material and the type of food (e.g. fat content). Temperature, contact time and packaging size in proportion to food volume also affect migration (packaging of smaller size has greater proportional volume).

Even though most migration studies have focused on polymer-based packaging, certain other types of material such as ink, additives and surfacing/coating can reasonably be expected to function as quasi-polymers. Printing ink used on packaging in contact with food is also a potential source of contamination of the packaged food.[77] [78] More than five thousand different chemicals are used to produce printing ink.[79] A small proportion of these

[75] http://www.foodpackagingforum.org/
[76] http://www.foodpackagingforum.org/
[77] Food contact materials and articles: Printing Inks Check lists for compliance in industry and trade and control by food inspection. 2012:521TemaNord.
http://www.evira.fi/files/attachments/fi/elintarvikkeet/valmistus_ja_myynti/kontaktimateriaalit/food_contact materials_and_articles__printing_inks_.pdf
[78] Bradley, E.L., et al., Printing ink compounds in foods: UK survey results. Food Additives and Contaminants: Part B, 2012: http://www.tandfonline.com/doi/abs/10.1080/19393210.2012.725
[79] Food contact materials and articles: Printing Inks Check lists for compliance in industry and trade and control by food inspection. 2012:521TemaNord.
http://www.evira.fi/files/attachments/fi/elintarvikkeet/valmistus_ja_myynti/kontaktimateriaalit/food_contact materials_and_articles__printing_inks_.pdf

substances have been assessed by EFSA (the European Food Safety Authority)[80] and limited to a specific migration level (SML). Printing ink can migrate through the porous paper/paperboard and into the food product. Substances present in a recycled material can also migrate to the bulk material and from there into the food product. The use of barrier material can significantly reduce food contamination. An example is a carton provided with an inner bag containing the food product, the bag being made from aluminium foil or plastic with barrier properties.

Packaging that is in contact with food must fulfil EU Regulation 1935/2004 on materials and articles intended to come into contact with food. Packaging must also be manufactured in accordance with EU Regulation 2023/2006 on good manufacturing practice for materials and articles intended to come into contact with food.

EU Regulation 1935/2004/EC generally states that packaging must not

- emit substances to food that can be detrimental to human health; or
- entail a change in and/or diminish the food's colour, smell, taste or other physical characteristics.

For food contact materials of plastic a special regulation has been developed: EU Directive 2002/72/EC, which is now replaced by Regulation no. 10/2011 with subsequent amendments concerning plastic materials and articles intended to come into contact with food. For cardboard or paper products no statutory requirements are made, other than general legislation (Regulation 1935/2004). None of the Nordic countries have any special requirements of these materials.[81]

Since primary packaging for liquid foods is material in contact with food, both environmental and health aspects are emphasised in the Nordic Ecolabeling criteria. Due to aforementioned, the following chemical requirements are set in the criteria. Besides material in contact with food being required to fulfil current legislation,[82] Nordic Ecolabelling requires pulp, paper and paperboard in packaging to fulfil German BFR's[83] or CEPI's[84] recommendations (see also requirement O3). For glass, limit values set for migration of lead (Pb) and cadmium (Cd) in ceramic directives (EC) no. 84/500 with later amendments 2005/31 must be met in the packaging made from glass. Regarding aluminium, aluminium in packaging must comply with Resolution CM / Res (2013)9[85] (see also requirement O3). In requirement O4, the primary packaging shall be tested for potential non intentionally added migrating substances. In addition, Nordic Ecolabelling prohibits a number of chemicals in Nordic Swan Ecolabelled packaging, even though these chemicals are permitted under the authorities' regulations. Nordic Ecolabelling therefore sets the requirement that chemical substances with problematic characteristics shall not be included in chemical products used in the production/assembly of Nordic Swan Ecolabelled packaging.

[80] http://www.efsa.europa.eu/
[81] European Commission, Summary of the national legislation, Sanco E6/MS(28/09/2010):http://ec.europa.eu/food/food/chemicalsafety/foodcontact/documents_en.htm
[82] (EU Regulation no. 1935/2004, EU Regulation no. 2023/2006) and plastic packaging and plastic elements must comply with EU Regulation no. 10/2011.
[83] https://bfr.ble.de/kse/faces/resources/pdf/360-english.pdf (2017-06-15)
[84]http://www.cepi.org/system/files/public/documents/publications/foodcontact/2012/Industry%20guideline-updated2012final.pdf
[85] https://www.edqm.eu/en/food-contact-materials

It is specified that the requirements in this criteria document are overall requirements in regulations and recommendations. This means that a chemical may be prohibited from Nordic Swan Ecolabelled packaging even though it is permitted under regulations and recommendations. See also the more detailed chemical requirements, section 7.5, requirements for polymers O17-O18 and paperboard (O12 and O13).

Nordic Ecolabelling has assessed that even though the production chains can be long, there is sufficient potential and steerability to set requirements of the constituent substances in material used in packaging.

Packaging must be easily recyclable

A major environmental benefit can be achieved if packaging is recyclable in the final phase of the packaging's life cycle.[86] The European Parliament recently presented an ambitious objective for the increased recyclability of packaging[87] in order to benefit the circular economy and thereby also collection and recycling. Recently published EU's Plastic Strategy[88] focuses e.g. on to promoting plastic recycling, reducing the use of disposable plastic articles and ending offshore pollution. Furthermore, EU Commission will continue to set requirements on packaging design to promote recycling.

There is potential to increase the recycling ratio in the Nordic countries, but the steerability to make direct requirements of the waste phase is generally considered to be rather low. The final phase of packaging's life cycle is affected by many factors, such as the sorting opportunities in each country or municipality, and how consumers sort the packaging in the final phase. Nordic Ecolabelling can, however, generally work for the use of plastic in packaging that can easily be recycled and eliminate non-recyclable plastic or complex combinations of packaging materials in the criteria. This can be done by setting requirements intended to support recycling process, for example as requirements concerning packaging design, composition of materials and purity that promote health aspects, as well as opportunities to reuse.

There is also potential to benefit the circular economy by using recovered material such as recycled fibre or recycled plastic as the material in packaging. From a CO_2 perspective, there is an environmental benefit from working for packaging products made from recycled materials and which can also be recycled through existing recirculation systems. Subsequently, as in case of aluminium and glass can be recycled almost infinitely. Nordic Ecolabelling has therefore determined that packaging made of non-renewable materials and containing recycled material that can be recycled or reused is included in the first generation of the criteria. More detailed information about this can be found in section 7, Justification of the requirements.

[86] Nordic Council of Ministers, Karl Hillman, Anders Damgaard, Ola Eriksson, Daniel Jonsson and Lena Fluck, "Climate Benefits of Material Recycling – Inventory of Average Greenhouse Gas Emissions for Denmark, Norway and Sweden", TemaNord 2015:547.
[87] http://europa.eu/rapid/press-release_IP-17-104_sv.htm
[88] EU, Plastic Waste: a European strategy to protect the planet, defend our citizens and empower our industries, 2018, http://europa.eu/rapid/press-release_IP-18-5_en.htm (besökt 2018-01-24)

6.2 Material in the product group

In the first-generation criteria, the product group includes primary packaging made from a high ratio of bio-based material or recycled material. In this section, materials used in the packaging are described briefly.

Carton packaging

Paper and paperboard often occur in food packaging, including as beverage cartons.

Liquid packaging board (LPB) is used for various liquid packaging applications, of which the most common is milk and juice packaging. Beverage cartons are made of, on average (by weight)[89]:

- 75% paperboard
- 21% polymers, mostly polyethylene (PE), to prevent leakage
- 4% aluminium, to protect drinks from light and oxygen

Liquid packaging board is used for fresh and long-life drink and food products, enabling distribution either at ambient temperatures or under refrigerated conditions. Extended shelf life from half year to one year in a room temperature can be achieved by the aceptic packing of UHT (ultra-high-temperature) products[90]. The long shelf life products require high barrier coated paperboard with is attained by coating the paper board with aluminium or other barriers consisting of multilayers.

Manufacture of paperboard only uses 100% virgin wood fibre, to ensure good quality.[91] Cellulose fibres from wood may be bleached and non-bleached. Paperboard packaging for liquids is a multi-layer product which is made from chemical pulp and also CTMP (chemi-thermomechanical pulp) in the centre, to achieve good rigidity. [92] [93] The surface may be coated, depending on the end-use. The board is usually coated with barrier films such as molten polyethylene (extrusion coating). Other specific polymers may also be extruded. The different layers accomplish different tasks, such as reducing moisture penetration, reducing oxygen penetration, acting as light barrier, and preventing odours and chemicals to absorb to food[94]. Printing is often done by the flexo-graphic method[95].

[89] http://www.ace.be/beverage-cartons/what-are-beverage-cartons (hämtat 2017-06-14)
[90] Järvi-Kääriäinen, T. ja Ollila. M. 2007. Toimiva pakkaus. Pakkaustutkimus (Association of Packaging Technology and Research) - PTR ry
[91] http://www.ace.be/beverage-cartons/production/from-wood-fibre-to-paperboard (accessed 2017-06-14)
[92] Kiviranta, A. 2000. Paperboard grades. Paper and Board Grades. Papermaking Science and Technology, Book 18. Ed. Hannu Paulapuro. Publ. Fapet Oy. Jyväskylä Finland. pp. 54-72
[93] Kirwan, M. 2005. Paper and paperboard packaging technology.
[94] http://ilsi.eu/publication/packaging-materials-9-multilayer-packaging-for-food-and-beverages/ (hämtat 2017-06014)
[95] Järvi-Kääriäinen, T. ja Ollila. M. 2007. Toimiva pakkaus. Pakkaustutkimus (Association of Packaging Technology and Research) - PTR ry.

Polymers

Bio-based polymers

The European organisation for bioplastic (European Bioplastics) defines bioplastic as follows:[96]

- Plastic based on renewable raw materials
- Biodegradable polymers which fulfil all of the criteria for scientifically assessed norms for the biodegradability and composting of plastic and plastic products. In Europe this is EN 13432.

Bioplastic must fulfil either bullet point one or bullet point two. Note that, according to this definition, fossil-based biodegradable polymers will be called bioplastic. Since there is a risk of misunderstanding, Nordic Ecolabelling does not use the term "Bioplastic" in these criteria. Instead, the focus is on the raw material for polymers, i.e. it must be bio-based.

The European Committee for Standardization (CEN) has published a standard for definitions which do not concern bio-based polymer in particular, but bio-based products and concepts related thereto[97]. Here, bio-based is defined as "derived from biomass", and a bio-based product is a product fully or partly based on biomass. Plastic that is bio-based by applying the mass balance principle has also been introduced in the market. This is a system whereby a specific volume of bio-based raw material is mixed with fossil raw materials at the start of the production process. This is then sent into the facility together, without traceability as to what goes where. Finally, bio-based polymer equivalent to the volume of renewable raw material originally entering the system is sold. See more about Nordic Ecolabelling's position on mass balance in requirement O2.

Examples of various types of bio-based polymers are:

- Polymers extracted directly from biomass. These is e.g. polysaccharides such as starch and cellulose, or chitin and proteins such as casein (milk protein). An example of a known starch polymer is Mater-Bi® from Novamont S.p.A. in Italy.[98]
- Polymers produced through classical chemical synthesis by using monomers of bio-based origin. Monomers may be produced by fermentation or chemical synthesis. An example is PLA (polylactate), which is polymerised from lactic acid monomers. NatureWorks makes PLA from maize.[99] Another example is polyethylene, which is made from ethylene from sugar cane produced by Braskem in Brazil.[100]
- Polymers produced by bacterial fermentation of sugar or lipids. One example is PHA (Polyhydroxyalkanoates).

[96] Definition of "Bioplastics" on the website of European Bioplastics, see http://en.european-bioplastics.org/press/faq-bioplastics/#define (accessed 17.11.2015)
[97] http://www.cen.eu/work/areas/chemical/bio-based/Pages/default.aspx (accessed 26.10.2016)
[98] http://www.novamont.com/eng/mater-bi (accessed 26.10.216)
[99] http://www.natureworksllc.com/The-Ingeo-Journey/Eco-Profile-and-LCA/How-Ingeo-is-Made (accessed 26.10.216)
[100] http://www.braskem.com/site.aspx/Im-greenTM-Polyethylene (accessed 26.10.216)

Today, bio-based plastics play an important role in the packaging area.[101] There are two main production trends. One is new types of plastic (such as PLA) and the other is the use of renewable raw materials for production of the traditional types of plastic, such as polyethylene, called stand-in bioplastic. The bioplastic market was previously dominated by plastic materials which are made for composting and/or marketed as degradable. In recent years there has been a great increase in bio-based plastic with the same characteristics as fossil-fuel plastic (stand-in), which is not compostable/degradable, and which can be included in recirculation systems and directly replace fossil-fuel plastic.[102]

There are approximately 115 producers in the market that play a significant role for the bio-based polymers' production capacity.[103]. The most dynamic development is expected for "stand-in" polymers, which are chemically equivalent to the petrochemical counterparts such as PET, PE and PP, but which are fully or partly based on biomass. It is difficult to find out how many raw materials suppliers are relevant for the production of bio-based polymers. It is possible to solely produce the raw material, such as lactic acid or succinic acid, from bio-based raw materials, and to sell this on to a producer of the actual polymer. This means that the producer of the actual polymer may have several different raw material suppliers.

Fossil-based polymers

Since Nordic Swan Ecolabelled packaging will mainly comprise bio-based material or recycled material, primary packaging made from 100% virgin fossil-based polymers is not relevant. These may still be included as a layer of paperboard packaging for liquids and polymer bottles, in order to achieve the required barrier properties. Polyethylene (PE) is a good liquid barrier and ethylene-vinyl-alcohol (EVOH) is used as an acid barrier for e.g. juice and yoghurt, in order to prolong the food's shelf life. High-density polyethylene (HDPE) and low-density polyethylene (LDPE) or polypropylene (PP) can be used in screw caps. Secondary packaging may also consist of polymers such as LDPE.

The production of plastic causes severe environmental problems, which include e.g. high energy demand during production and consumption of fossil fuels. PET bottles (polyethylene terephthalate) are mostly used for soft drinks today. In PET plastic bottles, the bottle and cap are fully recyclable. By recycling, raw materials can be saved, waste and greenhouse gas emissions reduced. In manufacturing of recycled PET, 2/3 less energy is used compared to the virgin PET manufacturing process. Bottle-to-bottle recycling processes have been developed together with appropriate regulatory frameworks allowing the use of recycled PET in food contact materials[104]. A number of major brands are also committed to using recycled PET (R-PET) in their bottles to increase sustainability in their beverage production. According to Coca-Cola's Sustainability report, 6 percent of their packaging materials within the global system currently come from recycled or renewable material[105].

[101] Michael Carus & nova-Team, Jan Ravenstijn, Wolfgang Baltus, Dirk Carrez, Harald Kaeb, Stefan Zepnik:2013. Bio-based Polymers in the World Capacities, Production and Applications: Status Quo and Trends towards 2020 available at http://bio-based.eu/markets/

[102] "Bio-based Building Blocks and Polymers in the World, Capacities, Production and Applications: Status Quo and Trends towards 2020", Nova Institute, 2015. Available on the website: http://en.european-bioplastics.org/market/market-development/market-data-methodology/ (accessed 5.11.2015)

[103] European Bioplastics' website: http://en.european-bioplastics.org/market/market-development/market-data-methodology/ (accessed 05.11.2015)

[104] https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX%3A32008R0282

[105] Coca-Cola, sustainability report 2013/2014, http://www.coca-colacompany.com/packaging-recovery

The Plastics Packaging and Packaging Waste Directive (94/62/EC and amendments 2004/12/EC and 2005/20/EC) set a target for plastics recycling in Europe. PET accounts for a major part of the plastics target[106]. According to the recent statistics, European collection rates for PET continue to rise in 2016, 59.8 percent of PET packaging was collected and great part of it was recycled[107]. PET bottles are collected and recycled through separate deposit return systems in the Nordic region[108.] PET bottles are commonly subject to bottle-to-bottle recycling in the Nordic countries. PET bottles returned can also be used as a raw material for the production of PET flakes for various industrial purposes. According to the latest statistics, sheets with the share of 38 percent are the largest of r-PET markets, followed by blow molding (26%) and fiber (24%) in Europe. See also recycled plastics in requirement O2 on material composition.

Aluminium

Aluminium itself can be used as packaging, but is also used as a barrier in contact with food, in order to achieve various required functions in packaging (gas and liquid barriers). So far, aluminium is one of the best barriers, e.g. in aseptic packaging of which the content has no additives and preservatives, but which has a long shelf life and can therefore be stored at room temperature, instead of refrigeration. It is not easy to replace aluminium as the barrier in packaging. In some products, such as fresh juice, fossil-based ethylene-vinyl-alcohol (EVOH) can be used as an alternative to aluminium. Today there is no bio-based material in the market that can replace aluminium.

From an environmental viewpoint, aluminium is one of the most adverse raw materials in carton packaging's life cycle[109] [110] and should be replaced with other material. There are several environmental problems related to the production of aluminium, such as bauxite extraction, high energy consumption and emissions during production. There are initiatives for sustainable production of aluminium today[111]. The Aluminium Stewardship Initiative (ASI) standard covers aluminium's value chain, including handling of biodiversity within mining operations, indigenous people's rights, greenhouse gas emissions, waste handling and traceability.

Electrolysis of virgin aluminium is energy-intensive. Smelting of recovered aluminium requires far less energy than primary production; only around 5% of the energy required to produce the primary metal is required in the recycling process.[112] Recycling of aluminium is therefore desirable and theoretically, aluminium is 100% recyclable without losing any of its natural properties. It is estimated that more than half of all of the aluminium produced in the European Union (EU-27) originates from recovered aluminium.[113] See also more about aluminium in requirement O2 concerning materials composition.

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[106] PlasticsEurope May 2011. Ecoprofiles and Environmental Product Declarations of the European Plastics Manufacturers Polyethylene Terephthalate (PET) (Bottle Grade).
[107] http://www.packnews.no/default.asp?id=12689&show=more&titel=Betydelig-%c3%b8kning-i-PET-gjenvinningen-i-2016
[108] Fråne, Stenmarck, Gíslason, Lyng, Løkke, zu Castell-Rüdenhausen and Wahlström. Collection & recycling of plastic waste: Improvements in existing collection and recycling systems in the Nordic countries. TemaNord 2014:543 http://norden.diva-portal.org/smash/record.jsf?pid=diva2%3A721027&dswid=9198
[109] http://assets.tetrapak.com/static/se/documents/sustainability-downloads/lca%20nordic%20final%20report.pdf
[110] http://www.environdec.com/en/EPD-Search/?query=elopak
[111] http://www.isealalliance.org/online-community/organisations/aluminium-stewardship-initiative
[112] http://www.alueurope.eu/about-aluminium/properties/
[113] Environmental Profile Report for the European Aluminium Industry April 2013-

Glass

Glass packaging is mainly made of two materials: sand and cullet (recycled glass). The biggest environmental impact in the manufacture of glass packaging occurs at the time of production, followed by virgin material recovery and transport of manufacturing materials.[114] [115]

Glass production is energy intensive. However, using recycled glass (cullet) in manufacturing reduces the amount of energy used without losses in the quality of glass. According to the LCA analysis, 1 ton of recycled glass replaces 1.2 tonnes of virgin raw materials and saves 0.67 tonnes of carbon dioxide per ton of finished glass (EU average). Expressed in percentages, carbon dioxide emissions are reduced by about 58% by replacing virgin raw materials with recycled glass.[116]

Glass containers can be recycled as well as reused and filled several times. According to the latest statistics, the average glass recovery rate in the EU is stable (74%). This means that over 11.6 million tonnes of glass bottles are collected and recycled for the manufacture of new glass containers[117]. In the Nordic countries, return levels of almost 90% are not uncommon. The most effective way to discard bottles is to recycle them to new containers. Some glass is used for glass wool and is thus converted into secondary products, such as glass sheets. The development of glass packaging is considered to be sluggish, but this type of packaging is still considered safe to store food and drink. Any chemical diffusion from the glass is obstructed due to the glass structure.

7 Justification of the requirements

This section presents proposed requirements and explains the background to the requirements and the chosen requirement levels. The appendices referred to are appendices in the criteria document: Nordic Swan Ecolabelling of Packaging for Liquid Foods.

7.1 Product group definition

What can carry the Nordic Swan Ecolabel?

Nordic Ecolabelling's criteria for packaging of liquid foods are based on a high ratio of renewable material or recycled material or a combination of renewable material or recycled material. The packaging can therefore consist of different materials - glass, aluminium, plastic or board - which is approved into contact with food. Exceptions are PVC and recycled paper that shall not be used.

Data for the year 2010. Life Cycle Inventory data for aluminium production and transformation processes in Europe.

[114] Environmental Overview Complete Life Cycle Assessment of North American Container Glass. Glass packaging Institute. GPI 2010. http://www.gpi.org/learn-about-glass/life-cycle-assessment

[115] http://www.o-i.com/Sustainability/Life-Cycle-Assessment/

[116] Recycling:Why glass always has a happy CO2 ending, available at http://www.feve.org/index.php?option=com_content&view=article&id=27&Itemid=13

[117] feve.org/recyclingstats2018/

The definition of the product group is as follows:

"The product group consists of primary packaging* for liquid pre-packaged foods**. The actual content, i.e. the liquid food product, is not included in the product group.

Packaging intended to be in contact with a liquid food product for a short time, e.g. take away coffee cups and pizza packs, cannot be Nordic Swan Ecolabelled according to these criteria. These products can be Nordic Swan Ecolabelled according to Nordic Ecolabelling's Criteria for Disposables for Food."

It can sometimes be a little difficult to define "liquid food products". An example is yoghurt that is labelled with a unit of weight on the packaging, although there is also drinkable yoghurt in the market that is labelled with a unit of volume on the packaging. In these borderline cases, the starting point is the packaging and its material, which determines what can be Nordic Swan Ecolabelled.

** In accordance with EU Directive 94/62/EC[118] on packaging and packaging waste, the term "primary packaging" is defined as consumer packaging, i.e. packaging conceived so as to constitute a sales unit to the final user or consumer at the point of sale.*

*** The term "pre-packaged foodstuff" is defined in accordance with EU Regulation 1169/2011: an individual product that in unchanged condition is intended to be sold to final consumers and mass caterers and which consists of a food product and the packaging in which it is placed before it is offered for sale, irrespective of whether the packaging contains the food in full or only in part, but in any case so that the packaging contains the food product in such a way that the contents cannot be altered without opening or changing the packaging; food products that are packaged at the place of sale at the consumer's request, or are pre-packaged for direct sale will not be considered to be pre-packaged foodstuffs.*

Licence holders

Brand owners of a pre-packaged food product may apply for a licence for their primary packaging. This hereby refers to e.g. breweries, dairies and other food producers, as well as brand owners such as various retail chains for which food companies produce under their own names. (Hereinafter brand owners are named food producers in this document.) Packaging manufacturers may also be licensed provided that the packaging manufacturer has full control over the manufacture of the primary packaging covered by the Nordic Ecolabelling requirements. In the case of plastic bottles this means, for example, that the packaging manufacturer is responsible for ensuring that all accessories included in the primary packaging such as labels, stoppers etc. comply with Nordic Ecolabelling requirements.

7.2 Overall requirement areas

This section considers overall requirement areas, product description and the material included in packaging. Some key definitions are highlighted at the beginning of the section. Concepts and definitions are also specified further in section 8, Terms and definitions.

[118] http://eur-lex.europa.eu/legal-content/SV/TXT/PDF/?uri=CELEX:01994L0062-20150526&from=EN accessed 2016-12-20

Definitions

In contrast to Nordic Ecolabelling's other criteria, the term product not only refers to the Nordic Swan Ecolabelled packaging, but the packaged food and its packaging.

Nordic Swan Ecolabelled packaging is primary packaging in which the food is packaged. (Hereinafter the term **primary packaging** is used for Nordic Swan Ecolabelled packaging in this document.) The definition of packaging adheres to the definitions specified in EU Directive 94/62/EC concerning packaging and packaging waste: **Primary packaging is** consumer packaging, i.e. packaging conceived so as to constitute a sales unit to the final user or consumer at the point of sale.

Secondary packaging is group packaging, i.e. packaging that is designed in such a way that at the point of sale they comprise a group of a certain number of sales units, irrespective of whether they are sold as such a group to the consumer, or are solely used to complement the shelves at the point of sale. Secondary packaging can be removed from the product without this affecting the product's characteristics.

Tertiary packaging is transport packaging, i.e. packaging that is designed in such a way that it supports the handling and transport of a number of sales units or group packaging, in order to prevent damage from physical handling or transport damage.

In this case the **packaging system** comprises food products and all related levels of packaging (primary, secondary and tertiary packaging).

Bio-based means that the material consists of biomass that may have undergone physical, chemical or biological treatment(s). Biomass has a biological origin, but excludes material that is found embedded in geological and/or fossil formations. Examples of biomass are: (all or parts of) plants, trees, algae, marine organisms, microorganisms, animals, etc.

Bio-based polymer/plastic: Polymer/plastic that is fully or partly based on biomass. Nordic Ecolabelling does not consider that biodegradable/compostable fossil-fuel plastic should be considered to be bio-based plastic.

The definitions of bio-based polymer/plastic are based on the definitions in the European standard EN 16575:2014119 and also include secondary raw materials in Nordic Ecolabelling's criteria. Calculation principles for the proportion of bio-based are specified in the requirement O2.

Secondary raw materials are defined as residual products from other production and manufacturing processes, such as waste products from the food industry, or by-products such as straw from cereal production or bagasse from sugar cane production.

Full traceability (for bio-based polymers): Full traceability means that there is control of the renewable material throughout the production process, such as by using a separate production line solely for renewable raw materials, so that the final polymer solely comprises renewable raw materials.

Mass balance method (for bio-based polymers): The mass balance method means a mix of fossil and renewable raw materials at the start of the production process, with mathematical allocation of the renewable raw material to the final polymer. This entails that there is no

[119] https://biobs.jrc.ec.europa.eu/sites/default/files/generated/files/policy/CEN%20Bio-Based%20Definitions%20EN16575.pdf (accessed 11.10.2016)

full traceability of the renewable raw material throughout the production process, and that the amount of renewable raw material in the final polymer can vary.

Recycled material: Recycled material is defined according to ISO 14021. Regulation 282/2008 also applies to recycled plastic. See also section 8, Terms and definitions.

Overview of requirements

Below is an overview of the requirements made in the criteria. The overview is structured so as to clarify who is primarily responsible for documenting specific requirements in the criteria. Packaging may comprise several materials and manufacturing consists of long chains of suppliers and possible subsuppliers, which can make it difficult for potential licence holders to ultimately see which requirements must be documented by whom. In certain cases, the requirements can overlap each other, but in these respects it is clarified who is to document what.

The overview is structured as follows:

- Requirements of Nordic Swan Ecolabelling packaging, i.e. primary packaging in which the food is packaged (O1-O8). These requirements apply to food producers, but primarily to packaging manufacturers, since the manufacture of packaging (manufacture of preforms, conversion) is subject to these requirements. Note that the quality and regulatory requirements (O24–O31) at the end of the document apply to licence holders. For a definition of what is meant by producer in these criteria, see section 7.1.
- Requirements of material included in packaging. Primarily the manufacturer of these materials must document the requirements.
- Requirements of chemicals. Primarily the chemicals producers/suppliers are responsible for certifying compliance with the chemicals requirements (O19–O23). Some requirements also apply to the polymer manufacturer and the paper manufacturer.

Table 1. Overview of the requirements made in the criteria

Requirement no.	Name of requirement	Who documents?	Use declaration
Requirement of primary packaging (Nordic Swan Ecolabelled packaging - packaging in which the food is packaged)			
O1	Information on the food and its packaging	Licensee*	1 2
O2	Materials composition	Packaging manufacturer	2
O3	Material in contact with food	Licensee	
O4	Testing - Migrates	Licensee	
O5	Packaging design	Packaging manufacturer	
O6	Recycling of primary packaging	Licensee	2
O7	Packaging - recycling design	Packaging manufacturer	
O8	Information to consumer	Food producer	

Requirements of constituent material			
O9	Pulp	Pulp producer	MSA*
O10	Paper and paperboard	Paper manufacturer	MSA
O11	Wood raw material	Pulp producer	MSA
O12	Agricultural commodities, including palm oil, soya and sugar cane	Polymer producer	
O13	GMO	Polymer producer	
O14	Energy - bio-based polymers	Polymer producer	
Requirements of chemical products and substances			
O15	Classification of chemical products	Chemical manufacturer/supplier	4
O16	Chemical substances, CMR	Chemical manufacturer/supplier	4
O17	Other excluded substances	Chemical manufacturer/supplier	4
O18	Inks for printing and dyeing	Chemical manufacturer/supplier	4
O19	Adhesives	Chemical manufacturer/supplier	4
O20	Optical brightener and antimicrobial agent	Paper manufacturer	MSA
O21	Coating and impregnation	Chemical producer, pulp and paper producer	4 MSA
O22	Plastic additives	Polymer producer	6
O23	Residual monomers of plastic	Polymer producer	6
O24	Chemicals - recycled plastics	Polymer producer	
Quality and regulatory requirements			
O25	Responsible person and organisation	Licensee	
O26	Documentation	Licensee	
O27	Packaging quality	Licensee	
O28	Planned changes	Licensee	
O29	Unforeseen non-conformities	Licensee	
O30	Traceability	Licensee	
O31	Laws and regulations	Licensee	
O32	Subsuppliers	Licensee	

* Licensee can be food producer/packaging manufacturer

** MSA, My Swan Account, is Nordic Ecolabelling's web-based application guide for pulp and paper producers.

7.3 Requirements of Nordic Swan Ecolabelled packaging

Requirements in this section concern Nordic Swan Ecolabelled packaging, i.e. primary packaging in which the food is packaged. Primarily the packaging manufacturer and food producer must document the requirements in this section. But in certain cases the requirements also apply to other manufacturers. Reference is made to this requirement at relevant places in the document.

O1 Information on the food and its packaging

The food producer and packaging manufacturer must state the following information concerning

- **the food** packaged in Nordic Swan Ecolabelled packaging. Report all product names and brands including volume units.
- **Primary packaging*** - trade name, manufacturer, design and a technical description of production of packaging. The description must also include any conversion at subsuppliers. Subsuppliers must be described with company name, production site, contact person and the production processes performed (e.g. coating, printing, labels and stoppers).
- Information on **constituent material** and function in the primary packaging (e.g. paperboard, polymers including type such as PE, PP, PLA, etc.) and the quantities of the various types of material (including percentage by weight of each material in relation to the packaging's total weight). The overview must include the trade name of the material and manufacturer and a product data sheet or similar for them all must also be enclosed. See also requirement O2 concerning the constituent materials, in which requirements are made of the input material.
- **Chemical products** used in the conversion of primary packaging including finishing, e.g. printing inks, varnish and adhesives. The list of chemical products must include full name, function and manufacturer. A safety data sheet must also be enclosed which must be in accordance with Annex II in REACH (Regulation 907/2006/EC).
- Information concerning **the packaging system**. Also state the trade name, manufacturer and material used for the secondary** and tertiary packaging*** or other elements**** which accompany the primary packaging on marketing to end-consumers.

Extrusion coating and adhesives are considered to be constituent material, but not other chemical products such as printing ink or mineral coating.

** Primary packaging is consumer packaging, i.e. packaging conceived so as to constitute a sales unit to the final user or consumer at the point of sale.*

*** Secondary packaging is group packaging that can be removed from the product without this affecting the product's characteristics.*

**** Tertiary packaging is transport packaging which supports handling and transport.*

***** "Other elements" are components which belong to the packaging, but which are not directly necessary to wrap the food. Examples of "other elements" are supplementary components such as straws.*

✉ Descriptions in accordance with the requirements. Appendix 2 is completed by the food producer, Appendix 3 by packaging manufacturer. A product data sheet or similar for constituent materials must be enclosed as part of the documentation. Declaration of the production chemicals used. Safety data sheet in accordance with Annex II to REACH (Council Regulation (EC) no. 1907/2006 can be included on demand.

Background to the requirement

The requirement is made in order to give Nordic Ecolabelling an overview of the primary packaging, which types of food it is to be used for, how it is produced, and the packaging system of which it will be part. Nordic Ecolabelling also requires information concerning e.g. labels and labelling adhesives, printing ink and toner used for date labelling, and other related elements added in the primary packaging. This will make it easier to see which criteria requirements are relevant for this particular packaging. Information concerning the constituent material volumes is important in the requirement concerning constituent materials (O2). The food producer and the packaging manufacturer shall provide information for their own sub-area, which means that if packaging manufacturer is the licensee, information about the packaged food in not needed. Appendix 2 is is completed by the food producer, Appendix 3 is used by packaging manufacturer.

Even though the product group definition concerns primary packaging, Nordic Ecolabelling requires information concerning the packaging system. Packaging system means the product and various levels of packaging, i.e. primary, secondary and tertiary.[120] The packaging levels are interrelated and influence each other. (Also see the background text to requirement O5.)

Primarily packaging manufacturers and brand owners of food products document the requirements of Nordic Swan Ecolabelled packaging. But in certain cases the requirements may also need to be documented by contracted subsuppliers. For more information: see section 7.1 concerning the product group definition and which packaging can be Nordic Swan Ecolabelled. Finally, Nordic Ecolabelling requires information on all subsuppliers used.

O2 Constituent materials

1. Paper/paperboard (fibre)

If the primary packaging consists mainly of paper/paperboard (fibre), at least 90% by weight of primary packaging must be made from bio-based material* annually.

2. Plastics (polymers)

If the primary packaging consists mainly of plastics (polymers), at least 80% by weight of primary packaging must be made from bio-based material* or recycled material** or a combination of bio-based or recycled material annually.

The recycled plastic must fulfill Regulation (EC) No 282/2008 on recycled plastic materials and articles intended to come into contact with foods. The recycling process must be assessed for safety by EFSA, please see http://www.efsa.europa.eu/en/topics/topic/plastics-and-plastic-recycling

3. Glass

If the primary packaging consists mainly of glass, at least 80% by weight of primary packaging must be made from recycled material** annually.

Recycled material shall derive from the collection of recyclable packaging glass. Quality requirements for recycled material in production must be stated.

4. Aluminium

If the primary packaging consists mainly of aluminium, at least 80% by weight of primary packaging must be made from recycled material** annually. Material flow and the origin of recycled material must be stated.

* *The definitions of bio-based polymer/plastic are based on the definitions in the European standard EN 16575:2014 and also include secondary raw materials in Nordic Ecolabelling's criteria, see Terms and definitions.*

** *For recycled plastic the definitions in ISO 14021 apply, see Terms and definitions.*

For all primary packaging applies that

- recycled pulp/paper/paperboard must not be included.
- PVC or plastic based on other types of halogenated plastics must not be used.
- Aluminium and other metals shall not be used. Exception is the packaging which solely comprises aluminium. The requirement does not apply threaded metallic seals or foil that can be removed completely at the opening of the packaging or when the packaging is emptied and sorted into metal recycling.
- Straws made of plastic (polymers) cannot be included in the packaging.

[120] Daniel Hellström och Annika Olsson; Managing packaging design for sustainable development - a compass for strategic directions, first edition, John Wiley and Sons Ltd. 2017.

In the calculation of constituent materials

- Extrusion coating/lamination and adhesives must be included. Other chemicals, such as minerals, printing inks and additives, shall not be included.
- Other elements described in O1 must be included.
- There must be full traceability for the bio-based plastic in packaging which solely comprises plastic, e.g. plastic bottles.
- Mass balance can be used for
  - constituent components of plastic, such as stoppers and coatings on paperboard
  - bio-based plastic included with less than 10% by weight in multilayer packaging

Renewable raw materials must be used for the production of polymers, not used as an energy source in process.

Mass balance must be controlled by an independent third party. As a minimum, it must be controlled that the amount of purchased renewable raw material is equivalent to the amount of polymer sold as renewable.

If the mass balance method is used, the packaging manufacturer must report, e.g. with an invoice, that bio-based polymers are purchased.

✉ Calculation showing that the requirement for the proportion of bio-based or recycled material in the primary packaging is fullfilled. Appendix 3 must be used.

✉ Declarations that metal, PVC and other plastic based on other types of halogenated plastics, as well as recycled pulp/paper/paperboard, are not included. Appendix 3 must be used.

✉ For recycled glass, documents showing that the glass is derived from the collection of recyclable packaging glass. The manufacturer of the packaging shall also enclose the quality requirements they set for recycled glass in their production.

✉ For recycled aluminium, material flows and origin shall be documented.

✉ For recycled plastic, documentation confirming that the plastic is is in compliance with Regulation (EC) No 282/2008 on recycled plastic materials and articles intended to come into contact with foods and that the recycling process is assessed for safety by EFSA1.

✉ In packaging which solely comprises plastic, it must be confirmed that there is full traceability on the bio-based material in the production, e.g. in the form of separate production lines or as batched production. Alternatively, an analysis of bio-based content according to the method under the EN 16640: 201 and EN 16785-1:2015 standards, or equivalent methods, can be enclosed.

✉ For constituent components of plastic such as stoppers or coatings for which mass balance can be used, a declaration from an independent party must be submitted, showing that:

- renewable raw materials are registered/booked as material production of polymers; and that
- there is a control system for purchased renewable raw materials and the amount of renewable polymer sold.

The packaging manufacturer must report, e.g. with an invoice, that bio-based polymers are purchased.

Background to the requirement

The requirement of constituent materials is one of the most important in the criteria and is directed at renewable raw materials or recycled material or a combination of renewable material or recycled material, which from an environmental viewpoint is one of the principal reasons for drawing up the criteria. The packaging can consist of different materials - glass,

aluminium, plastic or paperboard - which is approved into contact with food. Exceptions are PVC and recycled paper that shall not be used.

The criteria proposal submitted for open concultation was based on a high proportion of renewable material (90%) in the packaging, excluding in practice all material other than paperboard and plastics. The proposal was criticized for discriminating against other materials, particularly recycled materials and the deposit system. After the consultation, the criterion proposal has been amended to include also other material. There is potential for environmental benefits, if recycled materials such as recycled plastic or recycled aluminium are used in the packaging. From a CO2 perspective, there is an environmental benefit from working for packaging products made from recycled materials and which can also be part of existing recycling systems.

Limit values for the proportion of recycled material in the packaging vary depending on the material. There are beverage packaging with different share of recycled materials in the Nordic markets and there is the potential to increase that proportion to promote circular economy. Limits for the proportion of recycled material in different packagaging are set to be ambitious yet achievable. Percentage is not set to 100% to allow some flexibility as it may be necessary to add other materials and even virgin materials in the process to maintain the desired quality in packaging.

A prohibition against using aluminium and other metals in other packaging than aluminium cans remains in the requirement. The requirement does not apply to threaded metallic seals or foil that can be removed completely at the opening of the packaging and sorted into metal recycling. There is also a ban on straws made of plastic in the requirement. In January 2018, a new Plastic Strategy was introduced in EU. Follow-up to the EU's plastic strategy has now resulted in a request from the Commission to ban and restrict the use of plastic in disposable products such as straws and plates. Straws can sometimes be included as a supplementary component in Nordic Ecolabelled packaging. Nordic Ecolabelling is at the forefront and already approved a change of the criteria so that plastic supplementary components made from plastics, covering also bio-based plastics, cannot be included in Nordic Ecolabelled packaging.

Bio-based materials

Nordic Ecolabelling generally wishes to promote the use of renewable materials in these criteria. In terms of resources, it is advantageous to use renewable rather than fossil raw materials. This will help to reduce dependence on fossil raw materials and since the resource is bio-based, it can be built up again. Renewable raw materials as such will not contribute to increased emissions of climate gases compared to fossil raw materials, since fossil raw materials are not part of the natural cycle. It is important, on the other hand, that renewable raw materials are used on a sustainable basis; see also the requirements in section 7.4.

In the packaging consisting mainly of renewable raw materials (paperboard, plastic), non-renewable materials may be used to some extent. These non-renewable materials may consist of extrusion coating/lamination, adhesives and additives of non-renewable raw materials. A certain proportion of non-renewable materials are allowed in the packaging as there are not necessarily renewable alternatives available in the market for all applications, e.g. considering the product's self life in the packaging. The definitions of bio-based polymer/plastic are based on the definitions in the European standard EN 16575:2014[121] and also include secondary raw materials in Nordic Ecolabelling's criteria. However, the calculation principles for the proportion of "bio-based" in requirement O2 differ from the

[121] https://biobs.jrc.ec.europa.eu/sites/default/files/generated/files/policy/CEN%20Bio-Based%20Definitions%20EN16575.pdf (accessed 11.10.2016)

standard. For example, mineras such as the filler kaolin, calcium carbonate, chalk and silicates may be used in both paper and plastic material, and these are not included in the calculation of constituent materials. This means that if the primary packaging consists of paper (85%) and fossil PE (15%) and the paper in its part comprise of 80% pulp and 20% minerals, the proportion of paper is considered as bio-based (85%) in the primary packaging.

Calculation of ratio of bio-based material

The calculation of bio-based material in packaging will vary depending on whether it is packaging made solely from plastic, such as a plastic bottle, or a component included in packaging, such as layers, or which belongs to packaging, such as a screw cap. Polymers that are bio-based via mass balance cannot be approved in packaging that consists solely of plastic. The mass balance method means a mix of fossil and bio-based raw materials in production, with mathematical allocation of the renewable raw material to the final polymer.

Nordic Ecolabelling considers it important to have full traceability for the bio-based raw material in Nordic Swan Ecolabelled packaging. Requiring full traceability entails that the actual product will come to contain renewable raw materials. Nordic Ecolabelling takes a positive standpoint on renewable raw materials coming into the production flow and considers it important that Nordic Swan Ecolabelled packaging actually contains renewable raw materials, with regard to our credibility and communication with the world at large and with consumers. For bio-based polymers in plastic packaging, it must be confirmed that there is full traceability, e.g. in the form of separate production lines or as batched production. Alternatively, an analysis of bio-based content according to the method under the EN 16640: 201, EN 16785-1:2015 standards, or equivalent methods, can be enclosed.

For constituent components such as screw tops and layers in packaging, or for plastic which accounts for a small part of the multilayer packaging (below 10% by weight), the mass balance method can be used, provided that renewable raw materials are actually used in the production of polymer materials, and not as e.g. energy during production. This is in order to promote the market supply of bio-based polymers. The mass balance system must be controlled with a certificate from an independent third party stating that renewable raw materials are registered/booked for the production of polymer materials, and that, as a minimum, it is controlled that the volume of renewable raw materials purchased corresponds to the volume of polymer sold as renewable.

Metal

Aluminium ans other metals shall not be used in Nordic Swan Ecolabelled packaging. Exceptions are aluminium cans comprising mainly of recycled aluminium. An example of aluminium that shall not be used in the packaging is aluminium foil in the multilayer packaging such as beverage cartons where aluminium is required due to its barrier properties, in terms of the product's sustainability, in the packaging. There are, however, several environmental problems related to aluminium production, such as high energy consumption and emissions during production (see also section 6.2). From an environmental viewpoint it would be relevant that aluminium can be recycled, but the aluminium included as a barrier in multi-layer packaging is not recycled today, so it is not possible to set recycling requirements. Nordic Ecolabelling believes that the environmental impacts related to aluminium production are so extensive that aluminium is excluded from this first generation of the criteria. The requirement does not apply to threaded metallic seals or foil that consumer can remove completely at the opening of the packaging or when the packaging is emptied and thereafter, can be sorted into metal recycling. Nordic Ecolabelling wishes to

point out that this requirement can be adjusted if it is possible to separate and recycle aluminium even in multi-layer packaging in the near future. See also aluminium in section 6.2.

Recycled material

Nordic Ecolabelling is generally positive towards using recycled material. From a CO_2 perspective, there is an environmental benefit from working for packaging products made from recycled materials and which can also be part of existing recirculation systems. Nordic Ecolabelling has therefore decided that recycled materials such as r-PET shall be included in the first generation of criteria.

The recycled plastic must fulfill Regulation (EC) No 282/2008 on recycled plastic materials and articles intended to come into contact with foods. The recycling process must be assessed for safety by EFSA[122]. The Regulation sets requirements that the plastic from the recycling process must come from plastic that has previously been in contact with food, that is, plastic that meets the requirements of Plastic Regulation 10/2011.

According to the requirement for plastics, must annually at least 80% by weight of primary packaging be made from bio-based plastic or recycled plastic or a combination of these material. The criteria proposal submitted for consultation had a limit value 90% for bio-based materials, so the limit value have been reduced slightly efter the consultation. Nordic Swan Ecolabelled PET bottle can, for example, consists of 50% of r-PET and 30% bio-based material to meet the requirement. On the market, there are beverages packaging today where the proportion of recycled plastic is 25-50%[123]. Plastic bottles in Norway contain an average of about 20% recycled plastic today[124], so there is the potential to increase that proportion. As an example of combining bio-based and recycled materials, Coca Cola has launched some products in plastic bottles consisting of 15% of renewable materials and 50% r-PET in the Nordic markets[125].

Aluminium cans can be Nordic Swan Ecolabelled if 80% of the can is made from **recycled aluminium**. In principle, all aluminium in the can can consist of recycled material, there is no technical barrier to it. However, he proportion of recycled aluminium in the can seems to be lower in the markets today. For example, the proportion of recycled material in aluminium cans is about 40% in Norway[126]. There is therefore potential to make environmental benefits by setting a requirement of 80% in the Nordic Ecolabelling's criteria. For recycled aluminium, material flow and origin shall be documented. See also aluminium in the section 6.2.

Regarding **glass**, there are return and disposable glass in the market today[127]. Return glass means bottles that are refilled. The return glass system exists still in Denmark, Sweden and Finland. In Denmark, "return bottles" constitute approx. 16% of all deposited bottles[128], but trends in all countries are decreasing (return bottles decrease compared to disposable glass and for plastic bottles). Screening of LCA analyzes indicates that it is not always easy to distinguish the best - eg. if "return glass is more environmentally friendly than disposable glass" - due to varying data / starting values, how much recycled material has been used

[122] http://www.efsa.europa.eu/en/topics/topic/plastics-and-plastic-recycling
[123] http://www.petainer.com/petainersmallcontainer
[124] http://infinitum.no/aktuelt/Reisen%20bak%20panteautomaten
[125] https://www.coca-cola.fi/stories/maailman-ensimm-inen-t-ysin-kierr-tett-v-ja-osittain-kasvipohjaisesta-materiaalista-valmistettu-pet-pullo
[126] http://infinitum.no/aktuelt/Reisen%20bak%20panteautomaten
[127] http://sverigesbryggerier.se/statistik/fordelning-av-ol-lask-och-vatten-pa-forpackningstyper/
[128] https://www.danskretursystem.dk/presse/aarsrapport-noegletal/

etc[129]. Both bottles can be Nordic Swan Ecolabelled if it contains a certain proportion of recycled material. The proportion of recycled material in green glass bottles is high and therefore the limit value is set at 80% in the first generation of criteria. For recycled glass, it must be documented that the glass is derived from the collection of recyclable packaging glass, which is also a kind of assurance of quality. The manufacturer of the packaging must also enclose quality requirements their set for recycled glass in itheir production (see also requirement O3 below).

Recycled paper and paperboard shall not be used in the Nordic Swan Ecolabelled packaging. For recycled paper and paperboard, there are no rules in European legislation similar to those for approval of plastic. For paper and paperboard, general regulations for material in contact with food, Regulation no. 1935/2004, must be complied with. The possible migration to food of mineral oils from printing ink originating from return fibre has been identified in the European Parliament's Resolution on the Implementation of the Food Contact Materials Regulation (EC) no. 1935/2004. Nordic Ecolabelling has therefore decided that recycled paper will not be included in the first generation of the criteria. Nordic Ecolabelling believes that the use of recycled material must be promoted, but that it is more relevant to use these recycled materials for other products for which there is no risk of migration to food. The possibility of using recycled paper must be reviewed in the next generation of the criteria. See also the 6.1 RPS section concerning the use of recycled material.

PVC and PVDC

PVC is sometimes used in labels and packaging. PVC and other halogenated plastics are excluded from Nordic Swan Ecolabelled products since they lead to adverse environmental impacts in waste handling and contain substances with adverse health effects. The most important problem areas for PVC and PVDC are described in Nordic Ecolabelling's background report for floors[130]. Here is a brief summary of the issues: The most important problem areas are waste handling, use of additives and dioxin emissions. According to the report "Hazardous substances in plastic materials" published by the Norwegian Environment Agency in 2013, PVC can be added to more than 50% of plasticisers, of which phthalates are still the most popular.[131] PVC requires stabilisation in order to tolerate the temperature required for the production of a PVC product (extrusion, injection moulding, etc.). Stabilisers can be based on lead, metal compounds (such as barium-zinc and calcium-zinc), tin or cadmium. In modern production plant, the environmental impact is reduced, e.g. dioxin emissions from production. Dioxins can also be formed when waste is incinerated. Within the EU, the Waste Directive (91/689/EC) sets limits for emissions of dioxins from incineration plants. In overall terms, the environmental impacts related to the production, use and disposal of PVC are steadily diminishing, among other things due to new knowledge and the technological development. Yet there is every indication that there are still problems related to PVC, nor is there sufficiently adequate control of the PVC which is imported to the EU and the Nordic countries from other parts of the world that are not subject to the same European limitations. The use of PVC is therefore prohibited.

[129] https://www.sirkel.no/om-oss/
[130] Nordic Ecolabelling. About Nordic Swan Ecolabelled floors, Version 6.0. Background to ecolabelling, 18 November 2014. http://www.svanemerket.no/for-bedrifter/sok-om-svanemerket/svanens-krav/byggevarer-og-hus/gulv/ (accessed 3.10 2016)
[131] Norwegian Environment Agency, Hazardous substances in plastic materials, Cowi, January 2013

O3 Material in contact with food

Besides material in contact with food being required to fulfil current legislation[*], and plastic packaging and elements of plastic being required to comply with EU Regulations[**],

- pulp, paper and paperboard in packaging must also comply with one of the following recommendations:
  a) BfR's recommendation XXXVI. Paper and board for food contact, July 2015 or more recent versions, or
  b) CEPI's Industry guideline for the Compliance of Paper & Board materials and articles for food contact, published on 2 September 2012, or more recent versions.
- the glass in packaging must also comply with EU Directive 84/500 and its amendments (EU Directive 2005/31) on ceramic articles intended to come into contact with foodstuffs.
- aluminium in packaging must also comply with CM / Res (2013) 9 Metals and alloys used in food contact materials and articles published by the Directorate for the Quality of Medicines & Health Care of the Council of Europe (EDQM).

[*] EU Regulation 1935/2004 with related amendments on materials and articles intended to come into contact with food, and EU Regulation 2023/2006 on good manufacturing practice for materials and articles intended to come into contact with food.

[**] EU Regulation 10/2011 with related amendments on plastic materials and articles intended to come into contact with food.

✉ Producer must enclose copies of certificates, declarations or analysis results showing that material in contact with food fulfils legislation and,

- for paper, one of the aforementioned recommendations,

- for glass, the applicable requirements of EU Directive 84/500 and its amendments,

- for aluminium, the applicable requirements of Resolution CM / Res (2013) 9.

Background to the requirement

Regulation 1935/2004/EC and Regulation 2023/2006 EC are official requirements to be fulfilled by all packaging. For cardboard or paper products no statutory requirements are made, other than general legislation (Regulation 1935/2004). None of the Nordic countries have any special requirements of these materials,[132] and it is therefore necessary for BfR's recommendations or CEPI's industry guide to be followed in order to give further reassurance that the product is safe to use. In these recommendations, limitations are e.g. set concerning the amounts used of certain chemical substances in the manufacturing process, prohibition of certain azo dyes, and threshold values for the heavy metals lead and cadmium in paperboard. These are requirements and guidelines that are approved in the industry, at least in the Nordic region.

In terms of quality and safety, recycling of permanent materials, such as glass and metal, is generally considered suitable for food packaging, because the material properties do not change and the heat required for remelting destroys microorganisms and organic compounds[133] However, sand used for glass manufacture contain lead. As a consequence, lead is also present in container glass and may migrate into foods via surface cation

[132] European Commission, Summary of the national legislation, Sanco E6/MS(28/09/2010):http://ec.europa.eu/food/food/chemicalsafety/foodcontact/documents_en.htm
[133] Geueke, B., Groh, K. and Muncke, J. 2018. Food packaging in the cirkular economy: Overview of chemical safety aspects for commonly used materials. Journal of Cleaner Production 193:491-505. https://www.sciencedirect.com/science/article/pii/S0959652618313325?via%3Dihub

exchange by a diffusion mechanims. Additional trace elements known to be hazardous and present in container glass are for example cadmium. There are no harmonized or specific legal requirements for glass intended for food contact in Europe, but for lead and cadmium, limit values for migration of lead and cadmium in ceramic directives (EC) no. 84/500 with later amendments 2005/31 must be met. Regarding aluminium, aluminium in packaging must also comply with Resolution CM / Res (2013)9 Metals and alloys used in food contact materials and articles published by the Directorate for the Quality of Medicines & Health Care of the Council of Europe (EDQM)[134]. The resolution is is not legally binding for member states but serves as a reference for the implementation of Article 3 paragraph 1 of Regulation (EC) No. 1935/2004. Legality and thereby the requirement must be documented by the party manufacturing the end-product (the food and its packaging). But the requirement applies to all material that is in contact with food and the packaging manufacturer/raw materials producer is responsible for and delivers documentation for the manufacturer of the end-product.

O4 Testing of migrates

The requirement applies to primary packaging made mainly of:

- paper and paperboard (such as beverage cartons)
- virgin and recycled plastics (such as plastic bottles)
- aluminium including coatings (such as aluminium cans)

Finished primary packaging shall regularly* be assessed for migration of intentionally and non-intentionally added substances.

Non-intentionally added substances (NIAS) from finished primary packaging shall be subject to a documented risk assessment according to Article 19 of EU regulation 10/2011 and mustshall not migrate into food in quantities which could endanger human health.

The risk assessment shall be made according to "Guidance on Best Practices on the Risk Assessment of Non-Intentionally Added Substances (NIAS) in Food", ILSI Europe Report Series 2016, or equivalent documents can be used. The risk assessment shall also cover potential NIAS that are listed in requirements O16 and O17.

For non-intentionally added substances and **intentionally added substances (IAS)** that are listed in EU 10/2011, current rules must be followed, and substances must meet their respective specific migration limits.

A specific migration limit of 0.01 mg/kg is applied to substances covered by requirements O16 and O17. This applies to both intentionally and non-intentionally added substances.

* Regularly means at the least every two years.

✉ Declaration from the manufacturer that a risk assessment of NIAS has been done in accordance with the requirement.

✉ Documented risk assessment of NIAS migration. The risk assessment shall either be explained step-by-step or be verified by a competent third-party.

✉ Routines and procedures, including requirements and approval schemes for materials and chemicals used for production of the packaging and plan for frequency of testing, to assure compliance with this criterion.

✉ Results from regular analyses or non-targeted screening tests showing that migration limit values for NIAS, based on outcome from the risk assessment, are not exceeded.

✉ Results from regular analyses showing that migration limit values for IAS are not exceeded.

[134] https://www.edqm.eu/en/food-contact-materials

Background to the requirement

Nordic Ecolabelling sets the requirement that the finished primary packaging shall regularly be assessed for the migration of intentionally added substances (IAS) and non-intentionally added substances (NIAS). As any relevant regulation currently lacks a periodicity, it is specified that regularly means at the least every two years.

The requirement applies to primary packaging made of i) paper and paperboard, (ii) virgin and recycled plastics and (iii) aluminium including coatings. NIAS shall be subject to a documentet risk assessment according to Article 19 of EU Regulation 10/2011 and must not migrate into food in quantities which could endanger human health. Furthermore, IAS and NIAS that are listed in EU Regulation 10/2011 must meet their respective specific migration limits as given in the regulation.

Intentionally added substances (IAS) are substances that are intentionally added during the manufacturing process of the finished primary packaging. EU Regulation 10/2011 concerns plastic materials and products intended to come into contact with food, including plastic layers in multi-material multi-layered products (MMML). This regulation specifically regulates migration of IAS from these materials. There is currently no such legislation for paper and board nor for aluminium, therefore Nordic Ecolabelling sets the requirement that the requirements on IAS in plastic materials set out in Regulation 10/2011 also regards paper and board and aluminium and its coatings.

Non-intentionally added substances (NIAS) are chemical compounds that are not added intentionally during the manufacturing process, but which may occur in material in contact with food. Awareness of such substances has increased in recent years due to the increased sensitivity of the chemical analyses[135]. NIAS may originate from various sources and include degradation products from materials in contact with food and contamination with adverse products from the original material.[136] These can migrate to food and consumers can thereby probably be exposed to these chemicals. Nordic Ecolabelling therefore sets the requirement that the primary packaging, or its constituent materials, shall be subject to a documented risk assessment in accordance with “Guidance on Best Practices on the Risk Assessment of Non-Intentionally Added Substances (NIAS) in Food”, ILSI Europe Report Series 2016[137], which is the leading guideline for risk assessment of NIAS in materials that come into contact with food. Equivalent guidelines can be used, but shall be approved by the Nordic Ecolabelling. The risk assessment shall also cover potential NIAS that are listed in requirements O16 and O17.

Requirements O16 and O17 lists substances that must not be used in the production/assembly of Nordic Swan Ecolabelled packaging. Requirement O16 regards CMR substances and requirement O17 regards other substances excluded from use. If these substances can not be used in packaging production, it is also essential that they do not migrate as NIAS in the packaging.

O5 Packaging design

1. A packaging manufacturer must have procedures for the design phase of the primary packaging for ensuring that primary packaging is

[135] http://ilsi.org/europe/wp-content/uploads/sites/3/2016/04/2015-NIAS_version-January-2016.pdf
[136] http://www.foodpackagingforum.org/fpf-2016/wp-content/uploads/2015/11/FPF_Dossier03_NIAS.pdf
[137] https://ilsi.eu/publication/guidance-on-best-practices-on-the-risk-assessment-of-non-intentionally-added-substances-nias-in-food-contact-materials-and-articles/

- resource-efficient from a materials viewpoint. For disposable glass bottles, weight (kg) ratio to net content in the bottle (litre) shall not exceed 0.56. Refillable glass bottles are exempted from the requirement.
- optimised from a transport viewpoint, e.g. that the packaging's structure, and the quality and amount of materials, are matched to the relevant pressures during transport, warehousing and distribution, in order to avoid crushing/loss and that air is not transported unnecessarily;
- easy to open, reclose and empty; and
- easy to material recycle or reuse.

The packaging manufacturer must also have procedures for dialogue with customers to develop these together with the food producer and regarding recommendation for secondary and tertiary packaging that are adapted to the primary packaging.

2. Packaging manufacturers shall have procedures showing how they work with strategic goals to reduce environmental impact in the production of packaging (e.g. mapping of energy efficiency measures, dialogue with suppliers to reduce environmental impact in raw material production.) The goals shall be quantitative and time-based and they shall be determined by the management.

✉ Enclose procedures for the design of primary packaging and for the dialog with customers, showing fulfilment of the requirement.

✉ Enclose calculation showing that requirement for the disposable glass bottle is met. If the glass bottle is an exception for calculation, enclose documentation that shows that the bottle is refillable.

✉ Enclose procedures for policy or equivalent documentation of the manufacturer's work with environmental goals, showing fulfilment of the requirement.

Background to the requirement

Packaging design is the art of packaging the product as well as possible and at all stages, and effectively using the production equipment, transport and warehousing resources, as well as sales in the shops.

Design must also promote packaging that is optimised from an environmental viewpoint. in the first generation of the Criteria, it is difficult for Nordic Ecolabelling to set direct requirements on e.g. shape and weight of the packaging or transport from an environmental point of view. The requirement for weight to volume ratio of disposable glass bottles is the only absolute requirement for the packaging design. Nordic Ecolabelling can, however, work indirectly to promote these design adjustments. Requirement O5 is created for the design of packaging from an environmental viewpoint. The packaging manufacturer must have procedures to ensure that environmental issues are taken into account in the packagaging design or can be developed together with the food producer from the producer's own premises. By requiring the packaging manufacturer shall have procedures, wishes Nordic Ecolabelling to promote packaging that is focused on sustainability throughout the distribution chain. For example, Nordic Ecolabelling will promote packaging with optimised volume, air and packaging material with regard to primary, secondary and tertiary packaging during transport. From an environmental viewpoint, transport generally play a smaller role in packaging's life cycle, and Nordic Ecolabelling has very low steerability to set requirements of transport. Yet there are opportunities to set indirect requirements of transport contractors by focusing on the packaging design. The same applies to recycling of packaging or reuse of e.g. secondary and/or tertiary packaging by the producer. It is important that material for recirculation is not from the outset designed so as to limit opportunities to recycle the material. The EU's action plan for the circular economy also discusses product

design. Manufacturers, users and recyclers do not necessarily share the same interests and packaging designers do not always seem to know how materials and, most of all, the composition of the various materials, function technically in the recycling phase. The new German packaging act, approved in May 2017, encourages packaging manufacturers to include recycling aspects in packaging design.[138] Opportunities to set direct requirements of packaging design and function must also be reviewed for the next generation of the criteria.

The requirement for weight to volume ratio of disposable glass bottles is the only absolute requirement for the packaging design in the first generation of the Criteria. There is variation in the weight of individual packaging for the same purpose and thus weight reduction is important for all packaging materials. Requirement for weight of the packaging material glass is even more important because glass bottles are heavy. Lightweight glass reduces the consumption of raw materials and CO_2 emissions in production as well as energy consumption during transport and thus, the environmental impact. By setting requirements for weight reduction in combination with the requirement for the proportion of recycled material, one can control the development of glass bottles in an environmentally positive way.

Weight of the disposable glass bottle (kg) is limited in relation to the declared net content of the bottle (liters). The exception to the calculation is return glass that is refilled. Refillable glass bottles are typically heavier than disposable glass bottles because reusable bottles need to be more pressure-proof to reduce fractures and spills when reused. The limit for weight / volume ratio is based on information that Nordic Ecolabelling has received from stakeholders and which is possible to manufacture without impairing the properties of the disposable glass bottle. For example, the weight of the 0.75 l light bottle is 0.420 kg. The average value of the glass bottle is generally 0.540 kg, so the limit value of 0.420 kg is considerably below this.According to the requirment, the packaging manufacturer must also have procedures for dialogue with customers regarding recommendation for secondary and tertiary packaging that are adapted to the primary packaging. The packaging system is the product and various levels of packaging, i.e. primary, secondary and tertiary packaging.[139] The packaging levels are interrelated and influence each other so that a change at one level has an impact on the others. As an example, reducing e.g. the volume of materials at one packaging level can lead to an increase in material volumes at another stage. It is therefore important to adjust the packaging system. Packaging manufacturers do not have the controllability of secondary and tertiary packaging used by the food producer. However, they can provide a recommendation for environmentally-friendly packaging and therefore the packaging manufacturers shall have procedures for this. See also further secondary and tertiary packaging in section 7.8 Areas that are not subject to requirements.

It is also required that packaging manufacturers have routines for working with strategic goals to reduce environmental impact in their packaging production. This may be in the form of e.g. mapping of energy efficiency measures or dialogue with subcontractors to reduce environmental impact in raw material production. Then there will be concrete environmental work in the company that can be documented and lead to real environmental gains.

[138] http://www.bmub.bund.de/pressemitteilung/neues-verpackungsgesetz-passiert-den-bundesrat/
[139] Daniel Hellström och Annika Olsson; Managing packaging design for sustainable development - a compass for strategic directions, first edition, John Wiley and Sons Ltd. 2017.

O6 Recycling of primary packaging

It must be possible to recycle primary packaging in today's existing recirculation systems in the Nordic countries.

Incineration with energy recovery is not considered to be material recovery.

Example of polymers/plastic from which materials cannot be recycled include biodegradable/compostable plastics such as PLA.

✉ Enclose documentation showing that the primary packaging is recyclable and define which recovery methods are possible..

O7 Packaging with recycling design

Primary packaging shall have a design that enables effective material recovery.

For glass packaging applies

Combined materials - e.g. glass and plastic must not be included in the bottle itself. Ceramics or porcelain shall not be used in the glass or closures.

Adhesive used to attach labels to packaging must be hot-melt adhesive (melts at 60 to 80°C) or water-soluble and alkaline.

For aluminium packaging applies

Combined materials - e.g. aluminium and plastic must not be included in the can itself.

Outer surface of aluminium cans shall not be based on paper or plastic.

For plastic packaging applies

Filler

Filler such as $CaCO_3$ shall not be added to plastic packaging or closures in a concentration so that the plastic's density exceeds 0,995 g/cm^3.

Dyes

Plastic packaging including closing devices, such as stoppers, must not be coloured with Carbon Black.

This does not apply to caps/stoppers in plastic packaging that are recycled via the deposit-refund system for bottles.

Dyes that are used must fulfil requirements O15-O18.

Label/scanning plastic size

Labels/scanning plastic shall not cover more than 60% of the packaging surface. The requirement does not apply if the same material is used in the scanning plastic/label as in the packaging.

Adhesives for labels

Adhesive used to attach labels to packaging must be hot-melt adhesive (melts at 60 to 80°C) or water-soluble and alkaline.

✉ Packaging specification (including labels and closures) or documentation showing which material is used (see also requirement O1) and compliance with declarations showing that

- combined materials are not included in the glas bottle and aluminium cans,
- ceramics or porcelain are not used in the glass,
- outer surface of aluminium cans is not based on paper or plastic

✉ For plastic, packaging specification (including labels and stoppers) or declaration showing which plastic is used, including information on

- the type of mineral in the plastic and a calculation showing that the density measurement is not exceeded,

- dyeing and that carbon black is not in use, and

- the size of the label in relation to the packaging.

✉ Documentation (e.g. as a safety data sheet) of the adhesive showing that it is hot-melt adhesive or water-soluble and alkaline.

O8 Information to consumers

Packaging must be clearly marked with indicative information on how it is to be sorted. The information must be clearly visible to the end-consumer and be of such a nature that the consumer understands what is meant. Labelling can be in the form of symbols/pictograms* or text, e.g. "Paper packaging" or "Plastic packaging". Labelling can be embossed, stamped or printed.

* *Symbols are e.g. the deposit label or labels advocated by the Green Dot, FTI or Rinki. General symbols such as recycling symbols or general text can also be used, but must first be approved by Nordic Ecolabelling. Note, however that, the Green Dot label will not be approved as a general symbol Enclose documentation such as a picture of the embossing, label, artwork or equivalent, to document fufilment of the requirement.*

✉ Enclose documentation such as a picture of the embossing, label, artwork or equivalent, to document fulfilment of the requirement.

Background to the requirements

The waste phase plays an important role in the packaging's life cycle and it is therefore relevant for Nordic Ecolabelling to set requirements for this. There is potential to increase the recycling ratio in the Nordic countries, but the steerability of direct requirements of the waste phase is generally considered to be rather low. The waste phase is influenced by many factors, such as sorting opportunities in each country or municipality, and how the consumer ultimately sorts waste. Nordic Ecolabelling can, however, generally work for the recycling of packaging and set requirements intended to support this process. Therefore, sets the requirement for materialrecycling of primary packaging (O6). Nordic Swan Ecolabelled packaging is now subject to further requirements to facilitate the recycling of materials in the final phase of the packaging's life cycle (O7). In addition to this, the Nordic Ecolabelling can work to increase recovery rates by attempting to stimulate that food packaging actually are recycled (Requirement for Information to consumers O8). Food packaging is valuable in the recycling process since food packaging comprises a high ratio of virgin material. The statutory requirements of material in contact with food are furthermore stringent with regard to chemicals, which should also be an advantage from a recycling perspective. The Nordic Council of Ministers' report "Climate benefits of material recycling"[140] shows that there are climate-related benefits from recycling plastic, since emissions from secondary production are lower for all types of material. It is thus highly relevant to set requirements which promote the recycling of packaging in this product group.

Recycling of primary packaging

According to requirement O6, It must be possible to recycle materials from primary packaging in today's existing recirculation systems in the Nordic countries. The requirement also covers packaging for liquid foods included in the deposit system (pantsystem). The

[140] Nordic Council of Ministers, Tema Nord 2015:547, Climate benefits of material recycling – Inventory of Average Greenhouse Emissions for Denmark, Norway and Sweden, p. 74

deposit system is based on legislation in all Nordic countries. Return levels almost 90% are not uncommon for packaging in the deposit system.[141] [142] [143] [144]

Compared to bottles in the deposit system, the recycling ratio for plastic bottles and beverage cartons outside the deposit system is lower.[145] [146] [147] Forbeverge cartons, the highest recycling ratio is achieved in Norway (60%). whereas in the EU, the recycling rate of beverage cartons was 47% in 2016.[148] For plastic bottles in the Nordic region (under 40%) the recycling rate is lower. Yet there is potential to increase the recycling ratio in the Nordic countries. Nordic Ecolabelling will therefore promote packaging that can be material recycled in existing Nordic recycling systems. In addition, the waste phase is influenced by many factors, such as sorting opportunities in each country or municipality, and how the consumer ultimately sorts waste, which also affects the steerability of the recycling requirement. In Sweden, Finland and Norway the producer is responsible for packaging.[149] [150] [151] A party that puts packaging on the market also has a responsibility to handle the packaging after use. The organisation structure of collection and recycling varies between countries. For example, by joining Förpacknings- och Tidningsinsamlingen (FTI) in Sweden, or Rinki in Finland, these organisations, as commissioned by producers, can handle the packaging delivered by households for recycling. In Denmark, packaging waste is defined as household waste in the individual municipalities' regulations. This entails that recycling opportunities can vary across the different municipalities.[152]

Since Nordic Ecolabelling wishes to promote the development of materials recycling processes, incineration with energy recovery is not deemed to be recycling in these criteria. By setting requirements of the recycling of plastic, there is an indirect prohibition of polymers/plastics that cannot be recycled. An example of this is degradable/compostable plastics such as PLA. Compostable/degradable plastics such as PLA cannot be recycled in today's systems, and can also present problems for the existing recycling of materials. Composting and biogas facilities do not wish to have these plastics either, as they create problems in the facilities. Any other material than organic waste is discarded before the composting or biogas process. These compostable/degradable plastics therefore do not match the EU's objective of increased recycling of materials and the circular economy. The requirement that packaging should be recyclable material applies to the main material in packaging, and thereby packaging which solely comprises plastic cannot consist of compostable/degradable plastic. On the other hand, compostable/degradable plastics can be used as laminate, coating, etc. in e.g. paperboard products. In such cases the plastic will still be sorted and sent for incineration, as the situation is today. Nordic Ecolabelling wishes to point out that this requirement can be adjusted if, in the future, a recirculation system is created for compostable/degradable plastics.

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[141] http://www.palpa.fi/yritys/palautusasteet-1
[142] http://infinitum.no/infinitum/english/deposit-facts-of-2013
[143] http://www.dansk-retursystem.dk/content/dk/om_dansk_retursystem/nogletal_arsrapporter
[144] http://www.pantamera.nu/sv/v%C3%A4lkommen-till-returpack
[145] https://www.grontpunkt.no/gjenvinning (accessed 2017-06-30)
[146] http://assets.tetrapak.com/static/se/documents/sustainability-downloads/lca%20nordic%20final%20report.pdf
[147] http://ftiab.se/180.html (accessed 2017-06-30)
[148] http://www.ace.be/mediaroom/90/50/Beverage-carton-recycling-on-the-rise-in-Europe (hämtat 2017-09-28)
[149] http://www.ftiab.se/148.html, accessed 2017-05-31
[150] http://rinkiin.fi/var-verksamhet/ accessed 2017-05-31
[151] https://www.grontpunkt.no/ accessed 2017-05-31
[152] http://mst.dk/virksomhed-myndighed/affald/affaldsfraktioner/förpackning/kommunernes-indsamling-af-förpackningaffald/ accessed 2016-12-20

Packaging with recycling design

When food packaging is recycled, it is desirable that packagings are recycled to new packaging (Bottle-to-Bottle recycling) without that the materials are downgraded to some other products. High quality of the material in the recycling process can be maintained by setting requirements to packaging design.

Therefore, a requirement for the design the packaging is applied that is parallell to EU's recently published Plastic Strategy to set more requirements on packaging design. Regarding glass bottles and aluminium cans, mixing of different materials in the bottle/can itself is forbidden[153]. Ceramics or porcelain shall not be included in the glass bottle or closures as it may lead to increased process loss of glass in the recycling process[154]. Outer surfaces of aluminium cans shall not carry a label made from plastic or paper, it shall be only varnished or coloured.

A folder from the Swedish materials association Plastkretsen, together with Förpacknings- och Tidningsinsamlingen (FTI)[155], also draws attention to the fact that dyes and printing ink affect recycling potential and the quality of the recycled plastic. Reduced use of chemical dyes is therefore an obvious recommendation. In particular, strong, solid dyes with carbon black pigment can create problems in modern automatic sorting facilities, since the NIR technology cannot identify the material. These products can therefore end up in the residual fraction, so that they are not recycled. Therefore, it is also required that plastic packaging which solely consists of plastic may not be dyed black. The requirement also applies to closing devices, e.g. stoppers. However, caps/stoppers that are recycled in the deposit refund system are exempted since other technologies than NIR are used for sorting of refund bottles in the Nordic Countries. Subsequently, black stoppers do not end up in the residual fraction but are instead recycled to other products such as cable drums.

Undyed, clear plastic has the highest recycling value and is therefore easier to recycle. To ensure that the requirement does not have an excessively stringent impact in this generation of the criteria, plastic packaging may be dyed, but not in a black colour. The dyes that may be included must fulfil requirements O15–O18.

From a recycling viewpoint, requirements are also made of the adhesives used to adhere labels. One item of advice from Plastkretsen and FTI is to use as little adhesive as possible and that the label glue should be soluble in water at 60–80°C, and alternatively be an alkaline-soluble hot-melt adhesive. This is to make it easier to remove the label.

The materials commonly used for labels are PP, PE, PET and paper. When plastic packaging is sorted using IR, the detector can only separate one plastic material at a time. If plastic packaging carries a label of another type of plastic or paper, this impedes sorting. Nordic Ecolabelling therefore requires that any label/scanning plastic covers maximum 60% of the packaging's surface[156]. If the same material is used for the label/scanning plastic as for the packaging, this requirement can be disregarded.

The requirement is also made that the density of the plastic may not exceed 0,995 g/cm^3. Inorganic filler such as calcium carbonate is an additive commonly used in many types of

[153] http://www.dansk-retursystem.dk/wp-content/uploads/2016/10/10-raad-til-producenter.pdf
[154] https://www.glasatervinning.se/for-producenter-och-importorer/hallbar-design/
[155] Plastkretsen and Förpacknings och tidningsinsamlingen, Bättre förutsättningar for återvinning av plastförpackingar (Better conditions for the recycling of plastic packaging)
[156] https://www.grontpunkt.no/media/2777/report-gpn-design-for-recycling-0704174.pdf

plastic. Excessive amounts of inorganic filler make the plastic difficult to recycle since it becomes too heavy and sinks to the bottom of the recycling facility, and thereby ends up in the fraction sent for incineration. Since the criteria are to promote the recycling of materials, the addition of excessive amounts of inorganic filler can be problematic for plastic. The density of 0,995 g/cm^3 is based on FTI's guidelines for the recycling of plastic packaging.[157] This means that inorganic additives may be included, but the volume is limited from a recycling viewpoint.

Information to consumers

The waste phase of packaging's life cycle is affected by many factors such as the how consumers sort the packaging in the final phase. Studies show that households do not generally have any objections to sorting their waste.[158] But households do often lack clearer information on how to sort packaging at source.[159] This information breach can be decisive for the motivation to sort waste. Requirements are therefore set in the criteria for how packaging should display the information that the packaging is to be recycled. The requirement is also in line with Article 4 of the European Waste Directive 2008/98/EC concerning the waste hierarchy, of which the first section considers a prioritisation scheme for preventive measures, preparation for reuse and recycling of materials.

It is important that the labelling is clearly visible and of such a nature that it can be understood by the consumer. It is stated that this is possible using symbols/pictograms such as deposit label or those recommended by the Green Dot, FTI or Rinki. If the same product is sold in several Nordic countries, the labelling may be identical, even if the recommended symbols can vary across national borders. It is also possible to use text labels. General recirculation symbols can also be used, such as three arrows in a circle, or general text such as "recirculate me". In such case this must be specifically approved by Nordic Ecolabelling. It must be emphasised that the label or text used is of such a nature that it is easy for an ordinary consumer to understand what it means, as the intention of the requirement is to increase the sorting of products and increase opportunities for the product materials to be recycled. The Green Dot label will not be approved as a sorting symbol since this is only a receipt label showing that remuneration has been paid for the packaging.

7.4 Requirements of constituent substances

Pulp, paper and paperboard

The requirements of pulp, paper and board included in packaging are specified below. General requirements of the manufacture of pulp and paper can be found in Nordic Ecolabelling's modular system for paper products, to which the following requirements refer:

- Basic Module for Nordic Swan Ecolabelling of Paper products, version 2 or later.
- Chemical Module for Nordic Swan Ecolabelling of Paper Products, version 2 or later.

In addition to the existing criteria for paper products specified above, other paper, board and cardboard types may be included in packaging, and which are not subject to the aforementioned criteria. These are subject to their own specific requirements of energy and

[157] Förpacknings och tidningsinsamlingen, 2017. Plastic packaging, a recycling manual from FTI, version 0,7.
[158] http://norden.diva-portal.org/smash/get/diva2:788195/FULLTEXT03.pdf
[159] IVL Swedish Environmental Research Institute, Kunskapsunderlag for ökad kälsortering av plastförpackningar (Knowledge basis for increased sorting at source of plastic packaging)

emissions to air and water. These are specified as separate reference values in O10 below or given in the criteria for Disposables in contact with food, version 4 or later.

In addition to the following requirements, requirements O18, O20-O21, in section 7.5, Requirements of Chemical Products, still applies to pulp, paper and paperboard.

Pulp and paper manufacturers must document the requirement in the web-based application guide, My Swan Account. My Swan Account can be accessed via the Internet addresses on page 2 of this document, or via http://www.nordic-ecolabel.org/portals/paper/my-swan-account1/

O9 Pulp

Pulp must meet all the relevant requirements in the Basic Module for Paper Products, version 2 or later.

Documentation of the requirements must be done in the application tool My Swan Account (MSA). Please contact Nordic Ecolabelling for username and password.

✉ The pulp manufacturer must show that the requirements are fulfilled with completed forms in MSA.

O10 Paper and paperboard

Paper and paperboard covered by the Basic Module for Paper Products

Paper and board that is covered by the Basic Module for the "Nordic Swan Ecolabelling of Paper Products" version 2 or later must meet all the requirements in the Basic Module and the Chemicals Module for Paper Products, version 2 or later with the exception of R7 Fiber raw materials and R11 Transport in the Basic Module. There is an own requirement for fiber raw material in this criteria document, see O11.

If the paper or board already carries the Nordic Swan Ecolabel, or has been checked by Nordic Ecolabelling the requirement is considered to be fulfilled, except for fiber raw materials, which shall be documented according to requirement O11 below. State the licence certificate or information on the trading name and the manufacturer of the assessed material.

Paper and paperboard not covered by the Basic Module

Paper and board that are not covered by the Basic Module for the Nordic Swan Ecolabelling of Paper Products version 2 or later must meet all the relevant requirements in the Basic Module and the Chemicals Module for Paper Products, version 2 or later, with the exception of R7 Fiber raw materials and R11 Transport in the Basic Module. There is an own requirement for fiber raw material in this criteria document, see O11.

For energy and emissions to air and water, the reference values and requirement limits for the paper machine apply, as stated below or those given in the Criteria for Disposables in contact with food, version 4 or later. The calculation methods used in the Basic Module for Paper Products, version 2, are to be used.

Table 2. Referance values for energy

	Energy – reference values (kWh/tonne board)	
	Fuel	Electricity
Liquid packaging board	1700	800

Table 3. Reference values for COD, P, S and NOx

	Reference values (kg/tonne board			
	COD	P	S	NOx
Liquid packaging board	2	0.01	0.15	0.7

An application for approval of pulp, paper and board is to be made via the electronic application tool My Swan Account (MSA). Contact Nordic Ecolabelling for a user name and password.

☒ The manufacturer must show that the requirements are fulfilled with completed forms in MSA.

Background to the requirements

For paperboard-based products, primarily four areas are of greatest significance on assessing the product's environmental impact. The first is forestry, and the others are related to chemicals use, emissions to air and water, and energy consumption for production of pulp and paperboard. These environmental impacts are described exhaustively in the background document for paper modules – the Basic Module.[160]

Nordic Ecolabelling has longstanding experience with requirements of pulp and paper products. General requirements of pulp and paper manufacture can be found in Nordic Ecolabelling, Basic Module for Paper Products, version 2. Since in overall terms paper, cartonboard and pulp in packaging resemble other paper and pulp types included in the Basic Module, the packaging of paper or cartonboard must also comply with these requirements in the Basic Module. Reference is made to all relevant requirements in the Basic Module, but with the exception of the requirement of CO_2 emissions from transport and requirement for the certified fibre raw material (O11). New reference values and requirement limits are also introduced for energy and emissions for the liquid packaging board that is not included in the Basic Module today. The proposed new reference values are based on contact with the industry. It is also pointed out that recycled pulp/paper/paperboard is prohibited in O2.

O11 Fiber raw material

The requirement consists of four parts that all must be fulfilled:

1. Virgin tree species listed on Nordic Ecolabelling's list of restricted tree species* must not be used in pulp/paper.

The list consists of tree species listed on:

a) CITES (Appendices I, II and III)

b) IUCN red list, categorized as CR, EN and VU

c) Rainforest Foundation Norway´s tree list

d) Siberian larch (originated in forests outside the EU)

Exemptions

Eucalyptus and Acacia used for pulp and paper production are exempted from the list (note **).

Tree species listed on either b), c) or d) may be used if it meets all of the following requirements:

- the tree species does not originate from an area/region where it is IUCN red listed, categorized as CR, EN or VU.
- the tree species does not originate from Intact Forest Landscape (IFL), defined in 2002 http://www.intactforests.org/world.map.html.
- the tree species shall originate from FSC or PEFC certified forest/plantation and shall be covered by a valid FSC/PEFC chain of custody certificates documented/controlled

[160] Nordic Ecolabelling. Background to Nordic Swan Ecolabelling of Paper Products - Basic Module and Chemical Module, version 2. 22 June 2011.

as FSC or PEFC 100% through the FSC transfer method or PEFC physical separation method. Tree species grown in plantation shall in addition originate from FSC or PEFC certified forest/plantation, established before 1994.

** The list of restricted tree species is located on the website: http://www.nordic-ecolabel.org/certification/paper-pulp-printing/pulp--paper-producers/forestry-requirements-2020/*

*** Regarding pulp, fibre raw material from eucalyptus/acacia must be a minimum of 70% certified.*

2. The pulp producer must state the name (species name) of the wood raw material used in the production of pulp.
3. The pulp,- and paper/board producer must be Chain of Custody certified in accordance to FSC or PEFC.
4. Certification.

Paper/board: yearly/the latest 12 months, a minimum of 70% of the wood raw material that are used in the paper/board must origin from forestry certified under the FSC or PEFC schemes. The remaining proportion of wood raw material must be covered by the FSC/PEFC control schemes (FSC controlled wood/PEFC controlled sources).

Pulp: If the pulp is used directly in the finished packaging, for instance as pressed pulp, yearly/the latest 12 months, a minimum of 70% of the wood raw material in the pulp must origin from forestry certified under the FSC or PEFC schemes. The remaining proportion of wood raw material must be covered by the FSC/PEFC control schemes (FSC controlled wood/PEFC controlled sources).

☒ Declaration from the applicant/manufacturer/supplier that tree species listed on a)-d) are not used. Regarding acacia/eucalyptus, documentation showing that the quantity of certified fibre in pulp is met. Appendix 3 shall be used.

☒ If species from the lists b), c) or d) is used:

☒ The applicant/manufacturer/supplier are required to present a valid FSC/PEFC Chain of Custody certificate that covers the specific tree species and demonstrate that the tree is controlled as FSC or PEFC 100% through the FSC transfer method or PEFC physical separation method.

☒ The applicant/manufacturer/supplier are required to document full traceability back to the forest/certified forest unit thereby demonstrating that;

- the tree does not originate from an area/region where it is IUCN red listed, categorized as CR, EN or VU;
- the tree species does not originate from Intact Forest Landscape (IFL), defined in 2002 http://www.intactforests.org/world.webmap.html;
- For plantations the applicant/manufacturer/supplier are required to document that the tree species does not originate from FSC or PEFC certified plantations established after 1994.

☒ Name (species name) of the wood raw materials used in the pulp production. Appendix 4 can be used.

☒ A valid FSC/PEFC Chain of Custody certificate from the pulp,- and paper/paperboard producer covering all the wood raw materials in the pulp/paper/paperboard.

☒ Certification pulp/paper/paperboard: The producer of the packaging shall document, for instance based on invoice or delivery note, that the requirement of minimum 70% certified pulp/paper/paperboard are purchased on a yearly basis.

Background to the requirement

There is an own requirement to wood raw materials in pulp/paper/paperboard/ in this criteria document instead of referring to the Basic Module as before. This is due to the new forestry requirement approved by Nordic Ecolabelling after the approval of the Basic Module and in all new and revised criteria documents it is the new forestry requirement that should apply. The formulation of the requirement is based on the requirement as formulated in appendix 1E in the Basic Module. However, the formulations are adjusted to be suitable for carton packaging.

Nordic Ecolabelling wants to contribute to sustainable forestry (ecologically, economically and socially). From a life cycle perspective, forestry is an important part of a wood-based product's environmental impact. Nordic Ecolabelling's forest requirement focuses on sustainable forestry and traceability of wood raw materials. Sustainably managed forests deliver a whole host of benefits to society in the form of wood for materials and energy, protection against global warming, a place to live and thrive for local communities and indigenous peoples, preservation of biodiversity, and protection of water and soil against pollution, erosion and so on. By setting a requirement that wood raw materials must come from certified forestry, Nordic Ecolabelling supports the trend towards more sustainable forestry.

There is also a requirement that the pulp/paper/board producer are Chain of Custody (CoC) certified in line with FSC/PEFC's schemes. The requirement for Chain of Custody certification contributes to traceability in the supply chain within the FSC and PEFCs guidance and control systems for traceability. The company's Chain of Custody certification proves how certified wood is kept separate from not certified wood in the production, administration and warehousing and is checked annually by independent certification bodies. The certification limit of 70% is based on the situation and availability of certified material in the market. See also Nordic Ecolabelling's background document for the Basic Module for Paper Products.

There is now also a ban on the use of the tree species listed at: www.nordic-ecolabelling.org/wood/. On 17 December 2020 updated requirement for tree species with restricted use in Nordic Swan Ecolabelled products was introduced. A number of tree species are restricted or not permitted for use in Nordic Swan Ecolabelled product. The requirement applies only to virgin forest tree species and not tree species defined as recycled material according to ISO 14021.

The list of restricted tree species is based on the wood species that are relevant to Nordic Ecolabelling's criteria, i.e., tree species that have the potential to be included in Nordic Ecolabelled products. Listed tree species are indicated by the scientific name and the most common trade names. The scientific name/trade name is not always adequate, as there may be more than one scientific name/trade names for the listed tree species than the list indicates.

Criteria for tree species found in the list are wood originating from:

a) Tree species listed on CITES Appendices I, II and III.

b) IUCN red list, categorized as critically endangered (CR), endangered (EN) and vulnerable (VU).

c) Regnskogsfondet161 (Rainforest Foundation Norway) tree list

[161] https://www.regnskog.no/no/hva-du-kan-gjore/unnga-tropisk-tommer/tropiske-treslag (visited January 2020)

d) Siberian larch (originated in forests outside the EU)

CITES[162] is an international convention for the control of trade (across borders) of wild fauna and flora. CITES includes around 5600 animal species and around 28.000 plant species wherein a part is relevant timber tree species (mainly tropical species). The tree species is, dependent on how threatened they are, listed in Appendix I, II or III. Species listed in Appendix I, are highly endangered and trade with these species is totally banned. For the remaining tree species, special permits for import and export is required (Appendices II and III). CITES is regulated by EU legislation (Council Regulation (EC) No 338/97) and trees with valid CITES permits are considered to be legally harvested under EUTR (EU Timber Regulation). Nordic Swan Ecolabel's ban on the use of tree species listed in CITES (Appendix I, II or III) goes beyond the EU legislation. CITES regulates trade in endangered species, and there are also challenges with corruption in the trade in wild animals and plants[163]. Therefore, Nordic Ecolabelling does not want to approve species on any of the appendices.

IUCN Red Lists[164] are the world's most comprehensive inventory of the global conservation status of the planet's biological species, including trees. IUCN Red List has established clear criteria to assess the risk of extinction among thousands of species and subspecies according to the origin of the tree species. These criteria cover all countries and all species in the world. Nordic Swan Ecolabelling is aware that the IUCN's red list system only focuses on the extinction risk of species, and therefore is not designed for an overall assessment of whether a tree species can be provided with sustainable origin. However, the list is continually being updated and thereby is an important tool to estimate a specific tree species' conservation status on a global scale. Nordic Swan Ecolabel wishes to prohibit tree species listed as endangered (categories CR, EN and VU).

Regnskogfondet[165] (Rainforest Foundation Norway) is an NGO in Norway that works to protect the world's remaining rainforests. Currently, Regnskogsfondet does not see any credible certification schemes working in the tropics, and therefore recommends full stop of buying tropical timber. Regnskogsfondet has developed a list of tropical tree species based on tree species found on the Norwegian market. This list works as a guide to comply with Norwegian guidelines regarding non-use of tropical wood in public construction. We consider this a pragmatic approach for handling tropical tree species on the Nordic market.

In addition, Siberian larch (originated in forests outside the EU) is on the tree list. Siberian larch is a coveted tree species in the construction industry due to its high quality. The tree species is widespread in the Eurasian northern boreal climate zone, and particularly the species Larix sibirica, Larix gmelinii, Larix cajanderi and Larix sukaczewii are widespread in the large areas of intact forest landscapes (IFL) in Russia. Siberian larch is to be seen as an indicator species for boreal IFL-areas which are important to keep intact.

[162] https://www.cites.org/ (visited January 2020)
[163] Addressing corruption in CITES documentation processes Willow Outhwaite, Research and Analysis Senior Programme Officer, TRAFFIC, 2020: https://www.traffic.org/site/assets/files/12675/topic-brief-addressing-corruption-in-cites-documentation-processes.pdf
[164] http://www.iucnredlist.org/ (visited January 2020)
[165] https://www.regnskog.no/no/hva-du-kan-gjore/unnga-tropisk-tommer/tropiske-treslag (visited January 2020)

Exemption for the use of **Eucalyptus and Acacia** in criteria document where pulp and paper are used.

Eucalyptus and Acacia used for manufacturing pulp and paper are exempted from the list as these species are grown in plantations for the specific use in the pulp and paper industry. Fibre raw material from acacia/eucalyptus must, however, be a minimum of 70% FSC/PEFC certified. The remaining proportion of fibre raw material must be covered by the FSC/PEFC control schemes.

Annual follow-up: The applicant/manufacturer shall report pulps (name of pulps) used in the production of Ecolabelled products. This insures that the eucalyptus/acasia pulps contains min 70% certified raw materials.

Exemption from the tree list

Nordic Swan Ecolabelling is aware that tree species originating from b), c) or d) can originate from legal and sustainable forestry. Therefore, it is possible to use tree species listed on b), c) or d) if the applicant/manufacturer/supplier can demonstrate compliance with a number of strict requirements regarding certification and traceability.

Many of the tree species on the list are grown in countries which still have large areas of IFLs. These are important to protect due to biodiversity and climate. Many of these countries also have a high risk of corruption and the national legislation related to environment, human rights and ownership to land are weak and/or not controlled by the authorities. There are different views on whether certification is good enough to meet the challenges of forest management in land with a high risk of corruption and illegal logging. For instance, relevant challenges related to this have been published by Danwatch in a number of articles in 2018 [166,167] and by redd-monitor.org in 2019[168]. Greenpeace International has ended its memberships in FSC on the grounds that the certification body is no longer meeting its aims of protecting forests and human rights[169]. Other environmental organisations like WWF support certification as an important tool for sustainable forestry in these countries. However, due to the uncertainty whether FSC and PEFC certification systems are good enough in protecting important areas of biodiversity and ethical aspects like human rights and land ownership in areas with a high risk of corruption, Nordic Ecolabelling have a precautionary approach and wants further documentation about the tree species and its origin.

In order to document full traceability of the tree species, the applicant/manufacturer/supplier must present a valid FSC/PEFC Chain of Custody certificate that covers the specific tree species and demonstrate that the tree is controlled as FSC or PEFC 100%, through the FSC transfer method or PEFC physical separation method. This means that Nordic Swan Ecolabelling does not accept the FSC percentage or credit control

[166] https://danwatch.dk/undersoegelse/dokumentfalsk-og-millionboeder-danske-byggemarkeder-saelger-trae-forbundet-til-ulovlig-hugst-i-amazonas/
[167] https://danwatch.dk/undersoegelse/baeredygtighedsmaerke-er-ingen-garanti-for-baeredygtigt-trae/
[168] https://redd-monitor.org/2019/08/29/evicted-for-carbon-credits-new-oakland-institute-report-confirms-forced-evictions-for-green-resources-plantations-in-uganda/
[169] https://www.greenpeace.org/international/press-release/15589/greenpeace-international-to-not-renew-fsc-membership/

system as well as PEFC percentage system. Full traceability of the tree species back to the forest/certified forest unit, enables the applicant/manufacturer/supplier to document that the tree species does not come from an area/region where it is IUCN red listed, categorized as CR, EN or VU. Full traceability also makes it possible to document that the tree species does not come from Intact Forest Landscape (IFL), defined by Intactforest.org in 2002[170]. Intactforest has been monitoring IFL-areas since 2000 and has developed an online up to date mapping tool that shows the extent of IFL back to 2002. The monitoring results shows that the world's IFL are being degraded in an alarming speed, and that is the reason for Nordic Swan Ecolabelling referring back to 2002.

Plantation: Nordic Swan Ecolabelling believe, that responsibly run forest plantations can play a role in preserving natural IFLs by reducing the pressure to harvest the world's remaining natural forests. In order to secure that plantation has not replaced native ecosystems (forest/grasslands) within the last 25 years, tree species has to come from FSC or PEFC certified plantations that were established before 1994. 1994 is in line with FSCs international forest management standard (version 5.2), whereas PEFC is working with 2010.

The list of restricted tree species is located on http://www.nordic-ecolabel.org/certification/paper-pulp-printing/pulp--paper-producers/forestry-requirements-2020/.

Nordic Ecolabelling may demand more documentation for a specific tree species.

Other renewable raw materials

O12 Agricultural raw materials including palm oil, soy and sugar cane

Agricultural raw materials shall fulfil the following requirements. The requirement does not apply to secondary raw materials*.

For all agricultural raw materials, state the name (in Latin and English), plus geographical origin (country/state) and supplier of the agricultural raw materials used.

Sugar cane

For bio-based plastic in packaging that only consist of plastic or that constitute more than 10% by weight in the packaging: sugar cane must be Bonsucro-certified.

Palm oil and soy oil

Bio-based plastic in packaging that only consist of plastic:

Palm oil and soy oil can not be used as a raw material in the production of bio-based plastic.

Bio-based plastic used for coating or that constitute less than 10% by weight in the packaging:

Palm-and soy oil are allowed as a raw material in bio-based plastic used as coating and in plastic that constitute less than 10% by weight in the packaging. This also applies if the bio-based plastic for coating is bio-based by using the mass balance method. The raw materials shall have the following certification:

- Palm oil, palm kernel oil and palm oil derivatives must be RSPO certified
- Soy oil must be RTRS certified

Certified raw material (sugar cane, palm oil and soy oil)

Producer of bio-based polymer or suppliers of certified raw materials must be traceability (Chain of Custody, CoC) certified in line with the current certification system, and the

[170] http://www.intactforests.org/world.webmap.html, visited January 2020

traceability must be assured via the mass balance system. The book and claim system is not accepted.

The producer of the bio-based polymer must document the purchase of certified raw materials.

The licenseholder/producer of the packaging must document that it is purchased bio-based polymer with the use of certified raw materials, for instance by a specification on the invoice or delivery note.

* *Secondary raw materials are defined here as residual products from other production processes, such as waste products from the food industry, by-products such as straw from grain production, by-products from maize and dried palm leaves. PFAD from palm oil is not counted as a residual/waste product.*

Nordic Ecolabelling may assess other certification schemes for the raw materials above as they become relevant. The certification scheme will be assessed according to Nordic

Ecolabelling's requirements concerning standards and certification systems, as set out in Appendix 6.

✉ Name (in Latin and English language) and geographic origin (country/state) of the agricultural raw materials used.

✉ Copy of valid CoC certificate or certification number. Documentation such as an invoice or delivery note from the producer of the bio-based polymer and the packaging, showing that bio-based polymer with certified raw material was purchased.

Background to the requirement

There is a specific requirement for the renewable raw materials palm oil, soy oil and sugar cane. These raw materials can be associated with major environmental and social problems. The establishment of palm oil plantations is one of the main reasons behind the destruction of rainforest, which threatens the habitats of indigenous peoples, plants and animals. The rainforests are particularly important for biodiversity, since they are the richest ecosystems on the planet in terms of species density. Cutting down rainforest is also a serious threat to the planet's climate, and rainforest conservation was one of the themes at the UN's climate negotiations in Paris in 2015. Other environmental problems related to palm oil are the use of toxins in production, air pollution from the burning of the original forest, soil erosion and silting in rivers and watercourses, plus discharges of wastewater from the palm oil mills. Palm oil production is also associated with social problems, such as the risk of labour rights abuses.[171]

Soy beans are grown on land that is often established in the place of forest and forest savannah in South America. 80% of the world's soy production takes place in the USA, Brazil and Argentina.[172] Soy production is one of the greatest threats to the rainforest on the American continent, particularly in the southern Amazon.[173] This is due directly to the felling of rainforest in order to establish soy fields, and to soy cultivation forcing small-scale farmers off their previous land and into the rainforest. Soy has also brought land changes to the savannah in South America, known as the Cerrado – which is one of the areas declared a biodiversity hotspot.[174] Use of chemicals in production is also a serious environmental and health problem.

[171] OLSEN LJ, FENGER NA & GRAVERSEN J 2011. Palmeolie - Danmarks rolle i forhold til den globale produktion af palmeolie. WWF Report DK. WWF World Wide Fund for Nature Denmark.
[172] http://www.worldwildlife.org/industries/soy, (27.01.2016)
[173] http://www.regnskog.no/no/hva-du-kan-gjore/bruk-mindre-palmeolje/lys-uten-palmeolje, (27.01.2016)
[174] http://www.cepf.net/resources/hotspots/South-America/Pages/default.aspx, (27.01.2016)

Nordic Ecolabelling wishes the requirements to have an extra focus on the two raw materials above. For Nordic Ecolabelling the starting point is to set as strict requirements as possible for these raw materials, depending on their use in the specific product group. Nordic Ecolabelling is not currently aware that the raw materials palm oil and soy oil are relevant raw materials in any specific production of bio-based polymers, and therfore have a prohibition. However, it can not be ruled out that these raw materials become relevant in the future. The standards for certification of palm oil (RSPO) and soy oil (RTRS) have been assessed by the expert group for renewable raw materials at Nordic Ecolabelling, and the conclusion is that both the standards have their shortcomings.

For bio-based polymers used as coating, and where we allow the use of the mass balance method, as well as for bio-based plastic that constitute less than 10% by weight in the packaging, the raw materials palm oil and soy oil are allowed if they are certified according to RSPO or RTRS. Nordic Ecolabelling evaluates that these are the best tools on the market for a more sustainable production. Both RSPO and RTRS have a positive development, and Nordic Ecolabelling will follow the development of the systems and evaluate if it is possible in the future to accept these two systems on a general basis. For the use of mass balance in the calculation of the bio-based material, see O2.

Sugar cane, on the other hand, is a highly relevant raw material, with the green polyethylene produced by Braskem, for example, using ethanol from sugar cane in its production. Sugar cane is not currently associated as strongly with the problems of rainforest destruction mentioned above as palm oil and soy oil are, but there can also be challenges linked to its production. Over the period 1960–2008, the land used for sugar cane cultivation rose from 1.4 to 9 Mha. Around 65% of newly planted sugar cane is grown on plains (grasslands and savannahs) and the remainder comprises areas previously used for other types of farming. According to the background document for the Nordic Swan Ecolabelling of Biofuels[175], only one producer of sugar cane in Brazil is located in the area around the Amazon. However, as demand for sugar cane as a raw material rises, opportunities to expand the production areas are being explored. A loss of biodiversity in the rainforest may therefore become a problem associated with sugar cane in the future. At this point in time, the Cerrado is under the greatest pressure from the sugar cane industry. The Cerrado is a tropical savannah in Brazil that has unique biodiversity and specific ecosystems that are under threat.[176]

Nordic Ecolabelling's expert group on renewable raw materials has also assessed the standard for certification of sugar cane, Bonsucro, and has concluded that in its current form it does not meet Nordic Ecolabelling's requirements concerning standards. For one thing, it is unclear whether the standard goes any further than the relevant legislation, plus it does not refer to any international conventions. Nevertheless, the standard is considered the best available tool in the market for sustainable sugar cane production, which is why requirements are set concerning certified raw material.

Nordic Ecolabelling may also assess and approve other certification schemes. In such a case, a certification scheme will be assessed according to the requirements concerning standards, as set out in Appendix 6 of the criteria.

For all the certifications, a requirement is set concerning traceability at mass balance level. The book and claim system is not approved.

[175] About the Nordic Swan Ecolabelling of Biofuels, version 2, June 2012
[176] http://www.wwf.dk/wwfs_arbejde/skov/soja/skovomrader/cerrado/ (accessed 14.07.2016)

O13 Genetically modified raw materials

The requirement applies to bio-based polymer in packaging that only consist of plastic and if the bio-based polymer makes up more than 10% of the packaging by weight.

- The use of genetically modified agricultural raw materials in the production of bio-based polymer packaging is prohibited.
- GMO based on bacterias or enzymes manufactured in closed systems is allowed.
- Secondary raw materials are exempted from the requirement, see O12 for a definition.

✉ Declaration from the manufacturer of the bio-based polymer that genetically modified raw materials are not used.

Background to the requirement

Nordic Ecolabelling prohibits genetically modified agricultural raw materials. The requirement concerns packaging that solely comprises plastic and for plastic included in the packaging at more than 10% by weight. The requirement does not concern constituent material such as layers in packaging. GMO (genetically-modified organisms) based on bacteria or enzymes produced in closed systems are permitted.

The ban on GMOs are based on the precautionary principle. GMOs (genetically modified organisms) are a much debated topic and many countries have banned the cultivation of GM crops. The themes of the debate include food safety, land use, lack of scientific knowledge about the effects of GM crops under local agricultural/forestry conditions and the risk of negative impacts on health and the environment. The argument often put forward by advocates of genetic modification is that it will reduce the use of herbicides. Recent studies have, however, raised questions about this.[177] The report from Genøk: "Genetically Modified Organisms – A Summary of Potential Adverse Effects Relevant to Sustainable Development" [178], commissioned by Nordic Ecolabelling in 2011, states that GMO has possible negative effects along the whole value chain from plant research and development, via growing, to storage, use and waste handling. The report also describes a lack of scientific research in several of these phases and a lack of assessment of the overall picture. The report particularly highlights the lack of research results on the long-term effects of GM plants. It is important to make clear that Nordic Ecolabelling is not an opponent of the technology in itself, but is concerned about the consequences when genetically modified plants spread into nature.

O14 Energy – bio-based polymers

The requirement applies to bio-based polymer in packaging that only consist of plastic and bio-based polymers that make up more than 10% of the packaging by weight. Requirement a) or b) must be fulfilled.

a) The manufacturer of the polymer (production plant) must be certified in line with ISO 50001.

or

b) The energy consumed in the production of the bio-based polymers must not exceed 50 MJ/kg polymer. The calculation of energy consumption must include all the processes from monomer production to finished polymer. Energy from cultivation and extraction of the

[177] http://www.bioteknologiradet.no/2012/06/gmo-kan-gi-mindre-sproytemidler/ (accessed 08.10.2016)
[178] Georgina Catacora-Vargas, 2011, Genetically Modified Organisms – A Summary of Potential Adverse Effects Relevant to Sustainable Development, Biosafety Report 2011/02, GenØk – Centre for Biosafety

raw material, transport of the raw material to the production site and the energy content of the actual raw material should not be included in the calculation.

Energy from both renewable and non-renewable energy sources must be included in the calculation.

☒ **For alternative a)** certificate showing that the manufacturer of the polymer (production plant) is certified in line with ISO 50001.

☒ **For alternative b)** information about electricity and fuel consumption and copy of invoice or confirmation of consumption from the supplier. State total kg polymer produced plus a calculation of total energy consumption in MJ/kg polymer produced. A description must be provided of how the energy consumption from the different subprocesses is included in the calculation.

Background to the requirement

LCA studies of packaging show that one of the most important factors in packaging's environmental impact is the energy used to manufacture constituent materials such as polymers. Environmental benefits are also related to the opportunities to promote energy efficiency in the production of bio-based polymers, and thereby contribute to reducing the climate impact. Since many biopolymer materials are relatively new, there should also be potential to optimise the production processes. It is therefore relevant to set requirements concerning the energy used in the production of bio-based polymers. Energy consumption requirements are considered to be an indirect requirement to reduce the climate impact.

The requirement concerns bio-based polymers included in packaging at more than 10% by weight. The requirement has two alternatives, to ensure flexibility. there are two options for fulfilling the requirement. An additional option has been added, whereby the requirement can be fulfilled by being certified in line with ISO 50001. ISO 5001 is an international energy management system which among other things, includes controlling purchases and measuring consumption, employee engagement and focus on maintenance of equipment and machinery to maximize energy efficiency. It is a standard suitable for all types of productions and both small and large enterprises can certify themselves. It is pointed out that such a standard does not stipulate an absolute energy requirement, but that production constantly focuses on improving energy efficiency.

In the another alternative, the energy consumed in the production of the bio-based polymers must not exceed 50 MJ/kg polymer. The requirement for energy consumption is based on information from the literature, but it is limi but it is limited with information. See more detailed background documents for Nordic Ecolabelling Criteria for Disposables.

7.5 Requirements of chemical products and constituent substances

According to Nordic Ecolabelling's overall principles, the Nordic Swan Ecolabel must be a powerful tool that works to phase out substances that are hazardous for the environment and health. The vision is for Nordic Swan Ecolabelled products not to contain prioritised substances that are hazardous for the environment and health. Prioritised substances are e.g. substances that are classified as CRM or environmentally hazardous and which are persistent, bioaccumulative and toxic (PBT substances) and/or very persistent and very bioaccumulative (vPvB substances). The precautionary principle is the starting point when substances are suspected of having serious environment and health characteristics. Official regulations (classification, labelling, official lists and regulation) are used to exclude substances and products that are hazardous for the environment and health in the criteria. As the Nordic Swan Ecolabel is an ecolabel, the requirements in the criteria are more

stringent than legislation. This entails that the chemical may be prohibited from Nordic Swan Ecolabelled packaging, even though it is permitted under the authorities' regulations.

Nordic Ecolabelling's requirements concerning chemicals primarily concern chemical products and constituent substances in chemical products such as **varnish, adhesives and printing inks,** and which are used in the production/assembly (conversion) of the packaging. Certain requirements also apply to the production of pulp and paper (O18, O2O-O21) and polymers (O22-O24).

The requirement also concerns the finishing of packaging at the food producer, e.g. glueing of labels or printing of best-before date on the packaging, if this is not covered by the packaging manufacture.

Primarily the chemicals producer delivering chemicals for packaging production is responsible for documenting that requirements of chemicals are fulfilled.

The requirement does not apply to:

- chemicals for the production and printing of secondary and tertiary packaging;
- auxiliary chemicals used in production, such as lubricants, cleaning chemicals, etc.; and
- chemicals in production of pulp/paperboard, as these must fulfil the requirements in Nordic Swan Ecolabelling of paper products – Chemicals Module, version 2 or later. Note that chemicals used in the production of pulp/paperboard must, however, fulfil the following requirements in this criteria document:
    - O18 which applies to dyes for printing and dyeing
    - O20 and O21 which includes addition of chemicals to pulp/board

Note that the requirements of additives in plastic (O22)), residual monomers in polymers (O23) and chemicals – recycled plastics (O24) apply to the polymer manufacturer and refer to requirements of chemicals (O15–O17).

Nordic Ecolabelling's requirements concerning chemicals concern chemical products, e.g. the classification of printing ink, but can also concern individual requirements of constituent substances in chemical products, e.g. pigments in printing ink. The requirements apply to all constituent substances in the chemical product, but not to contaminants, unless otherwise specified in the requirement. Constituent substances and contaminants are defined as follows:

Constituent substances: all substances in the chemical product, including additives (e.g. preservatives and stabilisers) from the raw materials. Known degradation products from constituent substances (e.g. formaldehyde, arylamine, in-situ generated preservatives) are also considered to be constituent substances.

Contaminants: residual substances from production, including raw materials production, which are found in a raw material or the final chemical product, equivalent to concentrations ≤100 ppm (≤0.01% by weight, ≤100 mg/kg) in the chemical product. Examples of what are considered to be contaminants are residual concentrations of the following: reagents, including monomers catalysts, by-products, "scavengers", i.e. chemicals

used to eliminate/minimise adverse substances, cleaning agents for production equipment, "carry-over" from other or previous production lines.

O15 Classification of chemical products

Chemical products used in the assembly (conversion) and finishing of primary packaging, such as printing inks, varnish and adhesives, must not be classified according to Table 4 below. The classification must be in accordance with current legislation (CLP Regulation 1272/2008 or later).

Table 4. Classification of chemical product

Classification under CLP Regulation (EC) No 1272/2008		
Hazard class	**Category**	**Hazard code**
Hazardous to the aquatic environment	Aquatic Acute 1 Aquatic Chronic 1-2	H400 H410, H411
Acute toxicity	Acute Tox. 1, 2 Acute Tox. 3	H330, H310, H300 H331, H301, H311
Specific target organ toxicity	STOT SE 1 STOT RE 1	H370 H372
Allergenic	Resp. Sens. 1 or Skin Sens 1	H334 H317
Carcinogenic	Carc. 1A/1B Carc. 2	H350 H351
Germ cell mutagenicity	Muta. 1A/B Muta. 2	H340 H341
Reproductive toxicity	Repr. 1A/1B Repr. 2	H360, H361 H362

The classifications in the Table concern all classification variants. For example, H350 also covers classification H350i.

The manufactuerer of the chemical products is responsible for classification.

☒ Declaration from the producer of the chemical product in accordance with Appendix 5.

☒ Safety data sheet in accordance with the current statutory requirement in the country of application, e.g. Annex II to REACH (Council Regulation (EC) no. 1907/2006) for all chemical products.

Background to the requirement

Nordic Ecolabelling aims for the health and environmental effects of chemical products used in the manufacture of Nordic Swan Ecolabelled products to be as low as possible. Requirements are therefore made of the classification of chemical products, which is also a general chemicals requirement in several Nordic Swan Ecolabelling criteria documents. Chemical products classified as carcinogenic, mutagenic, reprotoxic, very toxic, toxic, hazardous for the environment or allergenic may not be used in the manufacture of the Nordic Swan Ecolabelled packaging. The classificatin requirement concerns chemical products used in the production and finishing of the primary packaging.

O16 CMR substances

The chemical products used in the assembly (conversion) and finishing of primary packaging, e.g. printing inks, varnish and adhesives, may not include substances (see definition above) that are classified as carcinogenic (Carc.), mutagenic (Muta.) or reprotoxic (Repr.) in accordance with CLP Regulation 1272/2008, see Table 6 below.

An exemption is made for formaldehyde in additives, see O19.

Table 6. Classification of CMR substances

Classification under CLP Regulation (EC) No 1272/2008		
Hazard class	**Category**	**Hazard code**
Carcinogenic	Carc. 1A/1B Carc. 2	H350 H351
Germ cell mutagenicity	Muta. 1A/B Muta. 2	H340 H341
Reproductive toxicity	Repr. 1A/1B Repr. 2	H360, H361 H362

The classifications in the Table concern all classification variants. For example, H350 also covers classification H350i.

☒ Declaration from the producer of the chemical product in accordance with Appendix 5.

☒ Safety data sheet in accordance with the current statutory requirement in the country of application, e.g. Annex II to REACH (Council Regulation (EC) no. 1907/2006) for all chemical products.

O17 Other substances excluded from use

The following substances must not be constituent in the chemical products used in in the assembly (conversion) and finishing of primary packaging e.g. printing ink and adhesives,

- Substances on the EU Candidate List*. D4, D5 and D6 in silicone polymer have an own requirement, see O21.
- Substances evaluated by the EU to be PBT (persistent, bioaccumulative and toxic) or vPvB substances (very persistent and very bioaccumulative), in accordance with the criteria in Appendix XIII of REACH and substances that have not yet been evaluated but which meet these criteria.
- Substances considered to be potential endocrine disruptors in category 1 or 2 on the EU's priority list of substances that are to be investigated further for endocrine disruptive effects.**

In addition, the following substances and substance groups may not be included. There may be overlap between the substances listed below and the substances or groups of substances listed above.

- Alkylphenol ethoxylates (APEO) and other alkylphenol derivatives (substances that release alkylphenols on degradation) excluding 2,4,6-tri-tert-butylphenol derivatives but not 2,4,6-tri-tert-butylphenol itself, note that other requirements should be met for these exempted substances
- Phthalates***
- Bisphenol A, bisphenol F and bisphenol S
- Butylhydroxytoluene (BHT CAS 128-37-0)

  There is an exemption for BHT up to 0.10% in solvent-based inks. The exemption ceases to exist if the substance fulfils one of the following during the validity of the criteria:

  - The substance is included on the EU Candidate List* or List 1 on the website www.edlist.org
  - ECHA Endocrine Disruptor Expert Group assesses the substance and considers it an endocrine disruptor https://echa.europa.eu/sv/ed-assessment
  - The substance is included on List 3 on the website www.edlist.org
- Substances that are added to create an antimicrobial or disinfectant effect in the packaging (e.g. nanosilver)****

- Halogenated organic compounds. An exceptions is made for: - halogenated organic pigments that meet the European Council's "Resolution AP (89) 1 on the use of colourants in plastic materials coming into contact with food", point 2.5
- MIT (CAS 2682-20-4), CMIT / MIT (CAS 26172-55-4, 2682-20-4), except for MIT in concentrations below 100 ppm in e.g. printing inks.

** The Candidate List can be found on the ECHA website: http://echa.europa.eu/candidate-list-table*

*** See Annex 1 – Candidate list of 553 substances at: http://ec.europa.eu/environment/chemicals/endocrine/strategy/being_en.htm*

**** The prohibition does not include polyethylene terephthalate (PET).*

***** An antimicrobial agent is a chemical/product that inhibits or stops growth of microorganisms such as bacteria, fungi or protozoa (single-celled organisms). Silver compounds, nano silver and nano gold are considered to be antimicrobial substances.*

☒ Declaration from the producer of the chemical product in accordance with Appendix 5.

☒ Safety data sheets according to prevailing European legislation for chemical products.

Background to the requirements

Nordic Ecolabelling's vision is for Nordic Swan Ecolabelled products not to include prioritised substances that are hazardous for health and the environment and it is especially relevant to focus on this for this product group that is in contact with food. Prioritised substances are e.g. substances that are classified as CRM or environmentally hazardous or which are persistent, bioaccumulative and toxic (PBT substances) and/or very persistent and very bioaccumulative (vPvB substances). Nordic Ecolabelling therefore sets the requirement that chemical substances with problematic characteristics may not be included in chemical products used in the production/assembly of Nordic Swan Ecolabelled packaging.

Substances of Very High Concern (SVHC) fulfil the criteria in Article 57 of the REACH regulation, which gives the following definition: Substances that are CMR (category 1 and 2 under the Dangerous Substances Directive 67/548/EEC or category 1A and 1B under the CLP Regulation), PBT substances, vPvB substances (see section below) and substances that have endocrine disruptive properties or are environmentally harmful without meeting the criteria for PBT or vPvB. SVHCs may be included on the Candidate List with a view to them being inscribed on the Authorisation List, which means that the substance becomes regulated (ban, phasing out or other form of restriction). Since these substances face being phased out or banned, it is only logical for Nordic Ecolabelling not to permit this type of substance in ecolabelled products. A substance may meet the criteria for SVHC without being included on the Candidate List, so there is no direct equivalence between SVHC and the Candidate List. To avoid cross-references between PBT, vPvB, CMR and endocrine disruptors, instead of excluding SVHC (which does cover some CMR, PBT, vPvB, etc.) Nordic Ecolabelling chooses to exclude from use the substances on the Candidate List and to separately exclude PBT, vPvB and endocrine disruptors. This should still cover all SVHC substances. "Persistent, bioaccumulative and toxic (PBT) organic substances" and "Very persistent and very bioaccumulative (vPvB) organic substances" are substances whose inherent properties are not desirable in Nordic Swan Ecolabelled products. PBT and vPvB are defined in Annex XIII of REACH (Regulation no. 1907/2006).

Potential endocrine disruptors are substances which can affect the endocrine balance of people and animals. Changes in the endocrine balance can have adverse effects, and there is extra focus on hormones which affect sexual development and reproduction. Nordic

Ecolabelling prohibits the use of substances that are considered to be potential endocrine disruptors, category 1 (there is evidence of a change in endocrine activity in at least one animal species) or category 2 (there is evidence of biological activity related to changes in the endocrine balance), in line with the EU's original report on "endocrine disruptors" or later studies. This entails a ban on substances such as bisphenol A, several phthalates and certain alkylphenols. Phthalates are, nonetheless, a separate item of the prohibited list, in order to make it very clear that phthalates are prohibited. Phthalates are esters of phthalic acids (1,2-benzene dicarboxylic acid). It can still be noted that the prohibition does not include polyethylene tetraphthalate (PET), since these can also be interpreted to be phthalates. Phthalates are a group of substances that comprise many different substances. They are mainly used as plasticisers in plastic and since they are not chemically bound in the plastic, they can leak out to the surroundings. Several phthalates are reprotoxic and environmentally hazardous. For some phthalates, food is considered to be the main exposure route, where food contact materials are a relevant source[179]. Some phthalates are listed in Annex 1 of Regulation no. 10/2011 on plastic materials and articles intended to come into contact with food, which means that it is permitted to use them. Even though limitations to their use have been introduced, phthalates that are classified as reprotoxic, such as DEHP, are permitted. A prohibition will therefore ensure that these substances are not included in a Nordic Swan Ecolabelled packaging. See also the background text to PVC requirements under O3.

Butyl hydroxytoluene (BHT) and bisphenols A, S and F are included on the list of prohibited substances based on the consultation responses received concerning the criteria for disposables and how these are relevant substances in food contact materials. BHT does not have an official harmonised classification and is not included on the EU's list of suspected endocrine-disrupting substances. BHT is, however, suspected of being an endocrine disruptor, even though it is not included on the EU's list, and is on the indicative list for self-classification, including CMR characteristics and environmental hazards. Nordic Ecolabelling has considered ChemSec's SIN.LIST for food contact[180] and registered that BHT is included in this list. On the basis that this is a relevant chemical in food contact materials, Nordic Ecolabelling specifically added BHT to the list of prohibited substances, since it is not included in the EU's list of endocrine-disrupting substances or the requirement of CMR-classified substances. An exemption to the requirement is made for BHT up to 0.10% in solvent-based inks, so long as it is not included on the candidate list[181] or lists 1 and 3[182] on www.edlists.org, nor that ECHA's Endocrine Disruptor Expert Group[183] considers it an endocrine disruptor during the validity of the criteria.

The SIN.LIST for food contact also includes other bisphenols besides Bisphenol A, such as Bisphenol F and S. These can be used as a substitute for bisphenol A. Nordic Ecolabelling has therefore introduced a general prohibition of bisphenol A, F and S on the basis of the precautionary principle and the suspicion that these substances may be endocrine disruptors.[184].

[179] http://www.foodpackagingforum.org/food-packaging-health/phthalates (accessed 03.10.2016)
[180] http://sinlist.chemsec.org/search/search?query=&uses=15 (accessed 24.04.2017)
[181] https://echa.europa.eu/sv/candidate-list-table (accessed 01.09.2020)
[182] https://edlists.org/ (accessed 01.09.2020)
[183] https://echa.europa.eu/sv/ed-assessment (accessed 01.09.2020)
[184] Johanna R. Rochester and Ashley L. Bolden Bisphenol S and F: A Systematic Review and Comparison of the Hormonal Activity of Bisphenol A SubstitutesEnviron Health Perspect; DOI:10.1289/ehp.1408989 http://ehp.niehs.nih.gov/wp-content/uploads/advpub/2015/3/ehp.1408989.acco.pdf

Alkylphenolethoxylates can be broken down into alkylphenols that are not easily degradable and of which some are suspected to be endocrine disruptors. There is a strong political ambition in the Nordic countries to phase out these substances and they are e.g. included on the Danish list of[185] adverse substances. After the consultation, the requirement has been formulated to exempt 2,4,6-tri-tert-butylphenol derivatives which are important antioxidants in plastic[186]. 2,4,6-tri-tert-butylphenol is on the Norwegian priority list. However, 2,4,6-tri-tert-butylphenol derivatives are much larger molecules where several butylphenols are chemically bound. Therefore, these derivatives are expected to have less harmful properties. This compromise enables the use of antioxidants that are important to plastic but exclude the poorer antioxidants such as BHT or 2,4,6-tri-tert-butylphenol.

Halogenated solvents are a large environmental and health and safety problem, and many chlorinated solvents are ozone-depleting and some are classified as carcinogenic.

Antimicrobial substances/products are not wished for in ecolabelled products, and especially not in products in direct contact with food. Therefore, substances that are added to create an antimicrobial or disinfecting effect in the packaging (e.g. nanosilver) shall not be used. This requirement does not apply to preservatives used in chemical products such as in e.g. printing inks during storage. An increase can be seen in products to which antimicrobial agents have been added. An example is nano silver in everything from socks and toothbrushes to refrigerators. Antimicrobial substances are a type of biocide. If the use of biocides increases, bacteria can develop resistance to substances that are highly necessary for hygiene and health in other contexts (see also the background text in requirement O12 for paperboard).

Isothiazolinones (MI) are effective preservatives which function in low concentrations. They are sensitising, however, and there is ongoing discussion within the EU concerning any limitation of MI in particular (CAS 2682-20-4). Allergies to preservatives, particularly MI (CAS 2682-20-4), have risen in recent years[187] and Nordic Ecolabelling does not wish to contribute to unnecessary exposure. The Scientific Committee on Consumer Safety (SCCS) also notes that for leave-on products there is no safe concentration of MI with regard to sensitisation/allergies.[188] After the consultation, Mixture of CMIT / MIT has also been added to the list. It is very allergenic and has long been limited in e.g. cosmetics[189].

O18 Colourants for printing and dyeing

The requirement applies to colourants for printing, dyeing and shading (regardless of material e.g. plastic, board).

All colourants used for printing, dyeing and shading must be declared and safety data sheets for the products must be submitted. All colourants must meet the following requirements:

- Halogenated organic pigments must meet the European Council's "Resolution AP (89) 1 on the use of colourants in plastic materials coming into contact with food".

In addition, the following requirements apply:

[185] http://www2.mst.dk/udgiv/publikationer/2010/978-87-92617-15-6/pdf/978-87-92617-16-3.pdf (accessed 05.10.2016)
[186] http://www.miljostatus.no/tema/kjemikalier/prioritetslisten/nonyl-og-oktylfenoler/
[187] http://ec.europa.eu/health/scientific_committees/consumer_safety/docs/sccs_o_145.pdf
[188] http://ec.europa.eu/health/scientific_committees/consumer_safety/docs/sccs_o_145.pdf
[189] kosmetikaförordning 1223/2009/EG http://eur-lex.europa.eu/legal-content/SV/TXT/PDF/?uri=CELEX:02009R1223-20160812&from=EN)

- Colourants used for printing, dyeing and shading must meet BfR's (Federal Institute for Risk Assessment) recommendations: "IX. Colorants for Plastics and other Polymers Used in Commodities" or Swiss Ordinance 817.023.21 Annex 2 and 10.

Alternatively, colourants used for shading and/or dyeing of paper/paperboard/ cardboard can meet the following requirement:

- BfR's recommendation XXXVI. Paper and board for food contact, from July 2015 or more recent versions.

✉ Declaration from the manufacturer of the colourant that the requirement is fulfilled. Appendix 5 may be used.

Background to the requirement

Since packaging products are in contact with food, it is considered particularly important to set requirements concerning printing dyes, gradation colours and dyeing, since there may be problematic substances. The requirement concerning the content of the dyes must fulfil BfR's recommendations, Swiss Ordinance 817.023.21 Annex 2 and 10 as well as Resolution AP (89) 1 requirements for halogenated organic pigments (see also below). Besides requirement O22, the general chemicals requirements such as classification requirement O19 and requirements of constituent substances, O20 and O21, also apply to dyes in the manufacture of packaging (conversion). On the other hand, requirement O22 and requirements of dyes in the Chemicals Module for paper products apply to dyes used in the manufacture of paperboard/pulp.

The requirement must be documented by sending a data sheet for the colourants used, as well as a declaration from the manufacturer of the colourant that the requirement is fulfilled.

Colourants that are not in direct contact with food are not covered by the legislation, and Nordic Ecolabelling therefore believes it is relevant to set requirements for colourants that are used to dye/shade or print on the disposable article.

The Federal Institute for Risk Assessment (BfR) provides a recommendation for colourants used in plastics that is well established in the industry, BfR IX. Colorants for Plastics and other Polymers Used in Commodities. Initial contact with the industry showed that these guidelines are also used for paper products. However, there is a general challenge that colourants for paper/paperboard/cardboard are not specifically regulated. Some of the requirements in BfR IX are difficult to fulfil for colourants used on other materials than plastic, like paper/paperboard/cardboard. Therefore, Swiss Ordinance 817.023.21 Annex 2 and 10 and BfR XXXVI are introduced as alternatives to BfR IX.

Colourants used for printing, shading and/or dyeing must meet the recommendations of the Federal Institute for Risk Assessment (BfR): IX. Colorants for Plastics and other Polymers Used in Commodities or Swiss Ordinance 817.023.21 Annex 2 and 10. The recommendations can be found on BfR's website and the Swiss FSVO's website.[190] BfR's recommendations are a type of restriction list that sets maximum limits for the content of different substances, including various oils and fatty acids, heavy metals and aromatic amines. The Swiss Ordinance 817.023.21 is a Swiss legislation for materials and articles intended to come into contact with foodstuffs, and Annex 2 and 10 lists permitted substances in the material and in

[190] https://bfr.ble.de/kse/faces/resources/pdf/090-english.pdf;jsessionid=FE1429F27793CC9BFA3F7E53BEF85B04 (accessed 07.10.2016) and https://www.blv.admin.ch/blv/en/home/gebrauchsgegenstaende/materialien-in-kontakt-mit-lebensmitteln/verpackungen.html (accessed 2020-06-23)

printing inks used for printing on said articles. Colourants used for dyeing/shading of paper/paperboard/cardboard are not covered either by BfR IX or Swiss Ordinance 817.023.21 Annex 2 and 10, therefore these substances shall fulfill the requirements set out in BfR XXXVI for paper and board for food contact.

BfR writes in its recommendation that the most suitable colourants for plastic are insoluble pigments that are incorporated so well in the plastic that they do not migrate out into the foodstuff. Incorrect use of soluble colourants poses a risk that they might migrate out into the food. Since the recommendations do not prohibit the use of toxic substances, it is extremely important that colourants do not migrate into the food. The recommendations point out that this should be verified (see also the requirement for testing av migrates O4).

In addition to BfR's recommendations and the Swiss Ordinance 817.023.21 Annex 2 and 10, organic pigments must also meet Resolution AP (89) 1 on the use of colourants in plastic materials coming into contact with food.[191] This requirement prohibits substances such as PCBs, which are not covered by BfR's recommendations. PCBs were found in analyses of paint that contained organic pigments. It is known that PCBs are present in two organic pigments, azo pigments and phthalocyanine pigments. Now, however, PCBs have also been found in products with other pigments. PCBs are not added, but can be formed in the production process as a result of reactions between various chlorinated solvents and the organic pigment. These pigments may be used in a wide range of products, including paint, textiles, paper and food.[192] Concern has been expressed about the content of PCBs, and the Norwegian authorities have looked at the Council of Europe's recommendation with a view to introducing measures against PCBs in pigments.

O19 Adhesives

Ethylene glycol ethers or rosin must not be ingoing substances in adhesives. The exception is modified rosin derivative which is not classified as allergenic.

Formaldehyde generated during the production process may amount to no more than 250 ppm (0.0250% by weight) measured in newly produced polymer dispersion*. The content of free formaldehyde in hardened adhesive must not exceed 10 ppm (0.001% by weight)**.

Hotmelt adhesives are exempted from the requirement to document formaldehyde.

Information on test methods and analysis laboratories is provided in Appendix 8.

* *Measured using the VdL-RL 03 method "In-can concentration of formaldehyde determined by the acetyl-acetone method" or the Merckoquant method (see Appendix X of RAL-UZ 102), or some other equivalent method.*

** *Measured using the Merckoquant method (see Appendix X of RAL-UZ 102), or some other equivalent method.*

✉ Safety data sheet for the product. Declaration from the adhesive producer that the requirement is fulfilled. Appendix 5 may be used. Results of analysis of the formaldehyde content of the adhesive.

Background to the requirement

Adhesive may be used to bond together the packaging or to affix coatings and labels and so on. In most cases, it is not in direct contact with food, but contact may occur unintentionally

191 https://rm.coe.int/CoERMPublicCommonSearchServices/DisplayDCTMContent?documentId=09000016804f8648

192 Hu D, Hornbuckle KC. Inadvertent polychlorinated biphenyls in commercial paint pigments. Environ Sci Technol 44(8):2822–2827 (2009)

at the seams and edges or via migration through the packaging or in the gas phase for volatile compounds. [193] Many different types of adhesive may be used in materials in contact with food, depending on the material and function, including reactive polyurethane (PU) adhesive, adhesive based on natural polymers such as dextrin and starch, and hotmelt adhesive. Adhesives may contain problematic substances, and Nordic Ecolabelling therefore sets requirements concerning certain constituent substances in adhesives via the general chemical requirements in O19 and O20 and other specific substances in this requirement.

Rosin is prohibited because it can cause contact allergies. Rosin is tapped from pine trees as a resin and extracted with turpentine. The blend contains many allergens. Formaldehyde is also allergenic, in addition to being classified as carcinogenic. A separate impurity limit has been introduced for formaldehyde. The content of formaldehyde must not exceed 250 ppm in newly produced polymer dispersion and there is a limit of 10 ppm in hardened adhesive. To document the requirement, one must submit the results of testing carried out in accordance with the Merckoquant method or the VdL-RL 03 method "In-can concentration of formaldehyde determined by the acetyl-acetone method." If the VdL-RL 03 method is used, it must be calibrated to measure results <100 ppm in order to be valid. The formaldehyde requirement does not require documentation of hotmelt adhesives, since such adhesives do not contain these substances.

O20 Optical brighteners and antimicrobial agents

Optical brighteners shall not be added in paper and paperboard.

Chemicals intended to provide antimicrobiall effect in paper and paperboard shall not be added.

An antimicrobial chemical is a chemical which prevents or stops the growth of microorganisms such as bacteria, mould or protozoa (unicellular organisms). Silver compounds, nano silver and nano gold are considered to be antimicrobial substances.

✉ Declaration from the pulp/paperboard manufacturer stating that the requirement is fulfilled.

Background to the requirement

The prohibition of optical brighteners is set to limit the use of chemicals that can lead to health and environmental problems. Optical brighteners are prohibited in the paper criteria from Blaue Engel, and in the background document to the EU's document for public procurement of paper (GGP for Copying and graphic paper)[194] the grounds for the prohibition are stated to be that optical brighteners can give allergies, are toxic and are poorly degradable in aquatic environments. In the German BfR regulations, the use of optical brighteners such as sulphonated stilbene derivatives is approved at up to 0.3 % in paper in contact with food, but it must be possible to prove that they are not transferred to food.[195] Nordic Ecolabelling does not know that optical brighteners are used in the production of liquid packaging board today but has chosen to go further than BfR regulations and introduce a prohibition.

[193] Migration testing of adhesives intended for food contact materials, FEICA – Guidance paper, May 2016
[194] EU GPP criteria (2008) Copying and graphic paper: Technical background report. Available at: http://ec.europa.eu/environment/gpp/pdf/toolkit/paper_GPP_background_report.pdf (accessed 21.05.2013)
[195] Database BfR Recommendations on Food Contact Materials (2012) Federal Institute for Risk Assessment in Germany. Available at: http://www.bfr.bund.de/en/database_bfr_recommendations_on_food_contact_materials__formerly__plastics_recommendations__-1711.html (accessed 21.05.2013)

Antimicrobial substances are a type of biocide. A substance with an antimicrobial effect is defined as "An antimicrobial chemical that impedes or stops the growth of microorganisms such as bacteria, fungi or protozoa (unicellular organisms)". Silver compounds, nano silver and nano gold are considered to be antimicrobial substances.

Antimicrobial substances are biologically active and often harmful to the environment. There is a significant concern that the increased use of these substances can increase bacteria's resistance to antibiotics.[196] Both nano silver and silver ions affect aquatic organisms. One problem is also that silver particles can reduce the effectiveness of water treatment plants. Silver can also continue into the aquatic environment and cause damage there. Nordic Ecolabelling has therefore introduced a requirement to prohibit chemicals added in order to achieve an antimicrobial effect in paper/paperboard. This requirement does not apply to biocides used for the control of micro-organisms in pulp and paper production, e.g. in water circulation systems. Nordic Ecolabelling is not aware of antimicrobial chemicals being used in food packaging in the Nordic markets, but there is carton packaging in e.g. other continents where nano silver may be added in order to extend the shelf-life of food.

O21 Coatings and impregnations

Liquid-proof and grease-roof properties in the packaging must not be based on chromium or fluorinated compounds used for coating/impregnating/mixing into the pulp/paper/board/packaging. The following requirements apply to the silicone treatment of packaging or parts thereof:

- Solvent-based silicone coatings must not be used.
- Octamethylcyclotetrasiloxane, D4 (CAS 556-67-2), decamethylcyclopentasiloxane, D5 (CAS 541-02-6) and dodecamethylcyclohexasiloxane, D6 (540-97-6) must not be present in the chemical products used for silicone treatment. The requirement does not apply to D4, D5 and D6 contained as impurities*
- Organotin catalysts must not be used in the production of the silicone polymer.

** Impurity refers to residues from primary production which may be found in the commercial product at concentrations below 800 ppm (0.08% by weight, 800 mg/kg). Finished commercial product refers to the silicone emulsion's coating bath.*

☒ Declaration from the chemical supplier that chromium or fluorinated compounds are not ingoing substances in the coating/impregnation chemicals. Appendix 5 may be used. Safety data sheet for the product.

☒ Declaration from the manufacturer of the pulp/paper/paperboard that no chromium or fluorinated compounds were added in the production of the pulp or paper/paperboard.

☒ Declaration from the chemical supplier stating that the requirement for silicone treatment is fulfilled. Declaration from the chemical supplier that octamethylcyclotetrasiloxane, D4, decamethylcyclopentasiloxane, D5, and/or dodecamethylcyclohexasiloxane, D6, are not present in the chemical products used for silicone treatment in concentrations above 800 ppm. State the amount of D4, D5 and D6. Appendix 4 may be used.

Background to the requirement

The requirement originates from Nordic Ecolabelling's Criteria for Grease-Proof Paper. Here, the requirement is made that liquid-proof and grease-roof properties in the packaging must

[196] Forbrugerkemi (2010) "Nanosølv bekymrer i Tyskland" (Nano silver raises concerns in Germany). Available at: http://www.forbrugerkemi.dk/nyheder/nanoteknologi/nanosolv-bekymrer-i-tyskland/?searchterm=nanosølv (accessed 21.05.2013)

not be based on chromium or fluorinated compounds used for coating/impregnating/mixing into the pulp/paper/board/packaging. For silicone treatment, solvent-based coatings/finishing may not be used and organotin catalysts are prohibited in the production of silicone polymers. The limit for pollutants (D4 and D5) is 800 ppm, based on experience of what it is possible for the industry to fulfil today.

Chromium coatings are no longer used in Europe, but it cannot be ruled out that they might be used in other places around the world. Chromium compounds are not readily degradable and can accumulate in organisms to varying degrees. Hexavalent chromium compounds are classified as very toxic to aquatic organisms. Trivalent chromium compounds are generally somewhat less toxic, although certain species can be particularly sensitive to these. The emission of chromium to the waste system from factories or factory wastewater should thus be avoided.

The requirement that coating/impregnation chemicals/chemicals added to pulp must not contain fluorinated compounds has been set in order to prevent the dispersal of fluorinated compounds such as PFAS (perfluoroalkyl sulphonates) in the environment. [197] PFAS is an umbrella term for various types of fluorinated compounds that are persistent and tend to bioaccumulate. PFOS (perfluorooctane sulphonate) and PFOA (perfluorooctanoic acid) are the two fluorinated compounds about which most is currently known. Both of these have serious effects on health and the environment. Long-chain perfluorocarboxylic acids (C9-PFCA – C14-PFCA) are another type of fluorinated substance that is also persistent, with high potential for bioaccumulation. There is less knowledge about short-chain perfluorinated compounds, but a new literature review published in 2015 by the Danish Ministry of the Environment shows that some short-chain PFAS may be just as harmful as the long-chain compounds they replace.[198] The study shows that the new substances have the potential to accumulate in nature, and since they have to be used in higher concentrations to achieve the same effect, the conclusion is that they are not a good enough alternative to the substances that have been partially phased out. Studies show that fluorinated coatings are used in food packaging and that various fluorinated compounds can migrate from paper and paperboard in contact with food.[199] [200] [201] The authorities in many countries have developed a strong focus on the use and occurrence of fluorinated substances in products and the environment. Previously, fluorinated compounds were mainly used as a coating to make the product waterproof, but since the price of chemicals has dropped, fluorinated compounds have also been added to the paper pulp, with the result that the paper may contain up to 10 times more fluorinated compounds than if it was just coated.[202] It should be noted that this requirement applies to the addition of fluorine. Wood contains natural fluorine, and

[197] Miljøstatus i Norge: http://www.miljostatus.no/Tema/Kjemikalier/Noen-farlige-kjemikalier/PFOS-PFOA-og-andre-PFCs/, (accessed 22.10.2015)
[198] Danish Ministry of the Environment, 2015: Short-chain polyfluoroalkyl substances (PFAS), A literature review of information on human health effects and environmental fate and effect aspects of short-chain PFAS, Environmental project No. 1707, 2015
[199] Trier X. et al, 2011: Polyfluorinated surfactants (PFS) in paper and board coatings for food packaging, Environ Sci Pollut Res Int. 2011 Aug;18(7):1108-20
[200] Tænk (2012) Muffinsformer, Denmark. Tænk des/2013: 8–11.
[201] The Danish Veterinary and Food Administration 2012, Migration af fluorerede stoffer fra fødevarekontaktmaterialer af pap og papir, J. nr.: 2010-20-793-00107
[202] Background document to the Criteria for the Nordic Swan Ecolabelling of Grease-proof Paper, version 4, November 2014

fluorinated compounds may therefore be found in products made from wood, even if no fluorine is added in the production process or as a coating[203].

Siloxanes are not readily degradable and therefore have the capacity to accumulate in the environment. Siloxanes are volatile and can become easily enriched in sludge from wastewater. Cyclic siloxanes are a group of compounds that the authorities have long had in their sights. Of the cyclic siloxanes, there has been a particular focus on octamethylcyclotetrasiloxane (D4) and decamethylcyclotetrasiloxane (D5), and D5 is on the priority list of the Norwegian authorities, for example[204]. In June 2018, the siloxanes D4, D5 and D6 were added on the Candidate List [205]. The requirement therefore limits the use of these two siloxanes, but permits silicone coatings (see also O17). See also the background document for Grease-proof Paper for more information on the silicone requirement.

O22 Additives in plastic

Additives in plastic, such as stabilisers, antioxidants, plasticisers, colourants/pigments and fillers (except for inorganic fillers) must meet the requirement concerning classification of chemical products, O15, and the requirements concerning ingoing substances in the chemical products, O16 and O17.

✉ Declaration from the plastic manufacturer of the additives used in plastic.. Safety data sheet for the additive and the declaration that the requirement is fulfilled. Appendix 5 and 7 shall be used. The plastic manufacturer can send this information directly to Nordic Ecolabelling.

Background to the requirement

Plastic polymers can include a compound of additives such as stabilisers, antioxidants, antistatic agents, lubricants, plasticisers and pigments, and also unintentionally added substances and pollutants. Additives are needed to give the plastic certain required physical characteristics and to ensure effective processing and handling of the plastic packaging. Additives are also added to bio-based polymers in order to improve the material's characteristics.[206] In Europe, additives for biopolymers are regulated in accordance with the European Commission's Regulation 10/2011. This requirement clearly specifies that additives to plastic must fulfil the requirement for classification of chemical products and the requirement of constituent substances. It is specifically stated that requirement O22 Colourants on dyeing/colouring applies to polymers. Note that requirements concerning additives in plastic apply to packaging which solely comprises plastic, such as a plastic bottle, and components that are included in packaging, such as layers or screw caps. The plastic manufacturer can send confidential information directly to Nordic Ecolabelling.

Setting requirements of additives used in the production of polymers corresponds to Nordic Ecolabelling's requirements of chemicals used to produce other primary materials for packaging, i.e. pulp and paper. Requirements of additives in plastic are thus in balance with the requirements structure in the criteria.

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203 https://www.foedevarestyrelsen.dk/SiteCollectionDocuments/Kemi%20og%20foedevarekvalitet/FKM/Fakta%20ark%20fluorerede%20stoffer.pdf (accessed 25.10.2016)

204 http://www.miljostatus.no/prioritetslisten (accessed 05.10.2016)

205 https://echa.europa.eu/da/-/ten-new-substances-added-to-the-candidate-list

206 http://www.foodpackagingforum.org/fpf-2016/wp-content/uploads/2015/11/FPF_Dossier06_Bioplastics.pdf

O23 Residual monomers in polymers

In the primary packaging, residual monomers that have a classification listed in Table 4 below shall only be present in the polymer to a maximum of 100 ppm per polymer. The amount can be maximum 100 ppm for each classification. The content of residual monomers must be measured on the newly produced polymer.

Table 4. Classification of CMR substances

Classification under CLP Regulation (EC) No 1272/2008		
Hazard class	**Category**	**Hazard code**
Carcinogenic	Carc. 1A/1B Carc. 2	H350 H351
Germ cell mutagenicity	Muta. 1A/B Muta. 2	H340 H341
Reproductive toxicity	Repr. 1A/1B Repr. 2	H360, H361 H362

✉ Declaration from the polymer manufacturer that the content is no more than 100 ppm. Appendix 7 may be used.

Background to the requirement

Residual monomers in polymers may have negative health effects. Remains from degradation products, e.g. residual monomers, can migrate to packaged food. Several residual monomers can have carcinogenic, mutagenic and reprotoxic characteristics, and Nordic Ecolabelling therefore sets a requirement in this respect.

Example of residual monomer that may be present in polymers used in materials in contact with food is styrene from the production of polystyrene. Styrene is classified as toxic for reproduction (Rep 2 H362d) and is a suspected endocrine disruptor. Products made from 100% polystyrene (PS) cannot be labelled due to the requirement that at least 90% of the packaging by weight must comprise bio-based materials. Polystyrene may, however, be present in components. There are no specific requirements concerning styrene in the regulations on plastic materials in contact with food. All that applies is the general migration limit.

Another residual monomer covered by the requirement is bisphenol A. Bisphenol A is employed in the production of polycarbonate and is used to make containers for food and drinks, soda bottles and storage containers. As the use of some fossil plastic is permitted, the use of polycarbonate cannot be ruled out. Bisphenol A is classified as toxic for reproduction and is banned from use in baby bottles in the EU. Sweden[207] and Denmark[208] also have a ban on bisphenol A in products in contact with food for children under 3 years of age.

The requirement limit is 100 ppm, which corresponds to the general impurities limit we have with regard to substances in chemical products. The requirement concerns actual plastic packaging, i.e. packaging solely comprising plastic (such as a plastic bottle), and components included in packaging (such as a coating or screw cap).

[207] http://www.kemi.se/vagledning-for/konsumenter/kemiska-amnen/bisfenol-a (accessed 07.10.2016)
[208] http://mst.dk/borger/kemikalier-i-hverdagen/kend-kemikalierne/bisphenol-a/ (accessed 07.10.2016)

O24 Chemicals – recycled plastics

Phthalates, bisphenol A, F and S and styrene must not be present in the recycled plastic. This may be documented using a test of the recycled material, or documentation of full traceability can be used to show that these substances are not present.

Additives in recycled plastic must meet requirements O15, O16 and O17.

For test methods, see Appendix 8.

✉ Test or documentation showing that the recycled plastic contains no phthalates, bisphenol A, F and S or styrene.

✉ Declaration from the plastic manufacturer of the additives used in recycled plastic. Safety data sheet for the additive and declaration that additives meet requirements O15, O16 and O17. Appendix 5 shall be used. The plastic manufacturer can send this information directly to Nordic Ecolabelling.

Background to the requirement

The requirement is new, since the use of recycled material is now permitted. It is important that the recycled plastic does not contain chemicals that we would otherwise not permit in virgin plastic. The requirement therefore states that the additives in plastic must meet O15, O16 and O17, and that documentation must be provided to show that the plastic does not contain phthalates, bisphenol A, F and S and styrene. These are substances that can occur in plastic approved for food, and they can potentially end up in the recycled plastic. This can be documented via a test or documentation showing that the recycled plastic material comes from known sources (with traceability from the recycling of the original product up to the finished recycled plastic material), substantiating the fact that these chemicals are not present.

7.6 Quality and regulatory requirements

Quality and regulatory requirements are general requirements that are always included in Nordic Ecolabelling's product criteria. The purpose of these is to ensure that fundamental quality assurance and applicable environmental requirements from the authorities are dealt with appropriately. They must also ensure compliance with Nordic Ecolabelling's requirements for the product throughout the term of validity of the licence.

O25 Responsible person and organisation

The company will appoint individuals who are responsible for ensuring the fulfilment of the Nordic Swan Ecolabelling requirements, for marketing and for finance, as well as a contact person for communication with Nordic Ecolabelling.

✉ Organisational chart showing who is responsible for the above.

O26 Documentation

The producer must archive the documentation that is sent in with the application, or in a similar way maintain information in the Nordic Ecolabelling data system.

🔑 This is checked on site as necessary.

O27 Quality of the packaging

The producer must guarantee that the quality of the Nordic Swan Ecolabelled packaging does not deteriorate during the term of validity of the licence.

🔑 The claims archive is checked on site.

O28 Planned changes

Written notice of planned product and marketing changes that affect fulfilment of the Nordic Swan Ecolabelling requirements must be notified in writing to Nordic Ecolabelling.

✉ Procedures detailing how planned product and marketing changes are handled.

O29 Unforeseen non-conformities

A written report on any unforeseen non-conformities that affect fulfilment of the Nordic Swan Ecolabelling requirements must be submitted to Nordic Ecolabelling and logged.

✉ Procedures describing how unforeseen non-conformities will be handled.

O30 Traceability

The producer must be able to trace the Nordic Swan Ecolabelled packaging in their production.

✉ Description of/procedures for fulfilment of the requirement.

O31 Laws and regulations

The producer must ensure compliance with all relevant applicable local laws and provisions at all production facilities for the Nordic Swan Ecolabelled product, e.g. with regard to safety, working environment, environmental legislation and facility-specific terms/concessions.

🔑 The requirement is controlled on-site.

O32 Subsuppliers

The producer must ensure that all subsuppliers and external processors engaged for the production of packaging that is to carry the Nordic Swan Ecolabel fulfil the requirements relevant for their activities, as specified in the criteria.

✉ Documentation to show that the requirement is fulfilled.

Background to the requirements

The supply chain in the manufacturing process for Nordic Swan Ecolabelled packaging can be long. Subsuppliers may be e.g. used in the manufacturing process or several components are used in packaging, such as labels, stoppers, etc., and it is therefore considered to be relevant to specify that the producer must ensure that all suppliers engaged for production also fulfil relevant requirements in the criteria.

7.7 Processing tools

Nordic Ecolabelling has developed the web-based application guide My Swan Account (MSA) for paper and paperboard manufacturers.[209] The tool also applies to pulp and chemicals producers wishing to have their products controlled by Nordic Ecolabelling. Paper customers can search MSA for Nordic Swan Ecolabelling-controlled pulp and chemicals.

7.8 Areas that are not subject to requirements

This section presents requirements that are not included in the criteria, but which were discussed during the development of the criteria.

Secondary and tertiary packaging

[209] http://www.nordic-ecolabel.org/portals/paper/my-swan-account1/

Since these criteria focus on packaging as such, it is justified to set requirements not only of the primary packaging, but also of the secondary and tertiary packaging that is used. The packaging system is the product and various levels of packaging, i.e. primary, secondary and tertiary packaging.[210] The packaging levels are interrelated and influence each other so that a change at one level has an impact on the others. As an example, reducing e.g. the volume of materials at one packaging level can lead to an increase in material volumes at another stage.

Secondary and tertiary packaging are required in order to adequately protect the packaged food throughout the distribution chain, so as to avoid crushing/waste. During the criteria development work it has been discussed about the possibility of requiring secondary and tertiary packaging ie that they may not contain PVC / PVDC, shall be made of renewable material and shall be recycled or recycled. However, in this first generation of criteria, it has been decided that requirements for secondary and tertiary packaging should not be included. However, the secondary requirement for secondary and tertiary packaging is subject to the requirement for packaging design (see O5). Opportunities to set requirements for the secondary and tertiary packaging should also be reviewed to the next generation of criteria.

Transport

From an environmental viewpoint, it is important to limit transport. During the criteria development the opportunity to set requirements of transport (transport route, vehicle quality, fuel used) was discussed, as well as setting indirect requirements of packaging's spatial volume in order to avoid unnecessary transport of air. In this first generation of the criteria, the decision has been taken, however, that this will not be included in the criteria. The packaging manufacturer must, however, have procedures to ensure that environmental issues are taken into account in the packagaging design (O5), by requiring that packaging are optimised from a transport aspect. Opportunities to set requirements of transport and e.g. the external filling ratio must be reviewed for the next generation of the criteria.

Absolute requirements of packaging design

The waste phase plays a major role in the packaging's life cycle and it is therefore relevant for Nordic Ecolabelling to set requirements for this. There has been discussion of the opportunities to set absolute requirements created for the design of packaging products intended for recirculation of packaging. One example is the requirement made of packaging design so that it is easy to empty the packaging of its content or separate various materials/components from each other and flatten the packaging after use. However, it is difficult to set such absolute requirements and Nordic Ecolabelling has therefore instead chosen to set an indirect requirement of packaging design, whereby the food producer must have procedures to require packaging to be optimised from a recycling aspect (O5). The same applies to efficient use of resources. Nordic Ecolabelling use to set requirements on the product's function. Good quality, i.e. functional characteristics, is important, as a good packaging function saves resources. Opportunities to set requirements of packaging design and function must also be reviewed for the next generation of the criteria.

Work to increase the recycling ratio

During the course of the work the opportunity to work for changes in consumer behaviour was also discussed. However, there are also other paths to changed consumer behaviour

[210] Daniel Hellström och Annika Olsson; Managing packaging design for sustainable development - a compass for strategic directions, first edition, John Wiley and Sons Ltd. 2017.

besides information flow, such as printed text on a product (O8), which may perhaps also be even more effective. An example is "nudging", a new trend which official authorities are already beginning to use. Nudging is about gently leading people in the preferred direction without using carrot or whip. Knowledge of nudging thus opens up opportunities to propose a new type of measures and steering tools, to contribute to more sustainable consumption. In Denmark, the non-profit organisation "iNudgeYou" works on assignments for e.g. the Danish Ministry of the Environment and the Danish Energy Agency. In Norway, too, there is an independent organisation, GreeNudge, which among other things has written a report on opportunities for nudging in Norway's climate policy.

Requirement of energy on conversion

Under criteria development, the opportunity to set requirements of energy on conversion has been discussed. According to the LCA analyses, the production of constituent material in packaging is of great significance from an environmental viewpoint (production of polymers, aluminium and paperboard). Conversion of packaging is of less significance, which also concerns filling and distribution to shops. In the conversion phase, the greatest environmental impacts will be from the use of electricity in production, and therefore opportunities were discussed to set requirements of energy use in conversion facilities where packaging (preforms, sleeves) is manufactured. The decision was taken that this will not be included in the first generation of the criteria, but that this opportunity to set energy requirements must be reviewed for the next generation of the criteria.

Requirements for constituent material

In the first generation of criteria, the requirements for constituent materials cover primarily bio-based materials such as beverage carton and biopolymers. Nordic Ecolabelling has long experience of working with paper-related criteria, where requirements for pulp and paper in these criteria also refer to. Possibilities to set requirements on the production of other materials such as recycled plastic, glass and aluminium shall be revised to the next generation of the criteria.

8 Terms and definitions

Term	Explanation or definition
Auxiliary component	Components which belong to the packaging, but which are not directly necessary to wrap the food. Examples of auxiliary components are labels, straws or corrugated cardboard packaging/paperboard as in a bag-in-box to support a bag of plastic.
Bio-based	Bio-based means that the material consists of biomass that may have undergone physical, chemical or biological treatment(s). Biomass has a biological origin, but excludes material that is found embedded in geological and/or fossil formations. Examples of biomass are: (all or parts of) plants, trees, algae, marine organisms, microorganisms, animals, etc. **Bio-based polymer/plastic**: Polymer/plastic that is fully or partly based on biomass. Nordic Ecolabelling does not consider that biodegradable/compostable fossil-fuel plastic should be considered to be bio-based plastic. The definition of bio-based polymer/plastic is based on the definitions in the European standard EN 16575:2014 and also includes secondary raw materials. Calculation principles for the proportion of bio-based are specified in the requirement O2.
Blanks	Preform of packaging. Preforms are delivered from the packaging manufacturer to the food manufacturer for further processing as a filling. See also conversion.
Bonsucro	Bonsucro (formerly the Better Sugar Cane Initiative, BSI) comprises guidelines for the sustainable production and processing of sugar cane. The first version of the Bonsucro criteria was adopted and published on 27 June 2010.
Component:	A component is one or more materials and/or chemical products which together fulfil a required function in packaging production. Examples of components are laminated paperboard or plastic screw tops.
Conversion	Conversion is the manufacturing phases in which e.g. rolls of liquid packaging board are processed into final products (packaging in which food is packaged). In the case of beverage cartons, conversion comprises phases whereby paperboard roll is processed into blanks, including coating, printing and cutting. According to these criteria, relevant elements of food filling may also be included.
Full traceability (for bio-based polymers)	Full traceability means that there is control of the renewable raw material throughout the production process, such as by using a separate production line solely for renewable raw materials, so that the final polymer solely comprises renewable raw materials.

Mass balance method (for bio-based polymers):	The mass balance method means a mix of fossil and renewable raw materials at the start of the production process, with mathematical allocation of the renewable raw material to the final polymer. This entails that there is no full traceability of the renewable raw material throughout the production process, and that the amount of renewable raw material in the final polymer can vary.
Material	Examples of material that may be included in packaging: paper, paperboard, glass, synthetic polymers such as PLA, PP, PE, and PET, as well as aluminium.
Intermediate product	In these criteria, intermediate products are packaging that does not contain packaged food. See also the definition of final product.
NIAS	Non-intentionally added substances (NIAS). Substances not added intentionally.
MSA	My Swan Account. Nordic Ecolabelling's web-based application guide for paper and paperboard manufacturers. The tool also applies to pulp and chemicals producers wishing to have their products controlled by Nordic Ecolabelling.
Packaging	According to the EU Directive on packaging and packaging waste, 94/62/EC, packaging is all products made from material of any type and which is used to contain, protect, handle, deliver and present products, from raw material to final product, and from producer to user and consumer. Disposable items used for the same purpose are also considered to be packaging. Norway is not an EU member state, but is subject to the EEA agreement See also primary, secondary and tertiary packaging.
Primary packaging	Consumer packaging, i.e. packaging conceived so as to constitute a sales unit to the final user or consumer at the point of sale. According to these criteria, primary packaging may be Nordic Swan Ecolabelled.
Product	In contrast to Nordic Ecolabelling's other criteria, the term product not only refers to the Nordic Swan Ecolabelled packaging, but also the packaged food and its packaging.
Renewable raw material	A renewable raw material is defined as a raw material (primary or secondary) originating from biological material which is renewed continuously in nature within the immediate future, such as cereals and wood (European standard EN 16575:2014).
Secondary raw materials	Secondary raw materials are defined as residual products from other production and manufacturing processes, such as waste products from the food industry, or by-products such as straw from cereal production or bagasse from sugar cane production. PFAD from palm oil is not counted as a residual/waste product.
Secondary packaging	Group packaging, i.e. packaging that is designed in such a way that at the point of sale they comprise a group of a certain number of sales units, irrespective of whether they are sold as such a group to the final user or

	consumer, or are solely used to complement the shelves at the point of sale. Secondary packaging can be removed from the product without this affecting the product's characteristics.
Tertiary packaging	Transport packaging, i.e. packaging that is designed in such a way that it supports the handling and transport of a number of sales units or group packaging in order to prevent damage from physical handling or transport damage. Transport packaging does not include road, rail, ship and air freight containers.
RSPO	Roundtable on Sustainable Palm Oil (RSPO) was created by organisations involved in the entire palm oil supply chain. The standard comprises eight principles and 39 criteria for sustainable palm oil production. The criteria comprise social, economic, organic and general aspects. There is great interest in the system and several companies have been granted certificates.
RTRS	Roundtable on Responsible Soy (RTRS) is initiated by operators from the entire soya production and distribution chain. The first version of the criteria was adopted and published on 10 June 2010.
Recycled material	Recycled material is defined in accordance with ISO 14021 in the following two categories. **Material in the pre-consumer phase.** Material that has been taken from the waste flow during the manufacturing process. The exception is the re-use of material that is generated in a process, e.g. waste that can be recycled within the same process that generated it. **Material in the post-consumer phase.** Material generated by households or by trade, industry or institutional facilities in their role as end-users of a product that can no longer be used for its intended purpose. This includes the return of materials from the distribution chain.