



## **About Nordic Swan Ecolabelled**

### **Outdoor furniture, Outdoor fixtures and Playground equipment**

Background for generation 3

23 August 2022

# **Nordic Ecolabelled Outdoor furniture, outdoor fixtures, and playground equipment – Background for ecolabelling version 3.16**

<b>Introduction .....</b>	<b>1</b>
<b>General comments on the criteria .....</b>	<b>1</b>
1.1 Products that are eligible for a Nordic Swan Ecolabel .....	1
1.2 The background to The Nordic Swan Ecolabelling of outdoor furniture, outdoor fixtures, and playground equipment .....	2
1.3 Delimitation of the product group .....	2
1.4 The version and validity of the criteria document .....	4
1.5 The Nordic market .....	5
1.6 Other labelling schemes for outdoor furniture, outdoor fixtures, and playground equipment .....	6
<b>About the revision process .....</b>	<b>7</b>
1.7 The objective of the revision .....	7
1.8 Project participants.....	7
<b>The background to the criteria .....</b>	<b>8</b>
1.9 The requirements in the document .....	8
1.10 The background to the requirements .....	8
1 Composition of materials .....	9
2 Environmental requirements .....	9
2.1. Solid wood, willow and bambus.....	9
2.2 Wood-based building panels.....	12
2.2.1 More than 10 weight-% wood-based building panels.....	14
2.2.2 Requirement concerning energy and the origin of raw materials used in the building panel.....	15
2.3 Highpressure laminate (HPL) panels.....	16
2.5 Wood preservatives.....	32
2.6 Surface treatment of wood.....	39
2.7 Maintenance products for wood .....	40
2.8 Metal.....	41
2.8.1 Surface treatment of metal.....	43
2.9 Plastic and rubber.....	45
2.9.1 Requirement that apply if there is more than 10 weight-% plastic in the product..	46
2.10 Requirements as regards consumer information, refuse processing and recycling systems.....	48
<b>3 Quality requirements and the requirements of the authorities .....</b>	<b>49</b>
3.1 Performance requirements.....	49
3.2 Quality management and the requirements of the authorities.....	51
<b>Future criteria .....</b>	<b>51</b>
<b>References .....</b>	<b>55</b>

## Introduction

The purpose of this document is to describe the background for the third version of the Nordic Ecolabelled criteria for the ecolabelling of outdoor furniture, outdoor fixtures and playground equipment. The document will give applicants, consumers, public authorities and other interested parties an opportunity to read the arguments on which Nordic Ecolabelling based its selection and formulation of the requirements in the criteria document.

The background document describes the reasons underlying the selection of this product group for Nordic Ecolabelling and how the requirements contained in the document are assessed in light of Nordic Ecolabelling's environmental philosophy<sup>1</sup>. Two environmental goals defined in this philosophy are of particular relevance given the environmental effects of the product group. These are:

to reduce emissions and the harmful effects of substances on the environment and consumers, and  
to reduce emissions of gases with a negative effect on climate change

In addition to these environmental goals, the environmental philosophy points out a number of ways in which the vision of sustainability can be attained, including references to the Factor 4 and Factor 10 concept, which states that we must increase the efficiency with which we exploit natural resources, materials and energy by a factor of 4 in the short term and a factor of 10 in the long term.

The selection and formulation of the requirements in the criteria document is based on the potential environmental improvements associated with ecolabelling outdoor furniture, outdoor fixtures and playground equipment relative to the scope that exists for documenting and checking compliance with the requirements.

In a larger context the direct contribution to global warming made by outdoor furniture, outdoor fixtures and playground equipment is small, and the primary focus of these criteria is, accordingly on environmental and working environment issues, relating to the ingoing substances. Generally speaking, the intention is that the quality requirements in the Nordic Eco criteria should secure products with a long useful life which in turn will contribute to a reduction in impact on the climate. In the case of outdoor furniture, outdoor fixtures or playground equipment incorporating building panels, requirements are imposed on energy consumption during the production of the panels.

## General comments on the criteria

### 1.1 Products that are eligible for a Nordic Swan Ecolabel

This product group encompasses outdoor furniture (garden furniture) and play and park equipment. Outdoor furniture means movable chairs, tables, armchairs, benches and sofas.

Playground equipment includes swings, slides, play houses and other outdoor equipment for play. The product group encompasses playground equipment for domestic use and

for public play areas – both conventional and natural play areas. Outdoor fixtures means for example wood/bike/bus/tool sheds, railings/fences, window boxes, flag poles, refuse baskets and outdoor furniture left outdoors on a permanent basis.

Outdoor furniture featuring padding or textiles does not form part of the product group. Nor are swing seats and hammocks encompassed by the product group. Nor does the product group encompass safety surfaces for playground equipment, cycles or toys for outdoor use.

## **1.2 The background to The Nordic Swan Ecolabelling of outdoor furniture, outdoor fixtures, and playground equipment**

The purpose of these criteria is to safeguard low environmental impact in the production and use of outdoor furniture, outdoor fixtures and playground equipment. Requirements are accordingly primarily imposed with regard to:

The use of wood from sustainable forestry operations.

Design requirements promoting the reuse of plastics and metals and the use of recycled raw materials.

The use of less environmentally harmful chemicals.

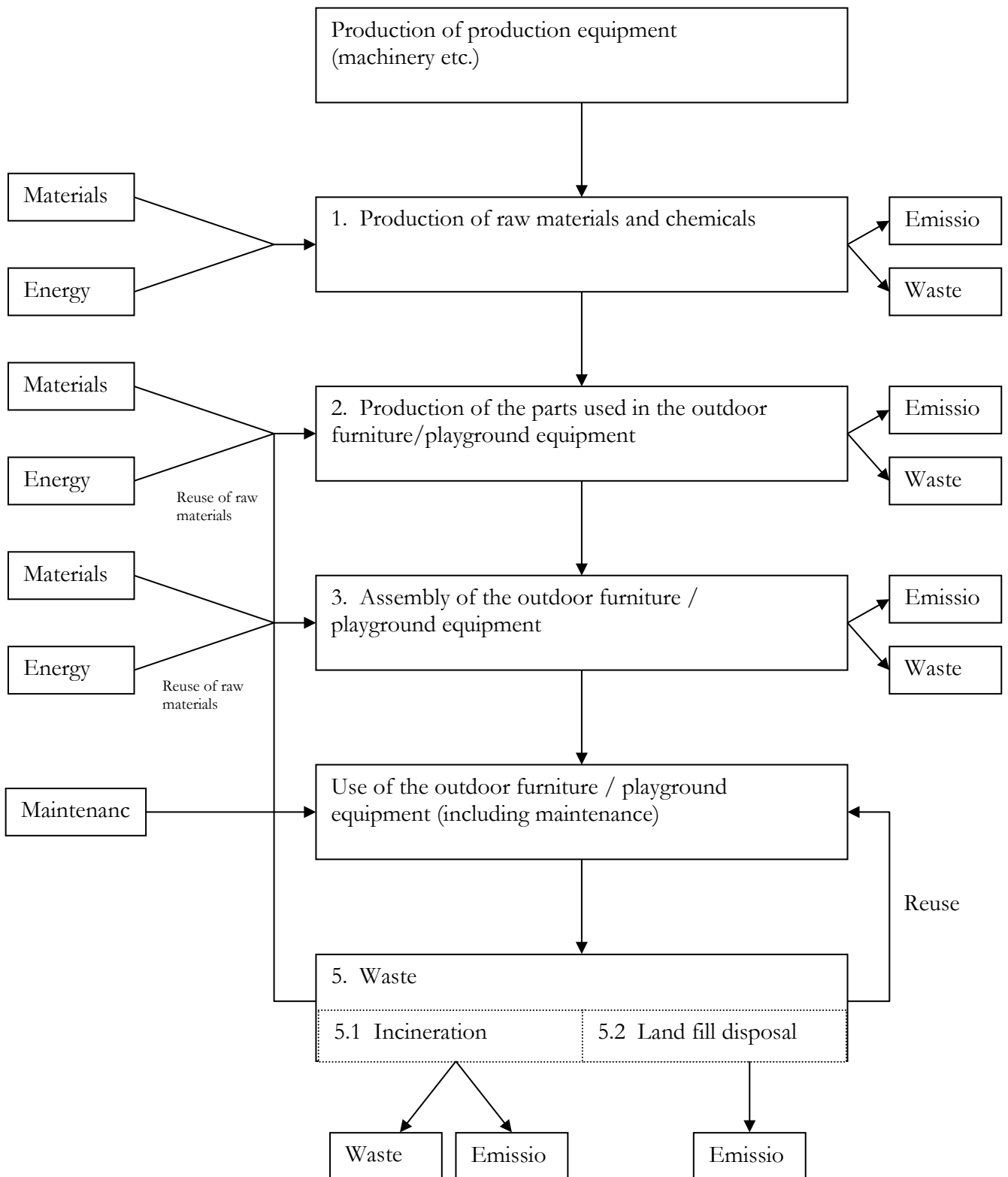
Good performance properties (safety, strength and stability).

During the course of the development of the criteria Nordic outdoor furniture, outdoor fixtures and playground equipment production has been studied. The possibility of producing outdoor furniture, outdoor fixtures and playground equipment using wood from certified sustainable forestry operations and the scope for using recycled plastic and metal has been examined. An assessment has also been performed of chemicals used during the various phases of production.

## **1.3 Delimitation of the product group**

The environmental impact of outdoor furniture, outdoor fixtures or playground equipment (viewed from a lifecycle perspective) will generally be determined by the raw materials used and the duration of the useful life of the product. Nordic Ecolabelling's requirements for outdoor furniture and playground equipment encompass the entire life cycle of the product with the exception of the production of production machinery (the production of the machinery used in making the products and their ingoing raw materials) and transportation during various levels of the lifecycle. An illustration of the lifecycle of outdoor furniture, outdoor fixtures and playground equipment is provided below.

Phase 1 "Production of raw materials and chemicals" imposes requirements on raw materials of wood, plastic and metal. Requirements are also imposed on the content of chemical products.



Phase 2 "Production of parts used in the outdoor furniture/outdoor fixtures/playground equipment" imposes requirements on the chemicals used. The requirements encompass products for protecting wood such as preservatives, surface treatment products such as laminates, stains and varnish as well as glue.

Phase 3 "Assembly of the outdoor furniture/outdoor fixtures/playground equipment" imposes the requirement that the product must be designed in such a way that ingoing raw materials can be separated and reused in new products.

Phase 4 "Use of the outdoor furniture/outdoor fixtures/playground equipment (including maintenance)" imposes requirements on the durability of the product and the provision of information on how the product should be maintained in order to maximise its useful life. Requirements are also imposed on the maintenance products that the manufacturer must recommend to users of the product.

Phase 5 "Waste" imposes the requirement that the manufacturer must inform the consumer on how to proceed when the product comes to the end of its useful life with a view to minimising environmental impact.

Nordic Ecolabelling's goal has been to develop criteria without imposing restrictions on the choice of materials. The present proposal encompasses outdoor furniture made of wood, plastic and metal as well as playground equipment for outdoor use. In addition to wood the main construction materials are plastic and metal or combinations of these materials.

Plastic and metals are not renewable natural resources, whereas wood from sustainable forestry operations is a renewable natural resource. However, using plastic and metal as materials in outdoor furniture offer certain advantages relative to the use of wood. Durability will often be good, and plastic and metal furniture also requires considerably less maintenance than wooden furniture.

The greatest potential environmental benefits with regard to plastic and metal are achieved by requiring environmental impact during the production of the material to be reduced and the use of recycled materials.

#### **1.4 The version and validity of the criteria document**

Nordic Ecolabelling adopted the criteria on 17 March 2011 and they will remain in force until 30 June 2015.

On 16 February 2012 the Secretariat Manager's meeting decided to adopt changes regarding formaldehyde (R7). The new version is called 3.1.

On 15 November 2012 the Secretariat Manager's meeting decided to adopt the following: Change regarding formaldehyde (R7) and exemption for requirements R22 to R25 for metal parts weighing less than 50 grams. The new version is called 3.2.

On 12 November 2013 the Secretariat Manager's meeting decided to adopt the following: Change regarding recycled metal (R23). Here is given an alternative in the requirement of combining the percentage share of the various metals. The new version is called 3.3.

On 3 April 2014 the Secretariat Manager's meeting decided to prolong the criteria until 31 March 2017. The new version is called 3.4.

On 3 September 2014 the Board of Directors decided to adopt changes regarding the requirements R19. It is now clear that the requirement only applies to wood preservatives with biocides or heavy metals. The new version is called 3.5.

At the Nordic Ecolabelling board meeting November 18, 2014, it was decided to extend the criteria by 2 years, to specify that wood / bike / bus and tool sheds are included in the product group, but that composite materials are not (R1).

As well as expanding the product group with requirements for HPL plates, when these are approved in version 6 of Building board in February 2015.

On 17 November 2014 the Board of Directors decided to remove requirement R43 Marketing. The new version is called 3.6 and is valid until 31 March 2019.

On 16 June 2015 the Nordic Ecolabelling's Criteria Group approved to insert requirements for HPL panels in its own section in the criteria at the same time the product group name changed to Outdoor furniture, outdoor fixtures and playground equipment. The new version is 3.7.

On 8 January 2016 the Nordic Ecolabelling's Criteria Group approved to insert an except for bronopol up to 0.05% by weight in requirement R21. The new version is 3.8.

On 7 February 2017 the Nordic Ecolabelling's Criteria Group decided to prolong the criteria until 31 March 2020. The new version is called 3.9.

On 8 March 2017 the Nordic Ecolabelling's Criteria Group decided to implement Nordic Ecolabellings new forestry requirements as an alternative to the present forestry requirements. The new version is called 3.10.

On 9 October 2017 Nordic Ecolabelling decided to remove recycling systems in requirement R39 Packaging requirements and recycling systems and on the 15 of November 2018 Nordic Ecolabelling decided to prolong the criteria until 31 March 2021. The new version is called 3.11.

The Ecolabelling licence will continue to apply for as long as the criteria are fulfilled and until these criteria cease to apply. The criteria may be extended or adjusted, in which case the licence will be extended automatically and the licensee will be notified.

One year at the latest (before the criteria cease to apply) the notification will be provided of the criteria that will apply after the final validity date of the current criteria. The licence holder will be given the opportunity to renew the licence.

On 19 February 2019, Nordic Ecolabelling decided to adjust requirement R36 Recycled/recovered plastic. The new version is called 3.12.

On 16 December 2019 Nordic Ecolabelling decided to prolong the criteria until 31 December 2021. The new version is called 3.13.

On 20 October 2020 Nordic Ecolabelling decided to prolong the criteria until 30 June 2022. The new version is called 3.14.

On 5 October 2021 Nordic Ecolabelling decided to prolong the criteria until 31 December 2022. The new version is called 3.15.

On 23 August 2022 Nordic Ecolabelling decided to prolong the criteria until 30 June 2022. The new version is called 3.16.

## **1.5 The Nordic market**

No market survey was conducted in connection with this revision.

## 1.6 Other labelling schemes for outdoor furniture, outdoor fixtures, and playground equipment

Other labelling schemes include FSC and PEFC which impose requirements on the origins of the wood. The aim here is to ensure that the wood does not originate in forestry environments that require protection for biological or social reasons. FSC-labelled garden furniture (Forest Stewardship Council) is sold by, amongst other retailers, COOP and Jysk. PEFC (Programme for the Endorsement of Forest Certification schemes) is used by amongst others Tvilum Scanbirk on all their furniture. PEFC is not used as widely on outdoor furniture as FSC. The demand for certified wood for playground use is not particularly great in Denmark (9).

The sustainability label "Cradle to Cradle" can be used on everything from shoes, clothing and furniture to electronic equipment, cars and buildings. Briefly stated, this programme involves designing modern consumer goods in such a way that the waste from the products becomes nutrients or raw materials for future generations of products. Instead of producing products that at the end of their useful life become waste that pollutes and fills up our refuse tips, we focus on designing with the entire lifecycle in mind. Cradle to Cradle is not about producing objects which cause less damage or returning to a lifestyle where we consume less, but about creating products that make an active contribution to the lifecycle. The originators of the Cradle to Cradle concept are Dr. Michael Braungart and the architect William McDonough (10).

Environmental product declarations provide detailed environmental information but impose no specific requirements on the products in question. In other words, there are no pre-specified requirement levels. The utility of the declarations will depend on the purchaser's knowledge of the environmental conditions associated with the product which he or she purchases. There is no international system for environmental declarations, although work is being conducted on this. Examples of environmental declarations include The Eco Cycle Council's Building Product Declarations, Sweden, and EPD, Environmental Product Declarations, Sweden. ECO Products is a Norwegian joint venture project between NAL (The National Association of Norwegian Architects), Byggforsk and Norsk Byggtjeneste. ECO Product focuses on the environmental properties of the products, or equivalent information, and assesses the products in terms of indoor climate, content of substances that are harmful to health and the environments, resource consumption and the greenhouse effect.

Environmental management systems enable businesses to control their processes and to work towards their own targets for improvement. This is a management tool for the business, which involves mapping the environmental impact of the business. The most important schemes are EMAS, which was developed within the European Union and ISO 14001, which is an international standard. These schemes are not especially visible from the outside. The system does not exclude products or businesses that are less desirable from an environmental perspective.

The EU-Ecolabel (the Flower). In 2009 EU-Ecolabel criteria for wood-based furniture was adopted. The EU has no criteria for building panels. The criteria focus on the origin of the used raw materials, recycled materials and formaldehyde.



## About the revision process

### 1.7 The objective of the revision

This background document is the third for this product group. It has not been an aim that the definition of the product group for outdoor furniture and playground equipment should be changed. The focus of the revision has accordingly not been on the range of products that will be eligible for Nordic Ecolabelling, but rather to update the requirements imposed on the products.

In general, the requirements applicable to building panels in the criteria for furniture and outdoor furniture have been amended to harmonise with the new revised criteria for building panels. In addition, Nordic Ecolabelling's forestry group has considered the traceability requirement for wood and work has been conducted towards creating harmonised wood requirements in the criteria for furniture, outdoor furniture and playground equipment and building panels.

In connection with the revision process investigations were conducted to determine whether uniform fundamental requirements could be imposed on production with a view to simplifying the criteria. The conclusion has been to concentrate e.g., the classification requirements together.

The progress on the work on the development of criteria for wood-based furniture by the EU-Ecolabel has been followed with a view to possible harmonisation.

The possibility of imposing basic requirements on production and at the same time reducing the number of product requirements was also considered. The aim here has been to simplify the documents relative to the existing documents. For the manufacturers it will be easier to deal with requirements that relate to the production process as a whole and not to individual products. In this way the proportion of certified wood for example can be documented on an annual basis for production as a whole, and it will not be necessary to calculate figures for each individual piece of outdoor furniture.

The following requirements have been reviewed and considered:

Plastic, metal, wood, and wood panels (in relation to the building panels)

Functional requirements and safety requirements have been updated

The possibility of imposing requirements on the production process for metals and plastics

The possibility of imposing requirements as to content of active ingredients in recycled plastics

Harmonisation with the building panel requirements in the criteria for The Nordic Swan Ecolabelling of outdoor furniture and playground equipment

### 1.8 Project participants

Criteria development work was conducted in the period January 2008 to November 2010. The project group comprised Jakob Waidtløw (PM, Denmark), Kristian Kruse (PGM, Norway), Heidi Belinda Bugge (PGM, Denmark), Harri Hotulainen (PGM, Finland), Jimmy Yoler (PGM building boards, Sweden) and Cathrine Westerlind (PGM, Sweden).

## **The background to the criteria**

Nordic Ecolabelling uses the RPS system to analyse and describe the reasons underlying the individual requirements. RPS stands for Relevance, Potential and Steerability:

Relevance is assessed against the background of the environmental problems caused by the product group and the scope of the problems. “Is it an environmental problem, and if yes, how great is the problem?”

Potential is assessed by considering the potential for existing environmental improvements within the product group, for example by distinguishing between the products as they are today and how the products might look in the future with the aid of possible changes in e.g., production. “Can anything be done about the environmental problem?”

Steerability is described as the scope of ecolabelling for remedying an environmental problem. Where it is technically possible – or politically realistic – for ecolabelling to achieve an influence relative to the problem. “Can The Nordic Swan Ecolabel do anything about the environmental problem?”

### **1.9 The requirements in the document**

Nordic Ecolabelling has formulated the requirements in the criteria document with the following ideas in mind:

The number of requirements has been kept to a minimum

The requirements have been formulated in such a way that they are easy to understand  
Declarations have been drawn up for producers and raw material producers to make it easy and straightforward to document compliance with individual requirements.

An important point throughout the criteria development process has been that the requirements should be formulated clearly, that they are easy to document so that they enjoy credibility, at the same time as which they must encourage the producer to implement measures that are environmentally improving.

Generally speaking, the requirements have been selected on the basis of an assessment of the impact of the product group on the consumer and the surrounding environment – indoors as well as outdoors – over the course of the lifecycle of the product.

Within those areas in which legislation or action plans already exist in the Nordic countries, account has been taken of this in the criteria based on the principle that ecolabelling should impose environmental requirements that are more advanced than those imposed by local/national authorities.

### **1.10 The background to the requirements**

This section describes the background to the requirements imposed and the changes made in this revision. The chapter and requirement numbers refer to the relevant sections in the criteria document for outdoor furniture and playground equipment, version 3.

## 1 Composition of materials

### **R1** The composition of outdoor furniture and playground equipment

The materials in the product must be described and the quantities specified which will make it clear which requirements in the criteria document the product is encompassed by. A table (Table 1) has been included in this requirement in order to help the applicant gain an overview of which requirements the product is encompassed by.

If more than one outdoor furniture or playground equipment is produced of the same materials the license can be based on a material list. Never the less the company has to document that all criteria are fulfilled. The company has to implement a quality system to document how the material list is used in praxis and how the traceability is ensured.

## 2 Environmental requirements

The requirements in the section headed "Environmental requirements" apply to all ingoing substances, save as otherwise specified. Ingoing substances are all substances in the product, including additives (e.g., preservatives or stabilisers) in the ingredients, but not pollutants from the production incl. the raw material production. A pollutant is a trace from production incl. the raw material production present in the finished product in concentrations of less than 100 ppm (0.01 weight %), but not substances that have been deliberately added to a raw material for a purpose, irrespective of quantity. This means that pollutants that are present in quantities greater than 100 ppm are counted as ingoing substances and must fulfil the requirements applicable to ingoing substances.

### 2.1. Solid wood, willow and bambus

The requirements encompass wood, willow, and bamboo present in a product, excluding small wooden parts such as wedges and the like.

For solid wood, veneer, willow, and bamboo the applicant may choose either to comply with and document requirements R2 and R4 or select the revised requirements for wood raw materials (both A and B) in form 8. It is not possible to mix requirements R2 and R4 with the revised requirements A and B in form 8.

Requirements R3 Biocides are applicable regardless of the requirements (R2 and R4 or form 8) selected.

### **R2** Solid wood - traceability

The manufacturer must maintain control over wood that has not been certified by ensuring that raw materials have been lawfully harvested and do not originate in forest environments with a high need of protection for biological and/or social reasons. This requirement is intended to make manufacturers more aware of the raw materials they use in their various products. In the event of suspicion that wood deriving from such areas has been used, Nordic Ecolabelling may require documentation to be submitted. In the worst cases the licence may be withdrawn.

The requirement has now been amended, as a result of which we now require wood producers to document how they ensure that the wrong type of wood is not used and to show which types of wood are used and their geographical origin. This increase in the stringency of the requirement will make it easier to verify compliance with the requirement. If a product originates in a forestry operation that has been certified in accordance with an approved forestry standard and has previously been documented, this requirement need not be documented again.

Nordic Ecolabelling regards FSC and PEFC “controlled wood” certification and Chain of Custody (CoC) certification as examples of systems which promote the traceability of fibre raw materials.

In Europe there is an increased focus on lawful felling. According to a report produced by the WWF on illegal timber used on the European market, an average of 40% of wood-based products imported from South-East Asia (including China) probably derives from unlawful felling. The EU has initiated an action plan to counter unlawful felling known as the FLEGT action plan (Forest Law Enforcement, Governance and Trade)<sup>2</sup>. A licensing system will be developed by means of bilateral agreements with the largest timber exporting countries. A number of countries in Europe have also adopted the EU’s green purchasing policy for timber, including Belgium, Denmark, France, Germany and the UK.

Demand for bamboo products has increased significantly and Nordic Ecolabelling therefore wishes to ensure that raw materials do not derive from areas where biodiversity or social conservation values are under threat. Bamboo is a type of grass and is the fastest growing plant on earth. It can be harvested after approximately 7 years without the plant dying. It is often claimed that bamboo is harder than hardwood and is therefore suitable for use in floors, chopsticks, salad bowls etc. Over 1200 bamboo species grow in Asia, Central America and South America and some species grow in parts of Africa and Australia. The areas of use of these species vary. Bamboo also represents an important food for pandas, making up 99% of their diet. Only one variety is used for flooring (Moso/*Phyllostachys pubescens*), and the panda will not eat this variety. Bamboo grows wild as a “weed” and does not normally require fertiliser or spraying. Bamboo is also used to prevent soil erosion in exposed areas. When bamboo is felled, new shoots grow on the remaining stump. This makes it difficult to remove bamboo after it has established itself. Bamboo is often cultivated by peasant farmers, but because of the increased pressure on bamboo there is a danger that the felling of forests and the use of insecticides and fertilisers will result in the destruction of well-functioning eco systems. According to INBAR (International Network for Bamboo and Rattan) bamboo is viewed as a natural resource and is harvested from unregulated natural forests in South-West China. In many places however the practice followed during harvesting is such that it may harm habitats that are dependent upon bamboo (such as the Red Panda and the Giant Panda) and also destroy the eco system in general.<sup>3</sup> Bamboo is also cultivated in plantations of various types.

### **R3 Solid wood – biocides**

The requirement is also imposed that wood (logs after felling) must not be treated with pesticides classified by the WHO as type 1A or type 1B. These agents have a negative effect on the environment and attacks can often be remedied in other ways, e.g., by keeping the wood covered and dry.

The criteria are not changes but the reference to the WHO's homepage has been updated to ensure the reference is to the newest list of recommended pesticides.

#### **R4 Solid wood – certified wood**

The background to the requirement

The requirement encompasses solid wood, laminated wood, veneer, but not willow and bamboo.

Forestry impacts on the environment. To reduce this environmental impact the requirement is imposed that products based on raw materials from all solid wood must contain at least 70% wood certified in accordance with a standard for sustainable forestry. Of the types of wood found in the Nordic countries, forests of softwood such as pine and spruce enjoy a high level of certification while smaller quantities of hardwood derive from certified forestry operations. Availability of wood from certified forests varies in the Nordic countries, the availability of certified wood is expected to increase in the coming years and Nordic Ecolabelling is in a position to help to increase the proportion of certified wood products used in the wood and furniture industry. Nordic Ecolabelling approves forestry standards (e.g., national and regional forestry standards) that fulfil the requirements in Form 1 of the Criteria document.

According to figures produced by the UN<sup>4</sup> for 2007-2008, 8.3% of the world's forests have been certified. This represents 320 million hectares. Between 2007 and 2008 the growth in certified forestry areas totalled 8.8%. This figure includes the US standard SFI and the Canadian standard CSA, which were adopted by PEFC in 2005, but not e.g. the Malaysian standard (MTCC) which is currently being considered by the PEFC. Table 1 shows figures from FSC and PEFC from September 2008.

**Table 1 Certified forests in September 2008 by continent. The figures are taken from the websites of FSC and PEFC ([www.fsc.org](http://www.fsc.org) and [www.pefc.org](http://www.pefc.org))**

	<b>Million hectares FSC</b>	<b>Million hectares PEFC</b>
EUROPE	48.1	54.7
N. AMERICA	35.6	145.5
ASIA-OCEANIA	3.7	7.9
LATIN AMERICA	11.6	7.9
AFRICA	3.5	0.0
Total	102.5	216.0

Moreover, according to the UN Market Report, Western Europe has certified more than 50% of its total forest areas, North America more than a third, whereas Africa and Asia have achieved only 0.1%. In tropical areas, 40% of the certified forestry areas are based on certification schemes that are not verified by third parties.

Reason for changing the requirement

Previously there was a requirement that at least 70% certified wood be used irrespective of type of wood. This requirement is different than the ones in "Ecolabelling of Furniture" and "Ecolabelling of Building boards" where a lower level is set for hard wood, e.g. oak. The reason for this is that mainly tropical wood and pine/spruce are used in outdoor furniture.

In the Nordic countries (and the rest of Europe) the availability of softwood from certified forestry is generally high, whereas the availability of hardwood is significantly

lower. In the case of tropical wood, the availability is less than for softwood whereas Nordic Ecolabelling's assessment has been that the requirement that a high proportion of tropical wood be certified was necessary in order to ensure the credibility of The Nordic Swan Ecolabel.

When Nordic Ecolabelling initially imposed requirements as to wood from sustainable forestry operations, the focus was on traditional forestry in Europe and tropical areas. Today, a number of forestry products originate from plantation operations. The environmental impact of plantation cultivation of forest varies considerably. By definition, this method of cultivation is a monoculture and has a negative effect on biodiversity. Similarly, there are issues relating to the conversion of land areas (virgin forest and untouched areas) to plantation use, as well as problems relating to the displacement of local populations. The FSC has developed requirements applicable to plantation forestry in their criteria for sustainable forestry. However, these requirements fail to address a number of problems caused by plantation cultivation. For this reason, the FSC is at present working on a revision of the standard for plantation farming. This standard is expected to be ready in 2009.

The requirement concerning wood from certified forestry operations does not distinguish between whether the wood derives from traditional forestry or from plantation forestry, only whether the wood comes from an area in which Nordic Ecolabelling has approved the forestry standard used. The criteria have to be documented for each of the fibres that are used in the product. E.g., if both pine and oak is used in the product the criteria of minimum 70% certified fibre encompasses both fibre types.

There is no requirement that a specific portion of bamboo or willow must be certified in accordance with a forestry standard or organic cultivation. At present, little bamboo from certified areas is available and this is the first time that bamboo has been included in the criteria. Requirement R7 will ensure that bamboo will originate from sustainable cultivation/forestry.

## 2.2 Wood-based building panels

Wood-based panels include chipboard, fibre-board (including MDF and HDF panels), OBS (oriented strand-board), veneer boards (plywood and parallel laminated veneer) and solid wood panels.

The requirements also encompass equivalent products made of willow and bamboo. Other equivalent raw materials may be included subject to an application to Nordic Ecolabelling. The requirement applies to panels present in the product in quantities in excess of 5 weight-%.

For panels of solid wood, veneer, bamboo or wood fibre, the applicant may choose either to comply with and document requirements R8 and R9, or select the revised requirements for wood raw materials (both A and B) in form 9. It is not possible to mix requirements R8 and R9 with the revised requirements A and B of form 9.

## **R5 Ecolabelled building panels**

If the wooden panel is ecolabelled, the requirements will have been fulfilled. No change.

## **R6 Environmentally harmful substances in the building panel**

The level of the requirement has been set on the basis of knowledge of a number of chemical products. The requirement is related to the quantity per kilo of panel (0.5 g/kg panel) so that it will to a greater extent reflect the potential environmental impact. Furthermore, this requirement offers producers greater flexibility to choose chemicals that overall result in the lowest environmental impact.

An exemption has been granted for ammonia classified as R50 because of its high pH value, as a result of which concentrations of over 24% are classified as R50. At 24% or lower the classification will not apply. This substance is accordingly not relevant for the purpose of calculating potentially environmentally harmful substances in the finished panel.

## **R7 Formaldehyde in building panels**

The background to this requirement is that the use of formaldehyde must be limited because it is harmful to health and may cause health problems during production and during use of the products. Formaldehyde is a toxic and sensitising substance that has a carcinogenic effect and must therefore be excluded insofar as this is possible.

The requirement is generally more stringent compared to previous levels, and there are still two alternatives to meet the requirement. The requirement now has differentiated emissions levels for MDF and other boards. A somewhat higher formaldehyde emission level of MDF can be accepted because these boards generally have higher documented content of formaldehyde.

The requirement for formaldehyde emission in MDF boards measured by chamber test is maintained at the same level as in the previous version of the criteria, while the content of formaldehyde in MDF boards measured by the perforator method is lowered to about half the previous level. The reason for this, is both because of the uncertainty in the correlation between chamber test method and the perforator method, and that market-information has shown, that it is difficult for small and medium-sized manufacturers to gain access to the restricted volume of MDF panels with low formaldehyde levels. For other types of boards, the requirements are lowered to about half the previous level for both options.

The development of wooden panels with lower formaldehyde emissions  
During the development of the Flower criteria for wooden furniture it was found that German manufacturers of wood-based furniture were capable of producing panels that emitted formaldehyde in concentrations equivalent to 50% of E1 (E1 is the level of the requirement in version 2 of the criteria).

Nordic Ecolabelling has contacted several producers of different types of panels. The conclusion was that it is technical feasible to produce panels with lower emissions ( $\frac{1}{2}$ E1) but the panels will be more expensive and that the request from customers for  $\frac{1}{2}$ E1 emission is low.

Adhesives in wood-based panels:

1. Urea-formaldehyde, which according to the APA – The Engineered Wood Association, is used in interior chipboard panels that do not need to be resistant to high levels of moisture, probably the most widely used today. There are two types: Urea-formaldehyde (UF) and Melamine urea formaldehyde adhesive (MUF). UF is not as efficient at binding formaldehyde in the panel as other adhesives. MUF binds the formaldehyde in the panels more efficiently, resulting in lower formaldehyde emissions. The environmental impact of urea is negligible as regards urea bound in a building panel.
2. Isocyanate-based adhesive: Isocyanates are highly harmful to health, especially during the production of panels, and accordingly this type of glue is not widely used. However, it is in use and could represent a means of reducing formaldehyde emissions.
3. Phenol formaldehyde adhesive. Can be used for wood-based panels that need to be capable of withstanding damp conditions. More costly. Phenol additive in the glue ensures that the formaldehyde is bound in the panel in a different chemical form. According to the APA all recent data indicate that measurements of formaldehyde emissions from panels bound with phenol formaldehyde glue correspond to outdoor background concentrations. They refer to tests of formaldehyde emissions from chipboard panels amounting to a maximum of 0.02 mg/m<sup>3</sup>. Phenol is known to be harmful to health and is on the list of undesired substances. However, the phenol is bound in the chipboard panel and reacts chemically with the formaldehyde and as a result the health and environmental problems associated with phenol and formaldehyde are significantly reduced in the finished panel.

## 2.2.1 More than 10 weight-% wood-based building panels

### **R8 Non-certified wood in building panels**

Must fulfil the same requirements as imposed in R2. Here too the requirement has been amended in such a way that we are now requiring wood producers to document how they safeguard themselves against using the wrong types of wood and to report on which types of wood are used and their geographical origins.

### **R9 Wood raw materials in building panels**

See the motivation in R4.

Background to the change to the requirement

In the last version of the criteria the requirement was that a minimum of 30% certified wood or 50% sawdust/off-cut/collected wood etc. or a combination thereof should be used. Previously sawdust etc. was regarded as a waste product. Today, however, it is a commercial raw material used by the biofuel industry, and as a consequence the price has risen. Today producers that use sawdust, fibre etc. must search for possible raw materials for production. Waste from forestry is used to a greater extent.

These are fractions from which the producers themselves produce sawdust, but which are not traceable in terms of certified forestry operations. There is accordingly a risk that although needed this raw material will be excluded as a raw material for panel producers if the requirements continue to apply that all fractions must be taken from certified forestry operations or be a residual product from other activities.



Accordingly, the certified wood requirement applies only as regards solid wood where the criteria are changed from a minimum of 30% certified wood to 50% certified wood.

## 2.2.2 Requirement concerning energy and the origin of raw materials used in the building panel

### **R10** Energy consumption

The following requirement has been taken from the criteria for The Nordic Swan Ecolabelling of building panels, version 5.

The energy requirement has been amended. The objective of the requirement in the consultative proposal is to impose specific requirements on different types of building panels and to separate out those panels that are best from an environmental perspective within each individual type of panel.

In the previous version energy consumption requirements were imposed in the form of a formula in which the fuel consumed was divided by a quota and the electricity consumed was divided by a quota. Requirements were also imposed with regard to emissions of CO<sub>2</sub> and the sulphur content of fuel with the aim of limiting the use of fossil fuels.

Requirements in the form of a matrix or formulae offer flexibility for the panel producer. If a producer has less scope for reducing electricity consumption in the production process, fuel consumption can be reduced. The above matrix/formulae have been supplemented with several parameters and the requirements have been differentiated for different types of panels. The rationale behind the differentiation of the requirements is that the different types of panels have different possibilities for energy consumption and the use of different raw materials.

Differentiation will enable the best (in environmental terms) building panels within the individual types to be ecolabelled: Fibreboard, chipboard/veneer/laminated panels as well as sound-absorbing panels. In addition to the earlier environmental parameters – the consumption of electricity and fuel – the use of renewable fuel, wood raw materials from certified sustainable forestry operations and of recycled raw materials is rewarded.

The new matrix requirement contains formulae for the various panel types as shown below. For each environmental parameter scores can be achieved in the range of 0-4. The better the production, the higher the points scored.

All panels except sound-absorbing:

$$P = \frac{A}{25} + \frac{B}{25} + \frac{C}{25} + \left(4 - \frac{D}{0,25}\right) + \left(4 - \frac{E}{0,85}\right)$$

Requirement: P must be at least 9.5 for chipboard panels  
P must be at least 8.0 for fibreboard/veneer and laminated panels

Environmental parameters	Requirement
A = Wood raw material from certified sustainable forestry <sup>1</sup> (%)	
B = Proportion of recycled wood <sup>2</sup> (%)	
C = Proportion of renewable fuel <sup>3</sup> (%)	
D = Electricity consumption (kWh/m <sup>2</sup> )	Max 1 kWh/kg
E = Fuel consumption (kWh/m <sup>2</sup> )	Max 3.4 kWh/kg

1 Proportion wood raw material from certified forestry operations on an annual basis

2 Recycled raw material = Residual products from other industry, recycled post-consumer material

3 Definition of renewable fuel: the energy raw material is not a fossil raw material or peat

In the following an example of a calculation is provided showing how the requirement is applied to a building panel.

Example of a calculation for a building panel:

Wood raw material from certified sustainable forestry operations: 0%

Recycled wood raw material: 50% (sawdust)

Proportion renewable fuel: 80%

Electricity consumption: 0.5 kWh/kg

Fuel consumption: 1.3 kWh/kg

$$P = \frac{0}{25} + \frac{50}{25} + \frac{80}{25} + \left(4 - \frac{0.5}{0.25}\right) + \left(4 - \frac{1.3}{0.85}\right) = 9.7$$

the building panel fulfils the requirement

## R11 Requirements applicable to emissions to water

The background to the requirement is that producers must limit emissions of organic materials. No change to this point.

### 2.3 Highpressure laminate (HPL) panels

The following requirements include HPL panels when the high-pressure laminate material represents more than 10% by weight of the finished ecolabelled product. The requirements include only the high-pressure laminate. Any wood-based panels is covered by the requirements of section 2.2. Requirements for HPL panels are inserted in version 3.7 of the criteria.

#### K1 R12 Ecolabelled product

If the product is Ecolabelled, all requirements in section 2 3 (R13, R14, R15, R16 and R17) are automatically fulfilled.

- If the product is Ecolabelled, the product type and manufacturer and licence number must be specified.

## **O1 R13 Wood fibre and waste wood in paper, cardboard, and pulp**

The requirement includes raw materials purchased as wood fibres in paper, cardboard, and pulp, that individually represents more than 10 percent by weight of the finished panel. The requirement does not apply paper labels attached to the product. One of the three following requirements opportunities have to be met.

Nordic Ecolabelled paper products as well as pulp and paper controlled under the existing Nordic Ecolabel basic module for paper, is automatically approved in this requirement.

### **Annually, at least:**

1. 30% of the fibre raw material in paper, cardboard or pulp must come from forest areas in which operation has been certified under the forestry standard and certification system stated in Appendix 4c or which is certified as organically cultivated or where cultivation is in the process of being converted to organic production,
2. or
3. 70% of the fibre raw material in paper, cardboard or pulp must be recycled fibre or bi-products such as shavings or sawdust,
4. or
5. a combination of 1 and 2. If the fibre raw material in paper, cardboard or pulp consists of less than 70% recycled fibre, the proportion of fibre raw material from certified areas must be calculated according to the following formula:

Requirement for proportion of fibre raw material from certified areas in paper, cardboard, or pulp (Y):

$$Y (\%) \geq 30 - 0.4x$$

where x = proportion of recycled fibre or bi-products such as shavings and sawdust.

- The declaration and any calculations from the supplier of the paper, cardboard, or pulp that the requirement has been satisfied. The declaration must contain the name of the paper, cardboard, or pulp. Appendix 2d may be used.
- Where points 1 or 3 apply, the paper, cardboard or pulp manufacturer must send a copy of the relevant forestry certificate which complies with the guidelines for forest certification and organic cultivation, as described in Appendix 2c.
- By using the Nordic Ecolabelled paper, cardboard or pulp submit trade name and license number of the product. When using products controlled by the existing Nordic Ecolabel paper basic module the producer, production plant, name of mass or paper quality and grammage shall be described.

### **Background for requirement**

The requirement is new, compared to the previous version. In the previous version, there was no requirement for either certified sustainability or recycled fibres or bi-products such as shavings and sawdust.

Paper, cardboard, and pulp are constituents of several of the panel types in this product group. It is therefore judged that paper, cardboard and pulp have high environmental relevance for this product group. The environmental relevance relates to ensuring sustainable cultivation of wood raw materials and to permitting the use of recycled fibre in paper, cardboard and pulp and thus reducing the use of new wood fibre.

Even though wood fibres are a renewable raw material, it is important to ensure that virgin wood raw materials are from sustainable forests in order to protect forest resources, biological diversity and socio-economic functions, etc.

In the case of recycled fibre and bi-products, which do not come directly from saw works, traceability back to the forest is not always available and thus there is reduced opportunity for documentation certified wood. The environmental benefit from using recycled fibre and waste wood lies mainly in avoided use of virgin wood raw material. By using recycled fibre for paper, further resources are saved, as it is more demanding to produce paper from new fibres than from recycled fibre<sup>1</sup>.

In the consultation, comments were received about if "Controlled Wood" could be used as documentation of the requirement. The answer to this is: "Controlled Wood" cannot be used to document the requirement. The purpose of "Controlled Wood" is to ensure that the non-certified wood in the product, do not come from controversial sources. "Controlled Wood" do not ensure, that wood or wood fibres is either recycled (post-consumer) or certified sustainable, like it says in this requirement. However, this requirement could be documented with a FSC Mix or PEFC Mix certificate, as this ensures 70% wood or fibre from sustainable forests or 70% waste wood or recycled wood fibres. Nordic Ecolabelling have after the consultation chosen to adjust the percentage of recycled fibres from 75% to 70%. Then the level fits with FSC Mix and PEFC Mix.

## **02 R14 Emissions of COD from paper and cardboard production**

The total emissions of acid-consuming organic material (COD - chemical oxygen demand) to water must be less than the specified COD value in Table 3 for the paper or cardboard used (for unfiltered sample). Each type of pulp has its own level in the requirement. The COD emission from pulp production must be included in the total COD calculation for the paper or cardboard used.

COD emissions is thus calculated by adding the emissions COD mass kg/ADT (weighted mean of incoming pulps) + COD emission paper machine kg/t.

Nordic Ecolabelled paper products as well as pulp and paper controlled under the existing Nordic Ecolabel basic module for paper, is automatically approved in this requirement.

**Table 2 COD requirement levels for different pulp and paper types**

<b>Pulp type</b>	<b>Total COD level kg/ADT for pulp and paper</b>
Bleached chemical pulp (sulphate and other chemical pulps except sulphite pulp)	22.0
Bleached chemical pulp (sulphite pulp)	29.0
Unbleached chemical pulp	14.0
CTMP pulp	19.0
TMP/Groundwood pulp	7.0
Recycled fibre pulp	4.0

- Submit a description of the sampling programme, including measurement methods, measurement results from previous 12 months and measurement frequency, see also Section 1 of Appendix 1.
- By using the Nordic Ecolabelled paper, cardboard or pulp submit trade name and license number of the product. When using products controlled by the existing Nordic Ecolabel paper basic module the producer, production plant, name of mass or paper quality and grammage shall be described.

### **Background for the requirement**

The requirement has been updated with differentiated requirement levels according to the type of pulp or paper used. The criteria now include several different panel types in

<sup>1</sup> Background for ecolabelling of paper products, Nordic Ecolabelling 2011.

which paper or cardboard may be used. Hence, greater controllability in the requirement is achieved by having requirement levels suitable for the specific paper and pulp types. All pulp processes and paper production emit COD (chemical oxygen demand), P (phosphorus) and N (nitrogen). Contaminants in emissions to water consist of dissolved organic material from wood and bark, fibres and residues of boiling, bleaching and paper-making chemicals, indicated as the content of oxygen-consuming substances, COD, together with the fertiliser components phosphorus, P, and nitrogen, N. The organic matter is broken by micro-organisms with the use of oxygen. This can lead to depleted oxygen levels - and in some cases, completely oxygen-free conditions - in the aquatic environment. This can have a negative effect on fish and benthic animals. The requirement level is based on the latest BAT for both the pulp and the paper production values from the BREF document of 2014.

**Table 3 BAT for both the pulp and the paper production**

<b>Pulp and paper types</b>	<b>BAT REF 2014 kg/ADt (for paper the unit is kg/ton)</b>
Bleached chemical pulp (sulphate and other chemical pulps except sulphite pulp)	7-20 kg/ADt
Bleached chemical pulp (sulphit pulp)	3-10 kg/ADt
Unbleached chemical pulp	5-8 kg/ADt
CTMP-pulp	12-20 kg/ADt
TMP/Ground wood	0,9-4,5 kg/ADt
Recycled fibre pulp	0,4-1,4 kg/ADt (deinked 0,9-3) kg/ADt
Paper machine (not special paper)	0,15-1,5 kg/ton

Previously there were requirements for bleaching of paper and for surfactants for decolourising recycled fibres. These two requirements have now been omitted, as it is deemed more relevant to set an energy requirement for paper production. The criteria have therefore been expanded with an energy requirement for paper and pulp production.

### **03 R15Energy requirements for paper and pulp production**

The requirement covers paper and pulp which individually are present at more than 30% by weight in the finished panel.

Nordic Ecolabelled paper products as well as pulp and paper controlled under the existing Nordic Ecolabel basic module for paper, is automatically approved in this requirement.

The following requirements must be satisfied for paper or pulp:

$$P_{\text{electricity(total)}} < 1.25$$

$$P_{\text{fuel(total)}} < 1.25$$

P stands for energy point for paper/pulp production. In  $P_{\text{electricity(total)}}$  and  $P_{\text{fuel(total)}}$ , energy points are included from both paper production and the pulps used in the paper. See further explanation in Appendix 2E.

- The pulp and paper manufacturer must submit a calculation according to Appendix 2E which shows that the point limits are being satisfied. The calculation sheet developed by Nordic Ecolabelling must be used for the calculation.
- By using the Nordic Ecolabelled paper, cardboard or pulp submit trade name and license number of the product. When using products controlled by the existing

Nordic Ecolabel paper basic module the producer, production plant, name of mass or paper quality and grammage shall be described.

### **Background for the requirement**

In panels where the paper fraction forms a high proportion of the material composition, the paper makes a significant contribution to the panel's total energy impact. Relevance has therefore been identified for an energy requirement for both pulp and paper production for paper types present in the panel by more than 30% by weight. The energy requirement for paper has been taken from the Nordic Ecolabelling basic module for paper and requires specific data and calculations from the paper manufacturer. Due to the high level of documentation, it has therefore been assessed that the requirement should only come into force for paper proportions above 30% by weight. This has been supplemented with a reference value for production of kraft paper in order to adapt the requirement to this product group. Appendix 6 gives a detailed description of the energy calculation.

Depending on the type of panel, the paper may occur in different weight percentages. In plasterboards, the paper proportion is often around 5% by weight, but may be higher. For HPL panels, around 50-60% craft paper and 2-15% decor paper is often used. In addition, paper may occur in both cement-based panels and mineral wool panels. The principle behind the energy requirement in the Basic Module for paper is that manufacturers of different pulp and paper types calculate specific values for both the electricity consumption and the fuel used in their production. This is done by totalling the energy consumption for the different part-processes.

In order to calculate energy points for heat consumption and electricity consumption, the actual specific electricity consumption or fuel consumption is divided by the relevant reference values in Appendix 6.

The requirement has been developed for the Nordic Ecolabelling basic module for paper, and the associated reference values are based on BAT values from the so-called BREF document, drawn up in accordance with the EU IPPC Directive, published in 2000. The reference values were formulated in 1999.

### **Points limit for energy**

Along with comparison with the reference value, energy use is controlled by a points limit.

This limit defines by how much the paper's total energy consumption may exceed the optimum figure. A point limit of 1.25 indicates that the average total energy consumption of the paper may be no more than 25% higher than when the energy use is at the level of the reference value. The point model allows higher energy consumption in order to provide flexibility for the paper manufacturer.

See a further explanation of this requirement in the Nordic Ecolabelling basic module version 2, which can be requested from Nordic Ecolabelling.

## **04 R16 Energy requirements for HPL panel production**

The requirement covers the applied energy for production of the panel and may be documented either for the ecolabelled panel production or for the company's total annual production of HPL panels.

### **HPL panels ≤ 2 mm thin:**

No more than 18 MJ/kg panel may be used for producing the panel.

### **HPL panels ≤ 2 mm thick:**

No more than 14 MJ/kg panel may be used for producing the panel.

*The requirement does not include extraction of resources or production of incoming raw materials. Paper has its own energy requirements in O12. Self-produced energy and resold surplus energy should be stated but will not count as applied energy in the calculation.*

- ☒ A calculation should be submitted documenting compliance with the requirement. The calculation must contain information about: quantity of produced panels, sub-divided into thick and thin, applied electricity and fuel, and which fuel sources are being used.

### Background for the requirement

There is RPS for energy requirements in the actual HPL panel production. A wide variation in energy consumption has been detected in panel production. From the sector EPD of 2010 from ICDLI – International Committee of the Decorative Laminates Industry – an average variation of 50% among the 10 production systems covered by the EPD can be identified. This variation is mainly due to the materials efficiency and energy efficiency of the HPL production system, and to different energy sources.

At the same time, HPL production is a very homogeneous production type in terms of materials composition.

The sector EPD describes the following materials composition: decor paper 2-12%, craft paper 55-62%, melamine resin 2-12% and phenolic resin 20-32%<sup>2</sup>. In addition, various additives are used to a minor extent, e.g., aluminium hydroxide or aluminium oxide, which are used as the top coating above the decor paper, and any UV protection for HPL panels for external use.

The limited materials variation stated in the sector EPD means, that the variation in energy consumption in production is mainly due to energy efficiency in the actual panel production. The potential for energy improvements in panel production lies in reducing heat consumption by reusing process heat. Electricity and heat energy are correlated in HPL production, as, for example, a heat pump may use electricity but is capable of reducing heat consumption. A requirement has therefore been set for the total energy consumption, in order to permit flexible interaction between electricity and fuel consumption.

The actual resin fraction also contributes to the panel's energy impact. Here, energy consumption stems especially from the production of the constituent raw materials in the adhesive and should therefore be capable of documentation by data several links behind in the product chain. Even so, the potential for energy reduction is unclear.

Together with the low controllability, it is therefore judged that no energy requirement for the resin should be set at the present time.

Table 4 Energy data for HPL panels

HPL – mm thickness	Energy for materials, total primary energy requirement, cradle to gate [MJ/kg]	Energy for production, total primary energy requirement [MJ/kg]	Applied energy in panel production MJ/kg (not primary energy)
Max Compact & Max Exterior panels 8mm*	67	4.5	3
Max Thin panel 1 mm*	66	13.7	8.9
Egger EPD		18 to 33	Unknown
HPL Sector EPD** - 8mm	76	30.8	19.2
HPL Sector EPD** -0.8 mm	76	116.6	64.6

<sup>2</sup> EPD for Decorative High-Pressure Laminates, International Committee of the Decorative Laminates Industry (ICDLI), 2012

*\* These values are in principle specific to the EPD, but have been calculated by subtracting the generic material energy and calculating back to the applied energy from the primary energy.*

*\*\* The values have been taken from the ICDLI sector EPD, which states the average for 10 different European HPL manufacturers.*

It is possible to make use of self-produced energy in HPL production. For example, by collection of VOC emissions and later recovering the energy by combustion. Self-produced energy does not count in the requirement but must be indicated when documenting the requirement. The same applies to surplus energy from production, which is sold to another user.

During the revision of the criteria, Nordic Ecolabelling has collected various energy data for HPL panel production. These include commissioned a report with energy mapping of different types of panel productions.

The collected energy data for HPL panels shows that there are large variations in energy consumption expressed in MJ/kg produced HPL panel. For example, energy data from HPL manufacturers from the International Committee of the Decorative Laminates Industry (ICDLI) shows great variation (table 4).

The found energy data also shows that there is a big difference in energy consumption between thin and thick HPL panels, when the unit is MJ/kg. Here, the thin panels have higher energy consumption per kg panel, than the thick. This can be explained by the smaller units in an identical manufacturing process. This gives a lower energy efficiency when comparing with larger units (thicker panels) per kg. Because of that a differentiated requirement level is set for thin HPL panels (< 2 mm) and thick (> = 2 mm) compact laminate panels. The ICDLI EPD also sub-divides HPL panels according to thickness in the same way.

In the consultation draft very ambitious requirement levels was proposed. The comments in the consultation pointed out, that these values were too harsh and the requirement of energy for the production of HPL panels is therefore adjusted after the consultation. The requirement level in the consultation proposal was < 10 MJ/kg for panels < 2 mm in thickness and is subsequently adjusted to < 18 MJ/kg. The requirement of < 6 MJ/kg for panels > 2 mm in thickness in the consultation proposal is now adjusted to < 14 MJ/kg.

Data from the HPL Industry EPD from the International Committee of the Decorative Laminates Industry (ICDLI) indicates an average value of 19 MJ/kg for thick panels and 64 MJ/kg for thin panels for the production. Then the final requirement levels of a maximum of 14 MJ/kg and 18 MJ/kg are ambitious requirements.

## **05 R17Emissions from HPL production**

In the case of production in countries where the mandatory national requirements are less stringent than the emission levels in this requirement, it must be documented that the following emissions levels have not been exceeded.

The requirement relates to panels in which the content of HPL (High Pressure Laminate) accounts for more than 10% by weight of the panel.

The following limit values for emissions to air at the workplace may not be exceeded during production of HPL (High Pressure Laminate):

**The limit value is expressed in relation to a reference period of 8 hours' time-weighted average (TWA):**

Limit value for formaldehyde cas. no. 50-00-0: 0.5 ppm or 0.6 mg/m<sup>3</sup>

Limit value for phenol cas. no. 108-95-2: 2 ppm or 8 mg/m<sup>3</sup>



**The limit value is expressed in relation to a short-term value of max. 15 min.:**

Limit value for formaldehyde cas. no. 50-00-0: 1.0 ppm or 1.2 mg/m<sup>3</sup>

limit value for phenol cas. no. 108-95-2: 4 ppm or 16 mg/m<sup>3</sup>

- Air measurements for phenol and formaldehyde for the past 12 months, containing a description of the sampling programme, including measurement methods and measurement frequency. For analysis methods, see Appendix 1,  
or
- Description of mandatory national regulatory requirements, showing that the requirement automatically is followed.

**Background for the requirement**

The requirement is new and included in connection with the extension of the criteria to HPL panels. HPL panels consist of kraft paper and decor paper impregnated with phenolic and melamine resin. During the hardening, drying, and pressing process, the methanol, formaldehyde and phenol evaporate from the laminate. These substances are harmful to the environment and to health but can be cleaned from the exhaust air with a special incineration technique. It is therefore important to ensure that the emissions level at the workplace is low and complies with the recommended limit values described by the Nordic authorities.

Resins used for impregnation in the HPL and laminate production has generally high formaldehyde content. Normally about 1% by weight of free formaldehyde. At the same time the resin may include formaldehyde oligomer (synthetic polymer) with a weight percent greater than 50.

The limit value is the average concentration in the air which can be inhaled at the workplace during an eight-hour working day, but also includes short-term values and possible ceiling values. Short-term value means that even if the time-weighted average concentration does not exceed the limit value, the concentration in a time period of maximum 15 minutes must never exceed the limit value by a factor of 2.

In Denmark, the limit value for formaldehyde is also a ceiling value and must therefore never be exceeded at any time.

In the Nordic Region, there are national emission values for both phenol and formaldehyde. These are either mandatory or, in some countries, advisory, but they may be made mandatory by official order. A limit value for phenol has also been defined in Commission Directive 2009/161/EU. However, this is not necessarily mandatory in all EU countries, and the requirement has therefore been laid down for all manufacture outside the Nordic Region to ensure that the level in the EU Directives is satisfied as a minimum for phenol and that the least stringent level from the Nordic authorities is complied with.

Phenol has an EU limit value of 2 ppm and 8 mg/m<sup>3</sup> laid down in Commission Directive 2009/161/EU. However, the EU Directive does not have direct legal application in the individual countries. Formaldehyde does not yet have an EU limit value. Table 27 below shows both EU and Nordic national limit values.

**Table 5 Limit values for formaldehyde and phenol emissions in relation to the working environment**

	Formaldehyde limit value		Phenol limit value	
	Working day (8 hours' exposure)	Short-term value	Working day (8 hours' exposure)	Short-term value
<b>EU*</b>	None	None	2 ppm or 8 mg/m <sup>3</sup>	None
<b>Denmark**</b>	0.3 ppm or 0.4 mg/m <sup>3</sup>	0.6 ppm or 0.8 mg/m <sup>3</sup>	1 ppm or 4 mg/m <sup>3</sup>	2 ppm or 8 mg/m <sup>3</sup>

<b>Sweden***</b>	0.3 ppm or 0.37 mg/m <sup>3</sup>	0.6 ppm or 0.74 mg/m <sup>3</sup>	1 ppm or 4 mg/m <sup>3</sup>	2 ppm or 8 mg/m <sup>3</sup>
<b>Norway****</b>	0.5 ppm or 0.6 mg/m <sup>3</sup>	1 ppm or 1.2 mg/m <sup>3</sup>	1 ppm or 4 mg/m <sup>3</sup>	3 ppm or 12 mg/m <sup>3</sup>
<b>Finland*****</b>	0.3 ppm or 0.37 mg/m <sup>3</sup>	1 ppm or 1.2 mg/m <sup>3</sup>	2 ppm or 8 mg/m <sup>3</sup>	4 ppm or 16 mg/m <sup>3</sup>

\* Commission Directive 2009/161/EU, \*\* Danish Working Environment Authority, \*\*\* Swedish Work Environment Authority, \*\*\*\* Norwegian Labour Inspection Authority: Regulations, Order no. 704, \*\*\*\*\* Finnish Occupational Safety and Health Administration.

## 2.4 Chemical products and materials

The requirement applies to all chemical products used at the factory/production site, including surface treatment. The requirement applies to products such as glue, varnish, stains, wood preservative (see the exception below), primer, filler, oil, soap, joint filler, sealants and colour products, binding agents, pigments, bleaching chemicals and the like.

Auxiliary chemicals e.g., lubricants or cleaning aids are not encompassed by these criteria.

As a simplification of the documentation ecolabelled products will fulfil criteria K18 – K21. The product must be included in a valid license at the time of application.

### **O6 R18 Ecolabelled chemical products**

For chemical products that are Nordic Ecolabelled the requirements R19, R20, R22 and R23 can be skipped.

### **R12 R19 Classification of chemical products**

This requirement combines the classification requirements applicable to individual materials in the previous version 2 of the criteria document.

Overall, there has been an increase in stringency in that the use of chemical products classified in the following way is now also prohibited: Xn with R68, T with R61, Xn with R62, Tx (T+ in Norway) with R26, R27, R28 and/or R39, T with R23, R24, R25, R39 and/or R48 and Xi with R43. However, the last version also prohibited classification as R23 and R28 for chemical products in building panels, wood preservatives for products that are not permanently outdoors and surface treatment of wood. In the case of glue however, there has been a considerable tightening-up (see the discussion below). In the case of product types that in the last version were subject to a milder classification requirement than the other chemical products used in production, exemptions have been granted here from the general requirement.

### Exceptions

In the case of additives in wood based panels, R6 give an exemption from the requirement concerning environmental hazard. See the specific requirements for building panels in R6. Exemptions are also given for classification H351 (category 2) for classified adhesives that contain isocyanate and/or formaldehyde. Chemical products used in high pressure laminates and classified as harmful for health (Carc 2, Muta. 2, Repr. 2 according to CLP-Regulation 1272/2008) are exempted from the prohibition.

In HPL panels, there is an exception for resins with up to max. 10-weight % phenol classified with H341 and H301, H331.

Formaldehyde with H350 (Carc.1B)/R45 and/or R49 and H341 (Muta.2)/R68 are exempted from the prohibition in this requirement. The formaldehyde

content in adhesives is instead regulated in requirement R7 and R20, which are requirements addressing formaldehyde emission from the panel. Emissions from HPL production is regulated in requirement R17.

Methanol in concentrations up to 10% by weight in adhesives and resins are exempted from the prohibition of classification according to the requirement. Wood preservative for products left outdoors permanently are exempted from this requirement. See R25 in chapter 2.4 for the requirements applicable to classification of these products.

Wood preservative for products not left outdoor permanently and containing biocides are exempted from the environmental hazard requirement.

R26 "Requirements as to surface treatment" grants an exemption as regard classification as an environmental hazard.

Nordic Ecolabelling's goal is that the effects of the products on health and the environment should be as limited as possible. The requirement is accordingly imposed that products containing substances that are classified as very toxic, toxic, harmful to health, carcinogenic, mutagenic, or harmful for reproduction cannot be ecolabelled.

<b>Classification</b>	<b>Associated hazard symbol and R-phrases*</b>	<b>CLP-regulation 1272/2008*</b>
Environmental hazard	N with R50, R50/53, R51/53 and/or R59	H400 very toxic to aquatic life H410 very toxic to aquatic life with long-lasting effects H411 toxic to aquatic life with long-lasting effects and/or EUH059 hazardous to the ozone layer
Highly toxic	Tx (T+ in Norway) with R26, R27, R28 and/or R39	H330 fatal to inhale H310 fatal in contact with skin H300 fatal if swallowed and/or H370 causes damage to organs
Toxic	T with R23, R24, R25, R39 and/or R48	H331 toxic if inhaled H311 toxic in contact with skin H301 toxic if swallowed H370 causes damage to organs and/or H372 causes damage to organs through prolonged or repeated exposure
Carcinogenic	T with R45 or R49. Or Xn with R40	H350 may cause cancer H350i may cause cancer by inhalation or H351 suspected to cause cancer
Mutagenic	T with R46 or Xn with R68	H340 may cause genetic defects H341 suspected to causing genetic defects
Toxic for reproduction	T with R60 and/or R61. Or Xn with R62 and/or R63	H360F may damage fertility and/or H360D may damage the unborn child H361f suspected to damaging fertility and/or H361d suspected to damaging the unborn child

*The classification applies in accordance with the Dangerous Substances Directive 67/548/EEC with subsequent amendments and adaptations and/ or the CLP regulation 1272/2008 with subsequent amendments. During a transition period, until 1st June 2015 both types of classification can be used. After the transition period only classification according to the CLP-regulation applies, see above table.*

These criteria have been changed after the public hearing where several stakeholders suggested that by not allowing products labelled R43 or R43 hole glue systems would be excluded from the criteria e.g. IPI-systems. It was not the intention by Nordic Ecolabelling to exclude these technologies and hence the criteria was changed in a way

R42/R43 is not included in this criteria. Products labelled R42 or R43 has not previously been excluded from the criteria.

#### Glue (formerly Chapter 4.9)

Chapter 4.9 glue from version 2 has been removed in version 3 of the criteria as the requirements have instead been included in the general chemical requirements (Chapter 2.3). The key difference is that glue used for gluing outdoor furniture or playground equipment is now encompassed by the same classification requirements as glue used in building panels. This means that all glue used in production must now comply with classification requirement R12 (see the description above), the requirement applicable to the content of and additives to chemical products in R14 and the requirement applicable to nanomaterials in R15. In the last version glue that was not used in a building panel was subject only to the requirement that it was not classified as environmentally hazardous and that it contained a maximum of 5 weight-% VOC. Accordingly this version of the criteria constitutes a significant increase in stringency. Where glue containing isocyanate is used, this will be captured by the general chemical requirements.

It is important to stress that an exemption applies in the case of the use of isocyanates in the production of polyurethane since isocyanates constitute an important component in this process.

#### A brief discussion on adhesives

Producers of outdoor furniture and playground equipment use glue for various purposes, including building panels, gluing laminates, or gluing the product together. Accordingly, this also means that a variety of different types of glue are used.

Four types of glue may be used for laminating, two of these are based on formaldehyde (urea resins and melamine-urea resins), one is based on polyvinyl acetate (PVAc glue) and one is based on isocyanates (EPI glue). Several of these products contain substances that are undesirable in terms of health and the environment.

Water-based dispersion adhesive is used for gluing wooden components. These products are largely not subject to a classification requirement. Where 2-component glues are used, one part may be classified as allergenic.

### **R13 R20 The content of free formaldehyde in chemical products**

The requirement has been changed.

Previously the criteria said: "the content of free formaldehyde in the products used to produce the building panel must not exceed 0.3% by weight, and the free formaldehyde in adhesives for fibreboards must not exceed 0.5% by weight."

The new criteria: The quantity of free formaldehyde chemical products used in the production of Nordic Ecolabelled furniture/fitments may be up to 0.2 weight-% (2000 ppm), with the exception of adhesive which is mixed with a hardener.

For adhesives mixed with a hardener the limit of 0.2 weight-% (2000 ppm) free formaldehyde is for the final mixture.

The requirement does not apply to resin used for impregnation in HPL and laminate production. HPL and laminate production must instead comply with Requirement R17 Emissions from HPL production.

The criteria have been changed after the public hearing where several producers stated that a lower level was possible. It has then been confirmed by other producers that the suggested new lower level is possible.

#### **R14 R21 The content of and additives to chemical products**

The requirement encompasses all chemical products used at the factory/production site, including surface treatment products.

The requirement applies to products such as glue, varnish, stains, wood preservative (see the exception below), primer, filler, oil, soap, joint filler, sealants and colour products, binding agents, pigments, bleaching chemicals and the like.

##### Exception

Wood preservative for furniture or playground equipment left outdoors permanently is exempted from this requirement.

After the consultation period, CMIT has been exempted from the ban of halogenated organic compounds. Instead, limit values have been set for the content of isothiazolinones and for the mixture of CMIT/MIT (3:1) at 0.05% and 0.0015% by weight respectively. The reason is that several manufacturers have commented that the trend is towards a greater usage of CMIT/MIT as a biocide since the mixture can replace other types of biocides having other harmful environmental effects, such as formaldehyde content.

In version 3.7 Nordic Ecolabelling became aware that the primarily used biocide for water-based paints and adhesives used in these producttypes, contains the preservative bronopol. Bronopol concentration in the paint or glue is very low - often below 0.05%. At present, no better biocide alternative is available on the market. Since the content of bronopol is very low, it has been decided to allow up to 0.05% bronopol as a preservative in chemical products used in the production.

The requirement is a combination of the individual requirements applicable to additives in the various sub materials in the previous version of the criteria. An increase in stringency has been introduced in this version of the criteria document in that this requirement includes a prohibition against the use of perfluorooctanic acid (PFOA), perfluorooctane sulphonic acid (PFOS) and bisphenol A. A second increase in stringency is that the requirement applicable to alkylphenolethoxylates, which now applies to all chemical products, but which in the previous version applied only to chemical substances in building panels.

##### Halogenated organic compounds<sup>5</sup>:

Organic compounds containing the halogens chlorine, bromine, fluorine, or iodine (halogenated organic compounds) must not be present in Nordic Ecolabelled outdoor furniture or playground equipment. Halogenated organic compounds encompass a large number of substances that are harmful to health and the environment, are highly toxic to waterborne organisms, carcinogenic or harmful to health in other ways.

The halogenated organic compounds do not degrade readily in the environment, which increases the risk that they will have harmful effects. The requirement is therefore imposed that halogenated organic compounds must not be present in Nordic Eco-labelled outdoor furniture or playground equipment. One consequence of this is that brominated flame retardants must not be present in Nordic Ecolabelled outdoor furniture or playground equipment. In O10 the requirement is limited to halogenated organic binding agents and flame retardants.

#### Perfluorinated and polyfluorinated alkylated compounds (PFAS)

Perfluoroalkyl substances, also called perfluoroalkyl surfactants or perfluoroalkyl acids (PFAS) is a term used for a group of chemical compounds containing a completely fluorinated alkyl chain and a group giving the compound a certain solubility in water. This group of compounds is fundamentally different from most other chemicals, since it is neither lipophile nor hydrophile, but generally binds to particle surfaces.

The compounds are used primarily because of their excellent surface properties and their water and fat repelling properties. They are used in various industrial and consumer products, inter alia where low surface energy, high chemical and thermal stability, low refractive index, high electrical insulation properties and high ability to withstand corrosion and external effects are important. Important product types include floor wax and polish, paints and varnish, degreasing and cleaning products, proofing products for textiles and leather and fire-extinguishing agents.

Perfluoroalkyl substances are very persistent, (stable) and break down very slowly. As noted in the introduction, these compounds show little lipo and water solubility and accumulation occurs in that they bond with surfaces of particles or tissue. They bind to proteins and are found at higher levels in apex predators. A Nordic screening study showed PFAS compounds in all the sample types examined and the highest was found in marine mammals. The report concluded that PFAS is found in considerable concentrations in the Nordic environment.

The PFAS compound on which most attention is focused is perfluorooctylsulphonate (PFOS), which is toxic to waterborne organisms, birds, and bees. /ref.: SFT: 927/2005/

#### Bisphenol A

The introduction of a prohibition against the use of Bisphenol A is a new requirement. Bisphenol A, CAS. No. 80-05-7, is used as a monomer in, inter alia, the following relevant areas and products: Various plastic and epoxy mixes, various building parts, paint, varnish, glue (binding agents, hardeners) and polyol in the production of polyurethane. Bisphenol A can be released into the environment from the production process and the substance has shown endocrine (hormonal) effects in both fish and in snails. The main source of terrestrial exposure is the spread of sludge from sewage treatment plants. Environmental risk-reducing measures are necessary in several areas of use. For consumers, there is no direct exposure, although polycarbonates and epoxy resins containing bisphenol A are present in many consumer products. Since bisphenol A has been shown to cause endocrine effects in animal experiments, its use is prohibited here.

#### Phthalates

No Nordic Ecolabelled outdoor furniture or playground equipment or raw materials may contain phthalates. A number of phthalates are included on the list of undesirable

substances, and several are classified as environmentally hazardous, accordingly phthalates are excluded from Nordic Ecolabelled chemical substances.

#### Aziridine and polyaziridines

Aziridine is on the list of hazardous substances (The Ministry of Environment and Energy, 1996) classified as a carcinogen in group Carc2 and as mutagenic in group Mut2. In addition it is classified as "Very toxic", "Corrosive", "Highly flammable" and "Environmentally hazardous". Ref.: Miljøprosjekt 1999, Environmental parameters in lexographic printing, MST.

#### Heavy metals

It should be noted that the requirement applicable to heavy metals in R14 does not apply to wood preservatives for products left outdoors on a permanent basis. These products are encompassed by requirement R17.

In the case of other chemical products, heavy metals or compounds thereof: cadmium, copper, boron, lead, chromium VI, mercury, and tin must not be present in the product or in the constituent chemical substances.

It is accepted that ingoing substances may contain traces of these substances deriving from impurities. The trace quantities of each individual heavy metal must not exceed 100 ppm (0.1 mg/kg, 0.01 weight-%) in the raw material.

#### Tin

Tributyltin (TBT), dibutyltin (DBT), dioctyltin (DOT) and triphenyltin (TPT) are all on the list of undesired raw substances. Tributyltin (TBT) is the organic tin compound that has been investigated most thoroughly. TBT is shown to cause endocrine disruption in marine organisms. Tin is no longer used as a preservative in Denmark (16), but this does not provide a safeguard against imports of pressure-impregnated wood from other countries where less environmentally friendly products are used. Accordingly, the use of pigments and additives based on tin is prohibited.

#### Creosote

Creosote is not a well-defined substance. Creosote is made from coal tar (in the production of coke) or from wood tar. Coal tar creosote contains PAH (polycyclical aromatic hydrocarbons). Many PAH-substances are genetically harmful for humans, affect the immune system and reproductive ability and are carcinogenic. In nature PAH breaks down slowly (although nature is able to recover, for example after a forest fire). Wood tar creosote contains substances such as cresol, phenols and guaiacol. Creosote and creosote compounds from coal tar contain substances classified as toxic and carcinogenic, depending on the PAH content, e.g., benz(a)pyrene. Creosote is included on the Danish EPA's list of undesirable substances if the PAH content is high. Creosote-treated wood may pollute the ground with PAH if it is for example used in gardens and in playgrounds. This is why the use of e.g., railway sleepers for these purposes is prohibited. Wood tar creosote contains substances classified as toxic but not carcinogenic (13).

The use of creosote-treated wood inside buildings is prohibited as is its use in the production of certain containers and in playgrounds and other outdoor facilities for recreational purposes, cf. the announcement restricting the sale and use of creosote No. 665 and 4 July 1996. The Danish EPA interprets the prohibition against the use of creosote in playgrounds and other outdoor facilities for recreational purposes to mean

that the following are prohibited: Any use in playgrounds is it in playground equipment, playhouses, fencing, walkways, driveways, and the like is prohibited.

Any use in private gardens and green areas adjoining residential properties for use in fencing, driveways, raised beds, terraces, sandpits and the like (14). Although creosote is not approved for use as a preservative in Denmark, wood treated with creosote that complies with the Danish EPA's announcement on creosote may be imported and may be found on the Danish market (15). Thus, maintaining a prohibition against creosote in the criteria remains relevant.

#### Chromium

Importing and selling wood treated with chromium is still permitted. This is because the chemical compounds in chromium are particularly dangerous in connection with production and disposal – but not in the day-to-day use of the finished wood.

An exemption has been granted in the case of the production of wood treated with agents containing chromium for use for special purposes such as coastal protection, in harbours and other maritime facilities (15). Accordingly maintaining a prohibition against chromium in the criteria remains relevant.

#### Arsenic

The EU Commission has performed an assessment of the risk associated with the use of arsenic for wood preservation. This includes the risk to children's safety/health associated with the use of arsenic-treated wood in playground equipment as well as the risk to human health in general in connection with the disposal of arsenic-treated wood. 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). Ref.

<http://www.europarl.europa.eu/sides/getAllAnswers.do?reference=E-2003-0112&language=DA>

Since arsenic is now encompassed by the restrictions in the Directive, the heavy metals requirement (R14) no longer encompasses arsenic, contrary to the case in the last version of the criteria.

#### Boron

Certain wood preservatives may contain boron compounds and boron is used as a hardener in metal alloys (especially steel) where it is present in small quantities. The boron compounds boron tribromide, boron trichloride and boron trifluoride can be found on the list of hazardous substances and are classified as very toxic if inhaled and/or ingested and as corrosive. Inorganic and organic boron compounds are not viewed as carcinogenic. The boron halides are classified as toxic because of their toxicity if inhaled and/or ingested. Ref. Miljøprojekt nr. 700, 2002.

#### Alkylphenols (APEO)

Alkylphenolethoxylates (APEO) and alkyl phenol derivatives, i.e., substances that release alkyl phenols when degrading, must not be used in ecolabelled furniture and fitments.



APEOs may occur in: binding agents, dispersants, thickening agents, siccative's, foam inhibitors, pigment pastes, wax etc. APEOs have a number of properties that are problematical for health and the environment.

APEOs are not readily degradable according to standardised tests for ease of degradability, they have a tendency to bioaccumulate, they are found in high concentrations in waste water sludge, the degradation products of APEO, alkyl phenol and APEO with one and two ethoxy groups, are highly toxic to aquatic organisms and some alkyl phenols are suspected of causing endocrine disruption – alkyl phenols and bisphenol A are amongst the most potent of the oestrogen chemicals and may be released in waste water.

The last version of the criteria document permitted a maximum of 0.6 weight-% alkylphenoethoxylates and alkyl phenol derivatives in chemical products in building panels.

In this version of the criteria the requirement is stricter, in that the substances are now entirely prohibited and in that the requirement now applies to all ingoing chemical products in outdoor furniture and playground equipment. This requirement is harmonised with the criteria for the ecolabelling of furniture and fitments.

The last version of the criteria document permitted a maximum of 0.6 weight-% alkylphenoethoxylates and alkyl phenol derivatives in chemical products present in the building panel. In this version of the criteria the requirement has been made stricter both by prohibiting the substances entirely and by applying the requirement to all ingoing chemical products in outdoor furniture or playground equipment. This requirement has been harmonised with the criteria for the ecolabelling of furniture and fitments.

#### Volatile organic compounds (VOC)

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 degradation of the ozone layer (5).

Strict requirements have accordingly been imposed with regard to the VOC content of the chemical products contained in Nordic Ecolabelled outdoor furniture and playground equipment. The VOC requirements have not been changed since the last version of the criteria since it is considered necessary to use VOCs in order to achieve a satisfactory quality in the products.

### Volatile aromatic compounds

Volatile organic 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 (5). The VAC requirements have not been changed since the last version of the criteria since it is considered necessary to use VACs in order to achieve a satisfactory quality in the products.

### **R15 R22 Nanomaterials**

Nanometals, nanocarbon compounds and/or nanofluorine compounds must not be actively added to products used in the production of Nordic Ecolabelled outdoor furniture and playground equipment.

For these purposes nanoparticles are microscopic particles where at least one of the dimensions is less than 100 nm. Nanometals include nanosilver, nanogold and nanocopper. Nanometals such as nanosilver and nanocopper are under particularly close observation since they are used in numerous products, from socks to refrigerators, in order to achieve an antibacterial effect.

The US Environmental Protection Agency (EPA) regards substances such as nanosilver as biocides. There is particular concern that the emission of nanosilver to waste water and other spreading of nanosilver may eliminate useful bacteria and cause resistance in bacteria. A general ban on nanoparticles would not be controllable since materials exist that are smaller than 100 nm and that are not viewed as problematical.

The requirement can for example be documented by describing how the nanoparticles are bound in the product, and thus prevented from being released into the surrounding environment (during use and after use) or the user (during use and after use).

Particles at nano level have particular properties that are suspected of causing harm to health and the environment. Various products may release nanoparticles and these particles may be absorbed through the lungs or penetrate through the skin and other barriers in the body or in the environment. The reactive properties of nanoparticles can cause tissue damage in organisms exposed to them. Knowledge about the effects on health and the environment of nanoparticles is limited. Based on the precautionary principle Nordic Ecolabelling therefore stipulates that nanomaterials may be used only if documentation can be provided that negative effects will not be caused to health and the environment.

## **2.5 Wood preservatives**

Wood preservatives shall fulfil criteria R23, R24 and R25 and the criteria in chapter 2.4 R19, R20 and R22.

Ecolabelled durable wood fulfils the criteria in chapter 2.5.

## R16 R23 Durability

The product must have long durability, i.e., be resistant to fungal attack. This requirement can be met by choosing the right sort of wood with natural long durability, constructive wood preservation, impregnation, heat treatment or surface treatment. Wood with natural durability (durability class 1 or 2 according to EN 350-2) must not be treated with wood preservatives.

One of the following types of sustainability must be met:

Wood with natural durability, defined as (durability class 1 or 2 according to EN 350-2) meets the requirement.

Constructive wood as risk class 2 see standard EN 335-1 is achieved.

Treatment of wood such as impregnation, heat treatment, coating, or other modification of the wood in accordance with the scope, as defined according to risk classes specified in the standard EN 335-1.

- Wood with natural durability: Describe the type of wood and the durability class.
- Constructive wood preservation: Description of the constructive wood preservation (cf. risk class 2, EN 335-1) and submission of fungicidtest according to EN 113 for biological testing for risk class 2 performed on the product. The tree must grow old with appropriate method, eg. EN 73 or EN 84.
- By impregnation, heat treatment or assault treatment submitted evidence of compliance risk class see the scope specified in EN 335-1. And: submission of a fungicidtest according to EN 113 for biological testing of the relevant risk class conducted on the product. The tree must grow old with appropriate method, eg. EN 73 or EN 84.

### Changes to the criteria

In this version the criteria also include heat treated wood which is a preservation type that has increased in the last 10-15 years.

Also, the criteria have been made clearer by referring to the standard EN 355-1: 1994, which describes the risk classes in regards to the climatic conditions and hence the biological degradation the wood is exposed of. This makes it more clear which durability that is necessary in relation to the function of the product.

To specify how it is documented that the product is resistant to fungus a reference to EN113 is made in the documentation part and the relevant age test listed in EN 73 or EN 84.

### Explanation of the requirement

A durability requirement has been imposed in order to ensure that the Nordic Ecolabelled outdoor furniture or playground equipment has a long useful life. In this version the requirement has been extended to also encompass the heat treatment of wood, which is a type of wood preservation that has gained considerable ground over the last 10-15 years (11).

From an environmental perspective it is important that the wood used in outdoor furniture and playground equipment should be durable in order to ensure that the product has a long life. High durability can be achieved through:

- The use of wood types that afford natural long durability
- Constructive wood preservation

- Chemical wood preservation such as impregnation or surface treatment of the wood
- Heat treatment of the wood

Nordic Ecolabelling requires wood used in Nordic Ecolabelled products to have a high resistance to fungal attack.

This requirement can be met by choosing the right sort of wood with natural long durability, constructive wood preservation, impregnation, heat treatment or surface treatment. Wood with natural durability (durability class 1 or 2 according to EN 350-2) must not be treated with wood preservatives.

Today there is a trend in the direction of systems that modify the properties of the wood in order to give it greater durability (Wood modification). The aim is to extend the durability of European wood varieties (which generally have low durability) without using environmentally harmful biocides. Wood modification involves modifying the chemical composition of the polymer in the wood. Modification allows the moisture content of the wood to be controlled.

The moisture content of wood is one of the main parameters in durability. Fungal attacks on wood occur if the wood has a moisture content of  $> 20\%$  (at temperatures of between 2 and  $> 40^{\circ}\text{C}$ ) (12).

Modification of solid wood can be divided into the following categories:

- Chemical modification
- Thermal modification
- Modification by impregnation
- Modification by surface treatment

#### Chemical modification

With this method the durability of the wood is increased by preventing water from binding to the wood. Non-water absorbent substances react with those areas of the wood in which the water is bound. These areas are known as hydroxyl groups or "OH groups". The most widely described method is acetylation where wood - typically a species of fir - reacts with acetic acid and hydride at 100 to  $120^{\circ}\text{C}$ . The resulting product is approximately 20% heavier than the original material and as resistant to fungal attack as teakwood and high dimensional stability (approximately 60-75% less moisture movement than untreated wood). The cell walls are permanently expanded by the added substance (fir: approximately 12% greater volume, see Fig. 2) and the wood attains a light greyish colour. The strength of the wood after treatment will depend on the process used but will usually be the same as that of the original material. The hardness of the wood is increased by the treatment, but generally not as much as in the case of modification by impregnation (see below). Chemical modification is a costly and difficult process for which reason a number of attempts at commercialisation over the years have failed (12).

#### Thermal modification

Also known as heat treatment. This method involves heating up wood to 160 to  $220^{\circ}\text{C}$  under special process conditions. A controlled breaking down of the hemicellulose of the wood takes place. Hemicellulose is responsible for much of the water binding in the wood. Heat-treated wood is not as resistant to fungal attack as chemically modified wood and cannot for example be used in contact with the ground.

On the other hand, it is cheap to produce and widely used for cladding buildings etc. where it offers an excellent protective effect because of its low moisture absorption. One of the strengths of heat treatment is that a very attractive brown colour can be achieved in light wood types. This has led to some use of heat-treated wood by the furniture industry.

Generally, the strength of the wood is reduced at process temperatures of over 100°C. Accordingly, heat-treated wood is not suitable for larger, load-bearing structures. However, as the process temperature increases, the resistance of the wood to fungal attack rises because the equilibrium moisture level is reduced considerably by increased substitution of the OH groups.

Heat-treated wood from a variety of species has been commercially available from the 1930s, particularly in Germany and the United States, but commercial success only came with the launch of the Finnish Thermo-Wood process at the start of the 1990s. In Finland, production capacity is in the region of 80,000 m<sup>3</sup>/year.

Other producers include PlatoWood in Holland, Retification in France and a mass of small producers including Celloc of Denmark. Heat treatment conducted in hot oil is marketed in Germany under the name Menz Holz (12).

#### Modification by impregnation

Also known as 'bulking' takes advantage of the ability of certain substances to penetrate the cell walls of wood and to fill out the gaps so that the area penetrated by water is occupied, reducing further penetration by other fluids. The systems available on the market are based on aqueous monomers which are impregnated into the wood after which they are polymerised to a chemical compound that cannot be washed out. Typically, a process temperature of about 100°C or slightly above will be used. The hardness of the wood is increased as the degree of treatment rises (polymer % in the wood). However, the primary advantage of the technology is that the dimensional stability and resistance to fungal attack of the wood is increased.

It is possible to achieve properties that are on a par with chemically modified wood, i.e. up to 60-75% less moisture movement and durability comparable to that of teak wood. In addition to use in outdoor environments, many of the products are well-suited for use in floors because of the significant increase in hardness.

Modification by impregnation is virtually synonymous in commercial terms with furfuralated wood produced by Kebony ASA Norway under the brand names VisorWood and Kebony. Furfuralation is based on a chemical called furfural alcohol produced from agricultural waste containing hemicellulose, e.g., bagasse from sugar cane or corn cobs. This product can be polymerised in the cell walls of the wood produce a dark very resistant mass which does not wash out after hardening. Production capacity is in the region of 15,000 m<sup>3</sup>/year. The products are marketed for use as, inter alia, cladding, terraces, wooden roofs, construction wood, furniture, and windows/doors. (Kebony) (12).

#### Surface modification

Typically used to improve the adhesion of a surface treatment to wood or to increase the weather resistance of wood. The modification process can, for example, be based on

enzyme systems or plasma treatment, although acetylation can also be used. At present there are no commercial technologies available for surface modification. Surface modification may perhaps have some usefulness since complete modification may be expensive and difficult to handle.

The main gains of surface modification appear to be associated with the scope for reducing UV degradation of wood (weather greying) by binding UV stabilisers chemically to the surface of the wood (12).

One risk of not permitting impregnation is that furniture manufacturers will Nordic Ecolabel untreated products, leaving it to the consumer to apply treatment to the furniture. Experience has shown that treatment of this nature involves higher emissions of substances that are harmful to health and the environment than would be the case had the furniture producer conducted controlled impregnation at the production site. Nordic Ecolabelling's objective is to minimise the use of substances that are harmful to health and the environment is, for example, surface treatment and impregnation. Accordingly, strict requirements are imposed with regard to substances in these treatments that are harmful to health and the environment.

Nordic Ecolabelling has chosen not to impose requirements as regards the method of impregnation itself because the greatest environmental impact is associated with the content of environmentally harmful substances in the impregnation agent, whereas the impregnation itself is of less significance.

In Denmark, Finland and Sweden, wood preservatives must be approved by the authorities. In Norway, there are no specific rules governing impregnation products. The requirement that the impregnation agent must be approved in a Nordic country means that Norwegian outdoor furniture producers must use products that have been approved in Denmark, Finland, or Sweden. This will ensure that Norwegian producers too use wood preservatives that have been checked by the environmental authorities. This requirement also applies to producers of outdoor furniture outside the Nordic region. Wood based preservatives (impregnation) with a low content of environmentally harmful substances are available. For this reason, strict requirements are imposed as regards the content of environmentally harmful substances and organic solvents.

Salt-based wood preservatives based on the dangerous heavy metal's arsenic, chromium and copper have been used. Boron and tin are also used as active ingredients in impregnation. These substances are associated with damage to health and the environment. According to these metals must not be found in wood preservatives. Copper is permitted in play and park equipment intended to be left outdoors on a permanent basis.

### **R17 R24 Wood preservatives for products that are not left outdoors on a permanent basis**

This requirement encompasses all types of wood preservatives used in production of the Nordic Ecolabelled outdoor furniture/playground equipment not left outdoors permanently.

Wood preservatives must fulfil the following biocide requirements as well as the requirements of Chap. 1.3. However, an exemption from the requirement concerning environmental harmfulness in R12 applies to wood preservatives with biocides. The active ingredients (biocides) in maintenance products must not be potentially bioaccumulable cf. the following definition:

If a substance has been tested for bioaccumulability on fish in accordance with OECD 305 A-E and the bioconcentration factor (BCF) is  $> 500$ , the substance is viewed as bioaccumulable. If there is no BCF value, the substance is viewed as bioaccumulable if the substance  $\log K_{ow} \geq 4.0$  in accordance with OECD 107, 117 or 123 Guidelines for Testing of Chemicals (ISBN 92-64-1222144) or similar, unless proven otherwise. If the lowest measured  $BCF \leq 500$  the substance is not regarded as bioaccumulable even if  $\log K_{ow} \geq 4.0$ .

OECD test guideline 107 cannot be used in the case of surface-active substances that have both fat and water soluble properties. Based on what we know today, documentation with a high degree of certainty must be presented to show that these substances and their degradation products do not represent any hazard to water-borne organisms in the longer time perspective. Computer models (such as BIOWIN) will be accepted, but if the results of modelling are close to the threshold value, or if Nordic Ecolabelling has conflicting data, more secure information must be obtained.

#### Explanation of the requirements

The requirement is now encompassed by the general chemical requirements in Chapter 2.4 and with this there has been a minor increase in the stringency of the requirements described in this document under R20. At the same time, a prohibition against bioaccumulable biocides in wood preservatives has been added. The requirement is imposed that biocides in maintenance products must not be bioaccumulable. In this revision of the criteria, the requirement has been updated so that the definition of bioaccumulability in relation to BCF value and  $\log K_{ow}$  value are in accordance with the CLaP Regulations. Under the new classification rules (the CLaP Regulations) a substance is regarded as bioaccumulable if  $\log K_{ow} < 4$  (old rules  $\log K_{ow} < 3$ ) and  $BCF < 500$  (old rules  $BCF < 100$ ).

As described above, the duration of the useful life of the product is of environmental significance and it may therefore be necessary for wood preservatives to contain biocides. The background to this biocide requirement is that substances of this nature, by virtue of the function, are generally environmentally harmful and do not degrade readily and should therefore be subject to further restrictions. The more bioavailable a toxic substance is, the greater the harmful effects it may cause. Bioaccumulability is one of the main indicators of bioavailability.

### **R18 R25 Wood preservatives for products that are outdoors permanently**

This requirement applies to products such as playground equipment and park and street furniture intended to be left out permanently.

Impregnation Class A and Class M (according to the Nordic Wood Preservation Council's classification) are not permitted.

The impregnation of the product with biocides, such as heavy metals must fulfil Class B or AB according to the Nordic Wood Preservation Council's classification scheme (Class AB corresponds to Class B NP5/HC3 and Class B corresponds to Class NP3/HC3 according to the European Standard EN 335 and EN 351).

Active ingredients must not be based on arsenic, chromium, organotin compounds or creosote oil.

For parts of the ecolabelled product which is in risk class 4 impregnation corresponding to NTR class A is allowed.

#### Explanation of the requirement

A new point is that a prohibition is imposed on CMR classification of wood preservatives for products that are outdoors permanently, otherwise the requirement is unchanged save for an updating of the penetration classes and use classes in accordance with the existing standards.

Class A and M impregnation (in accordance with the Nordic Wood Preservation Council) is not permitted since the categories are intended for use in far more demanding environments than those to which outdoor furniture and playground equipment will be exposed.

Heavy demands are imposed with regard to the active substances in these classes. However, in the case of playground equipment and park and street furniture designed to be left outdoors permanently, Class A and AB impregnation is permitted (in accordance with the Nordic Wood Preservation Council). The Nordic Wood Preservation Classes fulfil all common European standards, making it easier for the consumer to choose the right product. Accordingly, the Nordic Wood Preservation Council's penetration requirements for preservatives correspond with the penetration classes in the European Standard DS/EN 351-1 and the application classes from the Standard DS/EN 335-1.

The NTR system only applies to systems based on biocides/heavy metal and aims to secure a toxicity for fungi. So, if the playground or outdoor equipment is produced by modified wood (acetylation, furfuryl ring, silicon processing) it has not been treated with substances containing biocides. This is positive for the environment. But these alternative waterproofing is not approved by NTR in their classes for impregnation in different environments. These alternative systems are based on a modification of the wood so that the water does not bind in the wood, or the wood cannot be eaten by the fungus (silicon). For example, silicon processing «impregnates» man wood with silicon chemicals as the active liquid is pressed into the wood. However, no impregnating with biocides or heavy metals. Hence this treatment systems without biocides are not covered by this requirement. Though all treatment systems have to fulfil the R17 requirement to ensure durability of the wood.

#### Changes to the criteria

A new version of EN 351 (EN 351-1:2007) has been issued since the last version of the criteria were published and describes a revised scale for the wood penetration classes. As a consequence, the former P8 class now equates to NP5 and Class P5 equates to NP3. A reference to En 335-1 has been introduced, where HC3 refers to the 5 hazard classes in the standard. These classes have been compiled to provide guidance in connection with wood preservation. According to the document accompanying the Nordic Wood Preservation Classes, NTR B and AB correspond to Hazard Class 3. (16)

The criteria have been modified in order to allow impregnation according to risk class 4 which corresponds to NTR class A. In this way it is possible to ecolabel products, where parts e.g. poles, can be buried in soil.



## 2.6 Surface treatment of wood

Chemical products for surface treatment must comply with R12 and R14 in Chapter 1.3. Previously these requirements were specifically listed in this chapter. The requirement relates to the composition of the products at the time they are applied to the outdoor furniture/playground equipment. Surface treatment requirements apply to primer, varnish, colour/stain, oil, wax, film and laminate.

### **R19 R26 Surface treatment requirements**

Here there is a choice between 2 requirements. The first where requirements are imposed on the quantity of organic solvents applied and their content of aromatic solvents. The second where requirements are imposed on the total quantity of environmentally harmful substances applied as well as the quantity of organic solvents applied and their content of aromatic solvents.

The thinking here is that if number 2 is chosen which involves complying with a threshold value for environmentally harmful substances, a higher content of solvent will be permitted. This approach allows the applicants themselves to assess what constitutes the best surface treatment for their products. In addition, the quantity applied is calculated in relation to the method of application used. See the description of the requirement in the criteria document.

#### *Explanation of the requirement*

This requirement has not been amended since the last version of the criteria. The background to the surface treatment requirement can in part be found in the preceding section on preservatives. This section discusses the specific requirement levels for surface treatment. The requirement encompasses the composition of the surface treatment product when applied to outdoor furniture or playground equipment. In order to protect production personnel and consumers against substances that are harmful to health, requirements are imposed that exclude the most harmful surface treatment products. A significant portion of the environmental impact associated with paint and varnish consists of VOC emissions and the spread of environmentally harmful substances. The surface treatment is formulated in such a way that it is flexible from a technical perspective and takes account of the effectiveness of the surface treatment. This entails that if a surface treatment agent (e.g., varnish) is applied by means of a method with a great deal of wastage (low effectiveness) then a small content of environmentally harmful substances and organic solvents will be permitted.

If however, surface treatment agents are applied by means of a method involving less waste (higher degree of effectiveness) a higher content of environmentally harmful substances and organic solvents will be permitted. The requirements as to ingoing components in surface treatment products (and laminate and film) are based on the EU's Directive concerning the classification of environmentally harmful substances. One of the two alternatives must be fulfilled, cf. the Criteria. The first requirement imposes requirements on the surface treatment agent in its form prior to application on the product.

#### Example of calculation:

Spray varnishing with recycling, 70% efficiency (see Appendix 3 to the Criteria document).

Maximum permitted quantity of environmentally harmful substances = (3 X 0.7) weight-% = 2.1 weight-%.

Maximum permitted content of organic solvents = (7 X 0.7) weight-% = 4.9 weight-%  
For alternative two, which is the most relevant as regards flat surfaces, the functional unit is the size of the surface treated, specified as m<sup>2</sup>.

The level of the requirements relates to efficiency degree (70%) for the application technology used and corresponds to the criteria for furniture.

Requirement per m<sup>2</sup> provides a greater degree of flexibility in the choice of varnishing system. In practice, the requirement has to emission/m<sup>2</sup> surface is stricter than the content requirement since it also takes account of the quantities applied.

Coats	Product	Quantity applied, g/m <sup>2</sup> surface	Emissions of org solvents, g/m <sup>2</sup> surface	Emissions of environmentally harmful substances, g/m <sup>2</sup> surface
1	Primer	120	6	2.4
2	Primer	120	6	2.4
3	Coats	110	5.5	2.2
4	Topcoats	110	5.5	2.2
Total	100% efficiency*	460	23	9.2
Total	70% efficiency*	657	33	13.1
Total	50% efficiency*	920	46	18.4

The aim of these two alternative requirements is to provide an incentive to use more efficient surface treatment technology.

The level of the requirements has been set on the basis of information on products used for outdoor furniture.

The basis of information provided by the environmental authorities the requirement is imposed that chemical products used on outdoor furniture must not contain halogenated organic binding agents, halogenated organic flame-retardants, polychlorinated biphenols, biphenyls, alkylphenols, phthalates, Aziridine and polyaziridines. Pigments and additives based on lead, tin, cadmium, chromium, mercury must not be added to the chemical products. The permitted content of aromatic solvents is limited.

## 2.7 Maintenance products for wood

### **R20 R27** Classification and ingoing substances

Chemical products for maintaining wood must meet the requirements specified in Chapter 2.4.

### Background to the requirement

The stringency of the requirement has been increased and is now identical to the requirement for wood preservation products for outdoor furniture and playground equipment not left outdoors permanently.

Here too an exemption applies from the environmental hazard requirement for products containing biocides. So here the requirement has been modified. The thinking behind this change is that the product recommended to the consumer must as a minimum fulfil the same strict requirements as the content of the substances that are harmful to health and the environment (products without biocides) as applied to production.

At the same time, one cannot expect the application of maintenance products to be subject to the same requirements as apply for the purpose of safeguarding the working environment and the external environment.

## 2.8 Metal

Small metal parts (screws, hinges, brackets etc.) are not included for the purposes of weight and are not encompassed by the following requirements.

### **R21 R28 Scope for recycling**

The requirement is imposed that metal parts in the product must be separable from the other materials in the product without the use of special tools. This requirement has not been amended.

The criteria are included to enhance the likelihood that the products are separated after use and hence ensure a high degree of reuse as possible.

### **R22 R29 More than 50 weight-% metal in the product**

The requirement for recycled aluminium and other metals are activated when more than 50% by weight of aluminium or other metals in the product. The requirement applies, however, all metal types included, whether a single type of metal is present in a small proportion. The requirement is adjusted from version 3.2 to version 3.3, so that the requirement includes an option to combine the proportion of the different metals (inclusive aluminium) and thus rely on the total recirculation proportion.

At the same time, the definition of recycled metal is extended to include both pre-consumer and post-consumer as defined by the ISO standard 14021, where it previously was unclear in the requirement text.

#### Description of the product chain for metals used in furniture

- The metal mill purchases raw materials (iron ore, scrap, bauxite, other raw materials and chemicals) from raw material producers/suppliers, frequently from suppliers located outside the country.

The metal plant delivers metal products for surface treatment such as metal plating or chemical surface treatment (e.g., varnishing). Certain metal plants perform their own surface treatment e.g., varnishing. The metal plant may produce rod or pipe products and there are also metal businesses that work on refining metal products (e.g., pipe makers).

- Surface treatment plants perform coatings such as chrome plating, nickel plating, zinc plating and surface treatment with e.g., varnish.

- Metal wholesalers often sell semi-manufactured metals e.g., plate and rod products without final surface treatment.
- Components are often produced by businesses other than the metal plant and are often located outside the country. Component producers can acquire metals from metal producers or metal wholesalers. Component producers can also perform surface treatment on metal components.

- Furniture producers purchase ready-made metal parts, often from component producers or from the metal plant. The furniture producer may purchase some parts, e.g., pipe parts or structural parts directly from the metal plant and perform their own varnishing, alternatively, fully finished parts may be purchased from components manufacturers. In the case of office chairs, finished components are often purchased from outside the country.

Furniture producers order metal plating such as chrome plating from surface treatment providers.

#### The traceability of metals

Nordic Ecolabelling has compiled information on traceability from furniture producers in Finland, in Norway and in Sweden. In this revision of the criteria, new information on traceability was obtained from a couple of major Finnish furniture producers.

In addition, information on traceability has been compiled from Norwegian and Swedish furniture producers in connection with the processing of applications. In Denmark, information from the processing of applications for licences for furniture and fitments reveals that a traceability of 10% may be the reason that, for example, certain office furniture is unable to qualify for a licence.

Furniture producers purchase metal parts from component producers (suppliers) or metal plants. If the furniture producer purchases ready-made components, information from the metal plant will often not be included.

If the component producer is located outside the country, it will be difficult to acquire information from the metal plant such as the proportion of recycled metals in the parts.

It is considered reasonable to use a triviality limit of 50% instead of 10 weight-% as was the previous requirement.

Accordingly, there is a requirement as to recycled metal in Nordic Ecolabelled outdoor furniture and playground equipment where the metal proportion exceeds 50%. It is important for Nordic Ecolabelling to ensure the traceability of the primary material in Nordic Ecolabelled outdoor furniture or playground equipment which consists mainly of metal (or of wood).

This change is also supported by the fact that at the moment all collected metals are reused by the marked. The criteria for reused metal in ecolabelled products will not increase the amount of collected metal that are reused. Nevertheless, Nordic Ecolabelling finds the criteria relevant. This is to maintain the high reuse percentage but also the signal to consumers that if metal is a part of the ecolabelled product a high of reused metal has been used.

## 2.8.1 Surface treatment of metal

### **R23 R30 Chemical products in surface treatment of metal**

Chemical products and additives used in the pre-treatment and surface treatment of metal must fulfil requirements R12, R14 and R15 Chapter 1.2, as well as the following. An exception is given for the surface treatment of metal (encompasses cadmium, chrome, nickel, and Zink I R 25) for products labelled N with R52/53.

Explanation of the requirement and any change

The requirement has been made stricter in that it now requires compliance with the requirements applicable to the content of organic solvents and aromatics in the organic solvents in the product used for surface treatment, as well as the increases in stringency described in R14.

Before the metal parts (steel) can be surface treated, they must be pre-treated/degreased in order to ensure maximum adhesion. Water-based degreasing agents (surfactants in water) or zinc phosphate may be used for this purpose. Powder varnish is then used to surface treat parts.

As regards the water-based degreasing products, these may be classified as corrosive or irritants.

The ingredients that contribute to classification in the various products are sodium hydroxide, phosphoric acid, alcohol ethoxylates and dinatrium silicates. Some products also contain environmentally harmful ingredients but in such small quantities that the products are not classified as environmentally harmful.

Zinc phosphate products are classified as environmentally harmful whereas iron phosphate products are not subject to classification.

In order to minimise VOC emissions from the production of metal parts, requirements are imposed with regard to halogenated organic hydrocarbons. These substances are very harmful to health and cannot be used for the surface treatment of metals.

### **O7 R31 Surface treatment of metals**

Metals must not be plated with cadmium, chromium, nickel, zinc, or compounds thereof. In exceptional cases, plating with chromium, nickel or zinc may be accepted in the case of small parts (screws, bolts, mechanisms etc.) if this is necessary on the grounds of heavy physical wear or parts that need to close tightly, are exposed to heavy wear or require plating for reasons of safety (for example table legs, chair legs and the low-bearing parts of playground equipment). The exception does not apply to parts that are in frequent contact with the skin of users (e.g., armrests) and parts that are surface-coated must be recyclable.

The chrome plating process must be based on trivalent chromium and no hexavalent chromium must be used in any pre or post treatment processes. Chrome plating, nickel plating and zinc plating processes must use treatment processes, iron exchange processes and membrane processes or equivalent processes enabling chemical products to be reused insofar as this is possible.

Emissions from surface treatment processes must be re-used and destroyed. The system must be closed and without emissions, with the exception of zinc where the maximum emission must not exceed:

Zink: 0.5 mg/l

Explanation of the requirement and any changes

As a general rule, metal parts in the product must not be coated with cadmium, chromium, nickel, zinc or compounds thereof.

Cadmium is a heavy metal that is hazardous to the environment and must accordingly not be used in ecolabelled products. In exceptional cases, plating with chromium, nickel or zinc may be accepted in the case of exposed and small metal parts (screws, bolts, mechanisms etc., as well as table legs, chair legs and other parts that need plating for safety reasons), where necessary on the grounds of heavy physical/chemical wear or where the parts must close tightly. The use of N-Cr-Zn-coating of these parts is justified on the grounds that it is important to the functioning of the product that critical parts should be as durable as possible. Outdoor furniture and playground equipment is exposed to both physical wear and tear and needs great weather resistance. Safety is also a vital fact in the case of playground equipment. However, Ni-Cr-Zn-plating must be performed in such a way that it fulfils the specified requirements which are stricter than the guidelines provided in the Ospar requirement (Parcom recommendation 92/4).

In this revision the requirements relating to emissions from chrome plating and nickel plating have been made stricter and a closed system is now required, with the result that no emissions are permitted from surface treatment using these two processes. This increase in stringency is justified on the grounds that since the last version of the criteria was compiled, there has been considerable technical development within the industry in the form of a transition to closed systems for chrome plating and nickel plating. The conclusion in this revision is that closed systems for chrome plating and nickel plating are so prevalent that the requirement must be imposed that they be used.

In addition, a requirement is suggested with regard to zinc plating (galvanisation). Emissions from surface treatment with zinc must not exceed: 0.5 mg/l (in accordance with Ospar). e.g., The requirements of the authorities relating to zinc emissions are less stringent in municipalities in Finland.

Moreover, the exemption does not encompass parts that are in frequent contact with human skin, but it does now encompass metal parts in playground equipment that require a durability enhancing coating for safety reasons. At the same time the requirement is imposed that parts that undergo service treatment must also be recyclable. In addition, a new requirement is that the chrome plating process must be placed on trivalent chromium and that no hexavalent chromium must be used in any form of pre or post treatment. In the case of chrome plating, nickel plating and zinc plating processes, treatment technology, iron exchange technology and membrane technology or equivalent technologies must be used to allow the reuse of chemical products to the full extent that this is possible.

In the public hearing it was pointed out that the exception made in R25 was too general. Surfaces treatment of metals require energy consumption, use of chemicals and

generation of waste and for these reasons Nordic Ecolabelling do not wish to promote unnecessary treatment of the ecolabelled products and have chosen to elaborate the exception. It is made clearer that the exceptions cover chair legs, folding tables and the low-bearing parts of playground equipment. Moreover, metallization is allowed if the purpose is to prevent corrosion.

## 2.9 Plastic and rubber

Small plastic parts (e.g., screws, pins, and dowels) are not included for the purpose of calculating the weight proportion and are not encompassed by the following requirements.

Parts of PVC may not be used (except small parts as listed above).

Background for prohibition of PVC:

PVC is a shortening of polyvinyl chloride and contains of 57% chlorine. This means that PVC is not suited for combustion because the content of chlorine may contribute to increased development of dioxin in the waste gas from the waste incineration plant. Dioxin is one of the most acute toxic substances man has produced and suspected to interfere with hormones and could be carcinogenic (18). Therefore, as far as it is possible, PVC is often deposited, and part of the hard PVC is recycled for production of new PVC.

Private persons have to sort waste containing PVC from household waste according to rules applying in the relevant municipality. However, the problem for the general consumer often is that it is difficult to distinguish between materials containing PVC and the ones not containing PVC. Therefore, a large part of the PVC waste ends in the rubbish, which is combusted, even though PVC according to the order for waste is defined as not suitable for combustion.

The explicit prohibition against PVC has been entered after the hearing. In the draft proposal PVC was also excluded through the requirement "the content of and additives to chemical products", but the requirement is now inserted in the section regarding plastic to make it more clear to applicants and to avoid errors in the handling of the application.

Softeners in PVC

Soft PVC contains plastic softeners or phthalates that are added to make the material more flexible. Most of the used softeners are phthalates DEHP, DIDP and DINP (19). The use of DEHP is decreasing in Western Europe while the use of DIDP and in particular DINP is increasing. According to the PVC-trade itself DINP composes of approximately 56% of the phthalate consumption while DEHP composes 24% (21). In the EU DEHP is today classified as harmful to the capacity for reproduction and harmful to embryos (22) and found at EU's SVHC-list together with other phthalates as BBP, DBP and DIBP. Experience shows that softeners in plastic are very volatile and therefore an evaporation of plastic softeners may occur. Therefore, these should be avoided in rooms where persons stay a lot and therefore also in Nordic Ecolabelled products as furniture and fittings and panels for buildings.

DIDP and DINP are not officially classified in the EU framework. However, a task group within the EU Commission has found that both DIDP and DINP disrupt hormones in category II (22).

The reason why this does not result in an official classification within the EU framework simply is because there is not a classification for endocrine disruptors effect (which should not be mistaken for as damage to the capacity for reproduction that is reproductive damages). All phthalates used in a larger scale in PVC are everywhere in our environment today.

One of the reasons is that substances easily are released from PVC-products (19). In the environment phthalates as DEHP, DINP and DIDP are broken down slowly and they are highly bioaccumulable and therefore it cannot be excluded that they accumulate in the food chain (22).

## **R24 R32 Material description and labelling of plastics**

A description must be provided of the types of plastic, fillers, and reinforcements in plastic parts. Parts made of plastic and weighing more than 50 g must be visibly labelled in accordance with ISO 11469.

## **R25 R33 Requirements as to classification and additives**

Chemical substances used as additives or for the surface treatment of plastic are now encompassed by the chemical requirements in Chapter 1.3 as well as the following requirements. See the description of the increase in stringency in R12 and R14.

## **R26 R34 Nitrosamines in rubber**

The content of nitrosamines or nitrosamine soluble substances must not exceed 0.01 mg/kg and 0.1 mg/kg of vulcanised rubber respectively.

Explanation of the requirement and any change

The requirement is new. Nitrosamines are suspected of causing cancer. Nitrosamines are a by-product formed during the production of rubber. Nordic Ecolabelling applies the precautionary principle and is accordingly imposing a restriction on the content of nitrosamines in rubber in Nordic Ecolabelled outdoor furniture and playground equipment.

## **R27 R35 The surface treatment of plastic**

Surface treatment is permitted if it can be shown that this will not undermine the possibility of re-using the plastic and that the surface treatment process fulfils the requirements contained in R24.

No changes on this point.

### **2.9.1 Requirement that apply if there is more than 10 weight-% plastic in the product**

Different types of plastic materials present in quantities in excess of 1 weight-% of the weight of the plastic materials must be added up. If in total they make up more than 10 weight-% of the product, the following requirements must be fulfilled.

## **R28 R36 Recycled/recovered plastic**

For products consisting of more than 10% by weight of plastic, 50% of the plastic must consist of pre- or post-consumer recycled material.



Recycled plastics should not contain halogenated flame retardants. However, contaminants are allowed up to 100 ppm.

Recycled plastic is defined in the requirement according to ISO 14021 in the following two categories:

"Pre-consumed/commercial" is defined as material derived from the waste stream during a manufacturing process. The use of materials such as rework, regrind or scrap produced by a manufacturing process and recyclable in the same process as the material was created, is not considered as recycled pre-consumed material.

Nordic Ecolabelling defines reworking, regrind or scrap, which cannot be reused directly in the same process, but which requires reprocessing (for example in the form of sorting, re-melting and granulating) before it can be reused, in order to be pre-consumed/commercial material. Whether this happens internally or externally.

"Post-Consumed/Commercial" is defined as material generated by households or commercial, industrial, and institutional facilities in the role of end-users of a product, which can no longer be used for its purpose. This includes material from the distribution line.

SP Technical Research Institute of Sweden prepared a report for Nordic Ecolabelling aimed at illuminating the possibilities that exist for using recovered plastic in furniture. The report stresses that plastic does not have unlimited durability and that accordingly there are restrictions on the number of times it can be re-used. This is because the long polymers of the plastic break down and become shorter as a result of both preparation and use of the plastic. As a result, the mechanical properties and durability deteriorate.

Many polymers are affected by UV light and the acid content of the atmosphere for which reason antioxidants and stabilisers are added to protect the plastic and thereby extend its durability. The additives deteriorate over time.

Polypropylene in particular becomes brittle and breaks into pieces when the antioxidants in the plastic have been consumed. In the case of some types of plastic, antioxidants are also added to recycled plastic.

However, this has a negative effect since as a result the plastic will contain many different types of additives where, for example, the antioxidant and filler used will not always perform well together. This can cause quality problems.

Various furniture producers were contracted in connection with the report and asked for their views on the use of recycled plastic in their products. IKEA state that they are positively disposed towards the use of recycled plastic, but that it is difficult to find large quantities of traceable and quality assured recycled plastic. When these plastics are found in the market, they are so sought after that the price is virtually the same as for new plastic raw material. At present, IKEA uses only its own production waste which is traceable. One of the contacted manufacturers of furniture that uses recycled plastic in its production says that for safety reasons new plastic is used in load-bearing parts. The report concludes that if recycled plastic is to be used, then it is likely that production waste will be the only type that is suitable for the production of furniture. This is because the traceability of the plastic flows is better allowing purer plastic in terms of additives

and plastic types to be produced. Recycled postconsumer plastic is best suited for simpler products without the same quality requirements as regards the plastic.

The above report was prepared for furniture and since outdoor furniture and playground equipment will presumably be more exposed to sunlight and the acid in the atmosphere than furniture for indoor use the plastics will need to have a high content of anti-oxidants and stabilisers. Our experience during the revision process has been that it is difficult for producers of playground equipment to source plastic that possesses both the required of quality and meet the requirement that 50% of the plastic be recycled. To date, no licences have been awarded for either outdoor furniture or playground equipment made of plastic which supports the view that the requirement that there be 50% recycled plastic has been too stringent.

The requirement in the last version of the criteria to be a min. of 50% recycled plastic if the product contains more than 10 weight-% has been retained but with the addition that production waste from other plastic producers may also be used in order to obtain the possibility of better traceability in the used recycled plastic and by this a better quality. Thus, internal waste from furniture production is not regarded as recycled plastic.

## 2.10 Requirements as regards consumer information, refuse processing and recycling systems

### **R29 R37 Information for the consumer**

Correct maintenance of outdoor furniture and playground equipment helps to extend the useful life of the product. The producer/supplier must inform the consumer of how this maintenance is to be performed. The producer must offer specific recommendations for maintenance and maintenance products for the individual product. This can help to reduce the use of environmental harmful maintenance products. Information must also be provided on waste processing so that the consumer does not incinerate products treated with biocides under uncontrolled conditions.

Specific requirements relating to maintenance products for wood

The producer/supplier must recommend a specific maintenance product for the Nordic Ecolabelled product. The maintenance product must not be classified as harmful to health or the environment in Denmark, Finland, Iceland, Norway, or Sweden.

This requirement is justified on the grounds that a wide variety of maintenance products for wood is available on the market. Many of these products have a high content of organic solvents and biocides. It is not necessary to use environmentally harmful products for the continuous maintenance for outdoor furniture and playground equipment.

### **R30 R38 Production waste**

This requirement is imposed in order to ensure that all wood-based material waste is re-used either as a recycled raw material or as energy. Plastic and metal waste generated during production must also be sorted and re-used.

### **R31 R39 Packaging requirements**

Chlorinated plastics are not permitted for the following reasons:

During its life cycle PVC creates a number of persistent, toxic and bioaccumulable compounds.

The occurrence of hazardous substances in PVC products.  
PVC can cause problems in connection with the recycling of materials.  
PVC accounts for a large part of the chlorine release as a result of waste incineration.  
This causes a number of different environmental problems.  
The environmental problems associated with PVC are related mainly to the production of the raw material and in waste processing. PVC is a chlorinated plastic, the raw material ethylene is chlorinated in two stages to 1,2-dichloroethane which is cracked to vinyl chloride monomers (VCM). VCM is polymerised to PVC. Nowadays, chlorine gas is mainly produced using what is termed the amalgam method, i.e. with mercury as an anode material. Emissions of mercury are to the atmosphere. Chlorine production also generates a waste product that includes dioxins, heavy metals and hexachlorobenzene. The chlorine atoms in PVC provide a number of technically desirable properties but also result in a build-up of toxic, persistent and frequently bioaccumulable compounds, so-called persistent organic pollutants (POPs). POPs have high priority in terms of environmental protection since they have been shown to affect the reproductive, immune, and hormonal systems of animals and humans. Many of them are carcinogen.

## 3 Quality requirements and the requirements of the authorities

### 3.1 Performance requirements

#### **R32 R40 Durable wood**

Wooden parts in the product that come into contact with the ground must be made of a durable wood or be treated (proofed or surface treated) or protected by means of screening. No change in the requirement.

#### **R33 R41 Safety, strength, and stability**

It is important that Nordic Eco-labelled outdoor furniture and playground equipment should be of a high standard in terms of safety, strength, stability, and durability.

Outdoor furniture

Outdoor furniture must as a minimum fulfil the requirements applicable to domestic use in accordance with EN 581-1, 581-2 and EN 581-3. Outdoor furniture need not be tested in accordance with Annex A of 581-2 and 581-3 (testing at high and low temperatures). If the product is designed/marketed for contract use, the product must be tested in accordance with the requirement levels relevant for contract use.

Playground equipment for public playgrounds

Playground equipment for public playgrounds, e.g., parks and schools, must fulfil the relevant requirement levels for safety in the following standards:

Standard	Area
EN 1176-1	General safety requirements
EN 1176-2	Swings
EN 1176-3	Slides
EN 1176-4	Cableways
EN 1176-5	Carousels
EN 1176-6	Rocking equipment
EN 1176-7	Guidance for installation, inspection, maintenance, and operation
EN 1500	Natural playgrounds

#### Playground equipment for domestic use

Playground equipment for domestic use must fulfil the main requirements of the Toys Safety Directive 2009/48/EC as amended. This can be safeguarded in amongst other ways by documenting compliance with the harmonised standard, EN 71-1 (Mechanical and physical properties).

If the product fulfils the requirements of some other standard than the above EN standards, an independent test institution must give a statement on the way in which the standard relates to the above requirement levels.

#### Explanation of the requirement and any changes

##### Outdoor furniture

The criteria document refers to the series of standards for outdoor furniture EN 581, or an equivalent standard. A minimum requirement for domestic use is a guarantee that the outdoor furniture has good durability.

##### Amendment of the requirement

The requirement has been extended to also encompass EN 581-4: Outdoor furniture – Seating and tables for camping, domestic and contract use – Part 4: Requirements and test methods of durability under the influence of climatic conditions. This part of the DS/EN 581 series specifies requirements and test methods for determining the durability of structures and surface finishes for outdoor furniture for adult use on the camping, domestic and contract market, irrespective of material, design or production processes. In addition, this DS/INF specifies requirements concerning safety risks which might occur as an effect of climatic conditions (especially UV radiation) on plastic materials. A label has been specified for use for consumer information giving the various durability levels.

##### Playground equipment

Playground equipment must primarily be suitable for play. Moreover, it must not be dangerous to use (safety) and must have certain durability (useful life).

Whether or not the product is suitable for play can only be determined by practical experience. No measurable method of determining this has been identified.

Safety and durability can be subdivided into a number of factors:

The design of the equipment.

Installation in the play area.

Maintenance, inspection.

Any monitoring necessary during use (e.g. to ensure that small children do not climb up too high).

Producers have different methods of guaranteeing durability: guaranteeing a certain useful life or offering replacement products in the event of complaints.

In the case of playground equipment, there are two different types of safety standard.

One includes recommendations for installation and inspection.

Playground equipment for domestic use must fulfil the main requirements of the Toys Safety Directive 2009/48 EC, which has recently been made available in a new version and describes toys that must be equipped with a CE label. The requirements assume that

only a few children will use the equipment at the same time and not frequently. Sold in, for example, DIY centres and toysthops.

The producer may opt to document the product's compliance with the requirements by fulfilling the requirements of a European standard (harmonised standard) EN 71. This standard comprises several parts dealing with various primary properties of the product, the most relevant for outdoor playground equipment being EN 71 Part 1 Mechanical and Physical Properties. The Directive 2009/48/EC requires verification by a third party.

The European EN 1176 standard applies to playground equipment for public playgrounds, e.g. in parks and schools. The standard has been in force since January 1999 and any national standards covering the same area have been withdrawn.

The standard applies to new products, not to playgrounds already in use. The general safety requirements in EN 1176-1 include weather resistance requirements for the playground equipment.

#### Changes to the requirement

The requirement has now been extended to encompass playground equipment in natural playgrounds. Standard DS 1500, which is relatively new (2003), applies in this area. This standard supplements DS/EN 1176 and is accordingly not an independent standard. DS 1500 specifies safety requirements and test methods for natural playground equipment with a view to achieving a satisfactory level of safety for children using the equipment. The standard applies to natural playground equipment intended for collective use as well for art objects displayed for play. The standard also encompasses playhouses.

The addition of the standard DS 1500 for natural playgrounds and a specification of the product group definition in the section "What is eligible for Nordic Eco-labelling?" in the criteria, makes it clear that playground equipment for natural playgrounds is also encompassed by the product group.

### 3.2 Quality management and the requirements of the authorities

Nordic Ecolabelling imposes these general requirements on quality control in order to ensure that the product at all times meets the applicable ecolabelling requirements.

## Future criteria

In this chapter topic that will be dealt with in the next revision are listed.

Requirement in new version	Requirement in previous version	Same	Removed	New/changed
R1	4.1			Addition of text on pollutants and new table on materials.
R2	4.2 Traceability			New requirement on procedures for safeguarding compliance with the requirement.

Requirement in new version	Requirement in previous version	Same	Removed	New/changed
R3	4.2 Biocides	X		
R4	4.2 More than 10%			
R5	Ecolabelled panels	X		Sharpened the criteria for building panels.
R6	4.3 Chemical products in the panel			Encompassed by general chemical requirements in Chap. 2.3.
R7	4.3 Formaldehyde			Tightening up of requirement level.
R8	4.3 Traceability			New requirement concerning procedures for safeguarding compliance with the requirement.
R9	4.3 Wood raw material in panel	X		Sharpened the criteria according to the criteria for building panels.
R10	4.3 Energy consumption requirements			New requirement with new requirement levels and a link to the use of raw materials.
R11	4.3 Emissions to water	X		
R12	Combination of multiple requirements			New portmanteau for requirements for classifying chemical products used in the production of the Nordic Ecolabelled product.
R13	4.3 Chemical products in panel – free formaldehyde			The criteria have been sharpened – lower concentration permitted.
R14	Requirements as to additives in Chapters: 4.3 4.4, 4.5, 4.7 and 4.8			New portmanteau requirement applicable to all chemical products and not solely in building panels. Now includes requirements as to VOCs and their aromatic content. Change: alkylphenol ethoxylates and derivatives now prohibited. Now also encompasses maintenance products.
R15	New requirement applicable to nano materials			New requirement applicable to nano materials.
R16	4.4 Wood preservation – durability	X		

Requirement in new version	Requirement in previous version	Same	Removed	New/changed
R17	4.4.2 Wood preservation – products not left outdoors permanently			Now contains reference to general chemical requirements and the tightening up in that section. New modifications for use of biocides with eco class and new prohibition against bioaccumulable biocides.
R18	4.4.2 Wood preservation – products left outdoors permanently	X		Not changed.
R19	4.5 Surface treatment	X		Requirement level for surface treatment is unchanged. Requirement has not been given its own number.
R20	4.6 Maintenance products			Requirement tightened up - same requirement as wood preservation for products not left outdoor permanently.
R21	4.6 Maintenance products - Biocides			Change in connection with new definition of bioaccumulability.
R22	4.7 Metal - Recycling	X		
R23	4.7 Metal – More than 10 weight-%			Modification: Requirement now applies only where there is more than 50 weight-% metal in the product.
R24/25	4.7 Surface treatment of metal			Tightening up of requirement level for chromium and nickel and introduction of exemption for zinc.
R26	4.8 Description of materials and labelling of plastic	X		
R27	4.8 Plastic – classification and additives			Requirement tightened up – reference to general chemical requirements.
R28	New requirement			Requirement added to nitrosamines.
R29	4.8 Surface treatment of plastic	X		

Requirement in new version	Requirement in previous version	Same	Removed	New/changed
R30	4.8 Plastic – more than 10 weight-%			Modified. Now it is possible to use production waste from other production.
	4.9 Glue			Tightening up: glue is encompassed by the general chemical requirements.
R31	4.10 Information	X		
R32	4.11.1 Production waste	X		
R33	4.11.2 Packaging	X		
R34	5 Durable wood	X		
R35	5 Safety, strength and stability			Reference to the same standard for outdoor furniture. Requirement updated for labour and equipment.
R36-R42	6 Other requirements	X		



## References

---

- <sup>1</sup> Miljøfilosofi, Nordisk Miljømærkning 2000 (Philosophy, Nordic Ecolabelling 2000).
- <sup>2</sup> European Union (EU) Action Plan for Forest Law Enforcement Governance and Trade (FLEGT) Tilgængelig fra: <http://ec.europa.eu/environment/forests/flegt.htm> (besøkt 5. august 2009)
- <sup>3</sup> From INBARs website on "Bamboo Forest Biodiversity Conservation project", <http://www.inbar.int/Board.asp?BoardID=280>
- <sup>4</sup> UNECE/FAO Forest Products Annual Market Review, 2007-2008. Tilgængelig fra: <http://timber.unece.org/index.php?id=2> (besøkt juni 2009)
- <sup>5</sup> Miljøvejledninger.dk - <http://www.miljoevejledninger.dk/index.aspx?articleid=+787+787>
- <sup>6</sup> BREF dokument for LVOC (Organiske kemikalier i storskalaproduktion) - <http://www.mst.dk/NR/rdonlyres/8E0D0EE7-8888-40A0-B460-8C2183DD01D6/0/LVOCDAendelig.pdf>
- <sup>9</sup> [http://www.skovognatur.dk/NR/rdonlyres/E7E9387C-B2DE-4156-B871-2BEC25F917BF/0/Peter\\_DLH\\_SNSSeminar0810083.pdf](http://www.skovognatur.dk/NR/rdonlyres/E7E9387C-B2DE-4156-B871-2BEC25F917BF/0/Peter_DLH_SNSSeminar0810083.pdf)
- <sup>10</sup> [http://www.mcdonough.com/cradle\\_to\\_cradle.htm](http://www.mcdonough.com/cradle_to_cradle.htm)
- <sup>11</sup> <http://www.trae.dk/index.asp?page=/Dokumenter/Dokument.asp%3FDokumentID%3D175> available from 17/3 2009.
- <sup>12</sup> <http://vot.teknologisk.dk/21744.2> Available from 17/3 2009.
- <sup>13</sup> <http://www.kbhmiljonet.dk/>
- <sup>14</sup> Bekendtgørelse om begrænsning og salg af kreosot. BEK nr 665 af 04/07/1996
- <sup>15</sup> Ressourcebesparelser ved affaldsbehandlingen i Danmark, Miljøprojekt nr. 804, 2003
- <sup>16</sup> Miljø- og samfundsøkonomisk analyse af indsamling og behandling af imprægneret affaldstræ, Miljøprojekt Nr. 1208 2008
- <sup>17</sup> Nordiska träskyddsklasser, Del 1: Furu och andra lättimpregnerbara barrträslag NTR Dokument nr 1: 1998
- <sup>19</sup> Green Paper – Environmental issues of PVC, European Commission 2000.
- <sup>20</sup> "Alt for lidt PVC til Stigsnæs", Ren Viden 1, 2005.
- <sup>21</sup> PVC Informationsrådet i Danmark. [www.pvc.dk](http://www.pvc.dk). Hjemmesiden besøgt 22/3-05.
- <sup>22</sup> Status for viden om phtalaters sundhedseffekter. Orientering til Folketinget. Miljøstyrelsen 12. September 2004.
- <sup>23</sup> Status for phtalater, Miljøministeriet 2003.
- <sup>24</sup> Towards the establishment of a priority list of substances for further evaluation of their role in endocrine disruption. European Commission DG ENV 2000.
- <sup>25</sup> Communication from the Commission on the results of the risk evaluation and the risk reduction strategies for the substances: zinc; zinc chloride; zinc distearate
- <sup>26</sup> "Notat om miljøforhold i danske møbler og bygningsplader", 2008 2.-0 LCA consultants og Dansk Standard