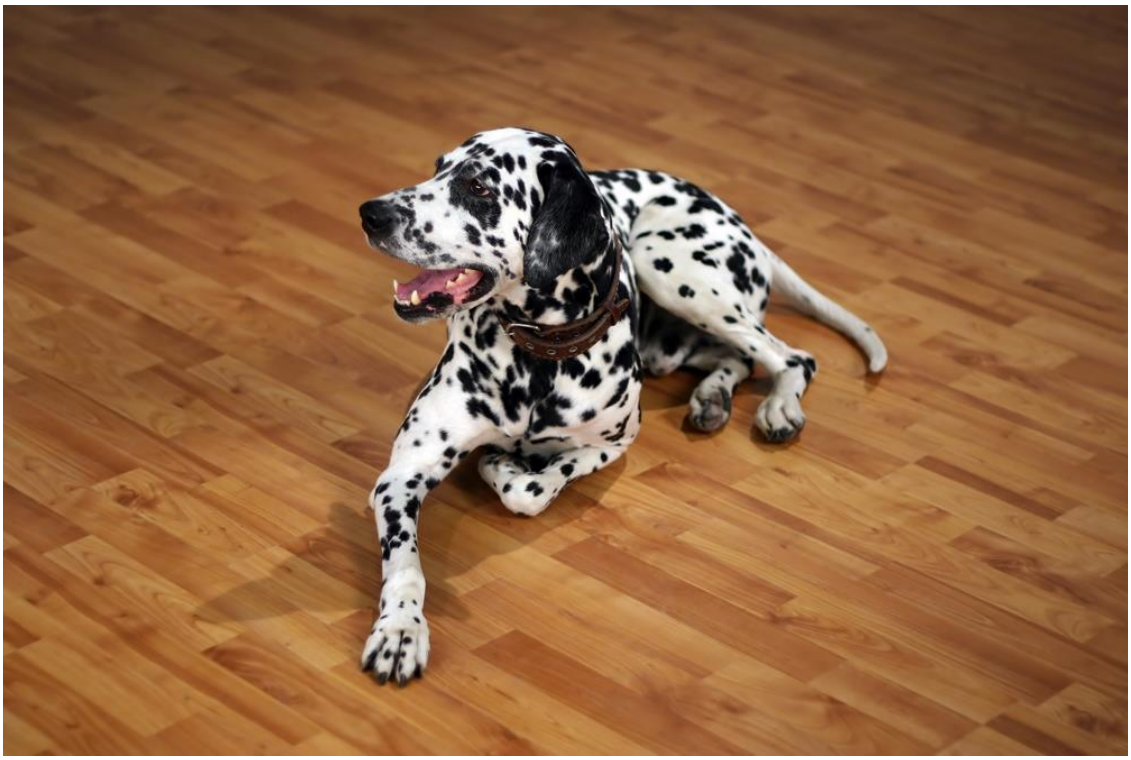
About Nordic Ecolabelled

Floor coverings



Version 6.0

Background to ecolabelling for consultation

Nordic Ecolabelling

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029 Floor coverings, version 6.0, 15 May 2014

This document is a translation of an original in Nordic languages. In case of dispute, the original document should be taken as authoritative.

Addresses

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

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1 Summary

Flooring is a heterogeneous project group that comprises several different materials/raw materials and combinations of materials. The floor coverings that may be Nordic Ecolabelled are wooden flooring (both solid wood floors and parquet), laminate flooring, linoleum flooring, cork flooring, bamboo flooring and textile flooring. As a multi-issue label, Nordic Ecolabelling sets requirement in all relevant areas of the life cycle, where there is good steerability. A Nordic Ecolabelled floor covering:

- Has a high proportion of renewable and/or recycled materials.
- Meets stringent requirements on chemicals harmful to health and the environment
- Guarantees low emissions and a good indoor environment.
- Has been manufactured energy efficiently.a
- Has good durability.

A Nordic Ecolabelled floor covering is completely free from PVC. This means that vinyl flooring cannot be ecolabelled and nor can flooring which includes PVC, e.g. as backing or as a surface treatment. The arguments for delimiting the product group are set out in section 5. Ceramic tiles are not included within the definition of the product group but can be labelled under the EU Ecolabel. Loose-laid mats and rugs can be Nordic Ecolabelled in line with the criteria for the Nordic Ecolabelling of Textiles, hides/skins and leather.

The very first criteria for the product group Floor coverings were laid down in October 1994. This revision, which began in 2012, seeks to create version 6 of the criteria. The most important changes in this revision are summarised below.

Requirements on the proportion of renewable raw materials and recycled materials

Life cycle analyses[1] of floor coverings show that a floor with a high proportion of fossil raw material(s) is worse from an environmental point of view than a floor which largely consists of renewable raw materials. This applies to the use of resources (finite resources), energy consumption and emissions with an impact on climate. Because society's demand for and extraction of raw materials is generally on the rise, resource-efficient ecocycles are important, and it is also important to consider end-of-life products and materials as raw materials for new products, i.e. recyclable materials.

For this reason it is a fundamental requirement – irrespective of floor type – that the proportion of renewable and/or recycled raw materials must be at least 80% in a Nordic Ecolabelled floor. Nordic Ecolabelling has chosen to merge renewable and recycled materials under a single requirement. At the same time an opportunity is provided to exempt fillers from the calculation of the percentage of the floor by weight, provided that the filler is available to an, in principle, unlimited extent in nature.

[1] Life Cycle Assessment of Flooring Materials, Dr Bowyer, J. Dovetail Partners Inc, 2009, Life cycle analysis of different cork floorings. Althaus H.-J. and Richter K. Swiss Federal Laboratories for Materials Testing and Research. 2001., Comparative Analysis of Flooring Materials, Ajla Aksamija, Ph.D. Perkins & Will, Research Journal, 2010.

Sustainable renewable raw materials

Many Nordic Ecolabelled floor coverings largely consist of renewable raw materials. It is relevant to set requirements for sustainable growing of raw materials such as wood, cork, bamboo, sheep's wool and flax, but steerability is not always good. It is possible to set requirements for sustainable growing for wood raw materials, including bark from cork oak. The requirement for the proportion of certified wood has been raised from 30% to 70% of the timber contained on an annual basis. At the same time the requirement has been extended to also cover cork and bamboo and the requirement here is set as 50% certified bamboo and cork oak. Requirements are also set for wool, both as a requirement on emissions from the wool washing process and the maximum permitted content of biocides/pesticides.

Other material requirements

The criteria contain specific requirements for synthetic fibres, such as polyamide (nylon) and foam material. As far as possible, the requirements have been harmonised with Nordic Ecolabelling's criteria for Textiles, hides/skins and leather, and with the criteria for Furniture and fitments, which also cover textile materials.

Chemicals and the indoor environment

Alongside a high proportion of renewable and/or recycled raw materials, the requirement for non-toxic materials and chemicals is vital, not least to ensure low risks of exposure in the indoor environment.

The section on chemical requirements covers requirements for the classification of chemical products, CMR substances and other non-desirable substances. The requirements have been updated with new knowledge and harmonised with Nordic Ecolabelling's internal steering document, Chemical guidelines.

Today nanomaterials are found in a broad spectrum of consumer goods and products for professional use. Examples of applications include surface treatments on various types of goods for protection and a self-cleaning effect. However, knowledge of the exposure of people and the environment to nanomaterial is minimal[2]. For this reason, Nordic Ecolabelling takes a cautious and a restrictive approach. The requirement on nanomaterials has been revised and harmonised with equivalent requirements for Nordic Ecolabelled chemical building products.

Up until now the Floor coverings criteria have not contained any emission requirements other than on formaldehyde emissions. The reason for this is that our stringent requirements on input raw materials, chemicals and surface treatment prevent or extremely limit emissions of problematic substances. Nevertheless, in this revision, we want to study whether an emission requirement (TVOC[3], formaldehyde and carcinogenic substances) should be introduced. The background to this is that emission measurements, emission requirements and indoor environment labelling are increasing in the industry and it could be an added value if a Nordic Ecolabelled floor could demonstrate compliance with these systems. If an emission requirement is introduced (see requirement O32), the specific requirements for formaldehyde would be deleted while all the general chemical

[2] Kemikalier i varor - strategier & styrmedel för att minska risker med farliga ämnen i vardagen, Report no. 3/2011, Swedish Chemicals Agency.
[3] TVOC stands for Total Volatile Organic Compounds. However, the term TVOC is not unambiguous but can be used to represent any combination and proportion of VOC.

requirements would remain. The response to the consultation will determine which alternative is decided on for the final criteria.

Energy

The energy requirement in the previous version of the criteria (version 5) has been revised and consists firstly of the total amount that must be attained and secondly the highest permitted energy consumption for electricity and fuel. The previous terms which allocated points for renewable raw materials and the proportion of certified timber have been removed as they are addressed by different requirements in the criteria. The combination gives manufacturers a certain amount of flexibility, while the requirement takes into account the climate aspect, since the proportion of renewables carries the same weight as the respective energy figure.

It has been difficult to obtain information on energy consumption from manufacturers. Nor is such information specific to a Nordic Ecolabelled floor as it is factory data and a factory often manufactures several different types of flooring. For the next revision, resources should be put into drawing up an energy requirement that takes a holistic approach and is felt to be well tailored to the product group, supported by Nordic Ecolabelling's energy guidelines.

Other

The previous criteria also included a requirement for achieving a certain level of durability. This requirement has now been differentiated, with requirement levels for private use and public environments, which require a higher level of durability. An added requirement states that Nordic Ecolabelled flooring marketed and sold as flooring for wet rooms must be approved for wet rooms.

2 Basic facts about the criteria

Products that can be labelled

A floor is defined as the bottom surface of the room and a floor covering (flooring) is the general term that describes a permanent covering for this surface. Flooring is manufactured from several different materials, some of the most common being: wood (solid or parquet), linoleum, ceramic tiles, plastic, textile fibres and cork.

The flooring material selected is guided by factors such as requirements for sustainability/durability, sound insulation, muffling tread, comfort, price, hygiene and ease of cleaning, aesthetics, etc. Certain flooring materials must not be installed on surfaces exposed to a high moisture level.

Flooring is a heterogeneous project group and can be divided into semi-hard flooring, soft flooring, wet room panels and tiles. Appendix 2 describes the different types of floor in general, mainly from an environmental perspective. Nordic Ecolabelling has chosen to limit the criteria to the actual floor covering itself. The flooring contained in this product group must be intended for indoor use and must be able to be laid on a surface of concrete or timber boarding, for example.

Flooring that can be Nordic Ecolabelled is solid wood flooring, parquet flooring, veneer flooring, laminate flooring, linoleum flooring, cork flooring, textile flooring and bamboo flooring. The definition of the product group is clearly described in section 5.

Justification for Nordic Ecolabelling

Flooring is a large proportion of the indoor surface area, e.g. in a home or office. This means that the materials the flooring contains are important for the indoor environment and for the risk of exposure to undesirable substances. Flooring and its health and environmental impact in the indoor environment are further complicated by the fact that the flooring itself may interact with the surface on which it is laid (usually concrete), damp proofing, levelling, caulk, soundproofing material, insulating material and the flooring adhesive.

Several flooring materials, the most common of which are wood floors, linoleum and cork flooring, largely comprise renewable materials and are often marketed by the industry as sustainable, "green" or "natural" flooring. Compilations of life cycle analyses and comparisons carried out[4] also show that bio-based flooring such as linoleum, cork and wood have a lower environmental impact in most, or all, the areas assessed compared with other types of floor covering.

The Nordic Ecolabel is a life cycle-based multi-issue label which for floor coverings sets the following criteria in the following areas:

- A high proportion of renewable and/or recycled materials
- Manufacturing of raw materials/materials
- Content of substances that are harmful to the environment and health in the flooring and its surface treatment
- Emissions to the indoor environment
- Energy consumption and proportion of renewable energy in manufacturing
- Durability, sustainability and ease of cleaning

Version and validity of the criteria

The very first criteria for Floor coverings were laid down in October 1994. Version 2 entered into force in February 1997. After a number of extensions the new revised criteria (version 3) entered into force in 2002. New revised criteria were once more produced in late 2007. Since then the product group has been expanded with the addition of bamboo flooring and in October 2012 version 5 of the criteria was laid down, with validity up to 31 December 2013. The criteria were extended and are now valid until 31 October 2015.

The Nordic market

Flooring manufacturers sell to wholesalers, builders' merchants and DIY stores, specialist stores, purchasers for the public sector and directly to construction projects. Sales in builders' merchants and DIY stores are made to professional customers (tradespeople and developers) and to end consumers (private customers). The following industry organisations are active in the Nordic flooring market:

- Sweden: Byggmaterialindustrierna and The Swedish Flooring Trade Association
- Norway: Treindustrin and the Construction Products Association
- Denmark: Gulvbranchens Samarbejds- og Oplysningsråd (GSO)
- Finland: The Confederation of Finnish Construction Industries

[4] According to the Building for Energy and Environmental Sustainability (BEES) program at the National Institute of Standards and Technology (NIST) at the US Department of Commerce.

Market overview Denmark
The Danish market is dominated by several large producers/groups: Armstrong, Ege, Junckers, Tarkett Sommer and Forbo. These producers cover a wide spectrum of different floorings – parquet/laminate/wood, textile flooring, plastic/PVC and linoleum.

The Danish flooring industry is partly covered by Gulvbranchens Samarbejds- og Oplysningsråd (GSO). This is an industry organisation for technical cooperation between suppliers of flooring materials and the contractors who fit them. There is also the "Flooring section" under the Danish Construction Association. This section is an umbrella organisation for contractor businesses in the flooring industry. These businesses lay all types of floor covering – linoleum, vinyl, carpets, wood flooring and seamless flooring as well as building many types of subfloors.

Around 50% of the carpets sold in Denmark (measured in m^2) are imported from Belgium (approx. 30-40 %), Holland (approx. 10-20%) and other countries. These carpets are typically sold via DIY stores and other cut-price chains. The remaining 50% of carpets sold on the Danish market are manufactured by Danish producers. Of this 50%, approximately 40% go to the professional market and approximately 60% to the private market. Carpets usually contain less than 50% renewable raw materials and can therefore not be ecolabelled under version 5 of the Nordic Ecolabelling criteria for flooring.

Market overview Norway
According to the Norwegian construction market analysis company Prognosesenteret, the flooring market in Norway amounted to approximately 16 million square metres of floor coverings in 2008. Based on a starting point of an average price per square metre of NOK 250, it was further estimated that this market amounts to approximately NOK 4 billion. The flooring market for new commercial buildings and homes was approximately 30 million square metres in 2011, which with the same price estimate amounts to a market of approximately NOK 7.5 million. On the basis of these estimates it can be calculated that the total market for flooring in Norway was approximately 12 billion in 2012, taking into account growth in sales and inflation.

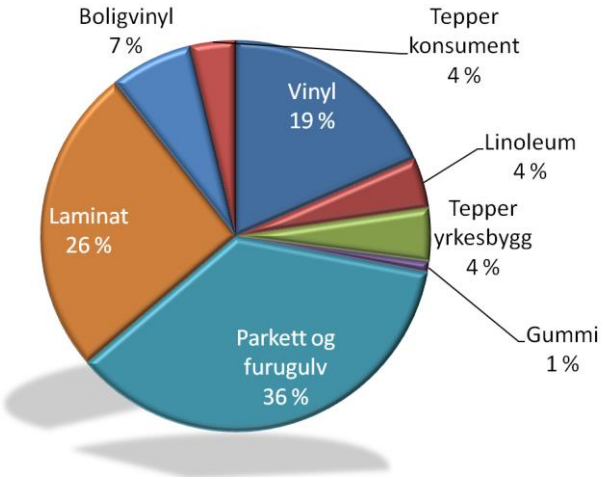

Figure 1: Flooring market in Norway (excluding ceramic tiles, stone and epoxy). Clockwise, starting with Boligvinyl: Vinyl domestic 7%, Carpet consumer 4%, Vinyl 19%, Linoleum 4%, Carpet professional 4%, Rubber 1%, Parquet and pine flooring 36% and Laminate 26%.

As shown in figure 1, the most popular product types are parquet, pine flooring, laminate and vinyl. However, these product types also have very different positions depending on area of use/end market. Office environments mainly use linoleum, carpets (textile flooring) and parquet. In education, the health sector and other public sector buildings, the most popular products are vinyl and linoleum. However, carpets, parquet and laminate are the most popular products in the hotel sector.

Market overview Sweden

Wood floors and plastic flooring are the most popular flooring types in Sweden, followed by laminate, linoleum and textile flooring. In 2012, 20.7 million square metres of semi-hard and soft flooring was sold in Sweden, a figure unchanged compared with 2011.

Table 1: Trends in flooring sales in Sweden in recent years. Source: Flooring industry annual report 2012. The table shows ESTIMATED SALES OF SEMI-HARD AND SOFT FLOORING, WET ROOM PANELS AND TILES (million square metres).

UPPSKATTAD FÖRSÄLJNING AV HALVHÅRDA OCH MJUKA GOLV, PLASTVÄGG OCH BYGGKERAMIK
(miljoner kvadratmeter)

	2006	2007	2008	2009	2010	2011	2012
Trägolv	6,7	7,2	6,8	6,0	5,9	6,2	6,0
Textilgolv[1]	1,7	1,9	2,1	1,8	2,0	2,0	2,5
Plastgolv	5,6	5,7	5,7	5,5	5,6	5,9	5,7
Linoleumgolv	2,8	2,7	2,5	2,3	2,2	2,2	2,2
Laminatgolv	5,5	5,4	4,9	4,4	4,3	4,1	3,9
Övriga golv	0,3	0,4	0,3	0,3	0,3	0,3	0,4
Totalt	**22,6**	**23,3**	**22,3**	**20,3**	**20,3**	**20,7**	**20,7**
1 Tuftade, nålade och vävda (ej avpassade)							
Plastvägg	0,9	1,0	1,0	1,0	1,1	1,1	1,1
Byggkeramik[2]	12,2	13,8	12,8	11,5	12,6	11,9	11,0 [3]
2 Byggkeramiken omfattar utöver golv även simbassänger, fasader, balkonger, terrasser, vägtunnlar m. m.							
3 Preliminär siffra							

For each flooring type there are one or two major manufacturers/importers and a number of smaller ones. The flooring is usually not manufactured in Sweden, with production, with a few exceptions, being carried out in Germany, the UK, the Netherlands and France. Bamboo flooring and cork flooring are often manufactured near to where the raw material is grown and imported to Sweden as finished flooring.

Market overview Finland

The interest group of the business is Lattian- ja seinänpäällysteliitto ry (Floor and Wall Covering Assosiation), part of the Rakennusteollisuus Ry (Construction Industry Association).

In Finland following floor coverings were sold 2012:

- Laminate 39%
- Ceramic tiles 26%
- Plastic carpets 18%
- Parquet 13%
- Textile carpets 4%

Source: Floor and Wall Covering Assosiation, statistics 2012 based on figures from member companies.

The Finnish markets overall turnover is ~200M€. The Finnish markets are dominated by a few biggest producer and importer. The biggest Finnish producers are Karelia-Upofloor Oy (from 2013 part of the Kährs Group), ParlaFloor Oy and Timberwise Oy. Most significant importers are Tarkett, Forbo, Pergo and Orient Occident.

Finnish producers are mainly specialized to produce wooden floorings (parquet, laminate, wooden floorings). The competition on the markets is tough. Imported products – specially imported products from Asia – are significantly cheaper than Finnish products. This has lead to a situation where the Finnish companies have to compete with other arguments than price: quality, being domestic, environment. Unfortunately this has not lead to an application to the Nordic Ecolabel in Finland. One reason is the lack of customers demand.

Nordic Ecolabel licences

The table below lists the flooring licences that exist in the Nordic countries. Several of the manufacturers have registered their Nordic Ecolabelled flooring in several countries.

Table 2: A total of six flooring manufacturers hold a Nordic Ecolabel licence.

Manufacturer	Type of flooring	Licence number
Armstrong	Linoleum	529007
Forbo	Linoleum	329003
Forbo	Parquet	329003
Pergo	Laminate	329001
Tarkett Sommer	Linoleum	329008
Tarkett	Parquet	329010
Siljan	Solid wood flooring	329005
Kährs	Parquet	329012

Other labels

CE marking

As of 1 July 2013, all construction products covered by a harmonised standard or European Technical Assessment (ETA) must have a performance declaration and be CE marked in order to be sold in the EU. This is regulated by the EU Construction Products Regulation (305/2011/EU), abbreviated CPR. This also applies in Norway, Switzerland, Iceland, Turkey and Lichtenstein. The purpose of the Construction Products Regulation is to ensure that reliable documentation on the performance of construction products is presented in a harmonised manner throughout the EU, so facilitating free trade. Common, harmonised European standards or European assessment documents (EAD) are used to test and report the product's performance. These serve as a basis for the CE marking of the construction product. Performance requirements are set by each member state, but there are also rules on restrictions in harmonised legislation such as REACH.

The harmonised product standard, EN 14041 "Resilient, textile and laminate floor coverings – Essential characteristics" covers flooring made from plastic, linoleum, cork, rubber and textile flooring, not including loose-laid mats and rugs. There is an equivalent European harmonised product standard for wood flooring; EN 14342 "Wood flooring. Characteristics, evaluation of conformity and marking". This means that since 1 July 2013 these types of flooring must have a CE marking.

CE marking and requirements for harmonised information on flooring performance do not constitute a barrier to voluntary ecolabelling, e.g. the Nordic Ecolabel.

Ecolabelling systems
The EU Ecolabel has criteria documents for textile floor coverings, wooden floor coverings and hard coverings. There are currently 17 licences for hard floor coverings.

The German ecolabel Der Blaue Engel has criteria documents for wooden flooring (criteria document: RAL-UZ 38), textile floor coverings (criteria document: RAL-UZ 128) and elastic floor coverings (criteria document: RAL-UZ 120). Elastic floor coverings means floors laid from wall to wall, including linoleum, rubber and plastic flooring).

FSC/PEFC – raw material labelling
The forest certification schemes Forest Stewardship Council (FSC) and PEFC (Promoting Sustainable Forest Management) play a certain role in the flooring industry. According to the manufacturers, these raw material labels/certification schemes do not compete directly with the Nordic Ecolabel on the Nordic market.

Environmental classification of buildings
There are many different systems for environmental classification of buildings used in the Nordic countries. The systems set requirements for construction materials, including flooring. In order for suppliers of construction materials to be included in the LEED system, they must first be certified under the FloorScore system, which assesses the indoor climate performance of construction products. The criteria set requirements on parameters such as VOC, formaldehyde, aldehydes and phenylcyclohexanes.

The British BREEAM classification system requires a life cycle analysis as the basis of an Environmental Product Declaration (EPD) which is then included in BREEAM's "Green Book". BREEAM's Green Book acts as an online list of assessed products and services in the construction industry. There are different ways in which a company's products or services can be added to the Green Book based on different assessment criteria from different organisations. BREEAM's Green Book also includes vinyl flooring. The Norwegian version of BREEAM (BREEAM NOR) sets criteria for selection of environmental toxins which must not be included in construction products. In addition, emission criteria are set equivalent to the level M1 in the Finnish classification system Emission Classification of Building Materials. Points can also be gained for the use of pre-assessed products with a low content of substances harmful to health and the environment. Points can be gained for Nordic Ecolabelled products.

The DGNB system in Denmark also sets environmental criteria for flooring, which includes evaluating the following substances contained: halogenated and partially halogenated fuels, heavy metals, biocides, Substances of Very High Concern and organic solvents and softeners. Level requirements are also set for the use of sustainable wood, where the lowest level is to use European wood without FSC/PEFC or tropical wood with an FSC certificate. DGNB does not set concrete emission requirements for

construction materials, but does set requirements for good air quality in buildings via suitable amounts of ventilation and low emission materials. There is a focus on VOC and formaldehyde levels.

Furthermore, the European standardisation organisation CEN is drawing up standards and tools to assess the sustainability of buildings and environmental quality. This work is based on international standards for LCA and environmental declarations and also includes conditions related to the indoor environment and life cycle costs. The purpose of standardisation is to create general and horizontal standards to assess the environmental performance of buildings over their life cycle.

Other assessments/labels
There are a number of national registration systems and environmental assessment systems for construction products and construction materials which have a major impact on the market. In Sweden there are:

- BASTA Online, based on self registration and self declaration followed by sample audits by an independent third party.
- Byggvarubedömningen and Sunda Hus, which are environmental assessment/environmental evaluation systems for construction materials which manufacturers sign up to.

In Norway there is SINTEF Technical Approval, which documents that a construction product has been found suitable for use. From 2010 onwards the approval also checks whether the product contains substances on the Norwegian priority list or on the REACH Candidate List. Another system in Norway is ECOproduct, which is both an environmental evaluation method and a database of already evaluated products. An environmental product declaration (EPD) is used as the basis for evaluating the product. ECOproduct was developed in partnership between SINTEF Byggforsk, Norsk Byggtjeneste and NAL-Ecobox. There is also the electronic information system ProductXchange, which shows whether chemicals/products contain substances on the REACH Candidate List, the Norwegian priority list and BREEAM NOR's list of banned substances. ProductXchange also shows whether the products are Nordic Ecolabelled. NOBB is another database for construction products which contains some environmental information, but this is currently not as extensive for environmental information as ChemExhange is.

At the moment there are no separate national indoor climate labelling systems in Norway. However there is a growing focus on the indoor climate. The Danish Indeklima label and the Finnish Emission Classification of Building Materials are the most widespread indoor climate labelling systems in the Norwegian market.

Danish Indeklima label
The Danish Indeklima label acts as a guarantee that emissions from construction materials do not exceed set health-based limit values. The label focuses on emissions of the following: individual VOCs (volatile organic compounds), carcinogenic substances, particles and fibres. The test includes chemical analysis of individual compounds and air assessment using sensors. The result is given as a time value related to indoor climate. The time value expresses the time it takes from the product being fitted until emissions of the individual compounds have reached an unacceptable concentration.

Emission Classification of Building Materials
A Finnish voluntary labelling system based on a climate chamber test and measuring emissions from the materials. The materials are divided into three groups based on their emissions, where class M1 sets the highest requirements for low emissions. The classification regulates emissions of formaldehyde, TVOC, ammonia, carcinogenic substances and odours. The carcinogenic substances included have recently been expanded from only CMR, class 1 IARC (International Agency for Cancer Research) to covering substances classified as Carc. 1A or 1B, Annex VI to the CLP Regulation 1271/2008.

Asthma and Allergy Association
The Asthma and Allergy Association works to increase awareness of hypersensitivity and allergic diseases. They also have a labelling system which focuses on requirements linked to health aspects. The Swedish Asthma and Allergy Association has no flooring recommended by the Asthma and Allergy Association. However, the Norwegian Asthma and Allergy Association (NAAF) recommends laminate flooring from one manufacturer on its website of labelled products. NAAF evaluates flooring on the basis of its criteria for product development of furniture/interiors. Requirements are set, whereby the product must not emit odours, other gases (e.g. gases from solvents, formaldehyde and similar) or particles considered to lead to an increased risk of asthma or other irritation of the airways. Nor must products release flame retardants that are harmful to the environment or plasticisers suspected to be harmful to humans, animals or the environment.

GUT
In 1990 European carpet manufacturers founded an association for environmentally friendly carpets (Gemeinschaft umweltfreundlicher Teppichboden) – GUT, in Germany. The purpose of GUT is to improve the environmental and consumer protection aspects throughout the life cycle of the carpet (from production to fitting, use and re-use)

Individual carpets can be granted a licence. There is a ban on particular substances and limit values for individual substances. In addition requirements are set on emission testing with limit values in the form of LCI[5] values for a long list of substances. The list includes groups such as TVOC, SVOC, carcinogenic substances, aldehydes (e.g. formaldehyde), and individual substances with LCI values. The total of VOCs without an LCI value must produce no more than 100 $\mu g/m^3$ after 3 days and no more than 50 $\mu g/m^3$ after 28 days.

Other tools in the industry
ERFMI (the European Resilient Floor Manufacturers Institute) is the common means for the flooring industry to compare products and materials. The organisation has had an LCA carried out by PE International in the light of data from ERFMI members which covered more than 85% of all European production of resilient flooring with the exception of cushioned vinyl. Output from this analysis is mainly used as input in an EPD calculator, where members can upload EPDs to their websites

[5] LCI=Lowest Concentrations of Interest. EU-LCI Definition: Health-based values used to evaluate emissions after 28 days from a single product. Presentation on 17 December 2012, Eurofins.
http://standards.nsf.org/apps/group_public/download.php/19938/LCI%20summary%20by%20Reinhard%20Oppl%202012-12-18.pdf

3 About the revision

Goals of the criteria review/revision

The aim of the project was to revise the criteria for the product group Floor coverings. The criteria must promote the best products in each flooring type that can be labelled.

A Nordic Ecolabelled floor covering:

- Has a high proportion of renewable and/or recycled materials
- Meets stringent requirements on chemicals harmful to health and the environment
- Guarantees low emissions and a good indoor environment
- Has been manufactured energy efficiently
- Has good durability

The revision of the criteria focuses on the following areas:

Materials
It must be investigated whether the product group should be opened up to include other flooring materials, such as vinyl and rubber. The requirement on the proportion of renewable raw materials must be evaluated from a life cycle perspective. The requirement on recycled material for non-renewable materials must be evaluated from a life cycle perspective.

Wood requirement
The requirement on traceability and proportion of certified wood has been revised with the aim of increasing the proportion of certified wood. The wording of requirements must be updated and it must be considered whether mass balance is to be permitted.

Chemical products
The requirement on substances harmful to health and the environment must be clarified and differentiated from chemical products, substances and raw materials. The wording of requirements must be updated and, if possible, harmonised with other product groups such as Panels for the building, decorating and furniture industry and Furniture and fitments.

Surface treatment
The revision must resolve the conflict of objectives between the requirement on environmentally harmful substances in surface treatment and a high-quality surface. During the revision, it must be investigated whether it is possible to differentiate the requirement for flooring for private and public environments.

Energy
The requirement must be revised such that there is a "pure" energy requirement, without involving other parameters such as materials. The level of the limit value must also be revised with the help of information obtained from manufacturing of different flooring types.

Indoor environment
The revision must investigate whether it is relevant to set more requirements in this area. The requirement on emissions of formaldehyde must be harmonised with Nordic

Ecolabelling's product groups Panels for the building, decorating and furniture industry and Furniture and fitments.

About this criteria review/revision

The project was started in 2012 and continued into 2013. Heidi Bugge, product group manager at Ecolabelling Denmark, was project manager up until the year end 2012/2013. Sara Bergman of Ecolabelling Sweden stepped into the project manager role in January 2013. Elisabeth Kolrud and Kristian Kruse at Ecolabelling Norway have also worked on the project. Karen Dahl Jensen holds the position of Nordic product development manager and commissioned the revision.

Face to face meetings and telephone meetings have been held with stakeholders in the flooring industry as part of this work. Many contacts have been established in order to gather information.

4 What is the environmental impact of floor coverings?

As mentioned above, the Floor coverings product group is a very heterogeneous group in terms of materials, and for this reason an environmental assessment has been drawn up for each of the following flooring types: wooden flooring (parquet and boards), bamboo flooring, linoleum flooring, plastic flooring, and carpets, divided into wool and synthetic. For these types of flooring an assessment has been made of whether, generally for the type of flooring, there is a high RPS (relevance – potential – steerability) for setting ecolabelling requirements and so ensuring good environmental performance for these types of flooring.

The environmental assessment for each of these flooring types includes a MECO (Materials, Energy, Chemicals and Other) analysis describing the most significant environmental impacts in the life cycle phases of the product group. The purpose of the analysis is to provide a qualitative picture of the important environmental impacts (also including energy consumption) in the life cycle of the flooring. The functional unit in the MECO analysis is 1 m^2 flooring for the average lifetime of the flooring type concerned, 20 years, including installation and maintenance. The MECO analyses are mainly qualitative and it is therefore not the intention that they should be used to carry out comparisons of the different flooring types, but rather to describe the important environmental impacts of the different types of flooring. The MECO analyses carried out can be found as a supplement to the background document[6]. Appendix 2 contains a summary of the MECO analysis.

Based on the MECO analyses, an RPS analysis was also performed that evaluates environmental impact relevance (R), improvement potential (P) and the possibility of introducing steerable criteria (S) for the different flooring types. The main conclusions of the environmental assessment are shown in the summary of the RPS analysis below.

Several LCAs of flooring have been carried out by different bodies. The purpose of the environmental assessments has not been to rank the different flooring types in relation to each other, but instead to define the important environmental parameters for the

[6] The separate report "MECO analysis Flooring 2013" is written in Danish and may be obtained from Nordic Ecolabelling: sara.bergman@svanen.se

different types of flooring. At the same time it has been investigated where Nordic Ecolabelling is able to go in and set environmental labelling requirements that steer the industry towards the environmentally best flooring within each of the different types of flooring, if there is a high RPS for doing so.

Summary of the RPS analysis for floor coverings

The summary of the RPS analyses shows that floor coverings with a high proportion of fossil materials, such as polymers in the form of polyamide, demand more energy in terms of raw materials compared with renewable raw materials such as wood and linoleum. It would therefore be an environmental benefit to limit the proportion of these raw materials, or ensure that a certain proportion of the fossil raw materials that are used recycled, so as to reduce total energy consumption. In conjunction with the resource load from a Nordic Ecolabelled flooring, it is also relevant to ensure a high proportion of renewable or recyclable raw materials in the flooring.

Regarding the production of the renewable raw materials such as wood, bamboo, wool, linoleum and bast fibres, the relevance lies predominantly in ensuring sustainable and where possible organic production of the raw material, and ensuring that the use of any chemicals involves the lowest environmental and health impacts. The total RPS for setting a requirement on either sustainable or organic production differs for the individual renewable raw materials. It varies according to how widespread certification systems are for the different renewable raw materials. For example, there is a high RPS for setting requirements for certified wood, but for linoleum there is low steerability as certified organic linoleum is not widespread. It should therefore be evaluated whether there is a high RPS for the sustainability and organic requirement for each type of raw material. Resource efficiency is also relevant for renewable raw materials. In addition to the environmental impact associated with the production of the renewable raw materials, such as forestry and sheep farming, and environmental burden is also associated with the processing of these raw materials.

Analyses also show a high RPS for setting chemicals requirements, both to ensure a low environmental impact in production, and a good indoor climate in the flooring's usage phase.

Energy is consumed in flooring manufacture both in the manufacture of the materials and the production of the floor covering itself. Where energy consumption is greatest varies between different flooring types. Generic tabular data could be used for energy consumed in the manufacture of the different raw materials. Steerability and potential for choosing better raw materials in terms of energy is low, however, for flooring manufacturers. In summary, in this revision Nordic Ecolabelling has chosen to start out from the energy requirement previously found in the criteria, which focuses on the energy consumed in the (final) manufacturing of the floor. See Energy requirements in section 6.5.

5 Justification of the requirements

This chapter outlines proposed requirement revisions and provides a background to why the requirement is applied and the requirement level chosen. The appendices referred to are those attached to the document "Proposed criteria". The chapter begins with a section setting out the product group definition and any changes compared with version 5 of the criteria.

Product group definition

Nordic Ecolabelling's experience from licensing and other customer contact is that the product group definition has worked well for the types of flooring listed as examples in version 5 of the criteria, i.e. bamboo, wood, parquet, laminate, linoleum and textile flooring. Because these types of floor covering are given as examples, a lack of clarity has arisen regarding whether other flooring materials, such as PVC, can be Nordic Ecolabelled. For this reason, one of the aims of the revision was to investigate whether the product group should be opened up to include other flooring material, such as plastic, cork and rubber. The result is that cork flooring and plastic flooring free from PVC have been included in the product group definition. PVC/vinyl flooring, on the other hand, falls outside the product group definition and cannot be Nordic Ecolabelled. The reasons for this are set out in requirement O3.

Rubber flooring is a very minor product in the Nordic market. Due to the fact that recycled raw materials cannot in principle be used in the production of new flooring, that synthetic rubber is the predominant raw material, and the various additives in the production process, it is very likely that a rubber floor would fail to meet our ecolabelling requirements. The potential for Nordic Ecolabelling is thus non-existent. In the light of this, rubber flooring is not described in more detail in this background document. Rubber flooring is not included in the product group definition and cannot be Nordic Ecolabelled. However, rubber can be included as an intermediate layer or as backing for other types of flooring, e.g. textile flooring.

What can carry the Nordic Ecolabel?

Nordic Ecolabelling has chosen to limit the criteria to the actual floor covering itself. The flooring contained in this product group must be intended for indoor use and must be able to be laid on a surface of concrete or timber boarding, for example. Flooring that can be Nordic Ecolabelled is solid timber flooring, parquet flooring, veneer flooring, laminate flooring, linoleum flooring, cork flooring, textile flooring and bamboo flooring. A Nordic Ecolabelled floor covering that is marketed and sold as flooring for wet rooms must be approved for wet rooms.

Floor coverings that cannot be Nordic Ecolabelled:

- PVC/vinyl flooring and other flooring that contains PVC.
- Rubber flooring. Rubber material can, however, be used, for example as an intermediate layer and/or backing for other flooring material.
- Ceramic tiles. However, the EU Ecolabel does accept this type of flooring.
- Flooring that is part of the load-bearing structure of the building.
- Flooring sold together with integrated underfloor heating systems.
- Seamless flooring, laid in liquid form which then hardens.
- The concept of floor levelling, a combined name for products and methods used to achieve a surface that is either ready for a floor covering or which can itself constitute a finished floor surface.
- Loose-laid rugs are not included in this product group, but can be labelled under Nordic Ecolabelling's criteria for textiles or those of the EU Ecolabel.

5.1 Description of products and materials

A table has been added at the beginning of the criteria, before the first requirement. The aim is to provide an overview of the requirements that are relevant to the different types of material that can be included in flooring.

As described in this background document, flooring often consists of different layers and different materials. A synthetic textile floor, for example, can contain polyamide yarn, backing material made from a polymer or bitumen, latex, non-organic filler, etc. The table also shows cases where the requirement has minimal limits.

O1 Information about the flooring

The applicant must provide the following information about the floor covering:

- Brand/trade name
- A description of the product/products and the materials involved. State the percentage composition of the material in the floor. State any additives, surface treatments and fillers. Product data sheets or equivalent covering all materials/more materials must be included in the application.
- A description of the manufacturing process. Suppliers must be described with the name of their business, production site, contact and the production step(s) carried out.

✉ A description in line with the requirement above. The template in Appendix 2 can be used to describe the composition of the materials. Product data sheets can be part of the documentation.

Background

The requirement is new for the product group Floor coverings, but is normal for other Nordic Ecolabelling product groups. The intention is to provide a sufficient picture of the manufacturing process (es) used, the materials that the flooring comprises, the additives, surface treatment, etc. that are used and in what proportion. This information is central to obtaining a good overview and a smooth licence processing procedure. Any suppliers must also be described. This is important to obtain an overall picture and for correct demarcation.

5.2 Raw material requirements

5.2.1 Raw materials in general

O2 Renewable and/or recycled raw materials

At least 80% of the flooring by weight must consist of:

- Recycled materials and/or
- Materials originating from renewable raw materials.

Non-organic fillers in the flooring may be exempted from the calculation of the percentage of the flooring by weight where these are in principle available to an unlimited extent in nature.

Renewable raw material is defined as a raw material that is continually and at a relatively fast pace reproduced in nature.

Recycled material is defined in line with ISO 14021 and covers both pre-consumer material and post-consumer material.

✉ Summary of the raw materials included in the floor stating the proportion of the raw materials as a percentage by weight. State which raw materials are renewable and which are recycled. Appendix 2 can be used.

Background

Nordic Ecolabelling wants to encourage the use of renewable and/or recycled raw materials in flooring where it has high relevance, see section 5. In version 5 of the criteria the requirement was that 50% of the flooring by weight should be made of renewable raw materials. Clear trends can be seen among Nordic and European manufacturers in moving towards more eco-friendly flooring. The trend is moving towards material being recycled to make new floors and fossil raw materials being replaced by vegetable crops. These two trends are described in more detail below.

1. Materials are recycled and become raw materials for new flooring.

There are industrial systems for recycling nylon at the end of its life. One example is the Econyl® Regeneration System, which has a plant in Slovenia. It takes in post-consumer waste, such as used fishing nets, flooring, carpets and other textiles plus pre-consumer waste such as oligomers and industrial waste from the manufacture of nylon 6. The waste received is first sorted and cleaned, then depolymerisation takes place and finally polymerisation to nylon yarn, used partly for manufacturing carpets and flooring and partly for manufacturing fabrics. In the first year the majority of the material was pre-consumer material, but post-consumer material has now increased to almost half and that trend is increasing. Econyl® supplies recycled nylon 6 yarn to several of the major leading manufacturers of textile flooring and carpet tiles.



Figure 2: Receiving used polyamide fishing nets

2. Polymers manufactured from vegetable (renewable) raw materials.

One example is nylon yarn manufactured from castor oil, a greasy oil obtained from the seeds/beans of the castor oil plant Ricinus communis. The castor oil plant thrives in dry areas where other crops can be difficult to grow, such as parts of India. The beans are harvested, dried in the sun and then separated from the pods. The oil is extracted and finally the nylon yarn is manufactured. The manufacturer Interface has a range in which 63% of the nylon yarn is polyamide extracted from castor oil.

Requirements for raw materials

This revision seeks to increase the requirement for the recycled proportion and/or renewable raw materials. The purpose is to reduce the total environmental impact of the flooring from a life cycle perspective. Because society's demand for raw material, whether this is wood, polyamide or any other flooring material, is increasing, it is important to close the ecocycle and see used products and materials as a raw material for new ones. It is not the role of Nordic Ecolabelling to steer technology and consequently Nordic Ecolabelling views it as natural to see renewable and recycled materials as equal and to merge them under a single requirement. A flooring manufacturer can thus focus on a high proportion of renewable raw materials or focus on recycled materials or a combination of these.

There is a difference between carpet on a roll (broadloom) and tiles. Carpet tiles require a stronger and heavier backing in order to ensure stability. A textile carpet tile typically consists of approximately 10% yarn. The proportion of yarn (% of flooring by weight) varies with yarn height and yarn density. As much as 70% to 85% by weight of the backing and the intermediate layer (primary backing) consists of different materials including filler. There are several different types of backing material on the market, some of the most common being bitumen, PVC or polyester, including polyethylene terephthalate (PET). Limestone is often used as a filler. If the flooring needs to meet higher requirements in terms of acoustics or provide extra shock absorption, the backing may consist of polyurethane with a filler. Although the composition of the material differs between tiles and flooring by role, the requirement for recycled raw materials can be the same. A tile offers opportunities to work with recycled material in the backing, e.g. by using recycled PET, recycled glass fibre, etc.

In summary, the requirement on the proportion of renewable and/or recycled raw materials is set at at least 80%, while we also introduce an opportunity to discount the filler in the flooring. The reason for this is that the filler is available in such large amounts in nature that it can be considered to be unlimited. This is the case for the fillers normally used in flooring, such as kaolin[7], calcium carbonate, calcium magnesium carbonate, calcium sulphate and silicates. Pigments are not counted as a filler but as an additive.

The requirement for renewable and recycled raw materials can be met by flooring whose main raw ingredient is renewable (wood or linoleum, for example). The requirement can also be attained by the floors that have a high proportion of recycled materials, where the filler is so abundant in nature that it can be discounted in the percentage by weight. The steps taken by the manufacturer to use recycled yarn, biopolymers, recycled materials for the backing, etc. is to be promoted alongside the naturally renewable flooring made from linoleum, wood, bamboo and cork.

Other materials in the floor covering or for the floor covering

It is very common for boards to be laid floating on a base, i.e. without glue. This offers a number of advantages for the indoor environment, the working environment and for disposal of the flooring at the end of its life. It also makes it easier to replace individual boards during use. There are different types of adhesive-free floor laying/joining systems or "click" systems. Many systems involve grooves milled in the boards. These can be developed with special locking springs embedded in the grooves that lock the rows of boards to each other for additional strength. There are also floor laying systems consisting of metal rails permanently attached to the underside of the boards which attach the boards together to create a complete floor. These metal rails provide a particularly strong locking mechanism and when the floor covering is removed, the metal rails can be separated out relatively easily and sent for material recovery. Textile carpet tiles can come with small self-adhesive plastic squares that are placed under the tile so that they attach to each other to create a strong floor, see figure 3.



Figure 3: Self-adhesive plastic squares in the corners help to attach carpet tiles to each other. Source: Interface

[7] Kaolin is a white, very plastic clay which largely consists of aluminium silicate

These components/materials amount to a very limited proportion of the materials for the entire floor, which is why the criteria document does not cover any specific material requirements for these. On the other hand, the requirement (O2) on the proportion of recycled and/or renewable raw materials must be calculated and met for the floor as a whole, including the laying/joining system. This is natural in cases where the joining system is permanently attached/an integrated part of the floor and should not give rise to any doubts in licensing. Examples of this include locking springs in milled grooves or permanently mounted aluminium rails.

If an adhesive-free floor is instead sold with a separate laying system, this must also be counted in the percentage of the floor by weight. Any other interpretation would disadvantage flooring with a permanently mounted joining system.

O3 Chlorinated plastics in flooring

Chlorinated plastics such as PVC (polyvinyl chloride) and PVDC (polyvinylidene chloride) must not be included in Nordic Ecolabelled flooring.

✉ Declaration from the flooring manufacturer that the flooring is free from chlorinated plastics. Appendix 2 can be used.

Background

The requirement covers both vinyl flooring and flooring which includes PVC and/or PVDC as a material/component. The latter may involve cork flooring coated with a thin outer layer of PVC or textile flooring with a PVC backing.

PVC has long been in focus in the environmental debate. Some of the environmental problems of PVC are due to the molecule itself – or more precisely the chlorine in the PVC molecule. In other cases the problems concern additives in the PVC which are harmful to the environment and to health. The latter environmental problem may be easier to tackle using greener alternatives.

Nordic Ecolabelling has no opinion for or against PVC in principle, but instead assesses PVC in each product group. Our role as an ecolabelling organisation is to set ambitious requirements that are meaningful in each product group. For this reason, Nordic Ecolabelling does not permit PVC as a material/component in Nordic Ecolabelled flooring. The most important arguments underlying this decision are:

1. The environmental problems caused by PVC manufacture, primarily where the mercury method is used to produce chlorine gas from salt (NaCl). Despite major reductions in emissions, mercury is still normally emitted to water and air.
2. It is difficult to achieve complete traceability regarding where the PVC has been manufactured. One reason is that many manufacturers balance out too much and too little dichloroethane (EDC) and vinyl chloride monomers (VCM) between different manufacturing sites. EDC and VCM produced from chlorine manufactured using the mercury method and the membrane method respectively are thus mixed. Hardly any manufacturer can deliver PVC guaranteed, with full traceability, not to have been manufactured using the mercury method in any respect.
3. Recycling of post-consumer flooring is very limited in the Nordic countries. It is partly the problem of additives that means that recycling does not work. Flooring has a long service life and old flooring that is taken up may contain cadmium and

lead which were used as stabilisers, pigments, etc. Adhesive residues and the fact that the base "comes too" when flooring is taken up are additional problems. In Sweden and Finland, installation waste is collected. However, the amounts are minimal compared with production waste. For example, 14,175 tonnes of production waste and 416 tonnes of installation waste were returned to Tarkett's vinyl flooring factory in 2012. The 416 tonnes of installation waste covers more manufacturers than merely Tarkett itself.

4. Used PVC flooring incinerated in waste incineration plants is associated with difficulties. Large amounts of neutralising lime must be added to protect the equipment and to keep emissions within the limit values. The amounts of flue gas cleaning residues increase. The amount of flue gas residues formed depends on the type of cleaning equipment installed. The plant needs to be halted several times a year. It increases the costs of incineration and for handling the waste product, which is classified as hazardous waste.
5. Not all the Nordic countries allow incineration of used PVC. Denmark has waste legislation which states that all PVC must first be sorted for material recovery. Because this does not exist in practice for vinyl flooring, used vinyl flooring ends up in landfill. The Nordic Ecolabel finds it hard to accept Nordic Ecolabelled products going to landfill.
6. Nor is PVC permitted as a material in floors, walls and ceilings in Nordic Ecolabelled small houses, apartment blocks or pre-school buildings.
7. Nordic Ecolabelling's decision to ban PVC in flooring is not based on problems with additives. Phthalates and other harmful additives can be replaced and phthalate-free vinyl flooring is already on the market. Nordic Ecolabelling's attitude is rather that PVC is not a sustainable material in flooring, whether or not harmful additives are substituted.
8. The European Commission investigated how Europe should strengthen its long-term competitiveness. The conclusion is that Europe's future lies in developing bio-based products, primarily for reasons of financial and security policy. Europe cannot compete with the Middle East or the USA on the production of oil and oil-based products and should instead focus on bioplastics. The European standardisation organisation CEN has been commissioned to produce standards for products manufactured from biomass. The purpose is to make Europe a leader in the field and encourage the production and use of bio-based products. This work is very broad, covering products from classic bio-based materials such as paper and cardboard to new types of bioplastics. In the light of this, it is likely that the transition we are seeing the start of now, with the move from fossil plastics to plastics of bio-based origin (entirely or in part) will intensify. Our role is to be part of creating this future. Currently there are no PVC floor coverings in which the polymer itself is from a renewable origin.
9. There is a clear risk that the trustworthiness of the Nordic Ecolabel would be undermined if Nordic Ecolabelled vinyl flooring were to be found on the market. This relates both to end customers (consumers and B2B) and our licence holders.
10. Some companies in the Swedish flooring industry have initiated a service that enables loose-laid flooring to be returned at the end of its life. The manufacturer guarantees to take back the flooring sold in order to recycle the materials. Because flooring has a relatively long service life, the effect of these guarantees will not be seen for a few years yet. Nordic Ecolabelling has very little steerability

regarding these types of activities. This is partly due to the time aspect but also to other factors. When flooring is taken up, it must be known that the flooring is covered by the take-back guarantee, the manufacturer must still be in business and the flooring must be actively sent back, i.e. it must not merely be simpler to throw the flooring away as waste.

Appendix 3 contains more facts on PVC and the environment.

Consequences
As a result of Nordic Ecolabelling's no to PVC in flooring:

- No vinyl flooring can be Nordic Ecolabelled.
- Nor can other flooring that contains PVC, e.g. textile flooring with PVC backing or PVC-coated cork flooring be Nordic Ecolabelled.
- On the other hand, this does not prevent cork flooring that is untreated or cork flooring waxed and surface treated with water-based polyurethane lacquer from being Nordic Ecolabelled.
- Nor does it prevent Nordic Ecolabelling for manufacturers of textile flooring that have avoided using PVC as backing and use other materials instead.
- Manufacturers of plastic flooring who produce plastic flooring free from PVC may be able to obtain the Nordic Ecolabel, provided that the other requirements on the renewable/portion of recycled raw materials, energy requirements, chemicals requirements, etc. are met.

It is important to point out that the decision not to accept PVC as flooring material applies under prevailing conditions. Nordic Ecolabelling does not consider it relevant to develop criteria for ecologically sustainable and recycled PVC when we know that the requirements cannot currently be met by any actor on the market. At the next revision, the question will be addressed once more and it is hoped that things will have moved forward and it will then be possible to draw up requirements for PVC which the best manufacturers and recyclers are able to meet.

5.2.2 Solid wood, cork, bamboo and manufactured board

The traceability requirement covers all parts of products that contain solid wood, cork or bamboo. The requirement also covers fibreboard, such as chipboard, MDF and OSB and parallel veneers and cross veneers/plywood. The exception is small details included in the flooring to a maximum of 1% by weight.

The requirement for raw materials from certified areas applies to solid wood, cork or bamboo and wood-based board included in the flooring at 10% or more by weight.

If the wood-based board is Nordic Ecolabelled, the requirements in this section are met. State the manufacturer, licence number and name of the manufactured board.

O4 Origin and traceability of wood and fibre raw materials, cork and bamboo

The requirement applies to both certified and uncertified raw materials.

The licensee must:

- demonstrate traceability for all wood and fibre raw materials. State the name (in Latin and one Nordic language) and geographic origin (country/state and region/province) of the kinds of wood and bamboo used.
- have a written procedure for sustainable wood, cork and bamboo supply.

Wood, cork and bamboo raw materials may not be sourced from:

- protected areas or areas in the process of being awarded protected status
- areas where ownership or usage rights are unclear
- genetically modified trees or plants.

Furthermore, forestry operations must not damage:

- standing natural timber, biodiversity, special ecosystems or important ecological functions
- important social and/or cultural values.

The requirement applies to wood chips, wood shavings, waste wood, untreated demolition wood and recycled fibre from other industrial activities used in manufactured board, but these must only meet the final documentation requirement (written procedure).

The requirement does not cover HPL (High pressure laminate), which is used as a surface finish on laminate flooring.

Nordic Ecolabelling may require further documentation if there is any uncertainty surrounding the origin of the raw material.

☒ Name (in Latin and one Nordic language) and geographic origin (country/state and region/province) of the kinds of wood, cork and bamboo used. Appendix 3a can be used.

☒ The manufacturer of flooring must have a written procedure for sustainable supply of wood, wood fibre, cork and bamboo. The procedure shall include up-to-date lists of all suppliers of wood, wood fibre, cork and bamboo raw material.

Background

It must be documented how it is ensured that no wood is used from areas where forestry is not sustainable, see the criteria laid down. Furthermore, the producer must set out which sorts of wood are used and their geographical origin. If the product comes from forestry that is certified to a forestry standard approved by Nordic Ecolabelling, it is not necessary to document the requirement further. Nordic Ecolabelling considers FSC and PEFC Chain of Custody (CoC) certification as examples of systems that underpin the traceability of fibre raw material.

In Europe there is increased political focus on illegal harvesting. Following a report from WWF on illegal timber reaching the European market, an average of 40% of timber-based products imported from South East Asia (including China) apparently come from illegal felling. As it is not possible to demand 100% certified wood, there is also potential to ensure that all wood used in a Nordic Ecolabelled floor is legal with full traceability to ensure that the wood does not originate from forest environments of high biological and/or social value. Nordic Ecolabelling has good experience of obtaining information on traceability of wood raw materials in the form of information on types of wood and geographical origin. Here there is thereby good steerability.

The new EU Timber Regulation (995/2010/EU) came into force in April 2013 and affects timber felled and wood products manufactured both within and outside the EU. The purpose of the regulation is to tackle the global problem of illegal felling and prevent the inflow and trade of illegally felled wood and wood products in the EU. The Timber Regulation's requirements of businesses do somewhat facilitate fulfilment of the Nordic Ecolabel's requirements with regard to wood raw material origin and traceability. However, it does not completely replace the Nordic Ecolabel's requirements, even though it can help to document the origin of the wood raw material. The Nordic Ecolabel's requirements, stating that wood raw material must not be sourced from natural forests, areas with a high level of biodiversity, unique ecosystems or important ecological functions, nor compromise important social or cultural values, are not covered by the Timber Regulation. The Timber Regulation applies to illegal felling and is consistent with the legislation of the country in question. It therefore fails to provide sufficient guarantees that the wood raw material has been sourced from sustainable forestry operations.

Version 5 of the criteria contained a requirement stating that the wood raw material must not originate from forest environments meriting protection due to their high biological and/or social value. This requirement remains relevant as flooring made using wood raw material from tropical regions continues to be sold on the Nordic market. The requirement applies to all wood raw material, regardless of geographic origin, even if the problem of illegal felling is greater in the tropical regions overall.

The requirement has been reformulated to correspond to Nordic Ecolabelling's formulation of its equivalent requirements in other criteria documents. The requirement has also been extended to cover cork, which was not previously included in the product group. In the product group Floor coverings, HPL may only be found as the outermost layer of a laminate floor. Other types of laminate are also used, such as direct laminate. These materials are exempt from the traceability requirement and also from the certified forestry requirement, because they are made from paper and traceability back to the forest is very difficult to document. The manufactured board that makes up such a large part of the laminate flooring is covered by the requirement, however.

Nordic Ecolabelling will start an evaluation of the forestry requirement in spring 2014. One question which must be examined is whether mass balance could be incorporated in the wording of the requirement and verification/licence processing. The result of this evaluation may affect the final wording of the forestry requirement. The way in which the proposed requirement is worded in the revision document, however, provides a sufficiently good picture of what Nordic Ecolabelling wishes to achieve with the requirements on traceability and origin.

O5 Wood, manufactured board, cork and bamboo from certified forestry

The requirement applies to flooring that comprises a total of at least 10% wood, manufactured board/fibreboard, cork and/or bamboo by weight.

On an annual basis:

- at least 70% of the wood and raw material content and/or
- at least 50% of the bamboo and cork content and/or
- at least 50% of the wood and bamboo raw material content of manufactured board/fibreboard*

shall be derived from areas where forestry operations are certified pursuant to a forestry standard and certification system that meet the criteria stated in Appendix 4 or be certified as organically grown or in transition towards organic production.

**Wood chips, wood shavings, waste wood, untreated demolition wood and recycled fibre from other industrial activities used in manufactured board are not covered by the requirement. Nor does the requirement cover HPL (High pressure laminate) which is used as a surface finish on laminate flooring.*

Nordic Ecolabelling may request the submission of further documentation to enable it to assess whether the requirements of the standard and certification system and certified proportion have been fulfilled. Such documentation may comprise copies of the certification body's final report, a copy of the forestry standard, including the name, address and phone number of the organisation that established the standard, as well as references to individuals representing parties and interest groups who have been involved in the development of the standard.

✉ The amount of timber derived from certified forests must be stated and the basis for calculations must be shown. Appendix 3b can be used.

✉ Copy of relevant forestry certificates that meet the guidelines for forestry certification and organic cultivation described in Appendix 4.

Background

Forestry involves a burden on the environment. To reduce this environmental burden, a requirement is set whereby products based on raw materials from solid wood must contain at least 70% wood, by weight, which is certified under a standard for sustainable forestry. For bamboo and cork the requirement is 50%. Recent figures from the first quarter of 2013 show that the total number of hectares globally certified under FSC or PFC now amounts to 418 million hectares, see table 3. Availability of certified wood is expected to increase in the years ahead, and Nordic Ecolabelling can hereby contribute towards an increase in the proportion of certified wood in flooring. Nordic Ecolabelling approves forestry standards (for example national standards) that meet the requirements of diagram 4 in the criteria document.

Table 3: No. of hectares certified globally. Data from first quarter 2013.

	FSC (ha)	**PEFC (ha)**
Europe	74,150,774	77,464,673
North America	69,612,819	148,932,137
Central and South America	12,052,506	3,191,820
Africa	7,259,901	0
Asia	7,433,420	4,646,460
Oceania	2,464,027	9,914,708
Total	173,973,446	244,149,802

Bamboo grows wild as a "weed" and normally does not require artificial fertiliser. When bamboo is harvested, it is harvested above the root system, preventing soil erosion problems. There is a major difference between whether bamboo is harvested traditionally, by hand, or by machine, with bulldozers. The latter involves a risk of a negative impact on the root system and the ecosystem. There are approximately 1500 wild growing types of bamboo and only 25 of these are normally



Figure 4: Bamboo is a fast-growing grass.

feed for pandas. None of the types of bamboo eaten by pandas are normally used for interiors or construction. Of all the different types of bamboo, Moso bamboo has proved to be the type most suited for flooring and panels.

Due to increased pressure on bamboo today, there is a risk that felling and the use of pesticides and fertilisers may lead to the destruction of functioning ecosystems. According to the International Network for Bamboo and Rattan (Inbar)[8] bamboo is seen as a natural resource and is harvested from unregulated natural forests in south-west China. However, often this is poor forestry practice which may damage the biotopes that depend on bamboo and may also destroy ecosystems in general. Bamboo is also grown in different types of plantations. Moso bamboo, which grows in low-lying areas is almost all grown in plantations. There are problems with illegal felling and with smuggling of bamboo, for example from India to Bangladesh and Burma. Nordic Ecolabelling wishes to ensure that this raw material does not come from areas where there is a threat to biodiversity or social values.

As well as wood and bamboo being able to be certified under a sustainable forestry standard, organically grown raw materials or raw materials originating from growers in transition towards organic production can also be approved. Systems accepted are those which comply with the EU Regulations 2092/91 or 834/2007 or are grown in a corresponding manner in accordance with an equivalent control system, e.g. KRAV, SKAL, IMO, OCIA, etc.

The cork oak forests in the Mediterranean area are a unique ecosystem that has developed over hundreds of years and created rich biodiversity and an industry in organic balance. When the cork oak forests disappear or their care deteriorates, they are replaced by forestry which is not as well adapted to the sensitive nature of the Mediterranean. The risks of fire also increase when the forest land can no longer be grazed. In Portugal, the world's largest exporter of cork, many cork oak areas are family-owned and run on a small scale. It is common for the relatively small forest owners to group together to run their forests in line with the FSC standard. FSC has certified Mediterranean cork since 2005. In 2012, 72,000 hectares of the cork stock in the Mediterranean area and North Africa was FSC certified and a further 1.5 million hectares in Spain was PEFC certified.

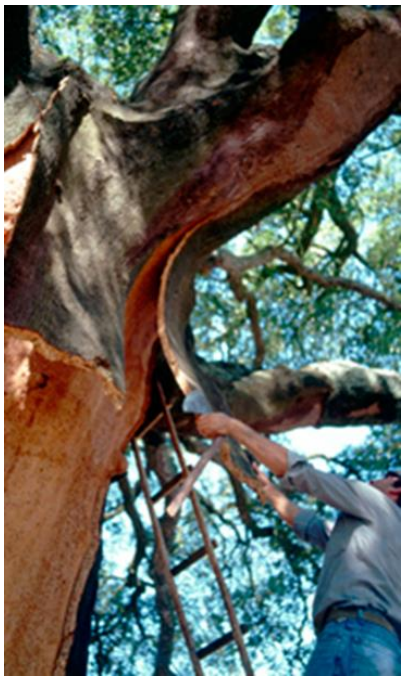

Figure 5: Cork from the cork oak is harvested.

The requirement has been raised from 30% to 70% of the wood content on an annual basis. The reason is that availability has increased over the last five years and Nordic Ecolabelling considers that it is possible to purchase this proportion of certified wood. Nordic Ecolabelling is aware that this is a major increase in the requirement and particularly welcomes comments on this during the consultation.

[8] The International Network for Bamboo and Rattan (INBAR) is an intergovernmental organisation dedicated to improving the livelihoods of the poor producers and users of bamboo and rattan, within the context of a sustainable natural environment.

At the same time the requirement has been extended to also cover cork and bamboo and the requirement here is set as 50% certified raw material. The use of bamboo has increased and is continuing to increase, and there are now forestry standards for sustainable growing of bamboo and cork oak in line with which certification can be obtained. For manufactured board, the requirement has been raised from 30% to 70%.

O6 Use of biocides in felling/harvesting

After felling, the timber or bamboo must not have been treated with pesticides classified as type IA and type IB by WHO.

The requirement refers to treatment of logs after felling.

WHO's website http://www.who.int/ipcs/publications/pesticides_hazard_2009.pdf contains guidelines and a list of pesticides and their classification. Any of the Nordic Ecolabelling secretariats can also be contacted.

✉ Account from the wood and bamboo supplier of the pesticides used and the declaration in line with appendix 3A for each individual product.

Background

Requirements will also be set stating that the wood (logs after felling) must not be treated with pesticides classified by WHO as type IA and type 1B. These have a negative impact on the environment. Pests can often be tackled in different ways, for example by keeping the wood covered and dry. See WHO's most recent list of recommended pesticides. The requirement is new for this product group and is also used in Nordic Ecolabelling's criteria for Furniture and fitments and for Panels for the building, decorating and furniture industry.

5.2.3 Textile fibres and polymers

The requirements in this section cover textile fibres and polymers contained in more than 1% of the flooring by weight. In general if the textile fibre is a raw material for textiles labelled with the Nordic Ecolabel or the EU Ecolabel, all the fibre requirements are met as the requirements are harmonised between the labelling systems. In this case, state the producer, licence number of the textile and the name of the fibre.

Vegetable fibres

O7 Flax, bamboo and other bast fibres

When growing bamboo, flax and other bast fibres (hemp, jute, coconut, etc.) the only pesticides which may be used are those permitted under the European Pesticides Regulation (1107/2009/EC).

The production of flax, bamboo and other bast fibres with water retting is only permitted if the effluent from the process is treated such that the chemical oxygen demand (COD) or the total amount of organically bound carbon (TOC) is reduced to at least:

- 75% for hemp
- 95% for flax and other bast fibres

Chemical oxygen demand (COD) must be analysed under ISO 6060 or another comparable method. The requirements for analysis laboratory and test methods for COD/TOC are stated in Appendix 1.

Analysis of PCOD or BOD can also be used to verify whether a correlation with COD can be demonstrated.

Bamboo must additionally meet the criteria for wood raw material (O4-O6)

✉ Declaration that only approved pesticides are used, Appendix 5 can be used.

✉ Analysis report from the producer of the bast fibre showing that the requirement has been met where water retting is used.

Background

The requirements for textile fibres and polymers used in flooring are taken from the corresponding criteria for Nordic Ecolabelling of Textiles, hides/skins and leather, and the EU Ecolabel's criteria for textiles. This means that all the fibre requirements are met for textile fibres used in textiles labelled with the Nordic Ecolabel or the EU Ecolabel. Although there may be minor differences in the limit values between the Nordic Ecolabel's criteria for textiles and those of the EU Ecolabel, Nordic Ecolabelling judges that the requirement levels are sufficiently high for both labels to be approved.

Water retting is prohibited unless the effluent is treated to reduce the content of organic material. Retting is necessary in order to separate the fibres in the stem from the shell/bark. This is done by exposing the stem or other bast fibre to moisture and heat. Water retting is the most effective method but there are other methods such as placing the fibres in a tank and adding enzymes. Effluent emissions from water retting with a high content of organic material to the aquatic environment can result in a lack of oxygen as they break down, and therefore damage the aquatic animal and plant life.

The requirement has been raised to now require a reduction of at least 95%, with the requirement only remaining unchanged at a 75% reduction for hemp fibre. The requirement has also been supplemented by only permitting the use of approved pesticides.

It has been chosen not to require certified organic raw materials for these vegetable fibres. There are two main reasons for this. The first is that cultivating these fibres has only a minor impact on the environment. They are rarely attacked by pests and there is little need for pesticides. At the same time there is no great need for fertiliser. Another reason is that largely there is no organic production of these fibres. Nordic Ecolabelling has been in contact with Helvetas (a Swiss NGO which works with organic fibre). According to them there is some organically cultivated flax, particularly from the Baltic, but it is apparently not certified as organic according to the standards required by Nordic Ecolabelling.

Animal fibres

O8 Harmful substances in unprocessed wool and other keratin fibres

The total content of the following substances must not exceed 0.5 ppm: γ-hexachlorocyclohexane (lindane), α-hexachlorocyclohexane, β-hexachlorocyclohexane, δ-hexachlorocyclohexane, aldrin, dieldrin, endrin, p,p'- DDT and p,p'-DDD.

The total content of the following substances must not exceed 0.5 ppm: cypermethrin, deltamethrin, fenvalerate, cyhalothrin and flumethrin.

The total content of the following substances must not exceed 2 ppm: diazinon, malathion, propetamphos, chlorfenvinphos, dichlorfenthion, chlorpyriphos, fenchlorphos.

The total content of the following substances must not exceed 2 ppm: diflubenzuron, triflumuron and dicyclanil.

The analysis shall be carried out on raw wool before wet treatment for each batch of wool that is used in the production of the Nordic Ecolabelled flooring.

The tests shall be in accordance with IWTO Draft Test Method 59 or the equivalent.

The requirement does not apply if the applicant can document which farmers have produced at least 75% of the weight of the wool or keratin fibres, and that the farmers

can confirm that the substances mentioned in the criteria are not used in the relevant areas or on animals.

The requirement does not apply if the wool is organically certified.

Organic means wool produced in accordance with Council Regulation (EEC) No. 2092/91 on the organic production of agricultural products, or produced in the same way and under equivalent control measures. Examples are: KRAV, SKAL, IFOAM, IMO, KBA, OCIA, TDA, DEMETER.

✉ The tests shall be in accordance with IWTO Draft Test Method 59 or a declaration from the fibre producing farmer stating that the substances listed have not been used. Overview of the percentage of wool that this applies to or a valid certificate which shows that the wool is organic in accordance with European Council Regulation (2092/91/EEC) on the organic production of agricultural products or equivalent systems.

Background

Of all the animal fibres, wool from sheep is by far the most dominant in the market. Australia is the largest producer, with 1/5 of the market, while other large wool producers include China, New Zealand, Iran, Argentina and the UK. Sheep can be exposed to the use of chemicals that are harmful to health and the environment in order to remove parasites from the wool. To avoid this, requirements are set on the maximum permitted limits for a number of named pesticides.

The levels that are permitted in the requirement are so low that if these substances are used they will be over the limit, and in practice these substances are therefore prohibited for use in wool that shall be approved for a Nordic Ecolabel. The requirement can also be documented through traceability back to the farmers for at least 75% of the weight of the wool or keratin fibres, and a confirmation from these that the substances are not used.

Whether a requirement shall be set that the wool must be organically produced has also been evaluated. It is possible to obtain organically produced wool, but it is mainly used in the clothing industry, where skin contact is of greater importance. The total wool production is estimated to be approximately 2.1 million tonnes[9], and Australia is the largest producer with a market share of approximately 25%[10]. In Australia approximately 1% of wool production is organic[11]. Nordic Ecolabelling has not been able to obtain a more accurate figure regarding how much of the world's total wool production is organic, but based on these figures, it can be said that access to organic wool is limited. Nordic Ecolabelling has therefore chosen not to set a requirement that the wool must be organic in Nordic Ecolabelled carpets in this version of the criteria, since market availability is small. The focus is therefore on setting relevant environmental and health criteria for the treatment of wool.

O9 Emissions from wool washing plants

COD emissions in scouring effluent must not exceed 20 g/kg unprocessed wool, expressed as an annual average, irrespective of whether the effluent is treated on-site/internally or off-site/externally.

When treated off-site, the COD discharge is calculated by multiplying the COD discharge from the scouring with the treatment plant's average cleaning effect.

[9] http://www.naturalfibres2009.org/en/fibres/wool.html
[10] http://en.wikipedia.org/wiki/Wool (accessed 15 Sept 2011)
[11] http://www.treehugger.com/files/2007/09/organic_wool_th.php (accessed 15 Sept 2011)

Measuring of PCOD, TOC (total organic carbon) or BOD-7 (biochemical oxygen demand) can also be used if a correlation to COD is shown.

In addition, where the effluent is treated on-site:

- the pH value of the water that is discharged into the recipient watercourse must be 6-9 (unless the pH value in the recipient watercourse lies outside this range).
- the temperature of the water discharged into the recipient watercourse must be less than 40°C (unless the temperature of the recipient watercourse is higher).

Chemical oxygen demand (COD) must be analysed under ISO 6060 or another comparable method. The requirements for analysis laboratory and test methods are stated in Appendix 1.

☒ Description of how the effluent from wool washing plants is treated and how COD emissions are measured and monitored.

☒ Test report from the wool washing plant showing that the limit value for chemical oxygen demand (COD) is fulfilled.

☒ Reports from the wool washing plant showing measurements of pH and temperature in the effluent.

Background

The requirement has been amended and tightened, compared with version 5 of the criteria for floor coverings. Wool contains a great deal of lanolin, a fat that has to be washed off. Effluent from wool washing plants can contain large quantities of oxygen demanding substances. If these reach the recipient watercourse, it can cause a lack of oxygen, causing the loss of fish and other aquatic species. This may not be a global problem, but locally and regionally there are examples of extremely serious consequences. Nordic Ecolabelling therefore sets requirements concerning the proportion of oxygen demanding substances in effluent from wool washing plants. COD (Chemical Oxygen Demand) is used to measure the total quantity of oxygen demanding substances during the complete chemical degradation of organic substances in water. The limit value of 20 g/kg untreated wool must not be exceeded. Several wool washing plants in Europe have closed over the past few years, and Nordic Ecolabelling is unsure about the proposed requirement level. During the consultation period, we would therefore like to receive feedback on the formulation of the requirement and the proposed limit value.

The international standard for determining chemical oxygen demand, ISO 6060, is to be used. Appendix 1 of the criteria document lists sampling methods and sampling frequencies. The treatment may be conducted internally, i.e. at the wool washing plant, before the treated effluent is discharged into the recipient watercourse. The treatment may also take place at an external facility, i.e. not on the site of the wool washing plant. In this case, the treatment level at the external treatment plant is used to calculate the final load on the recipient watercourse.

In addition to emissions of oxygen demanding substances, pH and temperature in the effluent must also be measured. The requirement is verified via reports on the measuring/monitoring of pH and temperature.

Synthetic fibres and synthetic polymer

The requirements apply to fibres and/or polymers that occur in the floor covering to a level of 5% or more by weight, and include:

- virgin synthetic fibres
- virgin synthetic polymers, for example in plastic flooring or as a backing material

Recycled fibres/polymers made from recovered raw material are exempted from these requirements.

If it were to become relevant to license synthetic fibres or polymers other than those contained in this section, Nordic Ecolabelling reserves the right to develop the criteria to include requirements equivalent to those in the Nordic Ecolabelling of Textiles, hides/skins and leather.

O10 Polyamide (nylon)

The annual average emissions to air of nitrous oxide (N_2O) from the manufacture of monomers must not exceed 10 g/kg manufactured polyamide 6 or 50 g/kg manufactured polyamide 6.6.

The requirements for analysis laboratory and test methods are stated in Appendix 1.

✉ Detailed information and/or test report from the manufacturer of the polyamide fibre, showing that the requirement is fulfilled on an annual basis by the manufacturing unit.

O11 Polyurethane

When manufacturing polyurethanes, isocyanate compounds must only be used in closed processes where recommended/prescribed safety equipment is worn.

Halogenated flame retardants must not be used.

✉ Declaration that the requirement is fulfilled. Appendix 5 can be used.

Background

Synthetic fibres currently account for around 60% of all textile fibre use in the world. Four fibre types dominate: polyester, nylon, acrylic and polyolefins[12]. Nordic Ecolabelling sets requirements concerning polyamide, which is most commonly used in the manufacture of textile flooring. Requirements are also set for polyurethane, which can be used as a polymer in floor coverings.

Polyamide:
The two commercial polyamide products are polyamide 6.6 and polyamide 6. Polyamide 6.6 is created through the polymerisation of adipic acid and hexamethy-lenediamine, while polyamide 6 (Nylon 6) is created through the polymerisation of melted ε-caprolactam.

The requirement is unchanged from version 5 of the criteria, since it remains relevant.

Polyurethane
Polyurethane is a material with extensive applications. The most common of these include insulation, wadding and paints and adhesives/binders. Polyurethane is formed through polyaddition between isocyanates and a di- or polyfunctional alcohol (polyol). Isocyanates are suspected of being carcinogenic. Toluene-based isocyanates are also extremely toxic if inhaled, as well as being suspected allergens and harmful to aquatic organisms.

Pre-hardened urethane plastic is considered not to be harmful, but due to the risk of unreacted isocyanates, it is important to protect employees' health through the correct personal protective equipment, proper ventilation and good general safety procedures.

[12] http://oecotextiles.wordpress.com/2010/07/07/man-made-synthetic-fibers.

Polyurethane causes considerable formation of toxic gases in a fire, which is why some form of flame retardant is commonly added, either a phosphorus-based or halogenated substance. Pigment is often added to avoid a polyurethane coating yellowing on exposure to sunlight.

The requirement concerning polyurethane is a new addition in this revision. Relevant parts have been taken from the requirement concerning polyurethane foam (O16).

5.2.4 Requirement concerning all textile fibres

The requirement covers chemicals and chemical products that are used in the treatment of all types of fibres. Other chemicals/chemical products used at the plant, for example for cleaning production equipment, are not covered.

O12 Chemical additives in fibre production

None of the substances below may occur in any of the preparations/products/formulations used:

- alkylphenol ethoxylates (APEO)
- linear alkylbenzene sulphonates (LAS)
- dihydrogenated tallow dimethyl ammonium chloride (DHTDMAC)
- distearyl dimethyl ammonium chloride (DSDMAC)
- ditallow dimethyl ammonium chloride (DTDMAC)
- ethylenediaminetetraacetic acid (EDTA)
- diethylenetriamine pentaacetate (DTPA)

✉ Declaration from the fibre manufacturer that the requirement is fulfilled. Appendix 5 can be used.

Background

The above chemicals have properties that are harmful to health and the environment. The requirement is unchanged compared with version 5 of the criteria and can also be found in the EU Ecolabel's criteria for textiles.

5.2.5 Foam material

Foam material is used as a carrier and backing for many different types of floor covering, both on a roll and as tiles. The requirements below apply to foam material that makes up over 1% by weight of the floor covering, irrespective of the flooring material/type.

The requirement does not apply to foam material in packaging and protective material used during storage and transport, and that is not part of the floor covering.

O13 Emissions to water from production of foam plastic/foam rubber

Emissions of oxygen demanding substances to water from the production of foam plastic/foam rubber must be reduced by 90% measured as COD or TOC. The reduction may be achieved through on-site or off-site treatment. In the case of off-site treatment, the average treatment level of the effluent treatment plant may be used.

Chemical oxygen demand (COD) must be analysed under ISO 6060. The requirements for analysis laboratory and test methods are stated in Appendix 1.

✉ Description of how the effluent from foam plastic production is treated and how COD emissions are measured and monitored.

✉ Test report showing that the limit value for chemical oxygen demand (COD) is fulfilled.

Background

Foam rubber may be used as the backing on textile carpets. There are a number of different types of backing material for carpets. Since there are environmental problems associated with the production of foam rubber in the form of latex and polyurethane, it is relevant to set requirements concerning these. Nordic Ecolabelling requires emissions of oxygen demanding substances from the production of latex to be low. The requirement remains unchanged.

O14 Vulcanised foam

Vulcanised foam may not be used on Nordic Ecolabelled floor coverings.

✉ Declaration from the applicant that the requirement is fulfilled. Appendix 6 can be used.

Background

Vulcanising is the heat treatment of latex using sulphur, which changes the latex sulphur compound's plastic properties, giving the rubber its familiar elasticity. This process includes the use of vulcanisation accelerators. Vulcanisation provides improved resistance to many chemicals, temperature variations and effects caused by exposure to air. Vulcanisation causes chemical emissions to air, and is therefore not permitted in Nordic Ecolabelled floor coverings[13]. The requirement is new compared with version 5 of the criteria for floor coverings.

O15 Supplementary requirement for synthetic latex (SBR) and natural latex

The content of 1,3-butadiene must be less than 1 mg/kg latex.

The content of the PAHs below must not exceed a total of 0.2 mg/kg latex.

- Benzo[A]Pyrene, CAS no.: 50-32-8
- Benzo[E]Pyrene, CAS no.: 192-97-2
- Benzo[A]Anthracene, CAS no.: 56-55-3
- Dibenzo[A,H]Anthracene, CAS no.: 53-70-3
- Benzo[B]Fluoranthene, CAS no.: 205-99-2
- Benzo[J]Fluoranthene, CAS no.: 205-82-3
- Benzo[K]Fluoranthene, CAS no.: 207-08-9
- Chrysene, CAS no.: 218-01-9

The concentration of N-nitrosamines must not exceed 0.0005 mg/m^3 measured in a climate chamber.

The impurity limit of 1000 ppm does not apply in this requirement.

The requirements for analysis laboratory and test methods are stated in Appendix 1.

✉ Results of an analysis/test of the content in latex of 1,3-butadiene and the PAHs listed in the requirement, plus N-nitrosamines.

[13] UMIP miljødata for tekstiler – et overblik, from MST.dk on 13/08/2012

Background

Flooring may contain latex in the middle layer and/or backing. Various PAHs are carcinogenic and genotoxic and PAHs are considered the largest single group of carcinogenic chemical substances. PAHs also occur in the pigment Carbon Black and mineral oils.

A German risk assessment of carcinogenic PAHs (polycyclic aromatic hydrocarbons) in consumer products has resulted in a proposal to restrict specific PAHs. The risk assessment was conducted by the German health risk assessment institute, BfR, and is part of a dossier drawn up by various German agencies for the EU with a view to tightening the legislation concerning PAHs, based on their well-known harmful effects on health. The dossier contains a recommendation to restrict the content of carcinogenic PAHs in consumer products to a maximum of 0.2 mg/kg and covers the following substances:

- Benzo[A]Pyrene, CAS no.: 50-32-8
- Benzo[E]Pyrene, CAS no.: 192-97-2
- Benzo[A]Anthracene, CAS no.: 56-55-3
- Dibenzo[A,H]Anthracene, CAS no.: 53-70-3
- Benzo[B]Fluoranthene, CAS no.: 205-99-2
- Benzo[J]Fluoranthene, CAS no.: 205-82-3
- Benzo[K]Fluoranthene, CAS no.: 207-08-9
- Chrysene, CAS no.: 218-01-9

For more detailed information, see BfR's risk assessment: Carcinogenic polycyclic aromatic hydrocarbons (PAHs) in consumer products to be regulated by the EU – risk assessment by BfR.

There are alternative oils with low levels of PAHs that can be used and that are used in consumer products. Both the Swedish Chemicals Agency (2003) and BAuA (2010) have drawn up lists of these alternatives to the traditional softening and process oils. The oils may also undergo supplementary treatment to remove PAHs and it is possible to substitute natural rubber or synthetic rubber with thermoplastic elastomer (TPE) (BAuA, 2010). Thermoplastic elastomer contains a hard thermoplastic component and a soft elastic component that are bonded to each other to form the elastic polymer.

As with the previous version (5) of the criteria for floor coverings, there is a requirement that the content of 1,3 -butadiene must be low. 1,3-butadiene is a volatile hydrocarbon that is classified as carcinogenic and serves as a monomer in the manufacture of latex rubber.

O16 Supplementary requirement for polyurethane foam

Tin in its organic form (tin bonded to a carbon atom) is not permitted.

CFC, HCFC, HFC (hydrofluorocarbons) or methylene chloride must not be used as a foaming agent.

Isocyanate compounds may only be used in closed processes were recommended/prescribed safety equipment is worn.

Production must not involve N,N-dimethylacetamide (DMAc).

✉ Declaration from the applicant that the requirement is fulfilled. Appendix 6 can be used.

Background

Polyurethane must not be foamed using CFC, HCFC, HFC or methylene chloride. These substances are stable organic substances that are strong greenhouse gases. CFC and HFC break down the ozone layer and methylene chloride is suspected of being carcinogenic. The requirement concerning polyurethane foam appears in version 5 of the criteria.

DMAc is inscribed on the REACH Candidate List and isocyanate compounds are suspected carcinogens and must therefore be handled correctly to avoid health and safety risks in the workplace.

The wording of the requirement has been harmonised with the corresponding requirements in the product group Furniture and fitments.

5.3 Chemical requirements

What do the chemical requirements cover?

The chemical requirements cover all chemicals and chemical products added to the floor covering or used in the manufacture of the floor covering, including surface treatments. Here, manufacture is defined as all manufacturing/treatment conducted by the manufacturer, but also by its suppliers of raw materials or constituent products. All the chemical requirements that are relevant for each flooring type must be fulfilled.

The requirements relate to areas such as adhesives, paints, stains, lacquers, impregnation, sealants, pigments, bleaching chemicals, binders, and so on. The requirements also apply to chemicals in the constituent parts of the flooring, such as manufactured board.

There are also specific chemical requirements for certain materials, in addition to the general chemical requirements below. These specific supplementary requirements appear in the section for the flooring material in question. The following sections have specific supplementary requirements concerning chemicals:

- 5.2.4 Requirement concerning all textile fibres
- 5.3.2 Paints, colourants and pigments in textile flooring
- 5.3.3 Chemical requirements applicable only to surface treatment (applies to surface treatment of all flooring types, relevant requirements fulfilled)

What counts as a constituent substance?

This definition applies generally for all the chemical requirements:

The term constituent substance refers to all substances in the product, including additives in the ingredients (such as preservatives and stabilisers) but does not include impurities from primary production. Impurity refers to residues from primary production which may be found in the finished product at concentrations below 100 ppm (0.01% by weight, 100 mg/kg), but not substances that have been added to a raw material or the product actively and for a particular purpose, irrespective of quantity.

Impurities of over 1% concentration in the primary product are, however, regarded as constituent substances. Substances known to be degradation products of the constituent substances are also themselves considered to be constituent substances.

For two-component products it is the added ingredients in the separate components that shall comply with the requirement. Alternatively, if it can be documented that protective equipment was worn when the hardener was mixed with the paint/varnish and the finished two-component product was applied in a closed system, the requirement may apply to the hardened product.

5.3.1 General chemical requirements

O17 Classification of chemical products

Chemical products used to manufacture Nordic Ecolabelled floor coverings must not be classified/labelled pursuant to the table below. The product must be classified in line with current legislation (CLP Regulation (EC) No 1272/2008 or the EU's Dangerous Preparations Directive 1999/45/EC as amended in 2008 or later).

Note that classification under the Dangerous Preparations Directive may only be used until 31 May 2015.

Chemical products for surface treatment are exempted from the requirement concerning the classification "Toxic to aquatic organisms/Dangerous to the environment" since these are regulated in a separate requirement, O30.

Adhesive products that contain isocyanates and/or formaldehyde are exempted from the requirement concerning the classification R40 (category 3)/H351 (Carc 2).

Classification under CLP Regulation 1272/2008		**Classification under Dangerous Preparations Directive 1999/45/EC 2008**
Hazard class and category	**Hazard phrases**	**Hazard class and risk phrases**
Toxic to aquatic organisms Category acute 1 Chronic 1-2	H400, H410, H411, H412	N with R50, R50/53, R51/53, R52/53
Hazardous to the ozone layer	H420	R59
Acute toxicity Category 1-3	H300, H310, H330, H301, H311, H331,	T+ with R26, R27, R28, R39 T with R23, R24, R25, R39, R48
Specific target organ toxicity (STOT) with single and repeated exposure STOT SE category 1-2 STOT RE category 1-2	H370, H371, H372, H373	T+ with R39 T with R39, R48 Xn with R68
Carcinogenic Carc 1A/1B/2	H350, H350i or H351	T with R45 and/or R49 (Carc 1 or Carc 2) or Xn with R40 (Carc 3)
Mutagenic Mut 1A/B/2	H340, H341	T with R46 (Mut 1 or Mut 2), Xn with R68 (Mut 3)
Toxic for reproduction Repr 1A/1B/2	H360, H361, H362	T with R60, R61, R64, R33 (Repr 1 or Repr 2), Xn with R62, R63, R64, R33 (Repr 3)
Skin or respiratory sensitisation	Category 1, 1a or 1b with H334, Category 1, 1a or 1b with H317 or labelled as follows: "Contains (name of sensitising substance). May cause an allergic reaction."*	Xn with R42, Xi with R43

** Exemption from this risk phrase if it is due to the content of in-can preservatives, see also O19 concerning preservatives.*

✉ Declaration from the manufacturer of the chemical product, in accordance with Appendix 7. In addition, safety data sheets pursuant to prevailing European legislation for all chemical products.

Background

Nordic Ecolabelling strives to ensure that the health and environmental effects of the chemical products are as small as possible. Chemical products that are carcinogenic, mutagenic, reprotoxic, very toxic, toxic or harmful to the environment must not be used in the manufacture of Nordic Ecolabelled floor coverings.

The term chemical products include adhesives, paints, pigments, surface treatments and impregnation agents used in the manufacture of the flooring. Here, manufacture is defined as all manufacturing/treatment conducted by the manufacturer, or that the manufacturer has ordered from a supplier.

The requirements have been amended such that the requirement concerning total environmentally harmful substances and the requirement concerning additives have been made separate requirements. The following risk phrases are no longer included in the requirement since they are judged to be less relevant for floor coverings: R52 Harmful to aquatic organisms, R53 May cause long-term adverse effects in the aquatic environment, R54 Toxic to flora, R55 Toxic to animals, R56 Toxic to soil organisms, R57 Toxic to bees. The requirement has also been tightened in comparison with the previous requirement R15 so that it is also not possible to use chemical products with R39 or R48, i.e. toxic or very toxic. The requirement has also been updated to include the classifications used in the CLP Regulation.

It should be pointed out that the requirement only addresses the classification of chemical products and not the individual substances that make up the product. Requirements concerning individual substances and classification of substances can be found in the following chemical requirements. Fulfilment of the requirement is to be documented by submitting data sheets for the individual chemical products.

Deleted requirements

Version 5 of the criteria included a requirement (R15 b) that regulated the content of environmentally harmful substances in chemical products added to floor coverings. However, the requirement had little practical meaning primarily for two reasons:

- Chemical products that are classified as environmentally harmful are regulated in an earlier requirement (R15 a)
- If harmful substances are used in flooring manufacture (and are not governed by other requirements), they are regulated in the requirement concerning environmental substances in surface treatment systems, R16. The new criteria also prohibit more environmentally harmful substances in the list of undesirable substances.

Nordic Ecolabelling has therefore decided to remove the requirement.

Under the old version of the criteria, R15 also meant that raw materials classified as allergenic were not permitted in the finished flooring at a level of more than 1% by weight. This requirement proved inappropriately drafted and allergenic substances are instead limited through:

- Requirement O17, which has been expanded to include the classifications Skin and respiratory sensitisation.
- The requirement concerning formaldehyde, VOC and other individual substances that are classified as allergenic (including colourants).

O18 CMR substances

The chemical products used in the manufacture of Nordic Ecolabelled floor coverings must not contain chemical substances that are or may degrade into substances that are classified as carcinogenic (Carc), mutagenic (Mut) or toxic for reproduction (Rep), according to CLP Regulation (No) 1272/2008 or the EU's Dangerous Substances Directive 67/548/EEC as amended, see table below. Note that classification under the Dangerous Preparations Directive may only be used until 31 May 2015.

Classification under CLP Regulation 1272/2008		**Classification under Dangerous Preparations Directive 1999/45/EC 2008**
Hazard class and category	**Hazard phrases**	**Hazard class and risk phrases**
Carcinogenic Category Carc 1A/1B/2	H350, H350i, H351	T with R45 or R49 or Xn with R40
Mutagenic Mut 1A/B/2	H340, H341	T with R46 or Xn with R68
Toxic for reproduction Repr 1A/1B/2	H360, H361, H362	T with R60 or R61. Or Xn with R62, R63 and/or R64

Adhesive products that contain isocyanates and/or formaldehyde with the classification R40 (category 3)/H351 (Carc 2) are exempted from the requirement.

✉ Declaration from the manufacturer of the chemical product, in accordance with Appendix 8. In addition, safety data sheets pursuant to prevailing European legislation for all chemical products.

Background

In addition to O17, which is a requirement concerning classification of the actual product, O18 requires that chemical products must not contain substances that are carcinogenic, mutagenic or toxic for reproduction (CMR substances). As such, the CMR requirement partially overlaps with the previous requirement concerning chemical product classification.

Substances that may cause cancer, change genetic material or interfere with reproduction (known as CMR substances in categories 1A and 1B) are prioritised substances within the EU's chemical legislation due to their inherently dangerous properties. It is therefore of central importance to considerably reduce, and in the long term move away entirely from, the use of CMR substances. It is not permitted to use CMR substances in chemical products that are accessible to consumers, but they do occur in other goods. The most common applications at this time are in fuels, soft plastics, rubber tyres, paints and pressure treated timber.

It is necessary to have an exemption for adhesive products with constituent substances classified as R40 (category 3)/H351 (Carc 2), i.e. isocyanates and/or formaldehyde, since these are essential ingredients in adhesives. The requirement is otherwise harmonised with equivalent requirements in the criteria for the Nordic Ecolabelling of Chemical building products.

Safety data sheets pursuant to prevailing European legislation are required as verification for the relevant chemical products. When these criteria were decided, the safety data sheets were those specified in Annex II to REACH (Regulation 1907/2006/EC).

O19 Isothiazolinones

The following preservatives are excluded from use in chemical products:

- Isothiazolinones at more than 500 ppm
- A blend (3:1) of CMIT/MIT (Chloromethylisothiazolinone CAS no. 26172–55-4 and Methylisothiazolinone CAS no. 2682-20-4) at more than 15 ppm
- Methylisothiazolinone at more than 200 ppm

✉ Calculation clearly showing that the requirement concerning isothiazolinones is fulfilled.

Background

Isothiazolinones are used as a preservative in many products, where they act as fungicides, biocides and algal growth inhibitors. They are, however, toxic to aquatic organisms and they have varying degrees of sensitising effect. It is very difficult to entirely avoid isothiazolinones without replacing them with some other harmful substance. This is why their use is instead restricted through the above requirement. The requirement is new.

O20 Other substances excluded from use

The following substances are not permitted in Nordic Ecolabelled floor coverings or in chemicals and chemical products used in the manufacture of Nordic Ecolabelled floor coverings:

- Substances on the Candidate List*.
- Persistent, bioaccumulative and toxic (PBT) organic substances**.
- Very persistent and very bioaccumulative (vPvB) organic substances**.
- 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. See following link: http://ec.europa.eu/environment/chemicals/endocrine/pdf/final_report_2007.pdf (Annex L, page 238 onwards)
- APEO – alkylphenol ethoxylates and other alkylphenol derivatives (substances that release alkylphenols on degradation).
- Halogenated organic substances***
- Phthalates
- Aziridine and polyaziridines
- Pigments and additives based on lead, tin, cadmium, chromium VI and mercury, or compounds of these. There is an exemption for chromium for dyeing textile fibres, see O24.
- Volatile organic compounds at more than 1% by weight

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

*** PBT and vPvB substances are defined in Annex XIII of REACH (Regulation (EC) No 1907/2006). Substances that meet, or substances that form substances that meet, the PBT or vPvB criteria are listed at http://esis.jrc.ec.europa.eu/index.php?PGM=pbt. Substances that are "deferred" or substances "under evaluation" are not considered to have PBT or vPvB properties.*

**** Halogenated organic paint pigments that meet the EU's requirements concerning colourants in food packaging under point 2.5 of Resolution AP (89) are exempted.*

✉ Declaration from the manufacturer of the chemical product, in accordance with Appendix 8. In addition, safety data sheets pursuant to prevailing European legislation for all chemical products.

Background

The requirement covers all chemical products used at the factory/place of manufacture, including surface treatment. The requirement applies to products such as adhesives, lacquers, stains, primers, caulks, oils, soaps, jointing compounds, sealants, paint products, binders, pigments, bleaching chemicals, preservatives, impregnation and similar.

The requirement is a new addition to this version of the floor covering criteria, but encompasses some of the stipulations concerning additives that in previous versions were to be found in requirement R15. The new requirement has been harmonised with the requirements for furniture and panels with a few adaptations. Appendix 4 of this background report describes the environmental aspects of the substances that are prohibited in the requirement and also sets out the relevance of the substances to the floor covering.

In 2012, the Swedish Chemicals Agency conducted an oversight project that involved inspecting 21 flooring companies[14]. The floor coverings were analysed for ten different plasticisers. A total of 44 flooring samples were analysed, 15 of which were textile flooring and 29 were floorings made of PVC/other plastic/rubber. The phthalate DINP was found in 14 of the floor coverings, DIDP was found in ten, and the reprotoxic phthalate DEHP was found in four. Only one of these four floorings was manufactured in the EU. The plasticiser DINCH (not a phthalate) was found in two flooring samples. Chloroparaffins, which are a halogenated organic compound, were found in one sample. The impregnation chemicals PFOS and PFOA were found in a total of six flooring samples. This report clearly shows the lack of knowledge surrounding what the products contain, and the requirement concerning the duty to declare SVHC substances, which was introduced alongside the European chemicals regulation REACH in 2007. All the substances that the Swedish Chemicals Agency found in its flooring inspection are excluded from use in Nordic Ecolabelled floor coverings. For the sake of clarity, it should be stated that none of the floor coverings investigated carry the Nordic Ecolabel.

O21 VOC in adhesives

Adhesives are permitted to contain no more than 3% by weight volatile organic compounds (VOC).

Volatile organic compounds (VOC) are defined here as any organic compound having an initial boiling point less than or equal to 250°C measured at a standard pressure of 101.3 kPa.

✉ Declaration from the manufacturer of the chemical product, in accordance with Appendix 8. In addition, safety data sheets pursuant to prevailing European legislation for all chemical products.

[14] Material i inomhusmilön-golv, inspection report 08/2012, Swedish Chemicals Agency.

Background

Floor coverings use adhesives for various purposes, including the adhesives in manufactured board and wood laminates, latex adhesive in carpets or other adhesives to keep the product together. There are thus also various types of adhesive in use. Four types of adhesive are used for lamination. Two of these are based on formaldehyde (urea-formaldehyde resins and melamine-urea-formaldehyde resins), one is based on polyvinyl acetate (PVAc adhesive) and one is based on isocyanates (EPI adhesive). Many of these products contain substances that are undesirable in terms of health and the environment.

Water-based dispersion adhesive is used for gluing together wood components. These are largely products that do not require classification. In cases where a two-component adhesive is used, one component may be classified as allergenic.

The requirement is a new addition in this version of the criteria, and has been harmonised with corresponding requirements in the criteria for the Nordic Ecolabelling of Furniture and fitments.

O22 Antibacterial substances and biocides

The following substances must not be added to fibres or to the finished floor covering for the purpose of achieving a disinfectant or antibacterial treatment or a disinfectant or antibacterial surface:

- Antibacterial substances (including silver ions, nanosilver and nanocopper) and/or
- Biocides in the form of pure active substances or as biocidal products.

✉ Declaration from the flooring manufacturer showing that the requirement is fulfilled. Appendix 10 can be used.

Background

Biocidal products and antibacterial products are not desirable in ecolabelled products, particularly not in products used in the home that will thus have an impact on the indoor climate. Nordic Ecolabelling has therefore introduced a requirement prohibiting the addition of biocides and antibacterial substances. There are an increasing number of products to which these substances are being added, for example as a surface treatment for floor coverings. One of the substances being added is nanosilver. Particular attention is being paid to nanometals such as nanosilver and nanocopper, since they occur in many products ranging from socks to refrigerators. These nanomaterials are added to achieve an antibacterial effect. Substances such as nanosilver are classified as biocides by the US Environmental Protection Agency (EPA). There has been a particular concern that emissions of nanosilver into effluent and other dispersal could eliminate desirable bacteria and cause resistance in bacteria. The requirement represents the merging of R17 and R18 in version 5, but remains otherwise unchanged.

The requirement also covers cases where the actual textile fibres have been treated with an antibacterial substance or biocide, rather than just the surface of the flooring.

O23 Nanoparticles

Nanoparticles (from nanomaterial*) must not occur in chemical products or in the finished Nordic Ecolabelled floor covering. The following are exempt from the requirement.

- Pigments**
- Naturally occurring inorganic fillers***

- Synthetic amorphous silica****
- Polymer dispersions

** The definition of nanomaterials follows the European Commission's definition from 18 October 2011 (2011/696/EU): "A nanomaterial is a natural, incidental or purposely manufactured material containing particles, in an unbound state or as an aggregate or as an agglomerate and where, for at least 50% of the particles in the number size distribution, one or more external dimensions is in the size range 1-100 nm."*

*** nano-titanium dioxide is not considered a pigment, and is thus not covered by the requirement*

**** this applies to fillers covered by Annex V point 7 in REACH.*

***** this applies to traditional synthetic amorphous silica. Chemically modified colloidal silica may occur as long as the silica particles form an aggregate in the end product. For surface treated nanoparticles, the surface treatment must meet the chemical requirements in O20 (Classification of constituent chemical substances) and O22 (Other substances excluded from use).*

☒ The manufacturer must declare any nanomaterials that occur in the product.

☒ Declaration in line with Appendix 8 from the manufacturer of the Nordic Ecolabelled floor covering and the manufacturer of each raw material.

Background

There remains a great deal of uncertainty about how nanoparticles affect human health and the environment[15]. Based on the precautionary principle, Nordic Ecolabelling wishes to adopt a restrictive stance on the use of nanoparticles, and thus proposes that nanomaterials are restricted in chemical products.

The definition of nanomaterials in chemical building products follows the European Commission's definition of nanoparticles[16]: "A nanomaterial is a natural, incidental or purposely manufactured material containing particles, in an unbound state or as an aggregate or as an agglomerate and where, for at least 50% of the particles in the number size distribution, one or more external dimensions is in the size range 1-100 nm."

A summary has also been given of Nordic Ecolabelling's assessment of nanomaterials in chemical building products. Nordic Ecolabelling can be contacted for more detailed information on specific nanoparticles.

In the product group Chemical building products, it has proven extremely challenging to set requirements concerning the content of nanoparticles. A range of different ingredients go into chemical building products and it is difficult to maintain an overview of all the different constituent components and their size. Many of the traditional ingredients in chemical building products contain particles of nano size, and are considered as nanomaterials under the European Commission's recommended definition. There are also examples of traditional ingredients with a fraction of nanoparticles being produced with an even greater level of ultrafine particles than before, and of the particles in many cases also having a surface treatment.

In chemical building products it is possible to differentiate between traditional and new nanomaterials. The traditional nanomaterials are widely used in chemical building products and include carbon black (furnace black, lamp black) and amorphous silica (SiO_2). The new nanomaterials include nano-titanium dioxide, nano-zinc oxide, fullerenes

[15] European Council, Recommendation 2017 (2013), Provisional version, Nanotechnology: balancing benefits and risks to public health and the environment. Available at the address: http://assembly.coe.int/ASP/Doc/XrefViewPDF.asp?FileID=19730&Language=EN (21.05.13)
[16] COMMISSION RECOMMENDATION of 18 October 2011 on the definition of nanomaterial (2011/696/EU)

and nanosilver[17]. The new nanomaterials are used to give the products new properties depending on particle size. The particles are increasingly being surface treated to prevent them agglomerating when added to a product. These are the findings in the 2010 report "Nanoteknologiske overflader og nye kvalifikationskrav" (Nanotechnological surfaces and new qualification requirements) by the Danish Technological Institute[18]. According to the report, it is necessary to modify the surface of nanoparticles, in order to stabilise and disperse the particles in water, polymers or some other solution. The stabilisation and dispersal of nanoparticles is achieved using various chemical modifiers (particle coatings), which span a broad spectrum from hydrocarbons and alkoxysilanes to phosphates, sulphonates and quaternary ammonium compounds.

Nanoparticle exposure in chemical building products

There have been several risk assessments of nanoparticles in paints, lacquers and sealants, including through NANOKEM and NanoHouse. "NANOKEM - Nanopartikler i farve- og lakindustrien. Eksponering og toksiske egenskaber" (Nanoparticles in the paints and lacquers industry. Exposure and toxicity) is a Danish project financed by the Working Environment Research Fund[19]. The timeframe for the project was 2007-2011, but articles were also published through this project in 2013. The main focus of the project was on the release of nanoparticles and their health effects when sanding paints and lacquers. The NanoHouse collaborative project is funded by the European Commission through Framework Programme 7 "Activities towards the development of appropriate solutions for the use, recycling and/or final treatment of nanotechnology-based products"[20]. The project began in January 2010 and has now been completed (January 2014). This project looked at the release of nanoparticles due to mechanical wear and weathering.

Both the NANOKEM and the NanoHouse projects show that wear on paint does not lead to the release of free nanoparticles, with the nanoparticles instead remaining locked into the released paint particles.

Another study of nano-TiO_2 as a coating on windows has shown that the photocatalytic effect is reduced and that TiO_2 is released from the surface into the environment when subjected to ageing tests (water, salt, UV light)[21]. It is, however, not entirely clear whether it is nano-TiO_2 that is released or larger TiO_2 particles. The research also shows that the photocatalytic effect is reduced during ageing, although no reason is given to explain this. A European Commission report from 2012 (see ref. above) states that there is an ongoing debate on whether leaching from outdoor paints and/or the waste phase can lead to a significant quantity of nanoparticles.

Pigment

In this context, paint pigments are considered to be pigments produced as a more or less finely ground powder, where the powder particles comprise individual crystals up to

[17] European Commission, COMMISSION STAFF WORKING PAPER, Types and uses of nanomaterials, including safety aspects, Accompanying the [..] second regulatory review of nanomaterials, SWD(2012) 288 final
[18] H. V. Kristensen et al, Nanoteknologiske overflader og nye kvalifikationskrav, Danish Technological Institute, 2010
[19] Website for the NANOKEM project: http://www.arbejdsmiljoforskning.dk/da/projekter/nanopartikler-i-farve-og-lakindustrien---nanokem (06.01.14)
[20] Website for the NanoHouse project: http://www-nanohouse.cea.fr/scripts/home/publigen/content/templates/show.asp?P=55&L=EN&ITEMID=2 (06.01.14)
[21] J. Olabarrieta et al, Aging of photocatalytic coatings under a water flow: Long run performance and TiO2 nanoparticles release, Applied Catalysis B: Environmental, Volumes 123–124, 23 July 2012

aggregates of multiple crystals[22]. In paint it is generally more effective to use pigments with smaller particles than larger ones to achieve the same colour.

Inorganic pigments used in the paint industry that may occur in nano size include carbon black, iron oxides and titanium dioxide[23]. The carbon black used in paint is very finely ground and has a particle size of around 10-30 nm[24]. Iron oxide pigment may entirely comprise particles of nano size, or only a fraction of the particles may be nano.

A discussion with Kronos International[25], a producer of titanium dioxide (TiO_2), established that none of their regular grade TiO_2 counts as a nanomaterial under the EU's definition of nanomaterials (where at least 50% of the particles must be of nano size for it to be deemed a nanomaterial). According to Kronos, around 25% of the particles in their regular grades are less than 100 nm.

Nano-titanium dioxide is not considered a pigment, but a new nanomaterial that is added to give the products new properties, such as a self-cleaning effect in paints. These are not exempted from the requirement and therefore must not be used in Nordic Ecolabelled chemical building products.

There are many organic pigments that may comprise or contain fractions of nanoparticles. Examples of such pigments are: pigment yellow 1, 13 and 83, pigment orange 5 and 34 and pigment red 3.[26]

Pigments are exempted from the requirements concerning nanoparticles, since they are necessary in chemical building products and no other suitable replacement is available to fulfil their function.

Amorphous silica (SiO_2)
As mentioned above, synthetic amorphous silica is considered a traditional ingredient in chemical building products. Since amorphous silica is a nanomaterial, under the European Commission definition, synthetic amorphous silica is exempted from the requirement concerning nanomaterials.

Surface-modified colloidal silica is permitted.

Consequences of the requirement
The requirement means that nanomaterials produced with the intention of containing nanoparticles must not be used. Examples of such nanoparticles are fullerenes, carbon nanotubes, nanosilver, nanogold and nanocopper. Traditional fillers are, however, permitted. Pigments are exempted from the requirement, such that TiO_2 may be used in pigment form.

It can be difficult to find out the particle size of inorganic fillers from raw material suppliers. Naturally occurring inorganic fillers such as chalk, marble, dolomite and lime are exempted from registration under Annex V, point 7 of REACH, as long as these fillers are only physically processed (ground, sifted and so on) and not chemically modified. They are also exempted from registration in the Danish Environmental

[22] Coatings Handbook; Thomas Brock, Michael Groteklaes, Peter Mischke; 2000
[23] Industrial Organic Pigments; W. Herbst, K. Hunger; Third edition 2004; pp 120-124
[24] Coatings Handbook; Thomas Brock, Michael Groteklaes, Peter Mischke; 2000; p 128
[25] Email correspondence with the SHE Director at Kronos International, INC, 12.11.12
[26] W. Herbst, K. Hunger, Industrial Organic Pigments, Third edition 2004

Protection Agency's draft Regulation on a register of blends and goods that contain nanomaterial and the duty of producers and importers to update the register[27].

Article 2(7)(b) of the REACH Regulation (1907/2006/EC[28]) states that 7.

The following shall be exempted from Titles II, V and VI:
(Title II relates to registration of substances, Title V relates to downstream user and Title VI relates to evaluation)
(b) substances covered by Annex V, as registration is deemed inappropriate or unnecessary for these substances and their exemption from these Titles does not prejudice the objectives of this Regulation.

Annex V EXEMPTIONS FROM THE OBLIGATION TO REGISTER IN ACCORDANCE WITH ARTICLE 2(7)(b):

7. The following substances which occur in nature, if they are not chemically modified. Minerals, ores, ore concentrates, cement clinker, natural gas, liquefied petroleum gas, natural gas condensate, process gases and components thereof, crude oil, coal, coke.

Inorganic fillers are exempted from the requirement as long as they are covered by Annex V, point 7 of REACH.

Polymer dispersions are also exempted from the requirement. The European Commission's report[29] to accompany the second Regulatory Review on Nanomaterials from 2012[30] states that solid nanomaterials in the dispersant in a liquid phase (colloid) are to be considered nanomaterials in accordance with the European Commission's recommendation. Nanoemulsions are not, however, covered by the definition. Polymers/monomers may occur in different phases and sizes, and the choice has therefore been made to explicitly state that polymers are exempted from the definition.

A requirement for information on the nanomaterials found in products has also been introduced in order to gain more knowledge about what nanoparticles occur.

5.3.2 Paints, colourants and pigments in textile flooring

The requirements below relate to the dyeing of yarn and fibres used in the manufacture of textile floor coverings by flooring manufacturers and their suppliers.

O24 Chromium mordants

Chromium mordants are not permitted.

✉ Declaration from the dyeworks that chromium mordants have not been used. Appendix 9 can be used.

[27] Link to the Danish Environmental Protection Agency hearing: http://hoeringsportalen.dk/Hearing/Details/16910 (visited 20.01.14)
[28] Link to REACH: http://eur-lex.europa.eu/LexUriServ/site/en/oj/2006/l_396/l_39620061230en00010849.pdf
[29] European Commission, COMMISSION STAFF WORKING PAPER, Types and uses of nanomaterials, including safety aspects, Accompanying the [..] second regulatory review of nanomaterials, SWD(2012) 288 final
[30] Communication from the Commission to the European Parliament, the Council and the European Economic and Social Committee, Second Regulatory Review on Nanomaterials, COM(2012) 572 final
Website of DaNa: http://nanopartikel.info/cms

O25 Metal complex dyes

Metal complex dyes are only permitted for the dyeing of wool or wool blend fibres. Emissions to water from treatment must not exceed:

- 5 mg/kg fibre for copper (Cu)
- 3 mg/kg fibre for chromium (Cr) and
- 5 mg/kg fibre for nickel (Ni)

Emissions of Cu and Ni are to be analysed in line with ISO 8288 and emissions of Cr are to be analysed in line with EN 1233 or equivalent methods. The requirements for analysis laboratory and test methods are stated in Appendix 1.

✉ Declaration from the dyeworks that metal complex dyes are not used and/or test reports showing fulfilment of the requirement. Appendix 9 can be used.

O26 Azo dyes

Azo dyes that may release any of the aromatic amines stated in the table below must not be used.

Azo dyes	**CAS no.**
4-aminobiphenyl	92-67-1
Benzidine	92-87-5
4-chloro-o-toluidine	95-69-2
2-naphthylamine	91-59-8
o-aminoazotoluene	97-56-3
2-amino-4-nitrotoluene	99-55-8
p-chloraniline	106-47-8
2,4-diaminoanisole	615-05-4
4,4′-diaminodiphenylmethane	101-77-9
3,3′-dichlorobenzidine	91-94-1
3,3′-dimethoxybenzidine	119-90-4
3,3′-dimethylbenzidine	119-93-7
3,3′-dimethyl-4,4′-diaminodiphenylmethane	838-88-0
p-cresidine	120-71-8
4,4′-oxydianiline	101-80-4
4,4′-thiodianiline	139-65-1
o-toluidine	95-53-4
2,4-diaminotoluene	95-80-7
2,4,5-trimethylaniline	137-17-7
4-aminoazobenzene	60-09-3
o-anisidine	90-04-0
2,4-xylidine	95-68-1
2.6-xylidine	87-62-7

Azo dyes are to be analysed in line with EN 14362-1 and EN 14362-3. The requirements for analysis laboratory and test methods are stated in Appendix 1.

✉ Declaration from the dye manufacturer that these dyes are not used and/or a test report showing fulfilment of the requirement. Appendix 9 can be used.

O27 Allergenic dyes

The allergenic dyes listed in the table below must not be used.

Generic Name	CAS no.
Disperse Blue 1	2475-45-8
Disperse Blue 3	2475-46-9
Disperse Blue 7	3179-90-6
Disperse Blue 26	3860-63-7
Disperse Blue 35	12222-75-2
Disperse Blue 102	12222-97-8
Disperse Blue 106	12223-01-7
Disperse Blue 124	61951-51-7
Disperse Brown 1	23355-64-8
Disperse Orange 1	2581-69-3
Disperse Orange 3	730-40-5
Disperse Orange 37	12223-33-5
Disperse Orange 76	
Disperse Orange 149	85136-74-9
Disperse Red 1	2872-52-8
Disperse Red 11	2872-48-2
Disperse Red 17	3179-89-3
Disperse Yellow 1	119-15-3
Disperse Yellow 3	2832-40-8
Disperse Yellow 9	6373-73-5
Disperse Yellow 23	6250-23-3
Disperse Yellow 39	12236-29-2
Disperse Yellow 49	54824-37-2

✉ Declaration from the dyeworks that these dyes are not used and/or a test report showing fulfilment of the requirement. Appendix 9 can be used.

Background

Chromium is toxic and is therefore only used to a limited extent. It can, however, be relevant for wool, wool blends (including blends with polyamide) and polyamide, and there is therefore a ban on the use of chromium mordants.

The use of metal complex dyes is only permitted for the dyeing of wool and wool blends, but with the requirement for low concentrations after treatment. It is difficult to avoid the use of metal complex dyes for these materials, particularly when striving for dark colours, and according to the industry they cannot be replaced with other dyes[31]. Metal complex dyes are problematic because they contain toxic heavy metals. There is therefore also a requirement that if metal complex dyes are used, the effluent must be treated. The required test method has been changed to ISO 17294-2, since contact with the industry[32] shows that the previous test methods, ISO 8288 for Cu and Ni and EN 1233 for Cr, are outdated and rarely used nowadays. It is, however, possible to document the requirement via methods that are equivalent to ISO 17294-2.

The use of azo dyes that release various amines is prohibited in the EU under Directive 2002/61/EC, but may still be used outside the EU. The amines released from azo dyes

[31] The EU Ecolabel's background document, 2007
[32] Ragnvald Svarstad, GU, personal communication January 2012

may be carcinogenic, allergenic, irritating and toxic. The German labelling scheme for carpets, GUT, as well as a ban in place against these azo dyes.

Allergenic dyes are prohibited by GUT, and the criteria for the Nordic Ecolabelling of Textiles prohibits dyes classified as allergens (R42 and/or R43). A floor covering such as carpet has a major effect on the indoor climate, and it is therefore important to ensure that allergenic dyes are not used.

There are two established standards for analysing and identifying aromatic amines that are released from azo dyes. EN 14362-1: 2012 applies to all dyed textiles and replaces the two previous standards EN 14362-1 and EN 14362-2 from 2003. There is also a supplementary standard specifying the analysis method for certain aromatic amines (primarily aniline and 1,4-phenylenediamine).

5.3.3 Chemical requirements applicable only to surface treatment

The requirements in this section apply to all surface treatment of floor coverings, irrespective of material/flooring type.

O28 Quantity applied and application method

The following is to be documented: number of coats, quantity applied (g/m^2) and application method(s) used.

When calculating quantities applied, the following efficacy rates* are to be used:

- Automatic spray application, no recycling, 50%
- Automatic spray application with recycling, 70%
- Spray application, electrostatic, 65%
- Spray application, bell/disc, 80%
- Roller coating, Curtain coating, Vacuum coating, Dipping or Rinsing 95%

** The efficacy rates are model values. Other efficacy rates may be applied if they can be documented.*

✉ Number of coats, application method and quantity applied per coat per m^2 surface area. Appendix 10 can be used.

Background

An examination of the EU's BAT report (Best Available Technology) on surface treatment using organic solvents and contact with the industry shows that it is appropriate to calculate the environmental impact of the use of organic solvents using the application method (g/m^2). The method involves calculating the quantity applied in g/m^2 and then determining the content of environmentally harmful substances based on the application method and the percentage content of any harmful substances in the solvents used.

O29 Environmentally harmful products and substances in surface treatment systems

Chemical products used in surface treatment systems (e.g. fillers, oils, stains, lacquers) must fulfil one of the following two alternatives.

a) None of the chemical products are classified as environmentally harmful according to the table below.

or

b) The quantity of environmentally harmful substances applied in the surface treatment system may be no more than 100 g/m², calculated in a wet state. One of the formulas below is to be used to first calculate the total amount of environmentally harmful substances in the surface treatment system (%):

100*H410 + 10*H411 + H412

or

100*(R50/53) + 10*(R51/53) + (R52/53)

H410 is the concentration of substances classified as H410 (same method for R50/53) in percent

H411 is the concentration of substances classified as H411 (same method for R51/53) in percent

H412 is the concentration of substances classified as H412 (same method for R52/53) in percent

All environmentally harmful substances included in the unhardened chemical products are to be included in the calculation. Classification according to the table below.

Hazard class	Hazard category and hazard phrase in line with CLP Regulation 1272/2008	Hazard designations and risk phrases in line with EU Dangerous Substances Directive 67/548/EEC
Toxic to aquatic organisms	Chronic 1 with H410	N; R50-53
	Chronic 2 with H411	N; R51-53
	Chronic 3 with H412	R52-53

The quantity of environmentally harmful substances applied is then calculated as follows:

Applied quantity (g/m²) x proportion VOC in surface treatment (%)
/surface treatment efficacy

When calculating quantity applied, the same efficacy rates are used as those stated in O28.

If information about a substance's harmfulness to the environment (in the form of data concerning toxicity and degradability or toxicity and bioaccumulation) is not available, the substance is treated as a worst case, i.e. as environmentally harmful – H410.

For tinting systems, a worst case calculation is made for the colour with the most tinting paste in the base paint containing the most environmentally harmful substances.

☒ Alternative a) requires a declaration that no chemical products used in the surface treatment are classed as environmentally harmful according to the table above. Appendix 10 can be used.

☒ Alternative b) requires a declaration from the manufacturer/supplier of the surface treatment product stating the content of environmentally harmful substances. Appendix 10 can be used. For each constituent classified substance, the concentration in the chemical product must be stated as a percentage by weight. Confidential details from the chemical manufacturer in the form of content declarations/formulations can be sent directly to Nordic Ecolabelling.

- ☒ Alternative b) requires details of the number of coats, the application method and the quantity applied per coat, stated as g/m² flooring. Appendix 10 can be used.
- ☒ Both alternatives a) and b) require safety data sheets pursuant to prevailing European legislation for all chemical products.

Background

The various types of floor covering are often surface treated to ensure a durable, easy to clean surface. Wood flooring in particular is often supplied with a surface treatment to ensure a hard wearing surface, and thus a long service life for the floor. The surface treatment largely takes the form of water-based lacquers, acid cured lacquers, UV lacquers and oils. Within the lacquers there are primers, sealants, undercoats and top coats that are used alone or together in systems.

The criteria for chemical building products have recently been revised and expanded to also include industrial chemical building products such as lacquers. It is desirable that a Nordic Ecolabelled lacquer could be used and accepted as a surface treatment product in the manufacture of a Nordic Ecolabelled floor covering. It is therefore relevant to harmonise the requirements across the two product groups. There is, however, an important difference that means the requirements cannot be identical between the product groups. A chemical building product – let us continue with the example of lacquer – has to individually fulfil the requirement concerning content. For a Nordic Ecolabelled floor covering, it is the quantity applied across the entire lacquering system that has to fulfil the requirement. Surface treatment of a floor covering often involves more than one lacquering product being applied and several coats being applied in different quantities. This renders it impossible to make direct comparisons. In an extreme scenario, it could be the case that a Nordic Ecolabelled lacquer with a low content of environmentally harmful substances, for example, is applied in such large quantities that the requirement in the floor covering criteria concerning environmentally harmful content is still not fulfilled. The opposite could also occur, i.e. that a lacquer that does not fulfil the requirement for Nordic Ecolabelling is used in such small quantities that it still enables the lacquering system to fulfil the requirements of the floor covering criteria.

In short, we are harmonising across the product groups as much as possible. For requirement O29 this entails:

- Introducing the factors for environmentally harmful content that are contained in the criteria for chemical building products. These weighting factors are drawn from chemicals legislation and are a good way of balancing the different degrees of potential environmental harm: H410 is weighted with a factor of 100 since it is the most environmentally harmful, H411 is weighted with a factor of 10 and H412, which is the least environmentally harmful, is multiplied by a factor of 1, i.e. no weighting is applied.
- The classification H400, which is acutely toxic to aquatic organisms (not chronically), has been removed. This classification is used where there is a clear risk of major concentrated emissions on site or where products for industrial cleaning, decreasing etc. reach the drainage system and/or surface water. This classification ought not to be relevant for products for the surface treatment of floor coverings.

- The classification H413 (suspected harmful to aquatic organisms) is harmful to such a low extent that it has been deleted from the requirement.
- The risk phrases R52 Harmful to aquatic organisms, R54 Toxic to flora, R55 Toxic to animals, R56 Toxic to soil organisms and R58 Can cause long-lasting damage to the environment have also been deleted, as they are not relevant to the surface treatment of floor coverings.
- The total quantity applied has been set at 100 g/m^2, which has been chosen to represent the best floor lacquers on the market, although there is a relatively large spread.

In summary, Nordic Ecolabelling can report that, since the requirement has been reworked and now applies a weighting to environmentally harmful content using factors of 1, 10 and 100, the requirement level for quantity applied, has been set at 100g/m^2. At first glance, the value may appear high, but it must **not** be compared with the limit value of 7 g/m^2 from the previous version of the criteria, which applied no weighting for environmental harm. There is, however, a certain amount of uncertainty associated with the proposed value of 100 g/m^2. We would appreciate feedback on the proposed limit value during the consultation period.

Lacquering products are normally classified as allergenic due to their content. If action is taken to reduce the content of allergenic substances, there is a risk that the content of environmentally harmful components will rise instead. This is another reason for raising the permitted limit value slightly. It is, of course, an unfortunate environmental development. Nordic Ecolabelling has nevertheless determined that we must adopt this approach and adapt our requirement accordingly.

UV lacquer
UV cured base coat lacquers and sealants are applied by roller or spray and then cured in a special kiln using UV light. The major advantage of these lacquers is the particularly rapid curing after application, which allows handling and packaging after less than 10 seconds. UV lacquers applied at around 70-100 g/m^2 wood flooring contain no or almost no VOC. UV lacquers may contain substances classified as environmentally harmful such as benzophenone and various acrylates. The concentration of environmentally harmful substances may range from around 10% up to 50% in different UV lacquers for flooring. These substances cure during lacquering and then remain stable.

Natural oils
Natural oils are also used as a surface treatment for wood flooring. In contrast to a lacquered floor, the surface of an oiled floor will retain the natural open-pore characteristics of the wood. The advantage of an oiled floor is that the surface treatment is easier to repair, even by the user. Surfaces finished with natural oil can both absorb and emit ambient moisture, giving them a regulating function with regard to the indoor climate.

UV oil
UV oil combines the benefits of an oiled floor and a UV lacquered floor. UV oil is based on natural oils that are UV stabilised through chemical modification. This gives better chemical properties and improved scratch resistance compared with natural oils. UV oiled floors do, however, require more maintenance than lacquered floors. UV oils can also contain high concentrations of environmentally harmful substances such as acrylates

and polymers based on polyether polyols and acrylic acid esters. This may include as much as 60% substances that are classified as toxic to aquatic organisms and may cause long-term adverse effects in the aquatic environment (R51/53). Since UV oil treatment does not provide the same durability as a UV lacquer, the requirement level for UV oils in alternative b) is a maximum of 10 g/m^2.

The requirement is primarily based on experience relating to wood flooring and linoleum flooring. Nordic Ecolabelling does not have much experience with the ecolabelling of carpets. The requirement does, however, apply to all types of floor covering in this product group, since a restriction on the use of environmentally harmful substances is relevant for all flooring types.

O30 Volatile organic compounds (VOC) – surface treatment systems only

Within each surface treatment system, the total content of volatile organic compounds (VOC) in surface treatment products must either:

a) be below 5% by weight in total, or

b) amount to a maximum of 2 g/m^2 treated surface in total.

The requirement relates to the total VOC in the chemical products with the chemical composition they have in wet form. If the products required dilutions, the calculation is to be based on the content in the dilutive product. When calculating quantity applied, the same efficacy rates are used as those stated in O27.

Volatile organic compounds (VOC) are defined as any organic compound having an initial boiling point less than or equal to 250°C measured at a standard pressure of 101.3 kPa.

The applied quantity of VOC according to alternative b) is calculated using the following formula:

$$\text{Applied quantity (g/m}^2\text{)} \times \text{proportion VOC in surface treatment (\%)} \; / \text{surface treatment efficacy}$$

✉ Alternative a) requires a declaration that the VOC content in each surface treatment system is below 5% by weight. Appendix 10 can be used.

✉ Alternative b) requires a declaration from the manufacturer/supplier of the surface treatment product stating the VOC content. Appendix 10 can be used. For each VOC, the concentration is to be stated as a percentage by weight. If necessary, details from the chemical manufacturer in the form of content declarations can be sent directly to Nordic Ecolabelling.

✉ Alternative b) requires details of the number of coats, the application method and the quantity applied per coat, stated as g/m^2 flooring. Appendix 10 can be used.

✉ Both alternatives a) and b) require safety data sheets pursuant to prevailing European legislation for all chemical products.

Background

One of the reasons for setting requirements concerning volatile organic compounds (VOC) is Nordic Ecolabelling's goal of reducing ground level ozone formation. Some organic solvents also contribute to the greenhouse effect and some to the breakdown of the ozone layer[33]. In addition, many of the VOCs traditionally used in products for surface treatment are harmful to health and could constitute a health issue in the workplace.

[33] Miljøvejledninger Ordbog, 2009: Section on organic solvents in the glossary at Miljøvejledninger.dk, found at http://www.miljoevejledninger.dk/ordbog/uddybendeforklaringer/o/organiskeoploslashsningsmidler.

The requirement represents a change compared to the previous R20 in order to make it easier to document and to adapt the documentation method to the most preferred method in the industry. An example calculation is also given to make it easier for applicants to make their own calculations. It was previously possible to document the requirement concerning VOC in surface treatment in two ways – either by measuring or calculating emissions of organic solvents and quantities applied per m^2 surface area (application method). An examination of the EU's BAT report (Best Available Technology)[34] on surface treatments using organic solvents and contact with the industry shows that the preferred method of documenting environmental impact is via the application method (g/m^2). This method forms the basis for calculating the quantity applied in g/m^2, before then determining the content of organic solvents and/or environmentally harmful substances based on the application method and content of (e.g. %) organic solvents and environmentally harmful substances.

If the combined VOC content in the applied products, within one surface treatment system, is less than 5%, it is not necessary to conduct the calculation in grams per m^2. The reason for this is that products with such little total VOC content will fulfil the set requirements, and an exemption from the calculation will not reduce the level of environmental protection. It will simply make it easier for both applicants and Nordic Ecolabelling when it comes to processing applications. The permitted level of VOC applied remains at 2 g/m^2 as before. Data from licensing shows that this is a low but achievable level, and that it is possible to fulfil the requirement concerning the quality and durability of the flooring surface at this level.

There is an increasing trend for the use of water-based lacquers, and these are approaching the acid cured lacquers in quality and durability. UV cured lacquers (water-based) are becoming increasingly widespread, and there is also a trend towards chemicals that are better for health and the environment. UV cured lacquers are the best in terms of quality and durability, and have a low VOC content. Acid cured lacquers are, however, still widely used, accounting for around 30-40% of the market in 2008[35]. This type of lacquer has a significantly higher VOC content than UV lacquer, for instance. Nordic Ecolabelling wishes to reduce the use of acid cured lacquers due to their high VOC content, and in practice it will be difficult to meet the requirement using an acid cured lacquer.

This requirement is largely based on experience relating to wood flooring and laminate flooring. However, the requirement applies to all types of floor covering in this product group, if they have been surface treated in a relevant manner.

O31 UV lacquering

Hexanediol diacrylate (HDDA) CAS no. 13048-33-4 must not occur in UV lacquers.

✉ Appendix 10, duly completed and signed by the chemical manufacturer.

Background

The requirement is new. One of the monomers used in UV lacquer formulations is 1,6 hexanediol acrylate (HDDA). According to the EU's list of dangerous substances,

[34] Surface Treatment using Organic Solvents, Integrated Pollution prevention and Control, Reference Document on Best Available Techniques. European Commission, Directorate-General, Joint Research Centre, Institute for Prospective Technological Studies, Spain, 2007. Available at:
http://eippcb.jrc.es/reference/_download.cfm?twg=sts&file=sts_bref_0807.pdf
[35] Kjetil Veidel, 2008. Private communication with Kjetil Veidel from Beckers Acroma.

HDDA – one of the monomers currently used in UV cured lacquers – is classified as a local irritant with the risk phrases R36/38 (irritating to eyes and skin) and R43 (may cause sensitisation by skin contact), i.e. it is allergenic. As such, unreacted HDDA can evaporate and expose users in a domestic environment. LC50 (Lethal Concentration 50, i.e. the concentration at which 50% of the tested group will die) values for fish indicate that HDDA is toxic to aquatic organisms, but the substance is readily biodegradable and does not appear to bioaccumulate.

In partnership with paint producer Teknos, FORCE Technology has therefore developed a project to reduce diffusible substances (particularly HDDA) in UV cured base coat lacquers for furniture. The project has shown that UV cured furniture lacquers, which are usually comparable with floor lacquers, contain more or less unreacted monomers after UV curing. However, through judicious choice of relevant raw materials, the lacquer manufacturer can reduce these emissions. Lower reactivity (and insufficient UV curing) leads to more unreacted compounds in the lacquer and this leads to greater diffusion. Chemical analysis showed, for example, that simply by changing its commercially used monomer HDDA to DPGDA (dipropylene glycol diacrylate – CAS no. 57472-68-1) or TPGDA (tripropylene glycol diacrylate – CAS no. 42978-66-5) the lacquer manufacturer could significantly cut emissions. Switching from HDDA to TPGDA also means shifting to acrylates with a larger molecular weight, and thus to less acutely toxic acrylates. According to the tests and investigations carried out, this optimisation could be implemented without technical or financial consequences for the lacquer manufacturer – and thus the end user[36].

5.4 Requirements concerning the indoor climate

Nordic Ecolabelling wishes to test two alternative approaches concerning potential harmful emissions from Nordic Ecolabelled floor coverings. The background to this is that many developers and certification bodies for buildings are demanding emission tests/indoor climate labelling for building products. To date, Nordic Ecolabelling has had emission requirements concerning formaldehyde in floor coverings, but has not set any other emission requirements. This is because Nordic Ecolabelling sets stringent requirements concerning the products' constituent raw materials, chemicals and surface treatment, and we therefore believe it is fairly unlikely that problematic substances will be emitted, and if they are it will be in extremely small amounts. However, since other players in the construction market set emission requirements, including for Nordic Ecolabelled products, we would like feedback during the consultation period on whether a new requirement for emissions would bring added value to Nordic Ecolabelled floor coverings. The problem is discussed further in the background text under requirement O33.

Emission requirements would be in addition to the extensive chemical requirements concerning constituent substances as set out in O17-O31. Requirements O33-O34 (concerning formaldehyde in manufactured board and textiles) will be deleted if O32 is introduced, since emissions from the whole floor covering will then be tested.

[36] Screening of alternative raw materials – MST Ecoproject No. 1353,2010

Alternative 1. Emissions from the floor covering (TVOC, formaldehyde and carcinogenic substances)

O32 Emissions from the floor covering (deleted if O33-O34 are introduced)

The floor covering is to be tested in accordance with CEN/TS 16516, ISO 16000-3/-6/-9/-10 or an equivalent method. Sampling is to be carried out by an accredited third-party.

Emissions from Nordic Ecolabelled floor coverings must meet the emission levels expressed either in mg/m²h or mg/m³ as set out in the table.

Substances or groups of substances	Limit value after 28 days in mg/m²h*	Limit value after 28 days in mg/m³ *
TVOC (C6-C16)	< 0.2	< 0.16
Formaldehyde in textile flooring Formaldehyde in other flooring	< 0.005 < 0.05	< 0.01 < 0.04
Carcinogenic substances**	< 0.005	< 0.004

** Conversion between mg/m²h and mg/m³, plus requirements for analysis laboratory and test methods are described in Appendix 1.*

*** Classified as Carc. 1A or 1B, Annex VI, CLP Regulation 1271/2008*

Other analysis methods can be accepted if they are judged to be equivalent by an independent and competent body.

☒ Test report showing that the limits in the table above have been met. A valid certificate from one of the following indoor climate labelling schemes may be used as documentation: M1 after 01.07.2014 and GUT (for textile flooring). The testing standard used, the laboratory that conducted the analysis and the accreditation of the analysis laboratory by an independent third party must be clearly stated, see Appendix 1.

☒ A certificate and supporting test report from other indoor climate labelling schemes, such as Dansk Indeklimamærkning, may be used as verification/documentation if an independent expert confirms that the certificate from that indoor climate labelling scheme fulfils the requirements.

Alternative 2. Emissions from manufactured board and textile flooring (formaldehyde)

O33 Formaldehyde in wood-based board in flooring (deleted if O32 is introduced)

Manufactured board in flooring that contains formaldehyde-based additives or substances that emit formaldehyde must fulfil a) or b) below.

Nordic Ecolabelled manufactured board already meets the requirements. In this case, state the name and license number of the manufactured board.

a) The average content of free formaldehyde must not exceed 5 mg formaldehyde/100 g dry substance for MDF board and 4 mg/100 g dry substance for other types of manufactured board in accordance with the current version of EN 120 or an equivalent method approved by Nordic Ecolabelling, see Appendix 1.

   The requirements apply to wood-based board with a moisture content of H = 6.5%.

   If the board has a different moisture content within the range 3-10%, the measured perforator value must be multiplied by the factor F, which is calculated using the following formula:

   For chipboard: $F = -0.133\ H + 1.86$

For MDF panels: F = -0.121 H + 1.78

b) The average emission of formaldehyde must not exceed 0.124 mg formaldehyde/m³ air for MDF panels and 0.07 mg formaldehyde/m³ air for other types of manufactured board in accordance with the current version of EN 717-1 or an equivalent method approved by Nordic Ecolabelling, see Appendix 1.

✉ Analysis report, including measurement methods, measurement results and measurement frequency. It must be clearly stated which testing standard was used, which laboratory conducted the analysis, and that the analysis laboratory is an independent third party, see Appendix 1.

O34 Formaldehyde in textile flooring (deleted if O32 is introduced)

Textile flooring that contains formaldehyde-based additives or substances that emit formaldehyde must fulfil the following:

The average emission of formaldehyde must not exceed 0.01 mg formaldehyde/m³ air in accordance with the current version of EN 717-1 or an equivalent method approved by Nordic Ecolabelling, see Appendix 1.

✉ Analysis report, including measurement methods, measurement results and measurement frequency. It must be clearly stated which testing standard was used, which laboratory conducted the analysis, and that the analysis laboratory is an independent third party, see Appendix 1.

Background to the emission requirements

Use of low emission construction materials is one of the many factors that contribute to a good indoor climate. In this context, flooring contributes a large surface area, making it important to limit emissions (evaporation) of substances harmful to health from the floor covering. There are concerns about various chemical substances due to their properties, such as CMR toxicity, allergenic effects, unpleasant odours or generally higher content of undesirable substances in the air.

The relevance of setting environmental and health requirements concerning emitting substances in floor coverings is judged to be high in the first instance. However, there is some uncertainty about whether an additional requirement concerning emissions in Nordic Ecolabelled products would bring greater health benefits, since Nordic Ecolabelling already sets strict requirements concerning constituent chemicals, individual substances and emissions of formaldehyde. It should also be noted that Nordic Ecolabelling prohibits more CMR substances than are measured in many indoor climate labelling schemes, and there is no information to suggest that CMR substances are formed during manufacture. VOC limits in chemicals used in Nordic Ecolabelled products also entail a reduction in TVOC and SVOC emissions.

Emissions from flooring may come from the following sources:

- Products used for surface treatment (lacquers, oils).
- The raw materials in the flooring, such as plastic, rubber, wood, linoleum, and backing materials such as various foams, jute and so on.
- Other chemicals are used, such as adhesive in manufactured board used in the floor covering.
- Adhesive used to glue the flooring to the subfloor and jointing compounds used, for example, in ship deck flooring.

It is possible for the manufacturers to substitute harmful substances with less harmful substances, and thus reduce emissions. Some materials and chemicals are however necessary in order to produce floor coverings of sufficient quality. The manufacturers can choose from a range of materials and chemicals for their flooring products, and there is therefore a certain amount of potential for achieving a better indoor climate.

Common emission parameters in existing indoor climate labelling schemes are: formaldehyde, volatile organic compounds (TVOC, SVOC and in some schemes individual VOCs), total CMR substances, ammonia, NH_3, (less common) and odour (less common). TVOC and SVOC are umbrella terms for volatile organic compounds and semi-volatile organic compounds that also includes natural terpenes from pine, for example. One particular challenge is that the emission requirements set by the various schemes are often rather different, both in terms of the parameters tested for, and the limit values. Nordic Ecolabelling has drawn up an overview of the indoor environment requirements set by different certification bodies for buildings[37].

Current trends in the construction market concerning emissions may be summarised as follows:

- Most flooring manufacturers test their floor coverings for emissions of volatile organic compounds.
- Some flooring manufacturers also use indoor climate labels showing that they meet the current emission levels applied by those labels.
- Most environmental certification schemes for buildings set requirements concerning emissions of formaldehyde. Some also have other emission requirements concerning VOC and other volatile substances. These schemes include BREEAM NOR, LEED international, and Byggevarebedømningen.
- Documentation in accordance with M1 is required in Norwegian EPDs, which are often required by major developers (including state bodies) and which give points in BREEAM NOR.
- The authorities have a focus on requirements concerning documentation of construction materials. The EU's Construction Products Regulation (which replaces the Construction Products Directive) entered into force on 1 July 2013. In addition, the manufacturer is required to provide information on the content of harmful substances included on the Candidate List (REACH article 59) and the Authorisation List (REACH article 57). The Construction Products Regulation also sets out revised requirements concerning the now obligatory CE marking of construction products. As an example, CE marking of textile flooring covers emissions of pentachlorophenol and formaldehyde.

[37] The document is written in Norwegian and can be requested from Nordic Ecolabelling by e-mailing sara.bergman@svanen.se

What does alternative 1 entail (O32)?
The requirement is new and ensures a documented minimum of specified emissions from the floor covering. Such an emission requirement will give direct peace of mind for the end user. The requirements could be important for manufacturers that wish to have a high health profile, particularly when it comes to vulnerable user groups such as asthmatics, allergy sufferers children.

The requirement takes the M1 scheme as its starting point, since it is widely used in the Nordic region, is referred to in several certification schemes for buildings and has simpler criteria than some of the other schemes. Nordic Ecolabelling is also happy to accept other recognised indoor climate labelling schemes, if it can be documented that the requirement is fulfilled and that this is confirmed by the independent expert. One difference compared with the M1 scheme is that Nordic Ecolabelling differentiates between requirements for formaldehyde in textile flooring and other floor coverings. This is because experience shows that textile flooring has a lower content of formaldehyde than other floor coverings (for example, compared with wood flooring, where formaldehyde may be emitted from the wood and adhesive).

Different indoor climate labels state emissions as an emission rate in mg/m^2h or as a concentration in a model room in mg/m^3. The requirement therefore states requirement levels for both measurements, in order to be able to use different test certificates as the basis for assessment. After 1 July 2014, the M1 method states that limit values are to be achieved both as an emission rate and as a concentration in the model room.

The majority of existing indoor climate labels are based on EN ISO 16000:2006, the international standard for determining volatile organic compounds from construction products[38]. There are, however, differences in how the indoor climate labels evaluate and present the results. 2013 also saw the following standard developed and published under the EU Construction Products Directive (89/106/EEC)[39]: CEN/TS 16516:2013, "Construction products – Assessment of release of dangerous substances. Determination of emissions into indoor air". This is a new harmonised test method for analysing indoor air that refers to the ISO 16000 series. Reference is therefore made to both the ISO 16000 series and CEN/TS 16516:2013 in requirement O35.

SP Technical Research Institute of Sweden has drawn up a report for the Norwegian Green Building Council (NGBC) which compares emission requirements at M1 level with other emissions tests[40]. Examples of converting between the different tests are shown. Information from this report is used as the basis for converting requirement limits from E (area specific emission rate, mg/m^2h) to C (concentration of VOC in the model room, mg/m^3) in requirement O34. The conversion assumes that the emission testing is carried out in line with ISO 160000-9 or -10 at a temperature of 23 ± 2°C and a relative humidity of 50 ± 5%. The following formula is used:

[38] Report No 27 Harmonisation framework for indoor material labelling schemes in the EU, The European Commission Joint Research Centre, 2010
[39] Eurofins, VOC emissions from products, on the website http://www.eurofins.com/product-testing-services/information/compliance-with-law/european-directives-and-laws/construction-products/voc-emissions-under-cpr.aspx (visited 31 January 2014)
[40] Emission test methods in BREEAM-NOR and comparisons with other emission test methods, SP Technical Research Institute of Sweden, 2013, Available from: http://ngbc.no/sites/default/files/SP-rapport%20om%20emisjonskrav%20i%20BREEAM-NOR%20vs%20andre%20ordninger_3.pdf

$$C = \frac{E}{q} = \frac{EA}{nV}$$

C = concentration of a VOC in the model room (mg/m^3)
E = area specific emission rate (mg/m^{2}h)
q = area specific air flow rate (m^3/m^{2}h)
A = area of sample in the model room (m^2)
n = air exchange rate, in changes per hour
V = volume of the model room, in m^3

SP's report states that ISO 160000-9 or -10 makes the calculation using a "model room" of 17.4 m^3 with a room height of 2.4-2.5 m and a minimum floor area of 7 m^2 and an air exchange rate of 0.5 h^{-1}. This means that for flooring products q, area specific air flow rate, is 1.25 m^3/m^{2}h. It is on the basis of these values that the conversions are made. After 1 January 2014, M1 is switching to a model room of 30 m^3 according to its website[41]. The floor area is 12 m^2 and therefore q will still be 1.25 for flooring products[42]. This change to the model room follows standard CEN/TS 16516:2013.

It is worth noting that q varies depending on what area the product is assumed to occupy in the model room. This differs, for example, between floor coverings and wall coverings (under ISO 16000-9 and -10). If converting emission rate (E) to concentration in the model room (C) for a wall product, q = 0.4 m^3/m^{2}h . In other words, C will be roughly 3 times higher for a wall product than for a flooring product. It is important to be aware of this for products that can be used for both walls and flooring, e.g. manufactured board.

The requirement allows for alternative analysis methods to be accepted if they are judged to be equivalent by an independent and competent body. The differences between the different tests are relatively complicated, and Nordic Ecolabelling therefore wishes competent laboratories, for example, to make the comparison. In this context, Dansk Indeklimamærkning (DIM) is a widely used and respected label in the Nordic region. Their certificates give an "indoor climate-related time value" which in simple terms states how long it takes from a product being installed in a building to emissions receding to an acceptable level in terms of health. This is rather different from schemes such as M1 and GUT, which have fixed limits in the same way as requirement O35. The supporting test report from DIM can, however, be used to judge whether the product fulfils the limit values in requirement O35. Another relevant example is testing of formaldehyde. In test method EN 717-1 for formaldehyde emissions from manufactured board q=1, which means that the test does not differentiate whether the product is to be used on the floor or walls, and the concentration is almost the same as the emission rate, but must be adjusted for variations in relative humidity. It is important to bear this in mind if comparing formaldehyde results measured according to EN 717-1 with results from measurements according to the ISO 16000 series. More details can be found in SP's report. There are generally also differences in how the tests are conducted when using the ISO 16000 series versus EN 717-1. In ISO 16000 the edges of the flooring sample are normally sealed, although for manufactured board parts of the edge are to be open. If flooring products are to be tested in accordance with EN 717-1, however, part of the edges must be open in all cases.

Requirement O32 states a limit value for TVOC rather than limit values for individual VOCs. The main reason for this is that there are no standard international limit values for individual VOCs. Work is under way to develop international levels, LCI values (LCI = Lowest concentration of interest), but no deadline has been set for the completion of

[41] www.rakennustieto.fi
[42] Correspondence with SP Technical Research Institute of Sweden, January 2014

this work. In the next revision of the criteria, it may be relevant to amend the emission requirement to bring it more in line with the EU's recommendations on setting requirements for individual VOCs via LCI values, if the values have become internationally standardised.

Nordic Ecolabelling has chosen not to set requirements concerning ammonia and odour. Only the M1 scheme tests for ammonia. BREEAM-NOR does not require ammonia testing, if the manufacturer of the construction product confirms that ammonia is not relevant or that the construction product does not contain substances that can emit ammonia. Odour is tested in M1, DIM and GUT. At this point in time, the odour tests are not directly comparable, according to Eurofins[43]. A standard has, however, just been issued for odour testing (ISO 16000-28). It may thus be relevant in the next revision to consider expanding the requirement to cover odour, if the odour tests have become more comparable. BREEAM-NOR also does not require odour testing for all types of floor covering.

Nordic Ecolabelling has been informed that an emission test that will satisfy the requirement in alternative 1 will cost around EUR 1500 (January 2014).

What does alternative 2 entail? (O33 and O34)
Alternative 2 is to continue with the current practice concerning emissions in the floor covering criteria and, in addition, introduce a new requirement concerning formaldehyde in textile flooring. The test method in O34 is EN 717-1, which is the method stated in the harmonised standard for textile flooring (EN 14041:2004 Resilient, textile and laminate floor coverings – Essential characteristics). The requirement level is the same as that required in O32, and is around 10 times lower than what is required in EN 717-1.

Version 5 of the criteria for Nordic Ecolabelling of Floor coverings only sets requirements concerning emission testing for formaldehyde in wood-based board. Nordic Ecolabelling is naturally focused on Nordic Ecolabelled floor coverings giving off low emissions of substances harmful to health. In contrast to pure indoor climate labels, however, our approach is to limit the potential for problematic substances to give off emissions by setting stringent requirements concerning the products' constituent raw materials, chemicals and surface treatments, including:

- Prohibiting a number of substances in the raw materials used.
- A general prohibition on chemical products and constituent substances that are classified as CMR, allergenic, toxic and harmful to the environment. Exemptions from the requirement apply only to chemical products that cure.
- Prohibiting a number of named chemical substances.
- Separate requirements for surface treatments: environmentally harmful substances, VOC, HDDA in UV lacquers that are allergenic and paints, dyes and pigments.
- A number of endocrine disruptors and substances on the list of SVHC are covered by these requirements.
- Separate requirements for formaldehyde emissions.

[43] Correspondence with Eurofins, November 2013

Nordic Ecolabelling has a particular focus on emissions of formaldehyde, since this substance is used in the manufacture of many products and can give rise to many negative health effects. Formaldehyde can cause health problems in conjunction with the production and use of products. Inhalation of formaldehyde gas can cause painful irritation of the mucous membranes in the nose and throat, and in the eyes after a couple of hours of exposure to concentrations below 0.2 ppm, although the reaction varies a great deal from individual to individual. Particularly sensitive people, such as children, can feel irritation of the mucous membranes and eyes at concentrations as low as 0.06 mg/m^3. Studies have shown that suffering formaldehyde irritation can suppress a child's resistance to respiratory infections. Around 1% of the population is sensitive to formaldehyde, and in the context of the workplace many instances of asthmatic reactions to formaldehyde have been reported. Formaldehyde has shown a broad spectrum of mutagenic effects in many types of testing system, in the form of bonding to genetic material. Experiments on rats have proven that formaldehyde is a carcinogenic substance, and it is now classified as such, rather than just as a suspected carcinogen. One likely source of formaldehyde in floor coverings is any manufactured board that may make up the flooring (due to the adhesive used in such board). If alternative 2 is chosen, the requirements will limit formaldehyde emissions from floor coverings with constituent manufactured board and from textile flooring.

Requirement O32 will be deleted if alternative 1 is introduced. The requirement is tougher compared with version 5 of the criteria and states two different test methods that can be used to show fulfilment of the requirement: the Perforator method (alternative a) and the Chamber method (alternative b). MDF panels are permitted a slightly higher limit value, since these generally have a documented higher content formaldehyde. For all boards except MDF, the limit value for formaldehyde has been tightened by around 50% compared with version 5 of the criteria. In simple terms, Nordic Ecolabelling's requirement level is 50% of E1 for the Perforator method for all boards except MDF. For the Chamber method, the requirement level is slightly higher, at around 55% of E1.

The formaldehyde requirement has been fully harmonised with corresponding requirements in Nordic Ecolabelling's product groups for Panels for the building, decorating and furniture industry, Furniture and fitments, and Small houses, apartment buildings and pre-school buildings. As such, Nordic Ecolabelled manufactured board fulfils the formaldehyde requirement and can verify the requirement simply using the product name and a valid licence number. Additional background information on the requirement, and on the chosen emission level can be found in the Nordic Ecolabelling background document for Furniture and fitments[44].

Alternative 1 or 2?

Despite Nordic Ecolabelling's stringent chemical requirements concerning constituent substances in building products, there have been several occasions on which developers and environmental certification schemes for buildings have still required emission testing for Nordic Ecolabelled building products. We would therefore like feedback on whether being able to document emissions as part of the requirements would bring added value to Nordic Ecolabelled floor coverings.

[44] http://www.svanemerket.no/PageFiles/4555/mobler_bkg_v45.pdf

O35 Cleaning quality

Textile floor coverings are to be tested for cleaning in accordance with INSTA 800 and achieve a dust index level of 5.

✉ Test report showing that the requirement is fulfilled.

Background

The requirement has been set to ensure that the floor covering can be cleaned thoroughly, in order to ensure a good indoor climate. INSTA 800 is a Scandinavian standard/system for assessing the cleaning quality in a room. The cleaning quality is checked by measuring both before and after cleaning. INSTA 800 measurements include dust deposits in the carpet before and after vacuuming. the measurements are then converted into a dust index that ranges from 1 to 5, with 5 being the best possible result. The requirement is a new feature of this revision.

5.5 Energy requirements

Energy consumption is calculated as an annual average. The following delimitations apply for what is included in the energy calculation:

- Electricity and fuel consumed in drying and sawing is included in the calculation for parquet flooring, bamboo flooring and solid wood floor.
- For flooring that includes wood-based board in its structure, the energy consumed in the manufacture of the board is to be included.
- For other flooring, the only thing included is the energy used in the final manufacturing of the flooring/in the flooring factory.

At least 95% by weight of the raw materials in the flooring must be included in the calculation of energy consumption. Energy consumption in the manufacture of adhesives and lacquers used in the manufacture of the flooring is not included in the calculation.

For energy, Nordic Ecolabelling has chosen the unit kWh/m^2, but this can be converted as follows: 1 kWh = 3.6 MJ.

O36 Energy consumption for Nordic Ecolabelled floor coverings

An energy calculation is to be made, and the total must amount to at least:

$$E = \frac{A}{20} + (5 - \frac{B}{3}) + (5 - \frac{C}{7})$$

- E shall be at least 11.0 for solid wood flooring and laminate flooring
- E shall be at least 8.0 for linoleum flooring, parquet flooring, bamboo flooring and cork flooring
- E shall be at least 8.5 for textile flooring and plastic flooring.

The following applies for the individual energy components:

Environmental parameters	Requirement/limit value
A = Proportion of renewable fuel (%)	—
B = Electricity consumption (kWh/m^2)	Maximum 15 kWh/m^2
C = Fuel consumption (kWh/m^2)	Maximum 35 kWh/m^2

Energy consumption relates to electricity purchased from an external supplier.

If the manufacturer has surplus energy and sells this in the form of electricity, steam or heat, the amount sold is deducted from the fuel consumption figure. Only fuel that is actually consumed in the manufacture of the floor coverings is to be included in the calculation.

The energy content of different fuels can be found in Appendix 12.

☒ Enclose the calculation of E as set out above.

☒ State which types of fuel have been used in the manufacture of the floor covering over the past year, and which fuels are renewable. State how much electricity has been used and how much flooring (m^2) has been produced over the past year. Appendix 11 can be used.

Background

The energy requirement in its current form was introduced in the 2006 revision of version 4 of the criteria. The purpose of this revision has been to trim the requirement down to a purely energy-related requirement, removing the parameters in the calculation relating to the proportion of wood raw material from certified forestry and the proportion of recycled wood raw material. The reason for this is that these points are dealt with in requirement O2 on the proportion of recycled materials and requirements O5 and O8 on the proportion of wood raw material from certified forestry.

The energy requirement comprises two parts. One part contains requirements/limit values for the use of electricity and fuel. The other sets out a certain sum total that must be achieved in the energy formula. The energy requirement promotes low energy consumption in terms of electricity and fuel, plus a high proportion of renewable fuels. The formulation provides a certain amount of flexibility for the flooring manufacturer. If the preconditions for reducing electricity consumption are poor, it is possible to prioritise initiatives for low fuel consumption instead. The proportion of renewable fuel affects the total energy outcome just as much as electricity and fuel consumption. A low proportion of renewable energy can thus to some extent be compensated for through low overall energy consumption.

Renewable fuel is defined as non-fossil fuels. Peat is not considered to be renewable. With regard to electricity, no account is taken of how the electricity is produced, or whether it carries an ecolabel or traceability label. It is only the number of kilowatt hours that affects the outcome.

The formula is designed such that a maximum total "E" is achieved as follows:

$$E = \frac{A}{20} + (5 - \frac{B}{3}) + (5 - \frac{C}{7})$$

Each term/subcomponent may be a maximum of 5. In the previous criteria revision, the maximum figure for each term was 4. The figure 5 is not actually important. The important thing is that each subcomponent contributes equally to the total E, making them all equally significant. The less energy used during manufacture, the higher the figure achieved within each set of brackets. In the same way, a high proportion of renewable fuel contributes a term that is close to 5. This means that the lower energy consumption and the higher the proportion of renewable fuel, the higher the sum total E.

The lowest acceptable value for the sum total E is set for different types of floor covering. Similarly, specific requirements concerning maximum electricity consumption and maximum fuel consumption are set out, expressed in kWh per square metre

manufactured floor covering. If energy consumption amounts to the maximum (15 kWh/m^2), the term/subcomponent will be zero and contribute nothing to the sum total E. The maximum fuel consumption is set at 35 kWh/m^2. If 35 kWh fuel is used to produce one square metre of floor covering, the contribution from the last term will, by analogy, also be zero.

For energy, Nordic Ecolabelling has chosen the unit kWh/m^2, but this can be converted to MJ/m^2 (1 kWh = 3.6 MJ). Appendix 12 of the criteria document lists the heating values, i.e. energy content, of different fuels. A licence applicant may also use its own specific fuel values.

What does the energy requirement cover?
The purpose of this revision has been to make the requirement more energy-focused, while retaining the character of the energy requirement in promoting low energy consumption and a low contribution to the greenhouse effect through a high proportion of renewable fuel, and in taking account of each specific flooring material.

This revision has also streamlined what must be included in the energy calculation. Since steerability is low for the manufacturing steps that take place before the flooring factory, we have limited the energy requirement to cover:

- Electricity and fuel consumed in drying and sawing is included in the calculation for parquet flooring, bamboo flooring and solid wood floor. Drying is included for wood flooring, since this often takes place in-house. The energy for drying was also included in the previous criteria.
- For flooring that includes manufactured board in its structure, the energy consumed in the manufacture of the board is to be included. The energy calculation is based on data from raw material handling (including conveyor to the production line), up until the finished product ready for any surface treatment. Energy consumption during surface treatment is not included.
- For other flooring, the only thing included is the energy used in the final manufacturing of the flooring/in the flooring factory.

The existing minimal limit states that at least 95% by weight of the raw materials in the flooring must be included in the calculation of energy consumption. This means that energy consumption for laminate flooring does not include the manufacture of structural and decorative papers. Energy consumption in the manufacture of chemical products such as adhesives and lacquers is also not included in the calculation.

How has the requirement level been tightened?
How has the requirement level changed compared with version 5 of the criteria? That question has no simple answer, since the energy formula has been changed. In version 5 of the criteria, the energy formula comprised an additional one and two terms that were added to the sum total. These related to the proportion of wood raw material from certified forestry (relevant for wood, bamboo and laminate flooring) and to the proportion of renewable/recycled raw material (relevant for all floor coverings). As mentioned above, these have been entirely removed, since they are dealt with in other requirements in the criteria document.

It is, however, clear that the requirement for:

- maximum electricity consumption has been tightened from max 20 kWh/m^2 to 15 kWh/m^2
- maximum fuel consumption has been tightened from 50 kWh/m^2 to 30 kWh/m^2.

A survey of existing licence data shows that the requirement level for the sum total of E has been tightened slightly, compared with previous requirements concerning the equivalent sum total (which was called P). The requirement is judged to have a steering effect, such that the floor coverings in each flooring category that have the highest energy consumption and/or lowest proportion of renewable energy do not meet the requirement level. Since the sum total P in version 5 of the criteria also included a contribution from the proportion of certified wood and renewable raw materials, P and E are not directly comparable.

In this revision, Nordic Ecolabelling has attempted to gather data on energy consumption even for the types of flooring that are not licensed or that have not clearly been included in the product group definition before. It has generally proven difficult to determine this information. A flooring factory often produces many different types of flooring, of which one or more may be Nordic Ecolabelled. It is often impossible to separate out energy consumption and ascribe it to a particular floor covering, since it applies to the whole factory. This means that the energy consumption data on which the requirement is based and which is to be used for licensing is an annual average, and is not necessarily the specific energy consumption linked to the particular Nordic Ecolabelled floor covering(s). Depending on how the energy meters are installed in the factory, energy consumption data may also include energy for heating and operation of the premises, which should not actually be included in the calculation. In summary, it is judged that the best factories in terms of energy consumption will be able to fulfil the requirement.

5.6 Waste requirement

O37 Handling of waste and production waste

The flooring manufacturer shall sort waste at source into the fractions that arise during production, including production waste. Furthermore, a plan for separating waste must be drawn up, stating waste fractions and describing how the waste is dealt with (e.g. recycling, landfill and incineration).

Hazardous waste must be treated and dealt with in accordance with the regulations applicable in the country of manufacture.

✉ Waste plan featuring waste fractions and waste recipients. Declaration of hazardous waste, if applicable, and a statement on how hazardous waste is handled in accordance with the regulations applicable in the country of manufacture.

Background

The requirement concerning waste management has been reformulated to include requirements for generally good waste management. It is based on legislation in the Nordic countries, which discourages the use of landfill. Environmental and commercial/economic drivers steer companies towards material recovery or energy recovery from the waste, where possible. Against this background, the waste requirement is judged to be fit for purpose in its revised form.

The requirement that the floor covering must not be classified as specialist waste is felt to have reached the end of its usefulness and has been removed as part of this revision. The purpose of the requirement is instead taken up through the general ban on chlorinated plastics in Nordic Ecolabelled floor coverings.

5.7 Functional requirements

O38 Durability

Only the requirements associated with the specific type of flooring have to be fulfilled.

If the flooring has been tested according to a test method other than what is specified below, this may be acceptable if the test methods are comparable in the opinion of an independent third party.

All Nordic Ecolabelled floor coverings must achieve at least:

- class 22+ for floor coverings intended for private use
- class 33 for floor coverings intended for professional/public use, see table below.

Semi-hard flooring, textile flooring and laminate flooring is to be tested and classified in accordance with the standards EN 14041 and ISO 10874 or EN 12104 (cork tiles).

Wood flooring, including solid wood flooring, factory lacquered wood flooring and parquet flooring, is to be tested and classified for durability/wear resistance in accordance with EN 14354, EN 335 or EN 438.

Textile flooring is to be classified in accordance with EN 1307 (textile flooring with pile), EN 15114 (textile flooring without pile) or EN 1470 (needle-pile carpets).

Area of use	Class of use	Intensity of use
Private use/Domestic	21	Moderate/light
	22	General/average
	22+	General
	23	Hard
Professional/public use/offices and commercial premises	31	Moderate
	32	General
	33	Hard
	34	Very hard

The requirements for testing institutes and test methods are stated in Appendix 1.

✉ Test report from an independent testing institute that the requirement is fulfilled.

Background

The durability of the floor covering has a major impact on resource consumption and the service life of the flooring. It is in principle impossible to put an exact figure on the service life of a specific flooring material, since the service life depends on a number of disparate factors. There is also no unequivocal definition of how worn a flooring material has to be for its service life to be declared at an end. Wear varies considerably over the surface of the flooring. In doorways, aisles, at the bottom of stairs and at a workstation, the material wears many times faster than in a corner where no foot traffic occurs, for example.

A basic rule is that durability should be adapted to the environment in which the flooring is intended to be used. The flooring should have generally good wear resistance, since the use of rooms in the home may change over the lifetime of the flooring. There are

currently testing methods and product standards harmonised across Europe for the majority of flooring material types. Flooring manufacturers place their products in different usage classes with the help of the various testing methods. The usage classes give the user a quick overview of the flooring material's durability and suitability for different environments. The usage classes are divided into Domestic, Commercial and Light Industrial, with 3-4 intensity levels in each class.

Version 5 of the criteria also contained requirements concerning durability, stating that floor coverings had to fulfil class 22. In this revision, the durability requirement has been made more specific, with class 22+ for domestic and class 33 for commercial premises. The requirement thus now differentiates between private and public environments. References to standards and test methods have been updated.

If there is no harmonised European testing standard, floor coverings such as bamboo flooring can be tested according to a test method chosen by an independent testing insitute with the competence to conduct wear tests on flooring. If no relevant test method for hard floors can be applied to bamboo flooring, this can be tested according to the test method ANSI/NEMA LD 3-2005, "High-Pressure Decorative Laminates", where the limit value is set at 500-600 revolutions. Hardness is measured according to ASTM D1037-99 (hardness test 68-73). The lowest permissible classification for bamboo flooring is the equivalent of class 2 as defined in EN 687.

Standard EN 14342, on which the CE marking of wood flooring is based, states that the biological durability of wood flooring is classified in accordance with standard EN 335-2: 2006. Here the usage classes applied to wood flooring are defined in relation to water contact. There are otherwise no standardised descriptions of usage classes for wood flooring. There are, however, usage classes for lacquers applied to wood flooring, and it is therefore relevant to set quality requirements concerning factory lacquered wood flooring.

At the same time, the National Institute of Technology in Norway states that EN 438 may be used for laminate flooring and lacquered wood flooring. This tests the number of revolutions the abrasive wheel can make, rounded to the nearest 100, before breaking through the laminate or lacquer.

Table 4: Number of revolutions the abrasive wheel can make before breaking through the laminate or lacquer.

Abrasion Class	**AC1**	**AC2**	**AC3**	**AC4**	**AC5**
Average IP value from three test specimens	≥ 900	≥ 1500	≥ 2000	≥ 4000	≥ 6000

Table 5: Abrasion classes transposed to classes of use:

Area of use	**Private use**			**Professional/public**		
Classes of use	21	22	23	31	32	33
Abrasion Class	AC1	AC2	AC3	AC3	AC4	AC5

O39 Product information

The following product information is to be enclosed with the Nordic Ecolabelled floor covering:

- Recommended subfloor for the floor covering.
- Recommended upper limit for the subfloor's relative humidity and temperature when laying the floor covering.
- Which adhesive is recommended for joining the flooring together and gluing to the subfloor. If there are suitable Nordic Ecolabelled adhesives, these are to be recommended. Recommended methods for laying and joining the flooring are also to be provided.
- If the flooring is to be welded together, a method for this is to be stated.
- Recommended cleaning method including cleaning products. If there are suitable Nordic Ecolabelled cleaning products, these are to be recommended.
- Recommended maintenance methods, including maintenance products. If there are suitable Nordic Ecolabelled maintenance products, these are to be recommended.
- Treatment is to be recommended for oiled and untreated flooring (type/quantity of oil or lacquer) in order to achieve the intended durability.
- The flooring's areas of use are to be stated. See classes in requirement O38.
- The flooring manufacturer is to inform the customer about how the service life of the flooring can be extended through renovation, e.g. sanding and surface treatment.

✉ Enclose a copy of the product information given to customers.

O40 Wet room approval

Floor coverings marketed and sold for wet rooms are to be approved for their intended use in wet rooms according to the national industry standard:

- approved as a surface layer in wet rooms and/or
- approved as a waterproof barrier in wet rooms, (acting as a barrier behind ceramic materials and natural stone)

Installation instructions tailored to wet rooms are to accompany the flooring and be made available on the manufacturer's website.

✉ Approval according to national industry standards.

✉ Installation instructions that accompany the flooring and are available on the website.

Background

The product information requirement remains unchanged from the previous version, since the requirement is judged to be relevant and fit for purpose. Wet rooms are rooms subjected to water or high relative humidity. Wet rooms are among the most critical rooms in a building, with any imperfections in the waterproofing posing a major risk of moisture damage to surrounding structures. Water damage costs a huge amount every year. Reliable construction solutions and professional performance are essential for problem-free and waterproof wet rooms.

Alongside industry rules on construction, performance and installation, there is an industry standard for approval of flooring materials and waterproof barriers. Wet room approval and approved labelling can be obtained once a product has been

tested and judged to meet the requirements in the national industry standard for plastic flooring in wet rooms.

Plastic flooring includes:

- products based on polyvinyl chloride (PVC)
- products based on thermoplastic polymers (TP)

There are two types of approval for plastic flooring. When plastic flooring is to be used as a surface layer in a wet room, it must be approved for this purpose. When plastic flooring is to act as a barrier under a layer of ceramic tiles or natural stone, it is important that it has been tested and approved for this purpose, which means that the product must also tolerate an alkaline environment caused by mortar and grouting.

Since the revised Nordic Ecolabelling criteria make it possible for PVC-free plastic flooring to obtain the Nordic Ecolabel, it is important that the fundamental requirements for wet room approval are fulfilled for flooring intended for use in wet rooms. A new requirement has therefore been introduced, such that plastic flooring marketed and sold for wet rooms is to be tested and approved according to national industry standards. These are stated, for example, in:

- Golvbranschens branschstandard för golvbeläggning av plast i våtutrymmen (The flooring industry standard for plastic flooring in wet rooms) (Sweden)
- Gulvfakta utgiven av Gulvbranchen (Flooring facts issued by the flooring industry) (Denmark)
- Anbefalt Våtromsprodukt från FFV – Fagrådet for Våtrom (Wet room products recommended by FFV – Expert Committee for Wet Rooms) (Norway)

The requirement also states that instructions for proper installation in wet rooms are to accompany the product, and be available on the manufacturer's website.

5.8 Quality and regulatory requirements

Requirements R27 to R34 in version 5 of the criteria are general requirements that are always included in Nordic Ecolabelling's product criteria. No changes are suggested for these requirements.

6 Changes compared to previous version

Appendix 1 to this report contains a summary of all the revised requirements and the changes made since version 5.

7 New criteria

Text will be inserted after the consultation.

8 Terms and definitions

To be completed in the final criteria document

Term	Explanation or definition
Click here to enter text.	Click here to enter text.

Appendix 1 Changes since the previous criteria revision

Previous criteria (version 5)	Previous criteria (version 6.0)	Comments
-	O1	Requirement not present in version 5.
R1	O2	Requirement level has been raised from 50% to 80%. As well as renewable raw material, recycled raw material is also included in the percentage. At the same time, a possibility of exempting inorganic fillers has been introduced.
-	O3	The requirement has been inferred through the product group definition, but has now been clarified in a separate requirement.
R2	O4	Updated so that it matches the way Nordic Ecolabelling formulates requirements concerning origin and traceability.
R3	O5	Requirement concerning certified raw materials now includes bamboo, cork and manufactured board. Percentages tightened.
-	O6	New requirement
R4	O7	The limit value for COD emissions during retting have been tightened from 75% to 90% Separate limit value for hemp (75%). Ban on pesticides introduced.
R5	O8	Requirement unchanged
R6	O9	The limit value for COD emissions from wool washing plants has been tightened. Requirement concerning pH value and temperature introduced.
R7	O2	Requirement integrated into O2
R8	-	Requirement deleted
R9	O10	Requirement unchanged
R10	--	Requirement deleted
-	O11	New requirement
R11	O12	Requirement unchanged
R12	O13	Requirement unchanged
-	O14	New requirement
R13	O15	Requirement developed to include the values for PAHs and N-nitrosamines.
R14	O16	Requirement developed to include requirements concerning tin in organic form, isocyanate compounds and DMAc

Previous criteria (version 5)	Previous criteria (version 6.0)	Comments
R15	O17	Requirement streamlined to apply to classification of chemical products.
-	O18	New requirement
-	O19	New requirement
-	O20	Requirement existed in part in previous R15, but has been further developed.
-	O21	New requirement
R16	O27 & O28	Requirement reformulated to now take account of different levels of harmfulness in constituent environmentally harmful substances.
R17	O22	Requirement practically unchanged
R18	O23	Requirement reformulated in line with Nordic Ecolabelling's guidelines on nanomaterials.
-	O24-O27	New requirement
R19	O33	Limit values for formaldehyde have been tightened.
R20	O29	Requirement practically unchanged
-	O30	New requirement
-	O32	Requirement is new and proposed as an alternative to formaldehyde emissions (requirement O35)
-	O34	Requirement is new and complements O33 if alternative 2 is produced.
R21-R23	O35	Requirement unchanged
R24	O36	Requirement is reformulated to be less micromanaging.
R25	O37	Requirement partially changed
R26	O38	Requirement unchanged
-	O39	New requirement for wet room approval
R27-R34	O40-O48	Quality and authority requirements are essentially unchanged.

Appendix 2 Flooring from an environmental perspective

The appendix including a summary of the MECO analysis, is available in a Nordic language and may be obtained from sara.bergman@svanen.se

Appendix 3 PVC and the environment

Introduction

The environmental problems associated with PVC have been well known for a long time. Almost as well known are the benefits of PVC as a flooring material in environments that demand high levels of wear resistance and durability from floor coverings. A PVC floor covering is hard-wearing, has a long service life, is easy to care for/keep clean and is resistant to chemicals. It is often hard to find alternatives for certain public environments such as schools and hospitals.

Polyvinyl chloride (PVC) is a thermoplastic that is primarily used in the construction industry for pipes, cables, flooring, wet room wall coverings, profiles and windows. Other common areas of use include the transport sector, the healthcare sector and covers for electronics.

Manufacture

PVC is manufactured in three separate stages: chlorine production, the production of the monomer VCM and finally polymerisation into PVC. The raw materials for PVC are 57% salt (NaCl) and 43% ethylene (oil or natural gas). Chlorine gas (Cl_2) and lye (NaOH) are extracted from the salt and sold to the pulp and paper industry, along with hydrogen that can be sold as a raw material or used as an energy source. In this way, the PVC industry is intimately linked with the pulp and paper industry.

There are three methods of producing chlorine gas. The membrane method is the most modern and most environmentally aware method. 46% of all PVC in Europe is produced using this technique. The two other methods that remain in use are the diaphragm method[45] (14%) and the mercury method (34%). According to political decisions, the mercury method should have been phased out back in 2010. INEOS has a large plant in Stenungssund in the west coast of Sweden. They have received special dispensation to continue using the mercury method until 2015. In addition to the problem of the harmful mercury in the mercury method, this is the most energy demanding of the three production techniques, consuming around 20% more energy than the membrane method, for example.

The chlorine gas is made to react with the ethylene to form dichloroethane (EDC), which is then broken down into vinyl chloride monomer (VCM) and hydro-chloric acid. Finally, the polymerisation takes place under high pressure to form PVC, which is dried to a fine white powder.

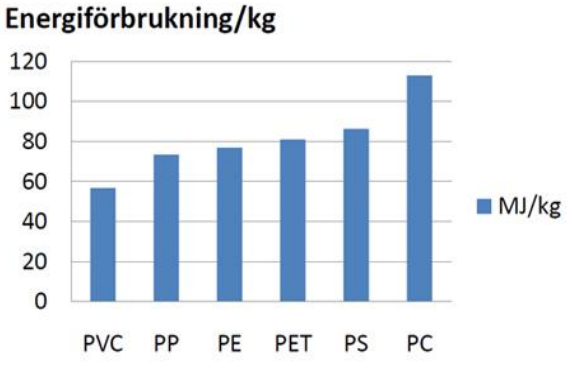

Figure 6: Energy consumption in MJ/kg, for some common plastics. Source: PVC Forum

One benefit often put forward in the PVC debate is that it uses less energy to produce compared with other plastics. According to European data, it takes around 55 MJ non-renewable energy to make 1 kg polymer granules.

[45] In the diaphragm method, the diaphragm may be made from asbestos.

The environmental effects of PVC manufacture are:

- Mercury emissions when the mercury method is used. INEOS' annual emissions are 0.4-0.5 kg Hg to water and around 15 kg to air. This is, however, the lowest in Europe, according to their own data.
- Dioxin formation, although to a very limited extent.
- Risk of the formation and dispersal of harmful substances such as EDC, VCM, hexachlorobenzene and pentachlorophenol. Handling involves risks in the workplace and in the surrounding environment.

Additives

Various additives are added to the polymer to make it workable and to give the end product the desired properties. The most common additives are fillers, pigments, flame retardants, plasticisers, stabilisers and antioxidants The last three are always added to PVC. The proportion of plasticiser can range from 0-50%. Below is a very brief summary of the relevant additives from an environmental perspective:

The most common stabilisers in Europe are currently calcium-zinc (80%). Stabilisers based on barium-zinc and organotin compounds also occur. Cadmium stabilisers were phased out within the EU from March 2001, and their use had been limited even before then. PVC with cadmium stabilisers may occur in imported PVC. No lead stabilisers are to be used within the EU 27 by the end of 2015. Around 75% had been phased out within the EU by 2010. Sweden and several other Nordic countries had phased out cadmium and lead several years earlier.

In its pure form, PVC is a rigid material that requires the addition of plasticisers to make it soft and formable, as required for flooring, hoses, cables and so on. A common group of plasticisers are the phthalates, which can be divided up into subgroups depending on how long a carbon chain they have. Short-chain phthalates are those with 3-6 carbon atoms in their main chain, such as di-2-ethylhexyl phthalate (DEHP), dibutyl phthalate (DBP), diisobutyl phthalate (DIBP) and benzyl butyl phthalate (BBP). The larger molecules have 7-13 carbon atoms in their main chain, which gives greater durability and a more stable molecule. Two examples of these are diisononyl phthalate (DINP) and diisodecyl phthalate (DIDP).

The short-chain phthalates DEHP, DBP, DIBP and BBP are suspected of being toxic for reproduction, and within the EU they are classified as Substances of Very High Concern (SVHC). In several cases, they are classified as CMR substances and are subject to various restrictions. Over a recent 10-year period, the use of low molecular phthalates fell from 40% in 2001 to 10% in 2009. Other plasticisers such as DINP have almost entirely replaced DEHP, which has long been the most criticised of the plasticisers. High molecular phthalates are also subject to restrictions, including a general ban in toys or more specifically in toys and childcare products that may be placed in the mouth. Overall, the focus is on the risk that phthalates are endocrine disruptors. In a recently published report, the World Health Organisation (WHO) stated[46]: "Several of the most common diseases continue to rise in the world, and researchers now present new evidence that there is a link between endocrine disrupting chemicals and some of these

[46] State of the Science of Endocrine Disrupting Chemicals, WHO, 2012.

diseases. Today, several hundred substances available on the market have been identified as endocrine disruptors, but most have not yet been studied."

In their report, the researchers suggest that we underestimate the risks that the chemicals pose for humans and the environment. Examples of disorders on the rise that may be linked to endocrine disruptors include:

- Low sperm quality and genital malformations in young boys
- Low birth weight and preterm births
- Thyroid disruption in children
- Various types of cancer, e.g. breast cancer and testicular cancer
- Premature breast development
- Obesity/diabetes

There should be a core focus on reducing exposure to endocrine disrupting chemicals, according to the researchers.

Other substances that may serve as plasticisers and that are in use, although to a lesser extent, are adipates and citrates. Adipates are considered readily degradable.

In recent years, brand new plasticisers that offer competitive pricing and technical performance have been established as alternatives to phthalates. Some have vegetable origins, while others do not:

- Hexamoll ® DINCH (manufactured by BASF) has been on the market since 2002. It has received Food Contact Clearance from the US Food and Drug Administration, which means that it can be used in applications such as food packaging. DINCH is heavily marketed as being safe. The Swedish Chemicals Agency stresses, however, that there have been very few studies of DINCH. Chemically, it shares similarities with DINP, but without an aromatic carbon ring. See Appendix 4.
- Emoltene ® (a new product from Perstorp) has similar properties to dioctyl phthalate (DOP). Emoltene has also been given Food Contact Clearance.
- DOTP (several manufacturers) is a phthalate-free plasticiser.
- Eastman 168™
- OXSOFT TOTM (manufactured by OXEA)
- GRINDSTED ® Soft-n-Safe (manufactured by Danisco). This is an acetylated monoglyceride derived from castor oil. It is thus vegetable-based and fully degradable.
- Epoxidised soybean oil (ESBT) is a vegetable product defined as a secondary plasticiser.

Flame retardants do not have to be added to PVC if it contains less than 40% plasticiser, due to the polymer's own inherent flame resistance. Flame retardants are, however, added for certain applications with particular fire safety requirements.

The environmental aspects of PVC have often been equated with the harmfulness of the additives. This has led to a major focus on the additives and has resulted in intensive work to find less harmful or completely safe alternatives. This is a narrow way of looking at the environmental problems of PVC, and is encouraging the attitude that once the issue of the additives has been solved, PVC will take its place as a material in a sustainable society.

Use

During use, there is a risk that additives will migrate from the PVC product. The risk depends in part on which substances/compounds are released and in part on how much the product is worn down. A floor covering receives more wear than a window, for example. Phthalates can leach out of plastic and be absorbed by the body. Phthalates are found in humans on analysis of breast milk, blood, urine, and so on.

The risk of more toxic gases forming has been highlighted in the case of fires where PVC material has been present. Vinyl flooring can cover large areas and be a significant contribution to the overall quantity of PVC in a building at risk of fire.

Recycling

In theory, PVC is a good plastic for recycling, since it can be melted down several times without a deterioration in its properties. Each year, the EU recycles around 260,000 tonnes of all the PVC scrapped. The PVC industry's environmental project Vinyl Plus is working to increase this to 800,000 tonnes by 2020, see figure below.

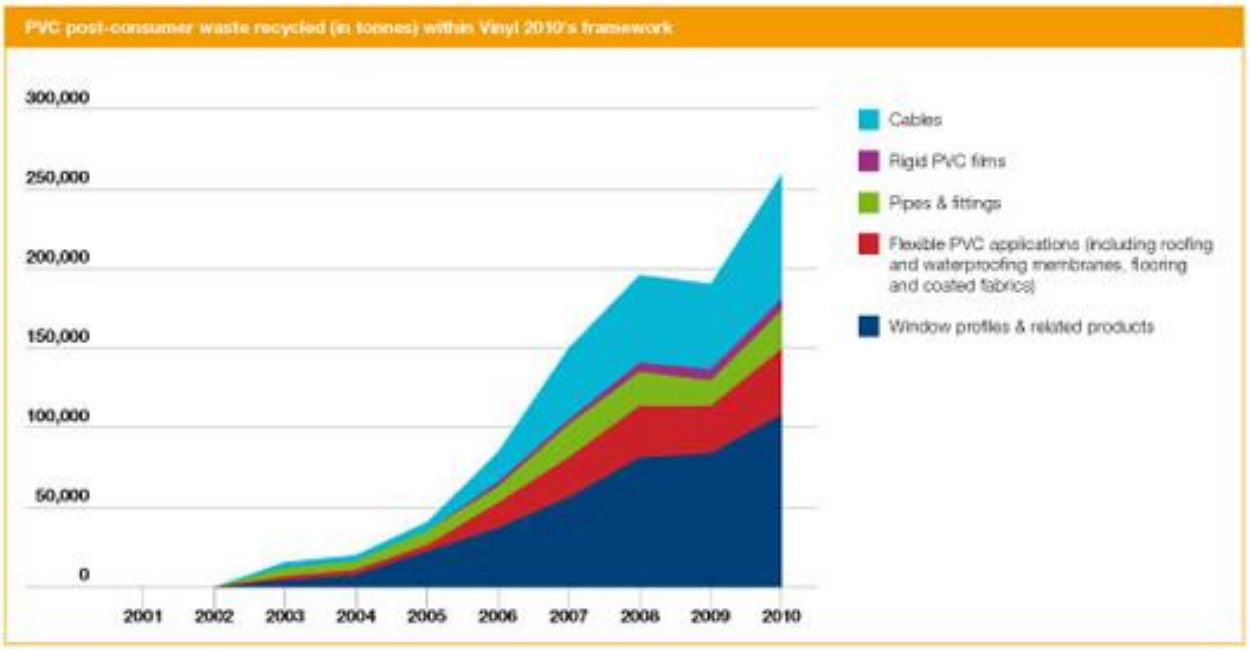

Figure 7: Quantity of post-consumer waste (tonnes) recycled within the framework of Vinyl Plus. Only a small amount of this is soft PVC. Source: Swedish Plastics and Chemicals Federation.

Recycling is split into:

- Mechanical material recovery. Here, the collected plastic is ground into small pieces that are then melted down and shaped into new products.

- Material recovery through raw material extraction. Here, the original raw materials are recovered and then used to make brand new PVC. This technique is only at the trial stage.
- Energy recovery. The energy content of PVC is around 20 MJ/kg, which is less than other plastics due to the high chlorine content. PVC does, however, have the same energy content as green wood chips (residues from newly felled trees), half the energy content of fuel oil and 1.5 times the energy content of municipal waste. Soft PVC products have a higher energy content, since the plasticisers are organic compounds.

The EPFLOOR project (European PVC Flooring Manufacturers) offers recycling solutions for all installers, private waste companies and municipal waste plants in Europe. In 2010, they collected 2448[47] tonnes of post-consumer material. EPFLOOR has no customers/operations in the Nordic countries. However, the Swedish Flooring Trade Association (GBR) has a collection system for installation waste. Around 5% of a floor covering becomes waste on installation. Major flooring manufacturers such as Tarkett and Forbo have been recycling their own production waste and running a take-back system for installation waste for several years. Tarkett, which has production facilities in Sweden, is a major recipient of the collected installation waste from the industry. In 2012, for example, 14,175 tonnes of production waste and 416 tonnes of installation waste were returned to Tarkett for its vinyl flooring production. That equated to 19% recycled material in the vinyl flooring, if production waste is also counted as recycling, which is debatable.

Forbo Flooring, which has no production in Sweden, sends no collected waste to its factories in the Netherlands, France and Switzerland. It would be neither profitable nor environmentally justifiable. They estimate that less than 10% of the raw material in their new vinyl flooring comes from their own production waste and installation waste[48]. Since the system for collecting installation waste is not as well developed in the rest of Europe as it is in Sweden, such waste makes up a very small proportion compared with production waste.

INEOS recovers unreacted VCM from its monomer production and recycles it. The small amount of PVC that makes it into the effluent from the INEOS plant is precipitated out and sold on.

There is an inherent conflict between the desire to recycle materials and the presence of harmful substances. It is often the case that end-of-life PVC products contain various undesirable additives that render material recovery impossible. A sustainable approach is to detoxify the ecocycle first!

Incineration of PVC

In the absence of a good collection and material recovery system for end-of-life PVC products, incineration and energy recover are a common way of handling PVC waste. In Sweden, the vast majority of all end-of-life PVC (from which material cannot be recovered) is incinerated. A high and effective landfill tax and a ban on landfill of combustible waste are key reasons for this. In Denmark, the situation is different.

[47] See www.epfloor.eu
[48] Discussion with Robert Jürke, Forbo Flooring.

National legislation (Affaldsbekendtgørelsens § 33) sets out the rules concerning the handling of end-of-life PVC:

- The local municipality must establish a collection system for PVC waste. The system must be designed such that a substantial proportion of both recyclable and non-recyclable PVC waste is collected.
- The municipality must ensure that a substantial proportion of the collected recyclable PVC waste is recycled, and that a substantial proportion of the non-recyclable PVC waste is sent to landfill.

The Danish Environmental Protection Agency and the Danish Waste Association also state that the rules are to be enshrined in the municipalities' waste regulations and that businesses must always sort PVC from other waste, irrespective of quantity.

The challenges of incinerating PVC for energy recovery

The incineration of PVC waste is not straightforward. Below are some of the key challenges, with a brief commentary on the state of the science[49]:

- **Dioxin formation.**This has been much debated since the 1980s. Modern studies show that there is no link between PVC and dioxin formation in waste incineration plants. Eliminating PVC from waste has little or no effect on dioxin formation. Back in 1999, the Danish Environmental Protection Agency warned that one should not conflate the dioxin problem with the issue of whether or not PVC should be incinerated.
- **Chlorine content.**PVC contains a large proportion of chlorine (57%). However, PVC-free waste streams to municipal waste incineration plants also contain large quantities of chlorine. Studies show that PVC accounts for 38-66% of the chlorine in waste incineration. Reducing the proportion of PVC in the waste would be expected to bring no significant changes in corrosiveness, heating value or the quantity of electricity that could be produced at a CHP plant.
- **Metal content.**It can be assumed that around 10% of the cadmium content in flue gas cleaning residues derives from PVC waste. Due to the long service life of the products, PVC waste containing cadmium is still being supplied to the municipal incineration plants. The proportion of lead and zinc is so small that it is practically negligible.
- **Increased quantities of flue gas cleaning residues.**The quantity of residues from flue gas cleaning rises when PVC is incinerated, due to its chlorine content. The additional amount of residue is heavily dependent on the type of cleaning process used (dry, semi-dry or wet flue gas cleaning). Other non-combusted residues end up in slag and fly ash. With dry and semi-dry cleaning techniques, the quantities rise by around 20%. Wet flue gas cleaning does not require a neutralising agent, since the hydrochloric acid is water-soluble and is dissolved in

[49] The main sources are "PVC and Municipal Solid Waste Combustion-Burden or Benefit?", TNO Institute of Environmental Sciences, Energy Research and Process Innovation, 1999. Påvirkning af massestrømmene gennem et forbrændingsanlæg, Ove Hjelmar, Institut for Vand og Miljø, DHI, 2002

the water phase. It does, however, require a certain addition of calcium carbonate or calcium hydroxide in order to adjust the pH in the water phase. Incineration of PVC increases the quantity of residues from the wet gas cleaning process by an estimated 5% or so. (These figures are based on the assumption that half of the chlorine in the waste comes from PVC and that 70% of the waste's chlorine and 50% of its sulphur end up in the residues from the acidic flue gas cleaning.)

- **Increased costs for the plants.**It cannot be ruled out that PVC in the municipal waste incineration system entails increased costs in terms of warehouse dimensions and feeding facilities. The chlorine in PVC can change the melting point of the waste, which leads to the ash melting and forming deposits on surfaces in the incineration plant. Several stoppages are then required each year to remove the deposits, which makes the process more expensive.

  There is no evidence to determine whether the change in corrosion conditions constitutes a significant economic factor. Studies do, however, show an increase in the operational cost of flue gas cleaning. The size of that increase depends on the type of flue gas cleaning technique used. The greater quantities of solid waste from flue gas cleaning also bring additional costs. This residual product is always classed as hazardous waste in all EU countries (whether or not it derives from PVC).
- **Revenue opportunities for the plants.** Flue gas cleaning residues from Danish incineration plants are currently being exported to Norway (NOAH on Langøya). NOAH is one of Europe's specialist plants for the treatment of hazardous waste. They are the market leader in Scandinavia, with a unique treatment method for ash that turns it into a raw material for plaster. This arrangment may not continue forever, since a full-scale plant for the treatment of flue gas cleaning residues is expected to come on stream in Denmark.

Appendix 4 Background to requirements on undesirable substances in chemical products

Requirement O20, which is a list of undesirable substances, has been reviewed to make sure it is as clear as possible and to avoid differing interpretations.. Below is a brief outline of the background to the ban for each of the substances:

Substances of Very High Concern and the Candidate List

Substances of Very High Concern (SVHCs) are, as the name suggests, substances that require great caution due to their inherent properties. They meet the criteria in Article 57 of the REACH Regulation: 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 Ecolabelled chemical building products. PBT and vPvB are defined in Annex XIII of REACH (Regulation (EC) No 1907/2006). Materials that meet or substances that form substances that meet the PBT or vPvB criteria can be found at: http://esis.jrc.ec.europa.eu/

Substances "deferred" or substances "under evaluation" are assumed not to have PBT or vPvB properties.

Potential endocrine disruptors are substances that may affect the hormone balance in humans and animals. Hormones control a number of vital processes in the body and are particularly important for development and growth in humans, animals and plants. Changes in the hormone balance can have unwanted effects and here there is an extra focus on hormones that affect sexual development and reproduction. Several studies have shown effects on animals that have been traced to changes in hormone balance. Emissions to the aquatic environment are one of the most significant routes for the spread of endocrine disruptors[50]. Nordic Ecolabelling bans 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

[50] Miljøstatus i Norge, 2008:

biological activity related to changes in hormone balance), in line with the EU's original report on "Endocrine disruptors" or later studies[51], see http://ec.europa.eu/environment/endocrine/documents/final_report_2007.pdf.

This entails a ban on substances such as bisphenol A, several phthalates and certain alkylphenols.

APEO[52,53,54]:

Alkylphenol ethoxylates and alkylphenol derivatives, i.e. substances that release alkylphenols on degradation, must not be used in ecolabelled chemical building products. APEOs can occur in binders, dispersants, thickeners, siccatives, anti-foaming agents, pigments, waxes, etc. APEOs have a host of properties that are problematic and harmful to health and environment. They are not readily degradable according to standardised tests for ready degradability, they tend to bioaccumulate and they have been found in high concentrations in waste sludge. Degradation products of APEOs, alkylphenols and APEOs with one or two ethoxy groups are very toxic to aquatic organisms and certain alkylphenols are suspected of being endocrine disruptors. Alkylphenols and bisphenol A are among the more potent chemicals with oestrogen effects that may occur in wastewater.

Halogenated organic substances.

Organic substances that contain halogenated substances such as chlorine, bromine, fluorine or iodine must not appear in chemical products. Halogenated organic substances include many substances that are harmful to health and the environment, in that they are very toxic to aquatic organisms, carcinogenic or harmful to health in some other way. Halogenated organic substances persist in the environment, which means they pose a risk of having harmful effects. This means that brominated flame retardants, chlorinated paraffins, perfluoralkyl compounds (PFOA and PFOS) and certain plasticisers are not permitted in chemical products for Nordic Ecolabelled floor coverings.

Phthalates

Many phthalates have negative effects on health and the environment. Some phthalates are inscribed on the EU's priority list of substances that should be investigated more closely for endocrine disruption – and some have already been identified as endocrine disruptors. Phthalates have also received a great deal of coverage in the media, and are therefore undesirable in ecolabelled products for many reasons.

Di-2-ethylhexyl phthalate (DEHP[55]), dibutyl phthalate (DBP) and butyl benzyl phthalate (BBP) are classed as toxic and as reproductive toxicants, i.e. they may cause reduced fertility and foetal damage. DBP is also classed as toxic to the environment and as highly toxic to aquatic organisms. The EU has introduced restrictions on these three phthalates and a total ban on them in toys and childcare products.

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[51] http://ec.europa.eu/environment/endocrine/documents/final_report_2007.pdf
http://ec.europa.eu/environment/endocrine/documents/bkh_report.pdf#page=1
http://ec.europa.eu/environment/endocrine/documents/wrc_report.pdf
http://ec.europa.eu/environment/docum/pdf/bkh_main.pdf

[52] Substitution af alkylphenolethoxylater (APE) i maling, træbeskyttelse, lime og fugemasser, Working report from the Danish Environmental Protection Agency, No. 46/2003

[53] Nonylphenol og nonylphenolethoxylater i spildevand og slam, Miljøprojekt nr. 704/2002

[54] Feminisation of fish, Environmental Project no. 729, Danish Environmental Protection Agency, 2002

[55] Di-2-ethylhexyl phthalate is usually abbreviated to DEHP, but the abbreviation DOP is also used.

The phthalates dicyclohexyl phthalate (DCHP), dihexyl phthalate (DHP) and diethyl phthalate (DEP) are found on the EU's priority list of endocrine disruptors.

The phthalates diisobutyl phthalate (DIBP), diisoheptyl phthalate (DIHP), bis(2-methoxyethyl) phthalate, diisopentyl phthalate and n-pentyl-isopentyl phthalate are included on the EU's Candidate List of Substances of Very High Concern.

Some phthalates can be found on the Danish "Listen over Uønskede Stoffer" (List of undesirable substances). These include: di-2-ethylhexyl phthalate (DEHP), dibutyl phthalate (DBP), butyl benzyl phthalate (BBP) and dimethoxyethyl phthalate (DMEP). The Danish list used to also include diisobutyl phthalate (DINP). This has now been removed, since it is not classified as toxic to reproduction, although suspicions remain that it may be an endocrine disruptor.

Aziridine and polyaziridines

Aziridine is on the list of hazardous substances (Danish Ministry of Energy and the Environment, 1996) classified as a carcinogen in group Carc2 and mutagenic in group Mut2. In addition, it is classified as "Very toxic", "Corrosive", "Highly flammable" and "Harmful to the environment". Ref.: Miljøprosjekt 1999, Environmental parameters in lexographic printing, MST. As an example, tris-(aziridinyl)-phosphinoxide, (TEPA), (CAS No.: 5455-55-1) may be used as a flame retardant in carpets.

Heavy metals

Heavy metals or compounds thereof: cadmium, lead, chromium VI, mercury and tin must not be present in chemical products or in the ingoing chemical substances used in the production of flooring. It is acceptable for ingoing substances to contain traces of these substances, deriving from impurities. The trace quantities of the individual heavy metal must not exceed 100 ppm (0.1 mg/kg, 0.01 weight %) in the raw material. The prohibition against pigments and additives based on heavy metals has now been extended to include chromium VI and all tin compounds. Chromium used in the dyeing of wool is regulated in requirement O24 and is accordingly excluded here.

Tin

Tributyltin (TBT), dibutyltin (DBT), dioctyltin (DOT) and triphenyltin (TPT) are all on the list of undesirable substances. Tributyltin (TBT) is the organic tin compound that has been investigated most thoroughly. TBT has been shown to cause endocrine disruption in marine organisms. Accordingly, the use of chemical products based on tin, e.g. pigments and additives, is prohibited.

Chromium

Chromium (III) and chromium (VI) are used, inter alia, in chrome plating, in dyes and pigments. Chromium (III) is essential, i.e. living organisms need chromium. The effects of the various forms of chromium differ. All chromium compounds are toxic. However, the most harmful effects are associated with chromium (VI) in particular, this being a carcinogen and an allergen. A number of chrome compounds are on the Danish EPA's list of undesirable substances. Accordingly, it continues to be relevant to prohibit chromium in the criteria.

Arsenic

The risk associated with the disposal arises primarily when private households incinerate wood waste treated with arsenic. An unacceptable risk was also ascertained in connection

with impact on organisms living in aquatic environments in certain seawater areas. Against the background of this risk assessment the Commission's Directive 2003/2/EC of 6 January 2003 relating to restrictions on the marketing and use of arsenic prohibited the use of arsenic-treated wood for consumer purposes (e.g. for fences and as construction timber). Since arsenic is now encompassed by the restrictions in the Limitations Directive, the requirement O20, no longer encompasses arsenic, contrary to the case in the last version of the criteria.

Volatile aromatic compounds

Volatile aromatic substances featuring one or more benzene rings are known as volatile aromatic compounds. These are very stable. The expression "aromatic compounds" describes substances including benzene, toluene, mixed xylenes, orthoxylene, paraxylene, metaxylene (generally known as BTX). Benzene is used in the production of styrene, cumene and cyclohexane. Most toluene is used in the production of benzene, phenol and toluendiisocyanate. There have not previously been direct requirements applicable to volatile aromatic compounds. They have not previously been direct requirements applicable to volatile aromatic compounds in these criteria, they have been indirectly regulated by the classification requirements. However, Nordic Ecolabelling wishes to restrict the use of these substances, as is also the case for other Nordic Ecolabelling product groups, for example building panels and furniture.

Volatile organic compounds (VOCs)

Volatile organic compounds are a particular cause for concern because of their inherent properties. "Organic solvents" may be absorbed through the lungs and skin and cause harm to a number of organs. This damage may be acute or chronic.

Acute harmful effects following the inhalation of vapour manifest themselves in amongst other ways as headache, fatigue etc. Organic solvents may moreover irritate the mucous membranes of the eyes, nose and throat. Organic solvents degrease the skin and may cause eczema. Long-term exposure to organic solvents may cause chronic damage to the brain and nervous system. Symptoms may include memory failure, nervousness and irritability, followed by more serious mental changes, e.g. depression. Certain organic solvents cause other irreversible forms of damage to health, e.g. cancer and effects on reproduction (harm to the unborn child). Furthermore, certain organic solvents contribute to the greenhouse gas effect, some to photochemical ozone formation and some to the depletion of the ozone layer.

Strict requirements have accordingly been imposed with regard to the VOC content of adhesives in Nordic Ecolabelled flooring. The VOC requirements have been made stricter since the last version of the criteria, since it is considered necessary to impose requirements on the use of VOCs both in the production of the flooring, where adhesives often contribute the greatest proportion of VOCs and with regard to emissions during the use phase of the finished flooring. In the last version of the criteria, VOCs were regulated in the form of an emission requirement applicable to the finished flooring.