About Nordic Ecolabelled

Construction panels



Version 6.0

Background to ecolabelling
08 August 2014
Consultation proposal

Nordic Ecolabelling

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Appendix 1 Other labelling schemes

010 Construction panels, version 6.0, 12 August 2014

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

Addresses

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

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1 Summary

Nordic Ecolabelling has drawn up Version 6 of the criteria for ecolabelling of construction panels. The product group has been expanded since the previous version to include new materials and function types. Accordingly, function type "facade panels" in the material types described below are now included in the product group. The material types have also been expanded to include various cement-based panels and high pressure laminate panels (HPL). See the new product group definition in Section 2.1.1.

This product group contains a wide variation of material types, production processes and functions among the different panels. The product group thus comprises many different functional units and it has therefore been decided to make the following general division into functional units within the product group: wood-based panels (incl. laminated wood panels), HPL panels, plasterboards, mineral wool panels and cement-based panels. The criteria thus seek to identify the most environmentally favourable panels within each panel type rather than directly comparing panel types with each other.

In order to gain an overview of the key environmental impacts in the products' life cycle, an environmental assessment of the product group and a qualitative MECO analysis for each panel type has been performed. MECO stands for the assessment of Materials, Energy, Chemicals and Other characteristics and describes the significant environmental impacts during the product's life cycle phases.

On the basis of the MECO analyses, an RPS (Relevance, Potential and Steerability) analysis is made for each panel type in which high environmental relevance (high R) has been identified in the MECO analysis. The RPS analysis is a tool for prioritising environmental labelling requirements and assessing where to focus the requirements in order to achieve the maximum environmental benefit. Tables 2 to 6 in Section **Fejl! Henvisningskilde ikke fundet.** show the main results of the RPS analyses.

In addition, it has been considered whether to expand the product group to include panels in plastics-based composite and sandwich panels of metal sheeting with a core material. The RPS analyses have shown that at the present time there is an insufficiently broad basis in the data for identifying the environmentally best plastics-based composite panels. The analysis also revealed a limited data basis for metal sheeting with a core, and that these panels are generally marketed with the main function of thermal insulation. Panels with the main function of thermal insulation are not included in this product group, and consequently this panel type has not been included.

Environmental advances of the Product group

The overall environmental advances to communicate for the total product group "ecolabelling of construction panels" is described here:

- Meets strict environmental requirements.
- Limited energy consumption during the whole production process
- High proportion of recycled or renewable materials
- No or reduced use of formaldehyde and organic solvents
- Ensure that quality and properties are documented

For ecolabelled wood construction panels, the following also applies:

- Wood from sustainable forests

For ecolabelled plasterboards, the following applies:

- 100% recycled or industrial gypsum

For ecolabelled construction panels for indoor use, the following also applies:

- Chemical requirements which guarantee a healthy indoor climate

Changes in the revised version

Based on the evaluation and the MECO and RPS analyses, the main changes in the revised version concentrate on expanding the criteria with new requirements for cement-based panels and high pressure laminates (HPL), on setting a pure energy requirement for panel production and on introducing quality requirements. Table 25 in Chapter 5 gives a list of all changes in the requirements. More detailed descriptions of requirement changes and new requirements are given in Chap. 4.

2 Basic facts about the criteria

2.1 Products that may be ecolabelled

The product group has been expanded since the previous version to include new materials and function types. Accordingly, function type "facade panels" in the material types described below are now included in the product group. The material types have also been expanded to include various cement-based panels and high pressure laminate panels (HPL).

2.1.1 Product group definition

Panels for both indoor and outdoor use are included. The product group includes panels in which the main function is one or more of the following: internal or outdoor cladding of buildings, construction panels, sound absorbent panels, panels for subfloors, facade panels, panels for subroofs and panels for production of furniture, outdoor furniture, internal fittings, etc.

The following material types are included in the product group:

- Wood-based panels with or without laminated surface
- Solid wood (surface-treated) for assembly into a panel for indoor use, e.g. by the consumer
- Panels based on renewable raw materials other than wood
- High pressure laminate panels
- Plasterboards
- Mineral wool panels (where the main function is **not** thermal insulation)

- Cement-based panels in the form of fibre cement, cement and magnesium oxide panels

The product group does not cover the following product types:

- Panels with more than 15 wt./% of materials other than the above are not included in the product group.
- Panels or cladding in which the main function is to insulate against heat or cold loss. Panels which are marketed as insulation panels or insulation products are thus not included.
- Wet room panels.
- Roofing panels (outer roof)
- Whole prefabricated wall elements are not included in the product group.
- Floor coverings, as these can be ecolabelled under the Nordic Ecolabelling criteria for floors.
- Facade panels in solid wood, as these can be ecolabelled under the Nordic Ecolabelling criteria for Durable Wood. If solid wood with a licence under the criteria for Durable Wood is included in a facade panel, Nordic Ecolabelling must be approached for clarification about this panel type.

Nordic Ecolabelling reserves the right to determine whether a product can be ecolabelled according to the Nordic Ecolabelling criteria, and to determine the criteria to be used for any product application. For further information please contact the Nordic Ecolabelling organisation (see addresses at the beginning of the document).

Fibre-based panels with more than 15% cement will be included in the functional unit "Cement-based panels". Panels based on renewable raw materials other than wood must fulfil the energy requirement for wood-based panels.

2.1.2 Functional units

This product group contains a wide variation of material types, production processes and functions among the different panels. Some panel types cover just one or only a few functions, while other panel types such as cement-based panels are used both indoors and outdoors. Hence, a plasterboard for indoor use cannot be compared with an outdoor cement panel. A single functional unit for a $1m^2$ construction panel would thus be impractical. The product group contains many different functional units, and several of the panel types figure in more than one of these. It has therefore been decided to make the following general categorisation of functional units in the product group: wood-based panels (incl. laminated wood panels), HPL panels, plasterboards, mineral wool panels and cement-based panels. The unit for each is 1 kg.

The differences between the functional units are seen especially in relation to the energy requirement and resource requirement. The use of several functional units allows better controllability of the requirements. The criteria thus seek to identify the most environmentally favourable panels within each panel type, rather than directly comparing the panel types with each other.

In other words, the criteria do not favour one particular panel material. Instead, it is ensured, that when an ecolabelled HPL panel is selected, the controllable environmental impact has been reduced and checked.

Depending on the material used in the panel, different requirements will be relevant for securing a reduced environmental impact in the finished panel. The material requirements in the criteria are thus brought into play in relation to the material composition of the panel.

2.1.3 Description of panel types

Wood-based panels

Types of wood based panel materials[1]:

- Plywood
- Solid Wood Panel (SWP): Panel composed of boards glued together and oriented in layers, e.g. as a 3-ply plywood
- Oriented Strand Board (OSB): Panel composed of long flakes glued together and oriented in layers, e.g. as a 3-ply plywood
- Chipboard/Particleboard
- Fibreboard: Traditional hard, semi-hard and soft (wet-process) panels
- Medium Density Fibreboard (MDF): Fibreboard made with a dry process
- Cement-bound chipboard
- Laminated Veneer Lumber (LVL): Panel consisting of layers of thin wood glued in parallel (unlike plywood)

The many types of wood-based panels result in variations in panel production. However, the most important raw materials are wood fibre, either as waste fibre or purchased as round timber and glue. Figure 1 shows a flow diagram for production of chipboard. From this it would seem that only chipboard uses wood waste, while the other wood panel production processes use round timber. However, there are examples of panel types other than chipboard using wood waste in their production.

[1] http://vot.teknologisk.dk/4021,2

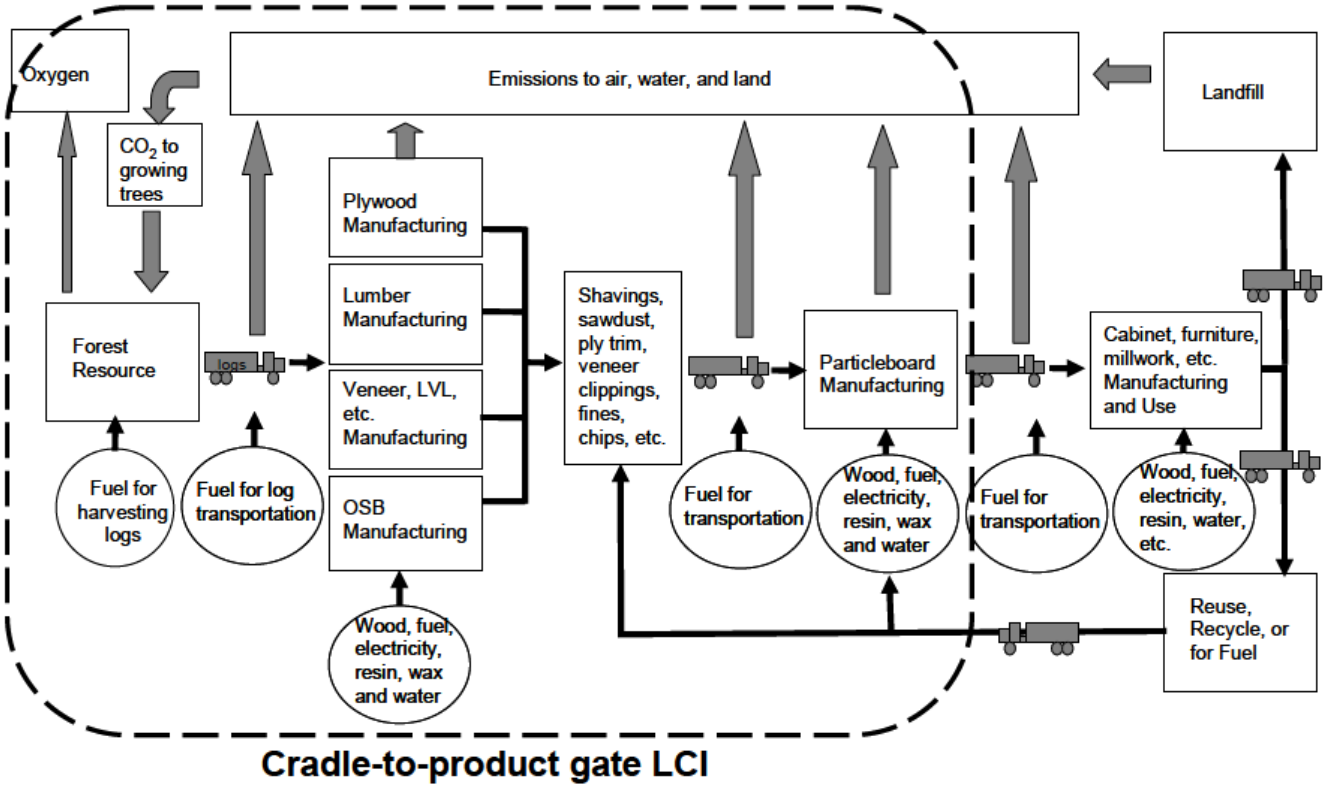


Fig. 1 Cradle to gate flow diagram for production of chipboard[2]

Between 70 and 95% of the panel consists of renewable raw materials in the form of wood fibre, either purchased as solid wood, waste wood or recycled wood fibre. The remainder is mainly adhesive and any surface treatment in the form of paint or laminate. Melamine-urea-formaldehyde and urea formaldehyde are mainly used for hardwood plywood and as low-emission formaldehyde adhesive for chipboard and fibreboards such as MDF panels.

Phenol-resorcinol- formaldehyde is the primary adhesive type for laminated panels which are designed to cope with severe operating conditions. Phenol-formaldehyde is particularly used for softwood plywood for outdoor use, fibreboard and low-emission chipboard[3].

Laminated wood-based panels

Lamination film may be paper or plastic and impregnated with melamine plastic. It is also called "decor paper". The film may be used for laminating the surface of wooden panels for use as cupboard doors, shelves, cupboard sides, surrounds, skirting boards, battens, moulded battens, etc. The film may be coloured or stamped like wood and it may be difficult to distinguish it from the real thing. PVC films were formerly very widespread due to their good properties, but in recent years have in many places been substituted with other plastics types[4].

During lamination of wood panels, a layer of melamine resin-impregnated decor paper or film (see description of decor paper in section on HPL panels below) is melted onto the

[2] Adhesive systems for laminated wood and chipboard, Sintef 2012
[3] General Technical report FPL
[4] Working Report from Danish Environment Protection Agency No. 11 2008

wood panel by means of pressure and heat. The resin-impregnated decor paper is self-adhesive, so no adhesive is added to the panel. In the case of production plants which manufacture both the decor paper and the wood panel, the lamination process is often adjacent to the panel production plant, with reuse of the heat from the different processes[5].

HPL panels

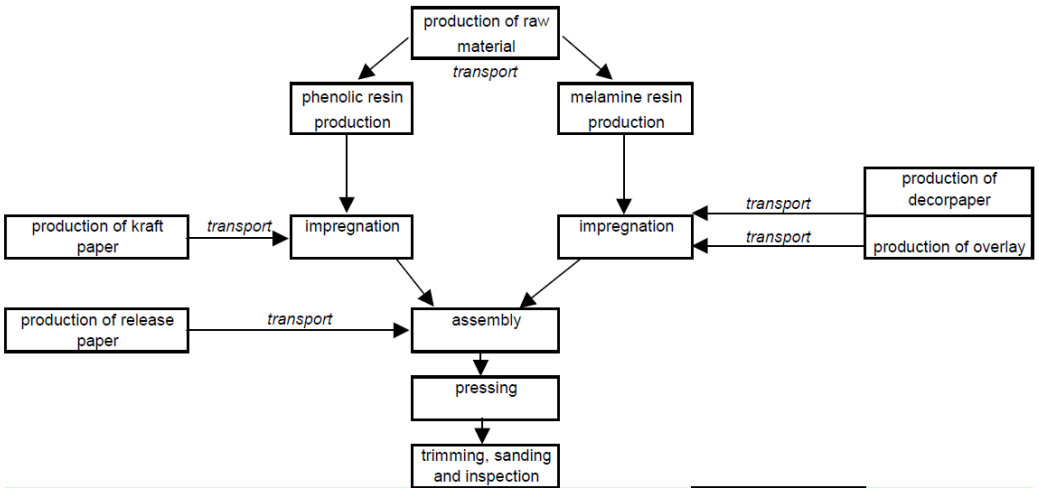


Fig. 2 Flow diagram for HPL panel production[6]

HPL panels consist of kraft paper and decor paper which are impregnated with phenolic and melamine resin. The surface and decor paper are impregnated with melamine resin. This gives the HPL panel its hard surface. The HPL core consists of kraft paper impregnated with phenolic resin. The phenolic resin gives the panel a certain flexibility.

There is rarely a large material variation in HPL panels, and typical material composition will be as follows[7]:

- 55-62% unbleached kraft paper
- 2-12% white decor paper
- 20-32% phenolic resin
- 2-12% melamine resin

The paper is impregnated by dipping in resin baths until it is saturated. A roller then presses the surplus resin from the paper which is then dried in a hot-air tunnel about 30 metres long. This is done with a flow of hot air between 120-165 ° C. The airflow is then cleaned by afterburning. The dried impregnated paper has low humidity and is rolled and stored in air-conditioned rooms for later production.

[5] BAT Reference Document for the Production of Wood–based Panels, EU Commission Draft 2013
[6] International Committee of Decorative Laminates Industry, ICDLI, "Environmental Declaration for High Pressure Laminate HPL and its elements" (1999)
[7] EPD from ICDLI - the International Committee of the Decorative Laminates Industry, 2012

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. Additives to the laminate include stabilisers, softeners, pigments and flame inhibitors. The finished product is not thought to emit any significant substances to the indoor climate [8].

Depending on the desired thickness of the HPL panel, several cores of paper can be combined. The transparent, impregnated decor paper is placed on top. The core and decor paper are placed in a press where the laminate panel is formed by a pressure of 25 to 50 bar and a high temperature of 150 to 170°C[9].

Plasterboards

Plasterboards consist of about 90-95% gypsum plaster, paper/cardboard material of about 5% and additives. A fibreglass mat may be embedded in the surface. This is covered with an acrylic water-based coating. The paper is often recycled cardboard or paper. The gypsum may be from three different sources:

- Recycled gypsum plaster is collected from building sites, recycling stations and demolition sites.
- Industrial residual gypsum from smoke cleaning at power stations
- Natural gypsum from quarries

The production process for plasterboards consists of crushing/homogenisation of the gypsum material which is then heated until it forms a casting plaster. The plasterboards are cast in lines in which the casting plaster is held in place with paper or cardboard. Water is mixed in, and the gypsum hardens[10].

The physical and chemical properties of gypsum make it particularly suitable as a building material with fire inhibiting effect, as high temperatures cause it to release the structural water. Only when this has happened do the panels start to conduct heat.

Plasterboards are available in different thicknesses and there are also variations in density. New types have been developed with a less compact gypsum core, resulting in lighter panels and thus better working conditions for persons installing the panels.

Mineral wool panels

Mineral wool panels are used both as acoustic panels and also, at the same time, for thermal insulation. This product group does not include panels whose main aim is thermal insulation, so the mineral wool panels in this product group will mainly be acoustic panels.

Mineral wool is usually either fibreglass or stone wool. Here is a list of the commonest materials in mineral wool production[11]:

[8] http://www.trae.dk/index.asp?page=/Dokumenter/Dokument.asp%3FDokumentID%3D26
[9] HPLWORLD The Duropal Magazine_ No. 01_ 2007–2008
[10] Life cycle assessment and social economic assessments of different alternatives for handling and treating gypsum waste, MST 2012
[11] BAT Reference Document for the Production of Glass, EU Commission 2012

Fibreglass: Quartz sand, process glass waste, external glass waste, other process waste, nepheline syenite, sodium, potassium carbonate, limestone, dolomite, sodium sulphate, borax, colemanite and ulexite.

Stone wool: Basalt, limestone, dolomite, blast furnace slag, silica sand, sodium sulphate and process waste

Binder raw materials: Phenol formaldehyde resin (in solution), phenol, formaldehyde and resin catalyst (if the resin is produced on site), ammonia, urea, mineral oil, silicone, silane and water. The binder can also be a bio-based binder. However, this is a relatively new development.

Example of materials structure of finished mineral wool panel:

- Possible coating on rear of panel
- Mineral fibre core – which may consist of the following: mineral wool, perlite, recycled paper, clay and maize starch.
- Possible scrim – a non-woven surface fixed (perhaps with adhesive) to the mineral wool core
- Surface coating – durable, possibly light-reflectant surface coating

In addition a steel suspension system is often used (especially for ceiling panels).

Production can generally be described with the following production processes:

- Production of raw materials
- Melting in furnace
- Formation of fibres
- Curing of product
- Cooling of product
- Post-treatment

Table 1: Example of a fibreglass panel.

Mineral fibre core	Function	Percentage quantity
Fibre	Acoustic	40-50%
Perlite	Filler	20-30%
Starch	Binder	1-10%
Recycled panels	Filler	5-10%
Recycled paper	Filler	1-10%
Coating	Finish	10-20%
Scrim*	Finish	1-5%
Adhesive	Finish	0.05-1.5%

** Scrim – is a non-woven material fixed to the mineral fibre core with latex adhesive*

Cement-based panels

Cement-based panels may be multipanels, indoor construction panels, fireproof panels, windproof panels, acoustic panels and facade panels.

Cement-based panels often consist of the following materials: cement (lime or magnesium oxide based), cellulose (wood fibre), inorganic filler (sand/lime) and any pigments and additives. Part of the cement may be replaced by fly ash or other inorganic materials to reduce overall energy impact. There is a wide variation in material composition between the different cement-based panels on the market.

For compliance with product standard EN 12467 for fibre cement panels, the panel must consist mainly of cement or a mixture of calcium and silicate reinforced with fibre. The cement must comply with the definition in EN 197-1 or other technical specification in the country where it is used. EN 197-1 contains five classes of cement mixtures, in which Portland cement is the basic cement constituent. In class 3 - Blast furnace cement - and class 5 - Composite cement - the Portland cement constituent may be of lesser significance.

The cellulose component can vary widely and in high-density panels the proportion may be down to 5-10% of constituent raw materials. However, part of the cellulose is dissolved in the water which is expressed from the panel at the end, and thus disappears from the panel. As a result its presence in the finished panel is about 1%. One of the functions of the cellulose is to make the panel pliable during the actual production process[12].

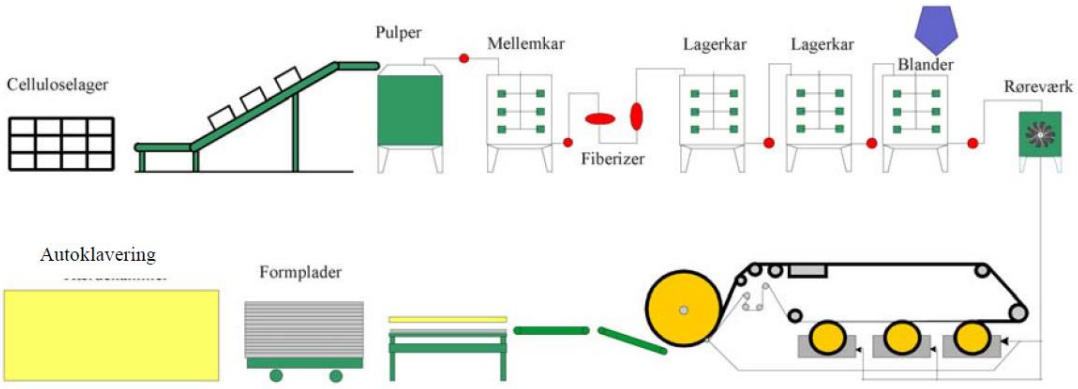


Fig. 3 : Diagram of fibre cement production (here Hatschek and autoclaving) [13]

The two commonest production methods for cement-based panels are Flowcoat and the Hatschek process. In the Hatschek process, many thin layers are formed as a kind of membrane and superposed until the desired panel thickness is achieved. Unlike the Hatschek process, the fibre-cement panel is produced in one layer. This does not necessarily achieve the same strength as the Hatschek process.

The subsequent curing of the panel can be done by air drying for 28 days in the store. This requires considerable storage capacity. An alternative is curing in an autoclave. This curing process achieves a higher degree of shape and dimensional stability. The uncured flat panels are stacked in the production facility with intermediate steel sheets and subjected to a pressure of approx. 50 kp/cm^2.

[12] Telephone interview with Peter Bech from Ivarsson on 10/1 2014
[13] Flat panels: Uses and mounting, Dansk Eternit

The panel is supplied either with the surface achieved in the curing process or with subsequent grinding and possible paint finish.

2.2 Environmental impact of construction panels

In order to gain an overview of the key environmental impacts in the products' life cycle, an environmental assessment of the product group and a qualitative MECO analysis for each panel type has been performed. MECO stands for the assessment of Materials, Energy, Chemicals and Other characteristics and describes the principal environmental impacts during the product's life cycle phases. The MECO analyses are based on LCA studies, datasets from generic databases, EPD's and scientific reports.

An overall RPS (Relevance, Potential and Controllability) analysis is then made for each panel type in which high environmental relevance (high R) was identified in the MECO analysis. The RPS analysis is a tool for prioritising environmental labelling requirements and assessing where to focus the requirements in order to achieve the maximum environmental benefit. The overall RPS analysis is available in Danish and Swedish and can be obtained on request to Nordic Ecolabelling.

Tables 1 to 5 give the results for the most important areas of the RPS analyses. Areas with an overall high RPS will trigger a requirement in the criteria. Areas with a medium RPS may trigger a requirement or may be subject to a requirement in a future version of the criteria. Areas with an overall low RPS will not trigger a requirement in the criteria. More detailed reasons for the individual requirements are given in Section **Fejl! Henvisningskilde ikke fundet.**.

2.2.1 RPS analysis of wood-based panels

Table 2 RPS analysis of wood-based panels

Overall priority	Area and level indication (high - medium - low) for R, P and S	Comments
High	**Resources - wood raw materials** High R, high P, high S	High RPS for requirement for sustainable or recycled wood raw materials.
	Energy - material and panel production High R, medium to high P, medium to high S	High RPS has been identified for the energy impact of panel production and drying of wood raw materials. The actual adhesive production also contributes a significant part of the energy impact. Here it is the production of the raw materials which requires energy and not the mixing of the adhesive. The controllability is therefore only medium, as there are several links further back in the product chain and the potential has been unclear.
	Chemicals - generally High R, medium P, high S	The chemicals requirements apply to all chemical products used in panel production. Here it is assessed that formaldehyde, VOC and isothiazolinones in the binders have the highest relevance. Also securing a low content of problematic chemicals in the surface treatment, e.g. VOC, flame inhibitors, heavy metals in pigments. Also a high RPS for requirements limiting the use of nano particles, for instance in the surface treatments.
	Chemicals - formaldehyde High R, high P, high S	Here there is high RPS for requirements for formaldehyde both in the form of reduced formaldehyde emissions in the use phase and reduced free formaldehyde in the chemical products used,
	Quality and properties	

	High R, high P, medium S	e.g. adhesives. Here there is RPS for securing conformity between the properties and the functions for which the panels are marketed and the performance declarations drawn up in relation to the CE marking. There is also RPS for ensuring that panels not covered by harmonised product standards also have documentation for the properties and functions for which the panel is marketed.
Medium	**Resources - bio-based adhesives** High R, low P, low S	There is a low to medium RPS for requirements for bio-based adhesives. Work is ongoing to develop bio-based adhesives. These are not particularly widespread yet, and the potential and controllability are therefore judged low at the present time. This will be a possible future requirement.
Low	**Resources - waste phase** High R, medium to low P, low S	Wood-based panels have a generally high calorific value (17-20 MJ/kg) and are suitable for incineration with energy recovery. For some types of wood-based panels, material reuse will be relevant.

2.2.2 RPS analysis of HPL panels

Table 3 RPS analysis of HPL panels

Overall priority	Area and level indication (high - medium - low) for R, P and S	Comments
High	**Resources - wood raw materials** High R, high P, high S	High RPS for requirement for sustainable or recycled wood raw materials in the paper.
	Energy - materials production (wood raw materials) High R, medium to high P, medium S	In Nordic Ecolabelling's experience, there is RPS for energy for paper, and therefore specific energy requirements can be set for the paper used.
	Energy - panel production High R, medium to high P, high S	Here, high relevance has been identified for energy impact from panel production. HPL panel production is a very energy-intensive production type. At the same time high potential has been identified for reducing energy consumption in production.
	Chemicals - pigments, VOC, biocides and other High R, medium P, high S	The chemicals requirements are applied to all chemical products used in panel production. Here it is assessed that formaldehyde, VOC and isothiazolinones in the binders have high relevance. Also securing a low content of problematic chemicals in the surface treatment, e.g. VOC, flame inhibitors, heavy metals in pigments. Also a high RPS for requirements limiting the use of nano particles, for instance in the surface treatments.
	Quality and properties High R, high P, medium S	Here there is RPS for securing conformity between the properties and the functions for which the panels are marketed and the performance declarations drawn up in relation to the CE marking. There is also RPS for ensuring that panels not covered by harmonised product standards also have documentation for the properties and functions for which the panel is marketed.
Medium	**Energy - materials production (resin)** High R, low to medium P, medium to low S	High relevance has been identified in relation to energy impact from material production, including raw materials extraction. All constituent materials are highly processed, with correspondingly high energy consumption. The potential for energy reduction in the production of phenolic and melamine resin is unclear. The different HPL production systems use much the same material types without wide variations in material proportions.

	Chemicals - resins High R, low to medium P, medium to low S	No potential or controllability has been identified for substituting the phenolic and melamine resins used, as these are essential for the panel type. However, requirements can be set to ensure low emission values during production.
Low	**Resources - waste phase** High R, medium to low P, low S	HPL panels have a generally high calorific value (17-20 MJ/kg) and are suitable for incineration with energy recovery. Materials reuse is not considered very relevant for HPL, as the materials are strongly combined in the lamination process and are hard to reuse. The lamination process is essential for the panel type, so no great potential for further resource requirements is envisaged, other than requirements for energy and sustainable or recycled wood raw materials.

2.2.3 RPS analysis for plasterboards

Table 4 RPS analysis for plasterboards

Overall priority	Area and level indication (high - medium - low) for R, P and S	Comments
High	**Emissions - dust emissions** High R, medium P, medium to high S	There is high RPS for requirements for dust emissions from the production of mineral raw materials.
	Energy - panel production Medium to high R, medium to high P, high S	Here, medium to high RPS has been identified in relation to energy impact from panel production. There is a potential for recycling heat from production processes
	Chemicals - VOC, biocides and other High R, medium P, high S	The chemicals requirements are applied to all chemical products used in panel production. Here there is judged to be high relevance for substances such as the additives and coatings used in the plasterboard. E.g. formaldehyde, VOC and isothiazolinones in binders.
	Quality and properties High R, high P, medium S	Here there is RPS for securing conformity between the properties and the functions for which the panels are marketed and the performance declarations drawn up in relation to the CE marking. There is also RPS for ensuring that panels not covered by harmonised product standards also have documentation for the properties and functions for which the panel is marketed.
Medium	**Resources - water** Medium R, medium P, medium to high S	There is medium RPS for setting requirements for a recycling system for water in panel production. Water is used in plasterboard production both as a binder and as a mixer.
	Resources - gypsum raw materials - feedstock High R, medium P, low to medium S	Here there is medium RPS for setting requirements for a minimum proportion of recycled gypsum in panel production. This will ensure that the production system can handle recycled gypsum and ensure that recycled gypsum is not used for other purposes with less environmental benefit, e.g. composting.
	Resources - wood raw materials Low to medium R, high P, high S	For paper where more than 15 wt.% is used. High RPS for requirement for sustainable or recycled wood raw materials in the paper. This requirement will rarely be activated on plasterboards, as there is generally max. 5 wt.% paper in the panel.
	Resources - gypsum raw materials - waste phase	Here there is judged to be medium RPS for encouraging reuse of the plasterboard material after final use and for providing

	High R, medium to low P, low S	information to customer that plasterboard waste can be reused, as can any dismantled old plasterboard.
Low	**Resources - gypsum extraction** Medium R, low to medium P, low S	Here there is relevance in relation to securing sustainable operation of gypsum quarries. For instance, with regard to noise, dust and land use. However, this is rated to have very low controllability and medium potential. Hence, no requirements have been laid down.

2.2.4 RPS analysis of mineral wool panels

Table 5 RPS analysis of mineral wool panels

Overall priority	Area and level indication (high - medium - low) for R, P and S	Comments
High	**Resources - mineral raw materials** High R, high P, high S	High RPS for requirement for recycled mineral raw materials in the panel.
	Resources - wood raw materials High R, high P, high S	High RPS for requirement for sustainable or recycled wood raw materials in the paper.
	Energy - materials production (wood raw materials) High R, medium to high P, medium S	In Nordic Ecolabelling's experience, there is RPS for energy for paper, and therefore specific energy requirements can be set for the paper used. RPS for requirements where more than 15 wt % is used.
	Energy - panel production High R, medium to high P, high S	High RPS has been identified for the energy impact of panel production and the actual mineral wool production.
	Emissions - dust emissions High R, medium P, medium to high S	There is high RPS for requirements for dust emissions from the production of mineral raw materials.
	Chemicals - pigments, VOC, biocides and other High R, medium P, high S	The chemicals requirements are applied to all chemical products used in panel production. Here it is assessed that formaldehyde, VOC and isothiazolinones in the binders have the highest relevance. Also securing a low content of problematic chemicals in the surface treatment, e.g. VOC, flame inhibitors, heavy metals in pigments.
	Resources - mineral raw materials High R, medium P, medium S	There is medium to high RPS for requirements for radioactive substances and heavy metals in virgin mineral raw materials for acoustic panels. Controllability is slightly lower for recycled mineral raw materials and waste raw materials such as slag and fly ash, but the relevance is still high and there is an overall medium to high RPS.
	Quality and properties High R, high P, medium S	Here there is RPS for securing conformity between the properties and the functions for which the panels are marketed and the performance declarations drawn up in relation to the CE marking. There is also RPS for ensuring that panels not covered by harmonised product standards also have documentation for the properties and functions for which the panel is marketed.
Medium	**Resources - binders**	There is medium RPS for replacing fossil fuel binders with biobased binders in the panel. Potential and controllability are

	Medium R, medium P, medium to low S	currently unclear. There must be a focus on this for a requirement in the future.
	Energy - materials production (resin) Medium R, low to medium P, medium to low S	There is a total low to medium RPS for energy requirements for binders. Here no requirements are set in this version of the criteria.
Low	**Resources - waste phase** High R, medium to low P, low S	Materials reuse is found to be of high relevanse and takes place with some panels. The controllability of encouraging this further with a requirement is low. Instead the controllability lies in ensuring that no problematic substances are included by means of the chemical requirements.

2.2.5 RPS analysis of cement-based panels

Table 6 RPS analysis of cement-based panels

Overall priority	Area and level indication (high - medium - low) for R, P and S	Comments
High	**Resources - mineral raw materials** High R, high P, high S	High RPS for requirements for a high proportion of recycled mineral raw materials in the panel.
	Resources - renewable raw materials High R, high P, high S	High RPS for requirements for a certain proportion of renewable or recycled raw materials in the panel.
	Resources - wood raw materials High R, high P, high S	Here a high RPS has been identified for ensuring that the wood fibres are either certified, sustainable or recycled.
	Energy - materials composition High R, medium to high P, medium S	High RPS has been identified for energy requirements affecting both material production and panel production. The highest RPS for material production is found to exist in relation to the actual material composition, as here a high potential can be identified for reducing the use of the most energy and CO_2 intensive materials.
	Energy - panel production High R, medium to high P, high S	Here, high RPS has been identified for energy impact from panel production.
	Chemicals - dust emissions High R, medium P, medium to high S	There is high RPS for requirements for dust emissions from the production of mineral raw materials.
	Chemicals - pigments, VOC, biocides and other High R, medium P, high S	The chemicals requirements are applied to all chemical products used in panel production. Here it is assessed that formaldehyde, VOC and isothiazolinones in the binders have the highest relevance. Also securing a low content of problematic chemicals in the surface treatment, e.g. VOC, flame inhibitors, heavy metals in pigments. Also a high RPS for requirements limiting the use of nano particles, for instance in the surface treatments.
	Resources - mineral raw	There is medium to high RPS for requirements for radioactive

	materials High R, medium P, medium S	substances and heavy metals in virgin mineral raw materials for acoustic panels. Controllability is slightly lower for recycled mineral raw materials and waste raw materials such as slag and fly ash, but the relevance is still high and there is an overall medium to high RPS.
	Quality and properties High R, high P, medium S	Here there is RPS for securing conformity between the properties and the functions for which the panels are marketed and the performance declarations drawn up in relation to the CE marking. There is also RPS for ensuring that panels not covered by harmonised product standards also have documentation for the properties and functions for which the panel is marketed.
Medium		
Low	**Energy - materials production** High R, high P, low S	Low to medium RPS has been identified for a requirement for production-specific energy consumption for all constituent materials.
	Resources - waste phase High R, medium to low P, low S	Materials reuse is found to be most relevant and takes place with some panels. However, this is mainly as downcycling to roadfill. The controllability of encouraging this further with a requirement is low. Instead the controllability lies in ensuring that no problematic substances are included by means of the chemical requirements.

2.2.6 Most important environmental properties of the product group

Nordic bullet points

The overall environmental advances to communicate for the total product group "ecolabelling of construction panels" is described here:

- Satisfy strict environmental requirements.
- Limited energy consumption during the whole production process
- High proportion of recycled or renewable materials
- No or reduced use of formaldehyde and organic solvents
- Ensure that quality and properties are documented

For ecolabelled wood construction panels, the following also applies:

- Wood from sustainable forests

For ecolabelled plasterboards, the following applies:

- Use of recycled materials

For ecolabelled construction panels for indoor use, the following also applies:

- Chemical requirements which guarantee a healthy indoor climate

2.3 The version and validity of the criteria

The criteria for ecolabelling of construction panels were first agreed by the Nordic Ecolabelling Board in October 1992. The present version is called Version 5 and was agreed by the Nordic Ecolabelling Board on 17 March 2011. Version 5 expires on 30 June 2015.

2.4 The Nordic market

2.4.1 Market descriptions

The construction panels product group is well represented in production in the Nordic Region and the rest of Europe. There are often very large production volumes and the potential for substantial environmental benefits from environmental labelling.

The following gives a list of some of the biggest panel manufacturers in the Nordic Region which are covered by the new product group definition. This is followed by a short description of the construction panel sectors in each Nordic country.

Table 7 Plasterboard manufacturers mainly in the Nordic Region and EU

Plasterboard manufacturer	Production location	Turnover in [14] million kroner in 2012
Gyproc	Sweden and Denmark	407 (Sweden)
Norgips	Norway	15 (Sweden)
Knauf Danogips	Sweden and Germany	0.5-1 (Sweden)
Rollform AS	Norway	40 (Norway)
Lafarge Gypsum	International	-

Table 8 Nordic wood panel manufacturers

Wood-based panel manufacturer	Production location	Turnover in million kroner in 2012
Swedspan	Sweden	858 (Sweden)
Byggelit	Sweden	183 (Sweden)
Plyfa	Sweden	167 (Sweden)
Moelven Vänerply	Sweden	146 (Sweden)
Novopan	Denmark	350,000 m3 panels/year
Hudevad Formfiner	Denmark	Manufactures to order
MetsäWood	Finland	904 million euro (group)
UPM (veneer)	Finland	390 million euro (group)
Oslo Finérfabrikk AS	Norway	129 (Norway)
Nortett Bygg AS	Norway	113 (Norway)
Hunton Fiber A/S	Norway	299 (Norway)
Bosvik AS	Norway	81 (Norway)

[14] Allabolag.se, 2013-04-15
http://www.allabolag.se/start

Table 9 International wood panel manufacturers

Wood-based panel manufacturer	Turnover [billion dollars]	Registered country	Market
Sonea Indústria – SGPS	2.45	Portugal	Iberian peninsula
Weyerhaeuser Company	2.44	USA	Global, 8 offices in China
Carter Holt Harvey	2.2	Australia	-
Pfleiderer AG	1.92	Germany	-
Kronospan AG	1.44	Switzerland	-
Medite	?	Ireland	-
Grupo Nueva	0.9	South America	Argentina, Brazil, Chile and Mexico
Kaindl	0.58	Germany	-
FINSA	0.26	Spain	-
Chinese Dare Group	0.15	China	China
Fantoni	0.10	Italy	International

Table 10 Nordic manufacturers of mineral and plastics-based panels

Manufacturer of mineral and plastics-based panels	Production location	Turnover in million kroner in 2012
Saint-Gobain Isover	Sweden and Denmark	928 (Sweden)
Paroc	Sweden	1152 (Sweden)
Rockwool	Denmark and Norway	448 (Sweden)
Knauf	Germany	11 (Sweden)
Thermisol	Sweden	167 (Sweden)
Sundolitt	Sweden	256 (Sweden)
Jackon	Sweden	469 (Sweden)
Protecta AS	Norway (UK)	42 (Norway)
Acusto AS	Norway	148 (Norway)
Norprodukter Sale AS	Norway	32 (Norway)
Moelven Nordia AS	Norway	406 (Norway)
Modulvegger Oslo A/S	Norway	135 (Norway)
Isola as	Norway	570 (Norway)
Glava	Norway	1323 (Norway)
Forestia (Byggma)	Norway	135 (Norway)
Cembrit	Norway	109 (Norway)
Ivarsson (Etex Group)	Belgium (office in Denmark)	-
Honeycore AB	Denmark/Sweden private label	-
Steni AS	Norway	177 (Norway)
Formica (HPL)	Finland	-

Table 11 International manufacturers of High Pressure Laminate

HPL panel manufacturer	Production location
Arpa Industriale S.p.A.	Italy
Formica Group	USA
FunderMax GmbH	Austria

Gentas Genel Metal Sanayi Ticaret S.A. – Turkey	Turkey
Ludwig Leitermann GmbH & Co. KG	Germany
Modekor Europe GmbH	Germany
Polyrey SA	France
Resopal GmbH	Germany
JSC Slotex	Russia
Sonae Industria de Revestimentos	Portugal
Sprela GmbH	Germany
Syriamica Company (Azzouz Corp.)	Syria
Trespa International B.V.	Netherlands

Sweden

The construction materials industry manufactures construction materials which either directly go to contractors or to the construction materials trade, which passes on the materials to contractors or private consumers. In recent years the trend towards consumers refurbishing their own home has led to a rise in sales of construction materials to the private market. Even though the Swedish Construction Federation demonstrates that their foreign members only make up 1.6% of the number of members, the tendency is for rising international competition in the construction industry, and this relates to the whole building process - from building owners and consultancy services throughout the construction materials industry and building contractors[15].

Sweden produces a large number of construction panels, such as: wood-based panels, plasterboards and insulation and a number of other construction materials such as wood fibre cement elements, see following tables under "Manufacturers and turnover". However, production of wood-based panels has been much greater than it is today and the number of manufacturers has fallen over the years. In 1980, there were 32 manufacturing companies in Sweden making chipboard. Today there are 5 panel manufacturers, of whom 3 produce chipboard.[16]

According to data from the Swedish Construction Materials Association in 2003[17] market share (expressed as turnover) of the relevant construction panels on the Swedish market was as shown in Table 10 below.

Table 12 Market share (expressed as turnover) of the relevant construction panels on the Swedish market in 2003

Material type	Turnover
Wood-based panels	SEK 1800 m
Insulation	SEK 1600 m
Roofing materials	SEK 900 m
Plasterboards	SEK 600 m

Denmark

[15] TMF (wood and furniture businesses) – Wood-based panels
http://www.tmf.se/statistik_11/statistik_9_1/traskivor_1_2_1
[16] TMF (wood and furniture businesses) – Wood-based panels
http://www.tmf.se/statistik_11/statistik_9_1/traskivor_1_2_1
[17] Byggmaterialindustrierna – en viktig näring för Sverige (2005)
http://www.byggmaterialindustrierna.se/index.php/vart-uppdrag/i-pressen/

Panel production is generally characterised by large companies with high capacity. There is a low number of manufacturers in Denmark. This means that there is a very large import share, which primarily goes via construction material suppliers, who also supply to the furniture industry and sale to the public.

There is no specific sectoral association for panel manufacturers. The Confederation of Danish Industry (DI) has a subdivision for construction (DI Byg), which covers all construction products, including construction panels. There is also the Danish Construction Association which is a sectoral and employers' organisation and the Træ- og Møbelindustrien association.

The members of the latter body represent businesses within:

- Furniture
- Saw works
- Building components, including windows, doors and floors
- Kitchens
- Craft industry and shopfitting

Finland

Finland produces different panel types for the construction, furniture and shopfitting industries. UPM is Europe's largest manufacturer of veneer panels, and turnover for veneer production is around EUR 390 m. MetsäWood manufactures veneer products in LVL=laminated veneer lumber with product brands Kerto og Kertopuu for the construction and furniture industries and has a group turnover of EUR 904 m.

Manufacturer Koskisen manufactures chipboard and has turnover of EUR 26 m.

Norway

In 2005, the Norwegian construction industry had an estimated turnover of NOK 71 bn (14% of the total) and a value creation of NOK 19.7 bn (13.1% of the total).

The construction industry is generally regarded as conservative. In terms of the environment it has by and large complied with Norwegian legislation. This hampers players from doing anything extra. The market players within Norwegian construction panels include manufacturers, importers, wholesalers and distributors (outlets for professionals and building product stores for consumers). According to earlier evaluation, Norway has a large import of construction panels from manufacturers outside the Nordic region. Many of these are approved for inclusion in ecolabelled furniture. For example, ecolabelled construction panels from Germany and Ireland are used in ecolabelled furniture.

The market players consist of all involved parties from manufacturer until the products reach the shop shelves/warehouse and are bought by consumers/professionals. In many building projects, the technical construction solutions have already been decided by architects, construction engineers, etc. at an early stage. Their planning and weighting of environmental questions and knowledge of environmental labels will be decisive for the building products selected by the professional end-user. Widespread breakthrough will therefore depend on the existence of ecolabelled alternatives within the different product types which are of interest.

2.4.2 Consumers and purchasers in the Nordic Region

The product group has three main groups of purchasers/end-users:

- Manufacturers of furniture and play equipment, which mainly use MDF, HDF, HPL and chipboard in their furniture production
- Contractors, tradesmen for house building activities (new-build, refurbishment)
- Members of the public for personal projects

The highest volumes go to construction, but furniture and kitchen also purchase large volumes of construction panels, together with the market for ready-painted easily assembled panels ("smartboards").

2.4.3 Nordic Ecolabelling licences

There are 13 licences in the Nordic region within the construction panel product group. The licences mainly relate to wood-based panels, both with and without laminate. There are also two licences for mineral-based acoustic panels.

The licences are a means of environmental communication within both construction and furniture production. With respect to ecolabelled production, ecolabelled construction panels are particularly required to permit ecolabelling of furniture.

Denmark

- Novopan Træindustri A/S, licence 510-015: Spaandex Green Line Series (wood-fibre panels)

Norway

- Mjøspanel, licence 210-016: Mjøspanel Elegant Vegg and Mjøspanel StrukturVegg (MDF panels)
- Pfleiderer Holzwerkstoffe GmbH, licence 210-017: StyleBoard MDF CARB2 (MDF panels)
- T-Komponent AS, licence 210-018: Talgø Eco wall panels (MDF panels)
- Medite Europe Limited, Licence no. 210 020 (MDF panels); Medite Ecologique, Medite Exterior, Medite Fire Retardant, Medite Moisture Resistance, Medite Premier, Medite Trade, Medite Ultralite, Medite Floor.
- RBI Interiør AS, Licence no. 201 019 (painted MDF panels); Smartpanel Pure (wall and ceiling panel).
- Arbor Hattfjelldal AS, licence no. 210 004 (chipboard); Arbor Vegg.
- Forestia AS Braskereidfoss, licence no. 210 001 (chipboard); Forestia Standard Møbel 1250*2500 mm, Standard Bygg Rettkant.

Sweden

- Byggelit Sverige AB, licence 310-005: Elit taket membrane-lined subroof panel innertakskiva and Elitväggen, wall panel of membrane-lined chipboard
- Saint-Gobain Ecophon AB, licence 310007: Ecophon acoustic panel (9 types)

- Paroc AB Akustik & Interiör, licence 310009, PARAFON acoustic panel (3 types)
- Formica Skandinavien AB, licence10-011: Axiom Bänkskiva, Worktops and Benkeplate (construction panel)
- Spanolux, licence no. 310021, MDF panels (S-Lux Swan + Umidax Swan)

2.4.4 Other regulations and marking schemes

Directives and Regulations

The EU Construction Product Directive, the aim of which was to ensure free trading of construction products within the EU's Inner Market has now been superseded by the EU's new Construction Product Regulations (CPR)[18].

Both the Directive and the Regulations describe how to implement the harmonisation of technical specifications, tests and test methods and other documentation, so that construction products can satisfy the aims of the six essential requirements:

- mechanical resistance and stability
- safety in the case of fire
- health and the environment
- safety in use
- noise
- energy

The biggest changes in the new Construction Product Regulations will be that future CE marking must capable of documentation by a declaration of performance, and that the Regulations automatically apply in all EU countries. In addition, the Construction Product Regulations introduce a new seventh essential requirement, that of "sustainability". In reality, this will only become a requirement when the harmonised standards are revised, as and when this is ordered by the EU Commission. It is therefore assumed that it will take several years before the sustainability requirement is included in all the harmonised product standards.

There is a requirement for CE marking of construction products covered by the applicable harmonised European standard. Most types of construction panel are covered by a harmonised product standard such as EN 13986: Wood-based panels for construction use, EN 12467: Flat panels in fibre-reinforced cement, EN 15283: Fibre-reinforced plasterboards and EN 14322: Wood-based panels - melamine coated panels for indoor use.

As time goes by, there are few construction products which do not need CE marking. The CE mark shows that the construction product has a product declaration with details about its properties, e.g. what it can withstand. It is also the manufacturer's promise that the construction product has been tested to verify that it can meet the requirements, e.g.

[18] http://byggevareinfo.dk/fra_cpd_til_cpr

for health and safety. Within the construction panels product group, there are a number of harmonised product standards, depending on the type of construction panel in question.

It has previously been queried whether the EU's Construction Product Directive and the CE marking of construction products constitute a hindrance to ecolabelling. This question has been clarified between Nordic Ecolabelling and the European Commission, Enterprise and Industry: "There is no contradiction. CE marking covers a performance declaration for regulatory requirements. In other words, if a member state is regulating specific characteristics of construction products, this could be considered as a barrier to trade, and the test methods used for the declaration of performance must be laid down in a harmonized product standard. Member states (MS) are no longer allowed to use their own national test methods and product marks for these characteristics (everything not regulated and therefore not obligatory is still part of the private market and is not covered by CPD/CPR CE marking).

Therefore, eco-labels and other voluntary marks are not covered by CE marking (it would be different if eco-labels were to become obligatory in a MS, but let's not start with the most complicated version)".

Communicating the environmental performance of the panel

Within construction, the term "sustainable building" is encountered more and more frequently. The term covers many different approaches with a focus on environmental, social and economic sustainability. This focus arises particularly in the end product - the construction work - and from here spreads to construction products such as construction panels. Here, more and more of the larger contractors make use of different certification schemes for sustainable construction, such as BREEAM, Nordic Ecolabelling, DGNB, LEED, etc. National Green Buildings Councils have been set up in the Nordic countries, with different portfolios of the above certification schemes (see further description in Appendix 1). Appendix 1 gives an overview of other certificationsshemes and concepts of relevance to construction panels.

Common to these sustainability certification schemes is that they set environmental requirements for construction products. In some cases, input is required for LCAs for the building work, or else environmental product declarations (EPD), emissions testing, environmental labelling or other environmental information. There are a huge number of useful solutions, but a lack of uniformity, and the construction product manufacturers often have to gather a great deal of different environmental information.

Not all of these sustainability systems ensure that action is being taken on the content of specific problematic substances in the construction materials employed.

There are also measures at the construction product level. In Sweden, there are several databases for approval of construction products, such as Basta, Sunda Hus and Byggvarubedömningen. In Norway there are the schemes "Enova anbefaler" and Eco-produkt, while in Denmark the Environmental Protection Agency is developing a project to test the viability of a substitution database for construction products.

There is also a focus on the impact of construction products on a building's indoor climate, and various indoor climate labels and product emission tests are used. These are primarily certificates for the following schemes: CE-mark E1, CARB PHASE 2, Danish Indoor Climate Label, the Finnish M1 scheme or EMICODE E1 or EC1PLUS.

The wide range of materials and thus wide range of environmental appraisal types make it hard to compare the environmental performance of the different construction panels. In Norway, there are several construction panels with environmental product declarations, especially plasterboards[19]. However, the focus is mainly on energy and climate and on LCA results for different environmental impact categories, which are hard to handle unless you are compiling an overall LCA for the building work. The different materials can lead to a difference in the panel's functions and maintenance. Together with the need for different panel functions in a building project, this makes it hard to compare the environmental performance of different panel types.

3 About the revision

3.1 Goals of the revision

Main goal

The overall aim of this revision is to ensure that the Nordic Ecolabelling criteria secure a positive environmental benefit via environmental labelling and also that the criteria are viable and clear for the industry. The revision must respond to the areas highlighted in the evaluation of the criteria. In addition, the revision must expand the product group to include facade panels and the material types high pressure laminate, magnesium oxide, fibre cement and plastics-based composites, providing it is possible to identify the best environmental products on the market with environmental labelling criteria.

The criteria must be ready for agreement at the Nordic Ecolabelling Board meeting in March 2015.

Subordinate goals

- The revision has the following subordinate aims, cf. the conclusions of the evaluation:
- Expand the product group to include facade panels and the material types high pressure laminate, magnesium oxide, fibre cement and plastics-based composites, with the consequent need to expand the requirements for new material types and energy requirements for additional types of panel production systems.
- Revision of the existing energy requirement for better controllability. The aim is a pure energy requirement for the product group - not a combination of energy and sustainable raw materials.
- Update the chemicals requirements in accordance with chemtech guidelines. This includes a focus on a possible prohibition of candidate list substances in construction panels.
- Update the chemicals requirements in accordance with the expansion of new product types in the product group.
- General updating/tightening up of existing requirements to ensure continued relevance. Focus on simplified criteria for the requirement with the highest RPS.

[19] http://www.epd-norge.no/

- Assess whether a new indoor climate requirement should be drawn up regarding emissions of TVOC, selected VOCs and carcinogens, etc., for panels used inside the climate screen. Here, attention should be given to emission requirements being drawn up for criteria for ecolabelling of floors.
- Draw up quality requirement for different types of construction panels in the product group, if possible. Despite the many functions in the product group, the assessment is that there is controllability for a quality requirement, as the different construction panels have product standards linked to the CE mark in which different quality parameters have been defined.
- Update the background document in relation to the revision of requirements, in order to clearly define which functional units are in view in the criteria and the conclusions from MECO and RPS found in this evaluation.

About this revision

The revision has been carried out by Product Coordinator Heidi Bugge as Project Manager and Jimmy Yoler, as Project Consultant. In each country, a national contact person has provided national input.

External input is being performed in connection with the consultation hearings, a Nordic sector seminar in September 2014 and regular contact with Nordic and European manufacturers within the product group.

4 Justification of the requirements

The following is a description of the individual requirements in the criteria, in which the reasons for setting the requirement and the specific requirement level are explained. The background for the requirement also states whether the requirement has been changed since the previous version.

4.1 Definition of terms used in the criteria

Material: Materials means the constituent materials such as wood, paper, cardboard, pulp, plastic, mineral raw materials, metal, etc.

Chemical products: Chemical products means liquid products, e.g. for surface treatment, additives, glues and other adhesives.

Ingoing substance: Unless otherwise stated, ingoing substance are defined as all substances in the product, including additives to the raw materials/ingredients (e.g. preservatives or stabiliser), but not impurities from raw material production.

Contamination limit: Impurities include residues from raw materials production which are found in adhesive, paint, additives and other chemical products in concentrations below 100 ppm (0.0100 wt.%, 100 mg/kg), but not substances intentionally added to a raw material or product for a purpose, regardless of quantity. However, impurities at the raw material level at concentrations of over 1.0% of the raw material will be regarded as a ingoing substance. Known substances realised from the raw materials are also regarded as ingoing substances.

Renewable raw material: Renewable raw material is here defined as a biological material which is reproduced in nature. It includes the degradable part of products, waste and residues from agriculture and aquaculture (both vegetable and animal), forestry and similar industries and the biodegradable fraction of industrial waste and municipal waste.

4.2 Product information

O1 Information about the product(s)

The applicant must submit the following information about the product(s):

1. Brand name(s) and trade name(s).
2. Description of product(s) included in the application). A product datasheet or similar for each product must be forwarded.
3. Description of manufacturing process of the product. Subcontractors must be described with company name, production location, contact person and the production processes used.
4. For each product: Attach a list of materials and chemical products used in producing the panel and any surface treatment of the panel. The list must contain the weight percentage of the constituent materials/chemical products in the panel. Safety datasheets for each chemical product must be included.

✉ Any information requested by the requirement. A product datasheet may be sent as part of the documentation. Information about materials, cf. Table 2 in Appendix 2, must be given. It is possible to use a separate Excel spreadsheet corresponding to Table 2 in Appendix 2 as a materials list.

✉ Table 1 in Appendix 2 should be completed and forwarded by the applicant for each product.

4.3 Environmental requirements

4.3.1 Mineral raw materials

The requirements apply to mineral raw materials and mineral bi-products (e.g. fly ash) which make up more than 5 wt. % of the finished panel

O2 Heavy metals

The main component(s) of the mineral raw material or mineral bi-product must as a maximum contain the following quantities of heavy metals:

Arsenic	10 mg/kg
Lead	25 mg/kg
Cadmium	1 mg/kg
Mercury	0.5 mg/kg
Chrome (total)	300 mg/kg

For the description of the measurement method, see Appendix 1.

✉ The declaration from the raw materials producer/refiner, containing measurement results, measurement methods and measurement frequency.

Background for the requirement

The limit values in the requirement have been tightened since the previous version of the criteria. Also, the value for chrome now covers both chrome III and chrome VI. The previous limit values were set on the basis of the Nordic authorities' limit values for soil quality. However, Nordic Ecolabelling has seen a potential for reducing these levels even further. This change has been made simultaneously with a requirement for a high proportion of recycled mineral raw materials in the construction panel. Recycled materials might be thought to vary more in heavy metal content and have lower controllability over the quantity of heavy metals. However, the required test takes account of this by requiring long-term testing.

The selected heavy metals have impacts on the environment and on health. It is therefore important to reduce exposure as much as possible, both in relation to human beings and the environment.

Different raw materials may contain higher quantities of heavy metals compared to the background levels, e.g. in soil. These include natural gypsum, gypsum from cleaning of smoke gas (industrial gypsum), fibreglass from collected glass and mineral wool from stone. It is important that the heavy metal content is not so high that it creates problems in the user phase or for reuse of product materials.

The standard referred to in the requirement, DS 259, and the sample-taking procedure described in Appendix 1, capture the variation in heavy metal content represented by both virgin and recycled mineral raw materials.

The requirement covers both primary mineral raw materials and mineral bi-products such as fly ash from heat and power generation at coal-fired power and district heating stations.

O3 Dust emissions

The production and refining of mineral raw materials must not generate dust emissions to the atmosphere (via a chimney) of more than 7 mg dry dust/m^3 air and 21 mg wet dust/m^3 air.

For a description of the measurement method, see section on dust emissions in Appendix 1.

✉ The declaration from the raw materials producer/refiner, containing measurement results, measurement methods and measurement frequency.

Background for the requirement

Based on dust emission levels in BAT reports and dust emission guidelines for fibreglass manufacture[20] and plaster and cement production[21], the assessment has been made that the requirement could be tightened up. The requirement level has therefore been tightened to maximum 7 mg dry dust/m^3 air and 21 mg wet dust/m^3 air. The previous level was maximum 10 mg dry dust/m^3 air and 25 mg wet dust/m^3 air.

[20] Official Journal of the European Union, Commission Implementing Decision of 28 February 2012 , BAT on industrial emissions for the manufacture of glass
[21] JRC Reference Reports, Best Available Techniques (BAT) Reference Document for the Production of Cement, Lime and Magnesium Oxide

The background to the requirement is that dust emissions to the atmosphere in many parts of the mineral raw material production industry are one of the most important local environmental issues. For example, the most important environmental issues in cement production are energy consumption and emissions to the air from the clinker burning process. The most important pollutants emitted to the air are here dust, nitrogen oxides and sulphur dioxide[22].

O4 Radioactive substances

The requirement covers all constituent mineral materials used in panels for internal uses such as walls, ceilings, sub-floors, fittings and joists. Hence, materials which are only marketed for outdoor use are not covered by the requirement.

For panel materials which contain:

Natural materials such as alum shale or building materials or additives of natural volcanic origin, e.g.:

- granitoids (such as granites, syenite and orthogneiss)
- porphyries
- tufa
- pozzolana
- lava

or

materials containing residues from industries which process naturally occurring radioactive material, e.g.:

- fly ash
- phosphogypsum
- phosphorus slag
- tin slag
- copper slag
- red mud (residue from aluminium production)
- residues from steel production

it must be documented that the gamma index (mγ) or activity index (l1) is less than 1.

The requirement applies to all constituent materials used in panels for internal uses such as walls, ceilings, sub-floors, fittings or joists. Radioactive substances in the panel material are expressed as a gamma/activity index in accordance with the following formula:

$C_K/3000 + C_{Ra}/300 + C_{Th}/200 < 0.5$

In the above formula, C_K, C_{Ra} and C_{Th} are the concentrations of potassium-40, radium-226 and thorium-232, expressed as becquerel per kilogram (Bq/kg) of the material. 1% potassium is equivalent to 310 Bq/kg potassium-40, 1 ppm uranium is equivalent to 12.3 Bq/kg of radium-226 and 1 ppm thorium is equivalent to 4.0 Bq/kg of thorium-232.

[22] Reference document on best available techniques in the cement, lime and magnesium oxide industries, EU Commission 2010.

For the analysis method, see section in Appendix 1.

☒ Sampling programme, including measurement methods, measurement result and measurement frequency.

Background for the requirement

The requirement has been tightened by lowering the limit value for the activity index from the previous 1 to 0.5 now. At the same time, the requirement has been made simpler in the specific requirement for the radium index: CRa/100 < 1.0 has been removed to harmonise with EU Directive 2013/59/Euratom. The EU's new radiation protection directive 2013/59/Euratom came into force on 6 February 2014 and must be transposed into national law by 6 February 2018.

The background for the requirement is that radioactive substances can have harmful health effects both during production and during use of the panel. The requirement covers all constituent mineral materials used in panels for internal uses such as walls, ceilings, sub-floors, fittings or joists. Hence, materials only marketed for outdoor use are not covered.

The Swedish radiation safety authority states that requirements for radiation levels are still necessary. In accordance with the European radiation directive 2013/59/Euratom, reference is made to an activity index of 1 applied to construction materials consisting of defined materials listed in the Directive's Annex XIII. The Swedish radiation safety authority points out that this has relevance for both virgin/natural raw materials and for recycled raw materials, as is also stated in the Directive.

Here a decision has been made that the requirement should refer to the whole "Advisory list of construction materials in respect of gamma radiation emitted" from Annex XIII of Directive 2013/59/Euratom, as the criteria have now been expanded with new panel types with a wide variation in the basic mineral raw materials used.

4.3.2 Wood raw materials, paper, cardboard and paper pulp

The following requirements cover wood fibres, paper, cardboard, paper pulp, veneer and solid wood, as used in the product where they constitute more than 5 wt.% of the finished panel.

O5 Wood fibre and waste wood in paper, cardboard and pulp

The requirement covers raw materials purchased as wood fibre in paper, cardboard and pulp. The requirement does not apply to paper labels attached to the product.

Every year, 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,

or

2. 75% of the fibre raw material in paper, cardboard or pulp must be recycled fibre or bi-products such as shavings or sawdust,

or

3. a combination of 1 and 2. If the fibre raw material in paper, cardboard or pulp consists of less than 75% 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 3 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 4c.

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[23].

O6 Solid wood, veneer and bamboo - origin and traceability

Constituent raw materials of solid wood, veneer and bamboo in the construction panel must comply with the following requirements.

Secondary raw materials from trees, e.g. palm leaves, are exempted from the requirement.

The licensee must:

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

[23] Background for ecolabelling of paper products, Nordic Ecolabelling 2011.

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

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

Furthermore, forestry operations must not damage:

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

Nordic Ecolabelling may require further documentation in case of uncertainty about the raw material's origin.

☒ Name (Latin and a Nordic language or English) and geographical origin (country/state and region/province/municipality) for the wood raw materials used. Appendix 4a must be used.

☒ The traceability system must be described. The Chain of Custody Certificate may be used as documentation for point 2.

☒ Written routines for ensuring sustainable bamboo and wood supply. A requirement for a Chain of Custody Certificate from a supplier may be used as part of the procedure. The procedure must ensure updated lists of all suppliers.

Background for the requirement
The requirement has been updated to harmonise with Nordic Ecolabelling's most recent formulation of requirements for origin and traceability. At the same time, the requirement has been extended to include bamboo.

Documentation is required as to how it will be ensured that forbidden wood raw materials are not used, cf. the criteria. In addition, the manufacturer must explain what wood types are being used and their geographical origin. There is still a limited supply of FSC and PEFC wood at the global level and hence a need to accept a minor proportion of non-certified wood in the panel. For wood raw materials FSC mixed and PEFC mixed, the requirement is for 70% certified wood (assessed as mass balance), with the rest as non-certified "controlled wood". FSC and PEFC "controlled wood" will automatically satisfy the requirement.

In many places, especially in the tropics, forests are being cleared to make way for other uses. These could be mining, different forms of agriculture or cultivation of soya, maize, palm oil, sugar cane etc. This requirement must thus ensure that the felled timber does not stem from natural forests or protected areas, etc., and that felling does not destroy or damage forest biodiversity or special ecosystems.

If a product comes from forests certified to a forestry standard approved by Nordic Ecolabelling, it is not necessary to provide further documentation of the requirement. For example, Nordic Ecolabelling regards FSC and PEFC Chain of Custody (CoC) certification as examples of systems for corroborating the traceability of fibre raw materials.

The new EU Timber Regulation (995/2010) came into force in April 2013. The Timber Regulation covers the felling of timber and the production of wood raw materials both in

and outside the EU. The aim of the regulations is to tackle the global problem of illegal logging and to counteract supply of and trading in illegally felled timber and timber products of illegal origin in the EU.

To a certain extent, the requirements of the Timber Regulation regarding businesses facilitate compliance with Nordic Ecolabelling's requirements for the origin and traceability of wood raw materials. However, the Timber Regulation does not completely meet Nordic Ecolabelling requirements for wood products, but may help to document the origin of the wood raw material. The Nordic Ecolabelling requirement that the wood raw material may not stem from natural forest, areas of high biodiversity, special ecosystems and important ecological functions, nor impair social and cultural assets, is not covered by the Timber Regulation. The Timber Regulation covers illegal logging and follows the legislation of the country in question. Hence it will not give sufficient assurance that the wood comes from sustainable forestry.

O7 Certified solid wood, veneer and bamboo

The requirement applies to solid wood, veneer and bamboo included as raw material for building boards.

70 wt.% of all wood for parts made of solid wood and veneer and 70% of all bamboo must come from certified forests. Alternatively, the bamboo may be organically cultivated or the cultivation may be in the process of conversion to organic production.

The requirement may be documented as purchased wood and bamboo on an annual basis either for the whole company or the Nordic Ecolabeled production alone (minimum 70% certified wood must be credited to the Nordic Ecolabeled production).

Certification must be performed by an independent third party.

Certification must be to a valid forestry standard which fulfils the requirements for standards and certification systems laid down in Appendix 4c.

✉ The proportion (%) of certified wood or bamboo included in the applicant's annual ecolabelled production. Appendix 4b may be used.

✉ Copy of forestry certificated signed and approved by a certification body.

Nordic Ecolabelling may require further documentation to assess whether the requirements for standards, certification system and certified proportion have been satisfied. E.g. a copy of the certification body's approval report, a copy of the forestry standard including name, address and telephone number of the organisation which drew up the standard, and references to persons who represent the parties and interest groups invited to participate in the development of the forest standard.

Background to requirement

The requirement has been updated to harmonise with Nordic Ecolabelling's most recent formulation. The requirement has been tightened since the last version, as now 70% certified wood is required, compared to 50% before. At the same time, the requirement has been extended to include bamboo. Forestry entails an impact on the environment. From a life cycle perspective, forestry is an important part of the wood product's environmental impact. Forests may gradually become impoverished unless exploitation is sustainable, for instance if felling consistently outstrips continuous regrowth. This can

lead to increased CO_2 emissions which increase global warming, and it can damage the forest's biodiversity. Other examples of non-sustainable forestry management could be ignoring the needs of forest workers, small local communities or aboriginal peoples who depend on the forest for their livelihood. The use of wood which cannot be documented as sustainable may risk stimulating such effects.

To reduce this environmental impact, requirements have been laid down that products based on raw materials made from solid wood must contain at least 70 wt.% certified wood according to a standard for sustainable forestry. At least 70% certified wood must be credited to the Nordic Ecolabeled production, but the requirement may be documented for the total production of the company.

Nordic Ecolabelling approves forestry standards (e.g. national standards) which fulfil the requirements of Appendix 4c of the criteria document.

The supply of certified wood is continuously being increased and in the first quarter of 2013 amounted to a total of about 418 million hectares. There is still a potential for increasing this, and Nordic Ecolabelling wishes to make a contribution here by encouraging the use of certified wood in ecolabelled products. Table 13 shows figures from FSC and PEFC for the first quarter of 2013.

Table 13 Number of certified hectares at global level. Figures from first quarter 2013

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

According to a market report from the UN, western Europe has certified more than 50% of its total forest area, and Northern America more than one third, while Africa and Asia have only certified 0.1%. In tropical areas, 40% of the certified forest areas are based on certification schemes that are not certified by third parties.

Bamboo

There has been a strong increase in demand for bamboo products, and Nordic Ecolabelling therefore wishes to ensure that this raw material is not sourced from areas where conservation of biodiversity or social assets are threatened. Bamboo is a type of grass and is the fastest growing plant in the world. It can be harvested after approximately 7 years, without any of the plant dying. It is often claimed that bamboo is harder than deciduous timber and thus well-suited for flooring, chopsticks, salad bowls etc. More than 1,200 species of bamboo are found in Asia, Central America and South America, as well as some species in parts of Africa and Australia, and the species have various uses.

Bamboo grows wild like a weed and generally does not require pollination or spraying. Bamboo is also used to prevent soil erosion in vulnerable areas. When bamboo is felled,

new shoots grow on the stump that is left. This also makes it difficult to remove bamboo once it has become established.

Due to the increased pressure on bamboo today, there is a risk that forest felling and use of pesticides and fertiliser may destroy well-functioning ecosystems. According to Inbar (International Network for Bamboo and Rattan) bamboo is a natural resource and is extracted from uncontrolled natural forests in southwestern China. But in many areas, poor felling practices can jeopardise the fauna that depend on bamboo (such as the red panda (bear cat) and the Giant Panda) and generally undermine ecosystems. Bamboo is also cultivated in plantations of different types.

Today bamboo can be certified according to a sustainable forestry standard, or certified as organically cultivated. Fibre raw material that is certified as organically cultivated or which stems from areas that are being converted to organic production must be cultivated in accordance with EU regulation 2092/91 or 834/2007 or cultivated in similar fashion under an equivalent certification system, e.g. KRAV, SKAL, IMO, OCIA, etc.

Nordic Ecolabelling has not developed its own requirements for sustainable production of biomass, but has chosen to lay down a requirement that sustainable production of biomass must satisfy existing forestry and certification standards or schemes.

O8 Use of biocides in tree felling

The requirement applies to solid wood, veneer and bamboo as constituent raw materials.

After felling, the wood must not be treated with pesticides with WHO classifications 1A and 1B.

The requirement relates to the treatment of logs after felling.

WHO classification: An overview can be obtained from internet address htttp://www.who.int/ipcs/publications/pesticides_hazard/en/, "The WHO recommended classification of pesticides by hazard and guidelines to classification 2009" or on application to one of the secretariats.

✉ A statement from the wood suppliers as to the pesticides used and a declaration in accordance with Appendix 4a for each product.

Background for the requirement

Wood (logs after felling) must not be treated with pesticides with WHO classifications 1A and 1B. These pesticides have a negative impact on the environment. Insect attacks can often be remedied in other ways, e.g. by keeping the wood covered and dry.

The requirement has not been changed from previously, but the reference to the WHO website has been updated to refer to the latest list of recommended pesticides.

Specific requirements for paper and cardboard

The requirements applies to paper or cardboard which constitute > 5 wt.% of the finished panel.

O9 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 14 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.

Table 14 COD requirement levels for different pulp and paper types

Pulp type	Total COD level kg/ADt for pulp and paper
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.

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 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, P and N. 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 values from the BREF document of 2000.

Previously there were requirements for bleaching of paper and for tensides 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.

4.3.3 Resources

The growth in the world economy and the growing world population (9 billion in 2050) mean that the world's resources are being quickly depleted. Higher demand for certain resources will lead to shortages. It is therefore necessary to manage resources more effectively throughout their life cycle. In the part of the resources' life cycle covered by the production of construction panels, it is therefore important to increase the use of recycled and renewable materials in order to reduce the drain on resources.

Due to the difference in recycling systems for the different materials and the different opportunities for using alternative raw materials, specific requirements have been developed for the individual panel types in relation to resources. For wood-based panels and constituent paper raw materials in e.g. HPL panels, the requirement for recycled fibres has been combined with a requirement for certified wood raw materials in requirement O2.

O10 Resource requirements plasterboards

As a minimum, at least 20 wt.% of recycled gypsum must be used in the plasterboard, in the form of waste gypsum from demolition and refurbishment of buildings.

The remainder of the constituent gypsum raw material must be industrial gypsum (residual product from power stations).

This requirement may be documented as an annual average for plasterboard production.

✉ A declaration from the recycled materials supplier, showing the amount of recycled material received in accordance with the requirement. Appendix 5 may be used.

✉ Applicant's calculation showing that the requirement level has been reached.

Background for the requirement

The requirement is new since the previous version of the criteria.

Plasterboards are produced from natural gypsum, industrial gypsum and waste gypsum powder. Natural gypsum is won from mines, mainly in Europe and USA. Industrial gypsum is a residual product from flue gas scrubbing for sulphur dioxide in coal-fired power stations. Waste gypsum comes from demolition and refurbishment of buildings. Both industrial gypsum and waste gypsum powder thus replace natural gypsum. Volumes of gypsum waste from building work, demolition and renovation of buildings in Denmark in 2009 were estimated at 54,000 t. Only 22,500 t of this went to either plasterboard production or cement production. The rest went to composting and for covering slag heaps (e.g. in Germany).

Recycled gypsum is here defined as waste gypsum from demolition and renovation of buildings. Here a potential has been identified for ensuring that plasterboard production is designed to handle waste gypsum, so that waste gypsum does not go to composting or covering purposes, where the environmental benefit is lower. At the same time, there is also a potential for increasing the amount of waste gypsum collected from the building industry. The percentage has been set to 20%, as the plasterboard manufacturers are dependent on the quantity of waste gypsum collected.

Most Danish industrial gypsum is reused, either by sale to the plasterboard industry or for cement production at Aalborg Portland. The fraction which is not reused does not meet the manufacturers' quality requirements. It must be anticipated that the volume of industrial gypsum will fall in the future, as coal is superseded by biomass or other sustainable energy source which does not generate as much sulphur pollution as coal. This means that the need for natural gypsum will rise in the first instance. Hence there is no potential for encouraging increased use of industrial gypsum in plasterboard production. What can be used will be used, and the volumes can only be increased by increasing the use of power and district heating stations. Therefore the biggest environmental benefit is from encouraging greater use of waste gypsum from buildings. The requirement level of 20% has been set to ensure that production is able to handle the waste gypsum collected[24].

The processing of gypsum waste to make gypsum powder for either manufacture of new plasterboards or use in cement production represents two environmentally equivalent solutions, although plasterboard production is slightly better than the cement solution from a socio-economic perspective. This can be seen from an analysis performed by the Danish Environmental Protection Agency in 2012[25]. Both solutions give the same environmental savings, largely from the substitution of natural gypsum. Apart from use in the production of new plasterboards or for cement production, gypsum waste can be used for composting or used for covering.

In the Nordic market, Gypsum Recycling has a presence throughout the region. According to the Gypsum Recycling website, large plasterboard manufacturers such as Norgips, Knauf Danogips and Saint-Gobain (with sub-brands Gyproc and Rigips) use about 20 to 25% recycled gypsum in their plasterboards. Thus the remaining 80% could be industrial gypsum. In Denmark, there are also the two firms Freiberg & Jespersen and PR Slam, each of which has a technology for producing gypsum powder, and all three seem able to process the powder to a quality which can be employed for demanding uses such as cement and plasterboard production. The financial difficulty of selling waste gypsum powder seems to be due to the powder reaching a poor price compared to natural gypsum, including shipping transport. The poor price must be assumed to be due to the very limited competition between purchasers of waste gypsum powder. One of the few reasons which gives the plasterboard manufacturers an incentive not to charge (or not to charge more) for the gypsum powder is that the gypsum waste is increasingly sold for composting and covering purposes. Without these two processing forms, plasterboard manufacturers would be able to set higher prices, as in practice they would have a local monopoly on the purchase of gypsum powder for reuse.

However, some of the gypsum waste processors are working to expand the market for sales of waste gypsum powder to other manufacturers who use gypsum.

It is therefore assessed that there is a potential for requiring a certain proportion of recycled gypsum in the plasterboard. On looking through the EPDs for plasterboards, it can be seen that there are examples of plasterboards with a content of recycled gypsum of 2% and others which have up to 99%. However, this includes both waste gypsum and industrial gypsum, and the two are not necessarily stated separately.

[24] Life cycle assessment and social economic assessments of different alternatives for handling and treating gypsum waste, MST 2012
[25] Life cycle assessment and social economic assessments of different alternatives for handling and treating gypsum waste, MST 2012

O11 Resource requirements for mineral wool panels

As a minimum there must be 50 wt.% recycled material in the panel. The requirement may be documented annually in the production of mineral wool panels.

Recycled raw materials are defined in this requirement as post-consumer, cf. definition in ISO 14021.

✉ A declaration from the recycled materials supplier, showing the amount of recycled material received in accordance with the requirement. Appendix 5 may be used.

✉ Applicant's calculation showing that the requirement level has been reached.

Background for the requirement

The requirement is new since the previous version of the criteria.

Fibreglass may have a high content (> 80%) of reused materials: household glass, discarded bottles, internal waste from fibreglass production process, etc. In fibreglass production it is common to reuse batch waste, fibreglass fragments and dust from collection systems directly in the furnace. Part of the fibreglass waste cannot be recycled directly in the melting furnace due to a content of organic binders, unless this organic fraction is removed by specific treatment of the waste. In stone wool processes, fibre waste can be reused by crushing/pulverisation. Selvedges from the stone wool can be pulverised and recycled[26].

However, internal production waste does not count in the requirement, as it is assumed that it is profitable to reuse this fraction, and that it will always be reused as much as possible. Additionally, this cannot be compared from an environmental point of view with post-consumer recycled mineral material.

A high potential is seen here for ensuring the use of post-consumer recycled fibreglass and stone wool or other recycled raw materials for new production of mineral wool. For example, it is possible to use crushed ceramic material from discarded sanitary ware in stone wool production.

O12 Resource requirements for cement-based panels

As a minimum there must be 50 wt.% renewable or recycled material in the panel. The requirement may be documented annually in the production of cement-based panels.

Recycled raw materials are defined in this requirement as post-consumer, cf. definition in ISO 14021, and as waste products such as fly ash and industrial slag.

✉ A declaration from the recycled materials supplier, showing the amount of recycled material received in accordance with the requirement. Appendix 5 may be used.

✉ Applicant's calculation showing that the requirement level has been reached.

Background for the requirement

The requirement is new since the previous version of the criteria.

[26] BAT Reference Document for the Production of Glass, EU Commission 2012

The main material in cement-based panels is often cement. There may be up to 80% cement in some panels, but there are also panels with a cement proportion down to around 30%. A high content of Portland cement (basic cement, cf. EN 197-1) in the panel leads to an overall high energy impact and thus correspondingly high use of resources in respect of consumption of energy raw materials. The commonest energy raw materials for cement production are the different conventional fossil and waste-based fuels[27]. A reduced cement proportion could thus reduce the resource demand for fossil raw materials. Portland cement consists of 95 to 100% cement clinker (mineral raw material) and is thus almost unmixed, apart from a small proportion of possible additives.

The cement helps to make the panel humidity-resistant and weather proof and give it good fire inhibiting properties. However, there are also examples of cement-based panels which are non-flammable and only contain around 40% Portland cement. Parts of the Portland cement can be replaced with other mineral raw materials which are waste raw materials from other industries. One example of this would be fly ash.

Apart from the cement, renewable fibres such as wood fibre (lignocellulose fibre between 2.5 and 3 mm) are often also included, often in varying amounts depending on panel type (between 3 and 30%). The wood fibres may be either virgin or recycled. Finally water and inorganic fillers such as sand, lime, silicates, kaolin and aluminium hydroxide are used. In certain panels, the wood fibre is replaced by synthetic fibres, such as PVA fibres.

A potential has been identified for ensuring a high use of recycled raw materials (recycled fibres) and waste products such as fly ash and industrial slag as materials in the panel. For example, fly ash could replace part of the cement in the panel in quantities up to 50%.

4.3.4 Energy

General background for energy requirements

The smallest environmental impact from energy is from energy we do not use. An improvement of the construction panel's total energy efficiency will thus entail lower energy consumption and thus lower the CO_2emissions. A reduction in energy consumption will thus help lower the consumption of fossil raw materials and reduce the greenhouse effect and, with it, global warming. As most of the energy raw materials used are still fossil-based, energy reduction will lead to overall reduced consumption of fossil raw materials, regardless of the energy sources used.

For construction panels, there is generally high environmental relevance associated with energy consumption in material production and the actual panel production. Several of the production systems have processes which use a great deal of heat or pressure, and some panel types use energy-intensive and/or CO_2intensive materials.

The energy requirements have been changed since the previous version. The requirement is now a pure energy requirement without weighting with other parameters such as certified and renewable raw materials. The latter parameters are dealt with by specific requirements where relevant.

[27] Reference document on best available techniques in the cement, lime and magnesium oxide industries, 2010

Differentiated energy requirements

There is a wide variation of material types and production processes among the different panel types. It has therefore been decided to set differentiated energy requirements formulated in a life cycle perspective for the individual panel types within the product group. This achieves the best controllability of the energy requirement. The product group comprises the following panel types: wood-based panels (including laminated wood panels), HPL panels, plasterboards, mineral panels and cement-based panels.

As the individual energy requirements have been set on the basis of the environmental impact of the specific panel type's life cycle, these may have different system limits, and in such cases the requirements are not mutually comparable. This accords with the idea that the product group consists of several functional units, and it is thus not the intention to pinpoint the overall best type of construction panel. Instead, each panel type (HPL panels, wood-based panels, plasterboards, mineral wool panels and cement-based panels) is a separate functional unit and the aim of the criteria is to find the best panels within the individual panel type.

Applied energy

For all panel types, it has been assessed that an energy requirement in this product group will best encourage a reduced environmental impact if the requirement relates to the actual energy applied and not to the primary energy. The requirement must therefore be documented in the form of applied energy without use of primary energy factors. In this case high potential or controllability has not been identified for an energy requirement which encourages specific fuel sources. Heat energy is the biggest energy item in the actual panel production systems. Most types of panel production systems are mainly based on fossil fuels, and some manufacturers still need to alternate between different types of fossil fuel. Only in the production of wood-based panels is there local application of a high proportion of renewable fuels. Here the waste wood of insufficiently high quality for the panels is put to use. It has therefore been assessed that the maximum controllability lies in ensuring reduced energy consumption in the panel and not in encouraging specific fuel sources. However, it is desired that the fuel sources applied should be indicated when documenting the requirements for panel production systems, as this information is relevant for future revisions of the criteria.

The main aim of the Nordic Ecolabelling energy requirement is to promote high energy efficiency. Hence, the requirements are formulated with requirement levels in the form of applied MJ/kg panel. Where energy requirements are also set for materials production, the functional unit could be MJ/kg material. The panels are produced in very different thicknesses and thus MJ/m^2 as a parameter in an energy requirement for panel production would not permit comparisons to be made. A functional unit in the form of MJ/kg has thus been selected.

Common to most of the panel production systems is that the main energy applied is heat energy (often around 80% of the total panel production energy), and that electric power and heat energy are sometimes correlated. For instance, this could be through the installation of heat exchangers, which provide a lower rise in power consumption, but may also reduce heat consumption considerably. By setting a total requirement for electricity and heating, the applicant gains flexibility for ensuring energy-efficient production, while the requirement encourages an overall low energy consumption (this does not apply to the applied fuel in the requirement for paper production).

As the total energy impact of the panel in its life cycle is often also correlated with the use of recycled materials, the requirements for recycled materials must be regarded as both a resource requirement and an energy requirement. For plasterboards and mineral wool and cement-based panels, it was found that a requirement for a certain proportion of recycled material in the panel is an important parameter for the product's energy performance. Further requirements for recycled materials can be seen in requirements O10 to O12.

O13 Energy requirements for paper and pulp production

The requirement covers paper and pulp which are present at more than 20 wt.% in the finished panel.

The following requirements must be satisfied for paper or pulp:

$P_{electricity(total)} < 1.25$

$P_{fuel(total)} < 1.25$

P stands for energy point for paper/pulp production. In $P_{electricity(total)}$ and $P_{fuel(total)}$, energy points are included from both paper production and the pulps used in the paper. See further explanation in Appendix 6.

✉ The pulp and paper manufacturer must submit a calculation according to Appendix 6 which shows that the points limits are being satisfied. The calculation sheet developed by Nordic Ecolabelling must be used for the calculation.

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 20 wt.%. 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 20 wt.%. 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 wt.%, but may be higher. For HPL panels, around 50-60% kraft 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 points 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 points model allows higher energy consumption in order to provide flexibility for the paper manufacturer.

Sub-division into electricity and fuel

The basic module proposes a points limit for both fuel and electricity consumption of 1.25. The requirement is intended to secure energy optimisation of electricity consumption. The reason for the new points limit of 1.25 for fuel and electricity consumption is to secure a stringent energy requirement for paper for approval according to the requirements in the basic module. This requirement limit may apply, for instance, to paper for printing works or for hygiene products, depending on how the requirements are formulated in the different criteria documents.

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

O14 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 10 MJ/kg panel may be used for producing the panel.

HPL panels ≤ 2mm thick:

No more than 6 MJ/kg panel may be used for producing the panel.

The requirement does not include extraction of resources. 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%, kraft paper 55-62%, melamine resin 2-12% and phenolic resin 20-32%[28]. 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 15 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

**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.

[28] EPD for Decorative High-Pressure Laminates, International Committee of the Decorative Laminates Industry (ICDLI), 2012

Energy data shows that more energy is used to produce 1 kg thin HPL panel than 1 kg thick HPL panel. To achieve the optimum controllability in the requirement and to ensure that the requirement is also stringent with regard to the thick HPL panels, a differentiated requirement level is stipulated for thin HPL panels (<2 mm) and thick (>= 2 mm) compact laminate panels. ICDLI sub-divides HPL panels according to thickness in the same way.

O15 Energy requirements for wood-based panels

Energy consumption is calculated as an annual average for either just the ecolabelled production or for the whole enterprise. Energy consumption calculated as MJ/kg panel must include the primary panel production and the production of the constituent main raw materials. Main raw materials are the raw materials which make up more than 2 wt.% of the finished panel (for example wood fibre and adhesive).

Energy consumption for obtaining raw materials must not be included. In panel production, the energy calculation must be based on data available from the time of raw materials handling (including drying of wood and conveyor belts both in the saw works and on the production line) up to the finished product prior to any surface treatment. Energy consumption for surface treatment must not be included. In production of chemicals such as adhesives, the energy calculation is based on data available from the time of the production of the adhesive and of the constituent raw materials. The energy content of the raw material must not be included. In exceptional cases, a table value for adhesive of 15 MJ/kg (ready-to-use solution) may be used.

Chipboards:

No more than 7 MJ/kg panel may be applied for producing panels (excluding any surface treatment)

Wood fibres/veneer and laminated panels:

No more than 8MJ/kg panel may be applied for producing panels (excluding any surface treatment)

The requirement does not include extraction of resources. Self-produced energy and resold surplus energy should be stated, but will not count as applied energy in the calculation.

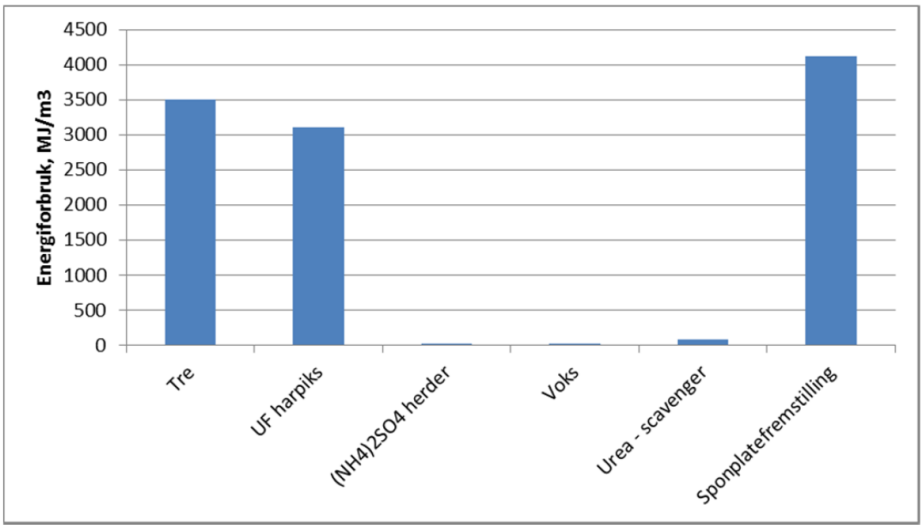
✉ A calculation should be submitted documenting compliance with the requirement. The calculation must contain information about: quantity of produced panels, applied electricity and fuel, and which fuel sources are being used.

Background for the requirement

An energy requirement is set with the same system boundary as in the present version. However, the requirement has been changed so that it is now an absolute requirement for applied energy without weighting for certified and recycled raw materials and fuel sources (as in the previous version of the criteria). The requirement level is expressed as applied MJ/kg panel and thus is solely aimed at energy consumption in panel production, including production of raw materials such as processing and drying of wood and production of adhesive and of the raw materials for the adhesive. The system limit for the energy requirement for wood-based panels also includes the production of main raw materials (except for obtaining the raw materials). The reason for this is that, in respect of wood-based panels, RPS (Relevance, Potential and Controllability) has been identified for letting the energy requirement additionally cover the drying of the wood, both at the saw works and by the panel manufacturer. It has been assessed that there is low

controllability for obtaining specific production data for production of both the adhesive and of the raw materials in the adhesive. Nor has it been possible to identify any potential in relation to energy-efficient adhesive production. The requirement thus contains an option for applying a table value for the adhesive of 15 MJ/kg adhesive. This ensures that the adhesive counts in the wood panel's energy calculation and that there is no advantage in using more adhesive than necessary.

Table 16 Energy consumption for chipboard production, cradle to gate[29]



Figur 9.3.2. Energiforbruket fordelt på de ulike prosesskomponentene vugge til port.

The energy impact of the production of a chipboard panel, including material production, breaks down as approx. 40% energy for the actual panel production and approx. 30% from wood production, with adhesive production also at 30%, cf. Table 16. The highest controllability for regulating energy consumption lies in the actual panel production. The potential for energy improvements in panel production lies in reducing heat consumption by reusing process heat. Heat consumption can be optimised by ensuring suitable operation of the drying process by adjusting drying temperatures and times to make effective use of energy and by selecting the lowest optimal drying temperature, while still achieving the necessary final moisture content. At the same time there is an opportunity for completely closed recirculation of flue gases from the drying processes when drying the wood particles. This can be used for chipboard and OSB production[30].

The adhesive generally makes up 10-12 wt.% of a chipboard panel, but out of the total energy consumption for a panel (cradle to gate), the adhesive accounts for 30%[31]. The actual adhesive production (mixing the finished adhesive) is not particularly energy-intensive. Here, depending on adhesive type, between 0.4 and 1.6 MJ/kg is applied. The majority of the energy for adhesive production stems from the production of raw materials such as melamine, urea, phenol and methanol, which are present in UF, MUF, PF and PRF adhesives.

[29] Adhesive systems for laminated wood and chipboard, Sintef 2012
[30] BAT Reference Document for the Production of Wood-based Panels, EU Commission Draft 2013
[31] Adhesive systems for laminated wood and chipboard, Sintef 2012

As the greatest energy relevance for the adhesive lies in the raw materials production, it can be difficult to obtain data for this, as it is several links back in the product chain. An option has therefore been given for using a table value for the adhesive contribution. The table value is 15 MJ/kg adhesive and represents the same system limit as is used in the requirement. The value thus does not include the extraction of the crude oil, but only the actual production of raw materials in the adhesive and the production of the adhesive.

O16 Energy requirements for plasterboards

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

No more than 4 MJ/kg plasterboard may be applied for total applied electricity and fuel in panel production.

The requirement does not include extraction of resources. 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, applied electricity and fuel, and which fuel sources are being used.

Background for the requirement

With plasterboard, the materials contribute more or less the same as the actual panel production, if 100% natural gypsum is used. The greater the proportion of recycled gypsum in the panel, the greater relative significance the actual panel production will have from a pure energy point of view.

Panels with a high content of recycled or industrial gypsum appear to have the greatest energy relevance for the production of plasterboards. Production is not particularly energy-intensive, but many heat-using processes are applied, which thus give a potential for optimising energy efficiency of production. In the actual panel production, approximately 90-95% of the energy applied is heat energy and the remainder is electricity (according to consultant's report from Force in 2013). Fossil-based fuel energy is the main source used, in the form of natural gas and, rarely, biomass.

Figure 4 shows the energy impact of a plasterboard with approx. 99% recycled plasterboard (industrial gypsum + waste gypsum). This reduces the energy impact of raw materials considerably. As the criteria require a certain proportion of recycled gypsum in the panel in requirement O10, the highest energy relevance, potential and controllability lie in the requirement for the actual panel production.

The majority of the energy in panel production is used in hot processes, and hence attempts are often made to improve the reuse of waste heat from the different production processes. Waste heat is lost from several part-processes and there is a potential for recovering waste heat from as many processes as possible. This can be done by installing efficient heat exchangers.

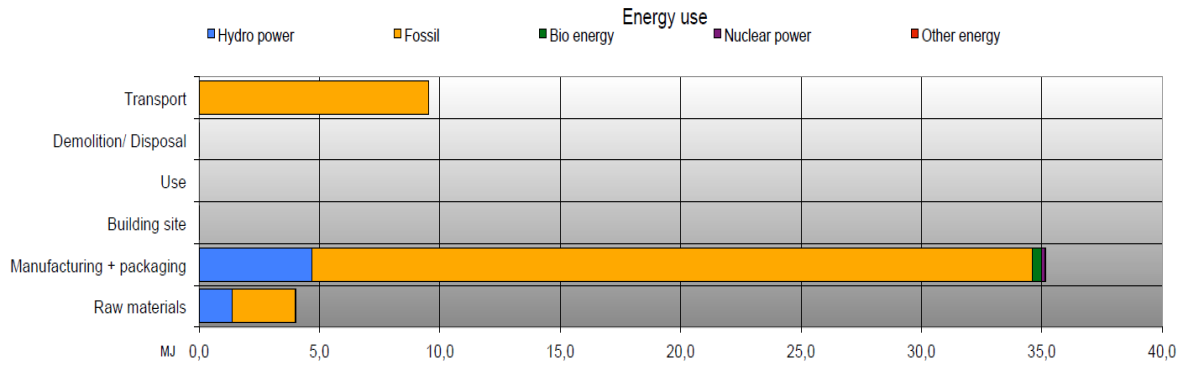


Fig 4 Source: EPD Norgips Plasterboard 13, figures per m²

O17 Energy requirements for mineral wool panels

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

In total, no more than 8 MJ/kg mineral panel may be applied for electricity and fuel

The requirement does not include extraction of resources. 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, applied electricity and fuel, and which fuel sources are being used.

Background for the requirement

In the case of panels made of mineral wool, such as fibreglass or stone wool, it is possible to use a high content of recycled material in the panel. This reduces the energy consumption for raw material production. By doing so, actual panel production will contribute the largest energy impact in the manufacture of mineral wool panels.

Fibreglass: Panel production of fibreglass panels includes the melting of the glass. This process is very energy-intensive and the selection of energy source, heating technology and heat recovery method are central parameters in the design of the furnace. The same choices are also among the most important factors affecting environmental performance and energy efficiency of the melting operation. The three most important energy sources for glass production are natural gas, fuel oil and electricity. The use of natural gas is increasing in the glass industry for reasons of economy, cleanliness, lightness, control and the absence of requirements for storage facilities. Many large furnaces are equipped for operation with both natural gas and fuel oil. Changing the fuel requires only a simple change to the burners. Some manufacturers exploit this by changing the fuel to use the cheapest source available. It is also common to use electricity as an energy source in combination with fossil fuel.

In fibreglass production, melting is often started in a cold furnace, but with the aid of residual heat from flue gas the material can be preheated, thus achieving considerable energy savings. This potential energy saving only applies to fossil-fuel fired glass furnaces. The stone wool industry generally uses furnaces which are designed to preheat the raw materials.

Stone wool: The commonest melting technology for producing traditional stone wool is a coal-fired hot-blast cupola furnace, which in operation can be compared with a blast furnace for steel production. This technology is used to melt a combination of aluminium silicate stone (normally basalt) and limestone or dolomite and sometimes blast furnace slag. The stone is in solid form to allow the formation of an air-permeable column of material in the furnace which permits the heat transfer processes which need to be maintained. There are also examples of electric melting and gas-fired furnaces for stone wool production.

A potential has been identified in mineral wool panel production for reducing the energy consumption of panel production. This could be by process optimisation through control of operating parameters, regular maintenance of the melting furnace, optimisation of furnace design and choice of melting technology, use of combustion control techniques, or use of waste heat in a boiler to exploit the energy, where technically and economically feasible. The extent to which this technology is viable and financially feasible will depend on the overall efficiency achieved, including how effective a use is made of the generated steam.

O18 Energy requirements for cement-based panels

The requirement covers the total energy impact from the constituent materials in the panel. The requirement covers all materials used in the panel which are present at more than 1 wt.%. To calculate this, table values are applied from Table 17 for each material, weighting them in proportion to the amount of material present in the finished panel.

No more than 5 MJ/kg panel may be applied.

The table values express the energy impact of the material with the system limit cradle to gate, e.g. the calorific value. It is not permitted to use privately obtained values.

Nordic Ecolabelling reserves the right to assess which table values are to be used when using materials not specifically laid down in the table or in case of doubt over choice of table value.

Portland cement is defined in accordance with Standard EN 197-1.

Table 17 Table value for energy for material production cradle to gate

Material	Primary energy MJ/kg (both renewable and fossil-based)
Portland Cement	8
Kaolin	5.4
Fly ash (hard coal ash from furnace)	0.4
Limestone flour	0.4
Silicate sand	0.6
Aluminium hydroxide	10
Magnesium oxide	2.7
Magnesium chloride (value for MgO)	2.7
Pozzolanic Filler	83
Residual wood (hardwood u=80% moisture content dry basis)*	5

Residual wood (softwood u=140 % moisture content dry basis)	2
Sawdust (chips u=70% moisture content dry basis)*	2
Wood chips (chips u=70% moisture content dry basis)*	1.5
PVA fibre (synthetic fibre)	202
Clay, expanded	4.8
Glass Foam	25.2
Fibreglass	35.2
Polyacrylonitrile (PAN) fibre	82
Other plastic fibres	200

** 70% "moisture content dry basis" means 0.7 m^3 water per 1 m^3 dry wood. This is the same as a moisture content of 41% "moisture content wet basis". In the case of a different moisture content in the wood raw material, a conversion must be made by using an energy figure for dry wood, which would be 2.5 MJ/kg dry substance wood (water content of 0%) for wood chips. A similar conversion must be made for other wood raw materials.*

✉ A calculation should be submitted documenting compliance with the requirement.

Background for the requirement

The main material in cement-based panels is often cement. There may be up to 80% cement in the panel, but there are also panels with a cement proportion down to around 30-40%. Apart from the cement, renewable fibres such as wood fibre (lignocellulose fibre between 2.5 and 3 mm) are often also included, often in varying amounts depending on panel type (between 3 and 30 %). The wood fibres may be either virgin or recycled. Finally water and inorganic fillers such as sand, lime, silicates, kaolin and aluminium hydroxide are used. In certain panels, the wood fibre is replaced by synthetic fibres, such as PVA fibres or fibreglass. Cement production is energy-intensive and also generates high CO_2 emissions. See a further explanation of this at the end of this section. There are alternative raw materials with a lower energy impact for part of the cement.

The cement-based panels on the market exhibit a wide variation in material composition. As there is a big difference in energy consumption in the production of the different material types, a potential has been identified for encouraging a material composition with low energy impact. Some of the material variation is justified by differences in the panels' functions and properties, as cement-based panels can be used both indoors and outdoors and also have different positions in the building's facade. The panel types with a high content of Portland cement have a high potential for substituting part of the Portland cement with fly ash or other mineral raw materials with a lower energy consumption.

No significant energy relevance has been identified for the actual panel production. Material production contributes the highest energy impact in the panels' life cycle. For this reason it has been decided not to set a requirement for the actual panel production, but instead apply a requirement to the materials as described above.

The energy requirement has been formulated to encourage panels of an overall material composition with a reduced energy and CO_2 impact, as the quantities of constituent materials are weighted by their energy impact (cradle to gate). The energy-intensive materials contribute a high energy impact, and the requirement thus encourages ecolabelled cement-based panels to replace their energy-intensive materials with less energy-impacting materials where possible. This means a reduced content of Portland

cement, for example, through the use of some of the cement composites/mixtures in which the proportion of Portland cement has been reduced. Components permitted in the various Portland composite cements are artificial pozzolans (industrial slag, silica fume and fly ash) or natural pozzolans (silicate materials or alumino-silicate materials such as volcanic ash, burnt clay and shale).

At the same time a potential has been identified for reducing the content of synthetic fibres, which are both fossil-fuel based and use a great deal of energy raw materials in their production. A potential has also been identified for using recycled raw materials (recycled fibres) and waste products such as fly ash and industrial slag as materials in the panel. Fly ash may replace part of the cement in the panel.

The cement clinker burning process is responsible for the biggest environmental problems in cement production, both in terms of energy consumption and emissions to air. The high energy consumption of the clinker burning process is the most significant for the serious environmental problems caused by cement production[32]. The production of 1000 kg basic cement requires 4567 MJ[33], while large quantities of CO_2 are emitted from the process. To produce 1 t clinker, the typical average consumption of raw materials in the EU is 1.52 t. Most of the difference is lost during the process as carbon dioxide emissions to the air from the calcination reaction ($CaCO_3 \rightarrow CaO + CO_2$). The cement thus has a higher CO_2 impact in addition to that due to energy consumption.

Table 17 contains database values for the materials' energy impact cradle to gate, e.g. calorific value. Values have here been taken from PE International Professional 2012 database, EcoInvent Integrated database and from a consultancy report prepared by Force Technology. For wood raw materials, for instance, the calorific value is approx. 10 MJ/kg and as this energy is available in the panel after end-use it is therefore subtracted here. The same has been done for other raw materials with a calorific value.

The cellulose fibres used also contribute to energy impact from material production, depending on how large a proportion of them is present. But if instead of looking at energy, when the total CO_2 impact from the use of cellulose fibre is considered, the picture looks different, as sustainable wood raw materials can be considered a CO_2 uptake. However, when comparing cement and wood fibre, it is also relevant to remember that the burning of lime in cement production emits a good deal of CO_2. Cement has a CO_2 impact of between 0.7 and 0.8 CO_2 equivalents per kg, while wood fibre is renewable and its impact is only around 0.37 CO_2 equivalents per kg[34]. For this reason, relevance has been identified in cement-based panels for other measures for dealing with the CO_2 impact from the materials in addition to the impact correlated with the energy consumption. Hence, the table value has been doubled, as approximately half of the CO_2 impact has been correlated with energy consumption, and similarly, the table values for renewable raw materials have been halved to reflect CO_2 take-up in the cultivation phase.

The table indicates the energy values with the unit MJ/kg material. From these figures it might look as if the wood raw materials are more energy-intensive than, for instance, cement. Here the unit must be borne in mind. If the table values were instead entered as MJ/m^3, the relationship between the different materials would change due to the

[32] Reference document on best available techniques in the cement, lime and magnesium oxide industries, EU Commission 2010
[33] EPD for Basic Cement from Ålborg Portland
[34] Ecoinvent integrated database

materials' different densities. For instance, the density of cement is approx. 1.25 t/m^3 while it is approx. 0.7 t/m^3 for wood chips (in cubic metres). This gives approx. 10,000 MJ/m3 for cement and approx. 1050 MJ/m^3 for wood chips. These values are again without calorific value and with a CO_2 weighting, as with the values for MJ/kg. However, it has been decided to express the energy impact in MJ/kg in this requirement, as the manufacturers communicate the products' material composition in wt.%. For example, via an environmental declaration for the construction panel. At the same time, the materials' energy figure is per kg material. Converting to the volume would impart uncertainty to these energy figures due to the variation in density within the material type.

4.3.5 Requirements for chemical products

The requirements cover the chemical products included in the production of the ecolabelled panels. Either as additives to the panel or in surface treatments. The requirement relates to chemical products such as adhesive, additives and surface treatment. Auxiliary chemicals such as lubricating oil for mechanical equipment are not covered by the requirement.

Several of the requirements are aimed at the ingoing substances in the chemical product. See definition of ingoing substance in Section 1.1.

O19 Classification of the chemical product

The chemical product used in the production of the ecolabelled panel must be classified in accordance with the current legislation (CLP Regulation 1272/2008 or the EU's Dangerous Preparations Directive 1999/45/EEC 2008, or later) and may not be classified in accordance with Table 18 below.

Exemptions:
Adhesives and resins of formaldehyde and phenol are exempted from the prohibition of classifications with R40/H351. Instead the formaldehyde content of adhesives is regulated in requirements O288 and O322, which deal with formaldehyde emissions from the panel.

Adhesives and resins for production of HPL panels are exempted from the prohibition of classifications with R23, R24, R25, R39/H301, H330, H331, H370 and combinations of these and with R68/H341 and R40/H351. Emissions from HPL production are regulated in requirement O300.

Table 18: List of non-permitted classifications of chemical products in accordance with the CLP Regulation 1272/2008, or later.

CLP Regulation 1272/2008			**EU Dangerous Substance Directive 67/548/EC**	
Signal words	**Hazard statement**		**Indication of danger**	**Risk phrase**
			Carcinogenic	
Danger, Carc. 1A or 1B	H350		T	R45 and/or
Danger, Carc. 1A or 1B	H350i		T	R49
Warning, Carc. 2	H351		Xn	R40
			Mutagenic	
Danger, Muta. 1A or 1B	H340		T	R46
Warning, Muta. 2	H341		Xn	R68
			Reprotoxic	
Danger, Repr. 1A or 1B	H360		T	R60
Danger, Repr. 1A or 1B	H360		T	R61
Warning, Repr. 2	H361		Xn	R62 and/or

Warning, Repr. 2	H361		Xn	R63
-	H362		-	R33
-	H362		-	R64
			Very toxic	
Danger, Acute Tox. 1 or 2	H330		Tx	R26
Danger, Acute Tox. 1	H310		Tx	R27
Danger, Acute Tox. 2	H300		Tx	R28 and/or
Danger, STOT SE 1	H370		Tx	R39
			Toxic	
Danger, Acute Tox. 2 or 3	H330 or H331			
	H331		T	R23
Danger, Acute Tox. 3	H301		T	R24
Danger, Acute Tox. 3	H370		T	R25
Danger, STOT SE 1	H372		T	R39 and/or
Danger, STOT RE 1			T	R48

The classification applies in accordance with the EU's Dangerous Substances Directive 67/548/EC with subsequent amendments and adjustments and/or CLP Regulation 1272/2008 with subsequent amendments. During the transition period, i.e. up to 1 June 2015, classification in accordance with the EU's Dangerous Substances Directive or the CLP Regulation may be used. After the transition period, only classification in accordance with the CLP Regulation is allowed.

✉ Declaration from the producer of the chemical product used in the Nordic Ecolabelled product that the requirement has been satisfied. Appendix 7 may be used.

✉ A safety data sheet for the chemical product used in the Nordic Ecolabelled product in accordance with Appendix II of Reach (Regulation 1907/2006/EC with subsequent amendments and additions).

Background for the requirement

The requirement level for classification of the chemical products in the construction panel has not been changed in this revision. However, the requirement has been updated in accordance with CLP, and the text of the requirement has been made clearer. At the same time, the requirement now also covers chemical products in the new panel types in the product group. Here an exemption has been made for specific classifications of adhesives and resins employed in closed systems in HPL production. These classifications are for the uncured product and not the finished HPL panel. HPL production is based on the use of resins with phenol and formaldehyde for impregnating the paper. It is therefore impossible to produce HPL without these resins. However, for working environment reasons, it is important to ensure that the resins do not contribute to emissions which damage health. Requirement O300 has been laid down to safeguard this.

In addition, an exemption has been made for R40 for adhesives which are chiefly used for wood-based panels. Instead, the formaldehyde content of adhesives has been regulated in Requirement O288, and to ensure that these adhesives do not contribute problematic formaldehyde emissions during the use phase, strict emission requirements have been laid down for the finished panel.

Nordic Ecolabelling seeks to ensure that the health and environmental impact of the products is as low as possible. Therefore requirements are made for the prohibition of specific classifications of the products. The RPS analysis in Section **Fejl! Henvisningskilde ikke fundet.** found generally high RPS for strict chemical requirements for this product group.

O20 CMR classification of constituent substances

The requirement covers all constituent substances in the chemical products used in panel production and for surface treatment.

The constituent substances used in chemical products in construction panel production (e.g. additives, adhesives and surface treatment) must not have any classifications listed in Table 19 below.

Table 19: List of non-permitted classifications of constituent substances in chemical products

CLP Regulation 1272/2008:			**EU Dangerous Substance Directive 67/548/EC:**	
Signal words	**Hazard statement**		**Indication of danger**	**Risk phrase**
			Carcinogenic	
Danger, Carc. 1A or 1B	H350		T	R45 and/or
Danger, Carc. 1A or 1B	H350i		T	R49
			Mutagenic	
Danger, Muta. 1A or 1B	H340		T	R46
			Reprotoxic	
Danger, Repr. 1A or 1B	H360		T	R60
Danger, Repr. 1A or 1B	H360		T	R61

The classification applies in accordance with the EU's Dangerous Substances Directive 67/548/EC with subsequent amendments and adjustments and/or CLP Regulation 1272/2008 with subsequent amendments. During the transition period, i.e. up to 1 June 2015, classification in accordance with the EU's Dangerous Substances Directive or the CLP Regulation may be used. After the transition period, only classification in accordance with the CLP Regulation is allowed.

✉ Declaration from the producer/supplier of the chemical product that the requirement has been satisfied. Appendix 7 may be used.

Background for the requirement

The prohibition on CMR substances in categories 1A and 1B has been given its own requirement in this version of the criteria. At the same time the requirement has been updated to match CLP Regulations 1272/2008.

Nordic Ecolabelling seeks to ensure that the health and environmental impact of the products is as low as possible. Hence requirements have been laid down prohibiting specific CMR classifications, thereby excluding some of the most problematic classifications of substances from a health point of view. Nordic Ecolabelling has prepared an Environmental Toxins Policy[35], in which CMR substances are one of the focus areas.

The RPS analysis in Section **Fejl! Henvisningskilde ikke fundet.** found generally high RPS for strict chemical requirements for this product group.

[35] NM Hedstein, 2007

O21 Excluded substances in chemical products

The requirement covers all constituent substances in the chemical products used.

The following substances must not be present in the chemical product:

- Substances on the EU Candidate List*
- Persistent, bioaccumulative and toxic (PBT) organic substances**
- Very persistent and very bioaccumulative (vPvB) organic substances**
- Substances regarded as potentially endocrine-disrupting in category 1 or 2 on the EU
- Priority List of substances for further investigation for endocrine disrupting
- effects***
- Halogenated organic compounds, such as organic chloroparaffins, fluorine compounds and halogenated flame inhibitors****
- Bisphenol A
- Isocyanates*****
- Alkylphenols, alkylphenol ethoxylates and other alkylphenol derivates
- Phthalates
- Aziridine and polyaziridines
- Pigments and additives based on lead, tin, cadmium, chromium VI and mercury, and their compounds

**Candidate List pursuant to REACH, 1907/2006/EC Article 59, Par. 10 is available on the ECHA website: http://echa.europa.eu/sv/candidate-list-table*

*** PBT and vPvB substances are defined in Annex XIII of the Reach Regulation (Regulation 1907/2006/EG). Substances which meet the PBT or vPvB criteria or which liberate substances which meet these criteria are listed on http://esis.jrc.ec.europa.eu/index.php?PGM=pbt. Substances which have been "deferred" or are "under evaluation" are not deemed to possess PBT or vPvB properties.*

****Se following link: http://ec.europa.eu/environment/chemicals/endocrine/pdf/final_report_2007.pdf (Annex L, page 238 ff.)*

***** The biocide CMIT, in combination with MIT, is an exemption from this rule and is regulated by Requirement O22.*

******Water-based polyisocyanates with a chain length of more than 10 are exempted from this rule.*

✉ Declaration from the raw materials producer or supplier showing that the requirement has been complied with. Appendix 7 may be used.

Background for the requirement

The requirement has now been clearly limited to cover only the chemical products used for the production of construction panels. The requirement has been extended to include isocyanates (apart from one exemption), Candidate List substances, potential endocrine disruptors in Category 1 or 2 on the EU Priority List and PBTand vPvBsubstances. See the reasons for this below. In addition there are now separate specific requirements for classification of the constituent substances, VOC and preservatives in the chemical products. For this, see Requirements O200, O266 and O222.

Candidate List substances

The requirement has been extended with a prohibition on the use of Candidate List substances in the chemical mixture. REACH, Article 57, defines the criteria used for assessing substances as Substances of Very High Concern (SVHC). These substances may be added to the Candidate List. There is no list of SVHC substances – only a set of criteria for assessing substances as SVHC. The mere addition of a substance to the Candidate List does not in itself have any regulatory consequence, but it indicates that the substance can be considered for inclusion on the Authorisation List (see below).

The Candidate List is published pursuant to REACH Article 59 on the Chemicals Agency (ECHA) website. The link to the list is here: http://echa.europa.eu/sv/candidate-list-table . Several of the Candidate List substances will also be covered by other requirements for the chemical products. The requirement is a way of taking account of REACH and the communications mode for substances in REACH.

PBT substances

PBT substances and vPvB substances are substances with innate properties which are undesirable in ecolabelled construction panels.

PBT (persistent, bioaccumulative and toxic) substances are defined in REACH Regulations Annex XIII as:

P: half-life in sea water is over 60 days or half-life in fresh or estuarine water is over 40 days or half-life in marine sediment is over 180 days or half-life in fresh or estuarine sediment is over 120 days or half-life in soil is over 120 days

B: bioconcentration factor (BCF) is over 2000

T: the concentration without observed effect over a long period (long term NOEC) for marine or fresh-water organisms is under 0.01 mg/l, or

CM (category 1 or 2 pursuant to 67/548/EEC or category 1A or 1B pursuant to the CLP Regulation) or R (category 1, 2 or 3 pursuant to 67/548/EEC, or 1A, 1B or 2 pursuant to the CLP Regulation), or other documentation for chronic toxicity as identified by classifications T, R48 or Xn, R48 (67/548/EEC).

vPvB substances

vPvB (very persistent, very bioaccumulative) substances are defined in REACH Regulations Annex XIII as:

vP: half-life in sea water, fresh water or estuarine water is over 60 days, or half-life in marine sediment, fresh water sediment or estuarine sediment is over 180 days, or half-life in soil is over 180 days vB: bioconcentration factor (BCF) is over 5000

Endocrine disrupting substances

Human exposure to endocrine disrupting substances is a ground for special concern. This is because the exposure to endocrine disrupting substances at important stages of development can cause irreversible damage to the foetus and lead to serious health

effects later in life, and because the consequences for the complex endocrine system of the long-term impact of endocrine disrupting substances are by and large unknown.

Endocrine disruptors are a problem in several ways. Firstly, there is no classification for endocrine disrupting substances as such, so the Nordic Ecolabel must refer to more or less official lists of substances that are suspected or proven endocrine disruptors. This unofficial status makes it difficult to give references when formulating the requirements. In addition, endocrine disruptors have proved to have a "cocktail effect", which means that the effect of several substances may exceed the sum of the parts. It is thus very important to consider the volume and triviality limit in this context. The requirement refers to the EU's priority list of substances for further investigation of endocrine disrupting effects in category 1 or 2*. The list can be found here: http://ec.europa.eu/environment/endocrine/documents/final_report_2007.pdf (Appendix L, side 238-)

Halogenated compounds

The requirement contains an exemption for the biocide CMIT in combination with MIT. These are instead regulated in Requirement O22.

Halogenated compounds is a broad term for various problematic substance groups, as described below.

Halogenated organic solvents include many substances that are hazardous to the environment and health and are very toxic for aquatic organisms, carcinogenic or hazardous to health in other ways. Halogenated organic compounds have low degradability in the environment, which also increases the risk of harmful effects from the substances. Organic compounds which contain halogenated compounds such as chlorine, bromine, fluorine or iodine must not be included in chemical products used for production of ecolabelled construction panels.

Perfluorinated and polyfluorinated alkylated substances (PFAS). Perfluorinated substances are also called perfluoroalkyl surfactants or perfluoroalklyl acids and are included in the category "halogenated compounds". (PFAS) is a designation for a group of chemical compounds which contain a completely fluorinated alkyl chain and a group which gives the compound a certain solubility in water. This group of compounds is fundamentally different from most other chemicals as it is neither lipophilic (fat-loving) nor hydrophilic (water-loving), but binds easily with particle surfaces. The compounds are mainly used for their good surface properties and water and fat repellent qualities. They are used in various industrial and consumer products, in which properties such as low surface energy, high chemical and thermal stability, low light refractive index, high electrical insulating power and good resistance to corrosion and external stresses are important. Important product types include floor wax and polish, paint and lacquer, degreasing and cleaning agents, impregnating agents for textiles and leather and fire extinguishants.

Perfluoroalkyl substances are highly persistent (stable) and slow to degrade. As mentioned above, the compounds have very low water and fat solubility, and accumulation takes place by binding to the surfaces of particles or fabric. They bind to proteins and can be detected in high concentrations in top predators. A Nordic screening study showed PFAS compounds in all examined sample types, with the highest levels in marine mammals. The report concludes that PFAS is present in significant

concentrations in the Nordic environment. The highest focus is on the PFAS compound perfluorooctyl sulphonate (PFOS), which is toxic to aquatic organisms, birds and bees. /ref: SFT: 927/2005/.

Bisphenol A

Bisphenol A is a monomer in polycarbonate plastic (PC) and in epoxy resin. Bisphenol A ends up in products such as feeding bottles, drinking flasks, food tins and plastic pipes for the construction industry. Bisphenol A (cas-no. 80-05-7) is classified Repr. 2 with H361f, STOT SE 3 with H335, Eye Dam. 1 with H318 and Skin Sens. 1 with H317. Bisphenol A is on the Danish Effect List and List Of Undesirable Substances and on the EU list of substances for further investigation of endocrine disrupting properties.

Some of the epoxy resins which may contain Bisphenol A are Epichlorohydrin, which gives Bisphenol-A-(epichlorohydrin)epoxy resin (cas-no. 25068-38-6), which is classified Eye Irrit. 2 with H319, Skin Irrit. 2 with H315, Skin Sens. 1 with H317 and Aquatic Chronic 2 with H411. Bisphenol-A-(epichlorohydrin)epoxy resin must be regarded as excluded if Bisphenol A is excluded as a constituent substance, as Bisphenol A is part of the resin.

Isocyanates

The requirement has now been tightened to include isocyanates. The isocyanate group methylene bisphenyl isocyanate (MDI) and toluene diisocyanate (TDI) is mainly used in the production of polyurethane (PUR). In addition, the substances are used as binders in the production of chipboard and in the production of surface treatment agents, adhesives and jointing compounds, e.g. in the form of hardeners.

Isocyanates are allergenic and asthmogenic, and some of them, such as toluene diisocyanate (TDI), are also classified Carc. 2 (in accordance with CLP). There are special rules for working with materials containing more than 0.5% isocyanates. Isocyanates are toxic for organisms in the environment. Nordic Ecolabelling has chosen to exclude isocyanates due to their problematic properties, which are described in greater detail elsewhere, for instance the following: "The risk from isocyanates is reflected in the limit value set for their use. Most people know that organic solvents are dangerous. However, if you compare the limit value for the solvent toluene with the limit value for isocyanates, the latter is 100,000 times lower. Isocyanates are 100,000 times more dangerous than Toluene". TDI is more volatile than MDI and there is therefore a greater probability for exposure, while TDI also exhibits greater toxicity when inhaled. Other possible problems are the effects on reproduction and the carcinogenic properties of TDI and MDI and their degradation products (mainly aromatic amines). The latter is one of the reasons why both substances are subject to further investigation under REACH.

For coatings (surface treatment agents such as paint and lacquer), Nordic data shows that about 70% of these are MDI based, and the rest TDI based. For adhesives such as glues and laminates, Nordic data shows that about 80% of these are MDI based, and the rest

TDI based. In binders, (binding agents for binding particles together), isocyanates are mainly used for chipboard[36].

Nordic Ecolabelling has chosen to exempt water-based polyisocyanates with a chain length of more than 10, as polyisocyanates are contained in water-based paint, for example in the binder. These long-chain polyisocyanates are regarded as unreactive, as they are deemed to be completely polymerised, in other words, fully reacted and stable, and are not seen as likely to liberate isocyanates in use, for instance when applying paint.

APEO og APD (alkylphenol ethoxylates og alkylphenol derivates)

APEO is excluded because its degradation products are not easily degradable and some degradation products are on the EU list of substances for further investigation for endocrine-disrupting effects (e.g. nonylphenol) Alkylphenol derivates (APD) are substances derived from APEO and are excluded because they are harmful to health or not easily degradable. APEO and APD are on the Danish List Of Undesirable Substances and the reason for this is: "Nonylphenol, octylphenol and nonylphenol ethoxylate are on the EU Priority List of substances for further investigation for endocrine-disrupting properties. Some octylphenol compounds have problematic properties according to the Danish Advisory List for Self-Classification: N; R50/53 and one compound also has R43. Use of the substances has only been partially restricted, but other uses too are regarded as of environmental concern". In addition, octylphenol ethoxylates and nonylphenol ethoxylates are on the Candidate List, due to their serious effects on the environment. See more about the Candidate List later in this chapter or under the REACH Regulation in Chapter 2 of the Legislation Module. The restrictions on use for nonylphenol ethoxylates are regulated via REACH Annex XVII. The reason why Nordic Ecolabelling still chooses to retain APEO and APD on the negative list is that alkyls relate to more than just octyl and nonyl compounds, and as a precaution it has been decided to exclude these related compounds as well, despite their not being identified as problematic substances.

Phthalates

Phthalates are mainly used as softeners for PVC, but can also be used as stabilisers, film formers, emulsifiers, lubricants, binders and many other functions, in which they end up occurring in numerous products such as adhesives, personal care products (e.g. denaturing products for perfume spirit), toys, packaging and much more.

Many phthalate compounds have undesirable health and environmental impacts. A number of phthalates are on the EU's Priority List of substances for further investigation of endocrine-disrupting effects - and a number are already been shown to have endocrine-disrupting effects. Phthalates also receive a good deal of attention in the media and may therefore be undesirable in ecolabelled products for many reasons. Some phthalates are on the Danish List Of Undesirable Substances. These are diethyl hexyl phthalate (DEHP), dibutyl phthalate (DBP), benzyl butyl phthalate (BBP), dimethoxyethyl phthalate (DMEP) and diisobutyl phthalate (DIBP) with the following justification: "All five phthalates have problematic properties according to the List of Harmonised Classification (CLP list). In addition, DEHP, DBP and BBP are on the EU Priority List of substances for further investigation for endocrine-disrupting properties.

[36] Strategy for risk management of certain isocyanates (MDI and TDI), Danish Environmental Agency 2014.

Some phthalate compounds are also on the Candidate List. These are: DEHP (bis-(2-ethyl hexyl)phthalate), DBP (dibutyl phthalate), BBP (benzyl butyl phthalate), DiBP (diisobutyl phthalate), DPP (dipentyl phthalate), PiPP (pentaisophenyl phthalate), DiPP (diisopentyl phthalate), N-pentyl-isopentyl phthalate and bis(2-methoxyethyl) phthalate. All are included because of their classification as reprotoxic.

Restrictions on use of DEHP, DBP and BBP, DINP (diisononyl phthalate), DIDP (diisodecyl phthalate) and DNOP (di-n-octyl phthalate) are regulated by REACH Annex XVII.

Aziridine and polyazidirines

Aziridine is classified as a carcinogen in group Carc 1B with H350 and a mutagen with Mut 1B with H340. In addition it is classified as "Very Toxic", "Corrosive", "Extremely flammable" and "Harmful to the Environment"[37].

Heavy metals

Heavy metals impact the environment, so their discharge must be limited as far as possible. It is relevant to ensure that metal parts used in the product group do not contain the heavy metals chromium, nickel, lead, cadmium or zinc (surface treatment only).

Chromium

Chromium (III) and chromium (VI) are used for e.g. chrome plating, in colours and in pigments. Chromium(III) is essential, since living organisms require chromium. The different types of chromium have different effects. All chromium compounds are toxic. Chromium (VI) has particularly harmful effects, as it is carcinogenic and allergenic. A number of chromate compounds are on the Danish Environmental Protection Agency's list of undesirable substances. It is therefore still relevant to include a ban on chromium in the criteria.

Nickel

Nickel is one of the commonest reasons for contact allergy in Denmark. However, cases have declined since new rules were introduced in 1991 for a large number of consumer products that are intended for direct and prolonged contact with the skin. The rules apply to e.g. jewellery, spectacles. buttons and belts, while mobile phones and laptop computers must also comply with the nickel requirements. Yet the rules do not protect all consumers, since some people are more sensitive. Even though metal elements comply with the rules, this is not sufficient to prevent particularly sensitive people from developing nickel allergy.

Mercury

Mercury occurs as inorganic and organic chemical compounds, and is one of the most dangerous environmental toxins. Mercury is a threat to the environment and to human health. Organic mercury compounds are particularly toxic. Mercury compounds are extremely toxic for aquatic organisms and for mammals. Mercury, even in small

[37] http://esis.jrc.ec.europa.eu/index.php?PGM=cla

quantities, can cause three chronic toxic effects. Mercury can also cause kidney damage, foetal damage and lead to contact allergy.

Lead

Lead is a toxic heavy metal that is accumulated in nature and in human beings. This means that even small quantities of lead can be hazardous to health. Children are particularly vulnerable. They are generally exposed to more lead than adults via food, soil and dust, while their gastrointestinal system absorbs lead far more effectively than adults. Lead affects the nervous system. As children's nervous system is still developing, they are particularly sensitive to these effects and American studies have shown that, even in small quantities, lead can affect children's learning ability and intelligence. Lead is also toxic for organisms in soil and water. If products containing lead are disposed of as waste, after incineration the lead will be present in slag and fly ash. A smaller element is dispersed in smoke and dust from incineration plants.

Zinc

Zinc is an essential metal, since living organisms require zinc. In excessive quantities zinc can be toxic for organisms in the environment and can cause stomach cramps and vomiting, and anaemia after prolonged ingestion. It can also affect rats' ability to reproduce, but it is not known whether it also has this effect on human beings. Zinc is a finite resource with a supply horizon of 20 years.

Cadmium

Cadmium and cadmium compounds are acutely and chronically toxic for human beings and animals. Most cadmium compounds are also carcinogenic. Cadmium is classified as very toxic on aspiration and as carcinogenic. Cadmium can also potentially be reprotoxic and cause foetal damage. Most cadmium compounds are extremely toxic for aquatic organisms, especially in fresh water, and acutely toxic for mammals. Cadmium also has chronic toxic effects on many organisms, even in very small concentrations. Cadmium is bioaccumulative in fish and mammals and has a long biological half-life in mammals.

O22 Biocides (preservatives and antibacterial treatment)

Antibacterial treatment

No biocides or biocide products may be applied to the surface of the finished panel, or to parts of it, for the purpose of providing a disinfectant or antibacterial effect.

Preservatives

- Preservatives added to chemical products used in panel production must not be bioaccumulative*.
- The total content of Kathon mixture (CMIT/MIT) 5-chloro-2-methyl-2H-isothiazolin-3-one (CAS no.: 26172-55-4) and 2-methyl-2H-isothiazolin-3-one (CAS no.: 2682-20-4) (3:1) in the chemical mixture may not exceed 15 ppm (0.0015 wt.%, 15 mg/kg).

All panel types excluding surface treatment of facade panels:

- The total content of isothiazolinone compounds in the chemical product may not exceed 500 ppm (0.05 wt.%, 500 mg/kg).

Surface treatment of facade panels:

- For chemical products for surface treatment of facade panels, the total content of isothiazolinone compounds in the chemical mixture may not exceed 1500 ppm (0.15 wt.%, 1500 mg/kg).

The biological accumulability of a substance can be tested on fish in accordance with the OECD's test guidelines 305 AE. If the biological concentration factor (BCF) of the substance is ≥ 500, the substance is deemed bioaccumulative, and if BCF < 500 the substance is deemed non-bioaccumulative. Unless otherwise established, substances are deemed bioaccumulative if logKow ≥ 4 according to the OECD's test guidelines 107 or 117 or equivalent methods.

If there is a measured BCF value, the highest measured value must be used instead of logKow. This means that a substance with a logKow value ≥ 4 is not considered to be bioaccumulative if the highest measured BCF value is < 500.

✉ Declaration from producer/supplier of all constituent chemical products, showing that the requirement has been met. Appendix 7 may be used.

Background for the requirement

The requirement for preservatives in chemical products has been formulated as a separate requirement in this version. The requirement has now been differentiated by a concentration limit for all isothiazolinone compounds, depending on whether the chemical products are used for surface treatment of facade panels or not. These two levels harmonise with the requirement levels in the Nordic Ecolabelling criteria for chemical building products, in which industrial paint and lacquer have a level of 500 ppm and outdoor paint and lacquer have a level of 1500 ppm.

At the same time the requirement has been tightened in relation to the concentration limit for the CMIT/MIT mixture of 5-chloro-2-methyl-2H-isothiazolin-3-one (CAS no.: 26172-55-4) and 2-methyl-2H-isothiazolin-3-one (CAS no.: 2682-20-4) (3:1). The requirement has also been tightened to include a general prohibition on bioaccumulative preservatives.

In addition, preservatives must meet the general classification requirements in the criteria and other relevant requirements. With these restrictions and with the requirements in the Biocide Directive (98/8/EC), there are few preservatives that comply with both legislation and the Nordic Ecolabel requirements.

Preservatives are an ingredient whose purpose is to kill undesirable organisms in products and consequently they are often more or less harmful to the environment. On the other hand, preservatives are often a necessity for ensuring satisfactory service life in the products, and they are used in small quantities. As an extra twist to the evaluation, the fact remains that many preservatives can affect health. So, there are many aspects to be taken into consideration when choosing requirements for preservatives.

<u>Isothiazolinones and the mixture (3:1) CMIT/MIT</u>

Isothiazolinones may occur as preservatives in the raw materials used in the chemical products. It is difficult to avoid isothiazolinones completely without substituting other problematic substances, so a limit value has been set for the content of the chemical products used in the chemical mixture. Preservatives may be either in-can or film preservatives.

Previously there was a prohibition on dimethyl fumarate in the criteria. Dimethyl fumarate (DMF) is a mould and fungus killing agent often used to protect furniture or

shoes etc. during long transport from countries such as China. Since 2009, it has been forbidden to import and sell goods containing over 0.1 mg DMF/kg, or in which DMG has been declared in the EU. The agent has been found in leather and synthetic leather products such as upholstered furniture, shoes and riding helmets, but is not particularly relevant for construction panels[38]. It is therefore assessed that the requirement is not relevant for construction panels.

O23 Nanoparticles

The product may not contain nanoparticles (from nanomaterial*)

Polymer emulsions are not considered to be a nanomaterial.

Exemptions from the requirement are granted for the following:

- Pigment**
- Synthetic amorphous silicate***
- Naturally occurring inorganic fillers****

**The definition of nanomaterials follows the EU Commission's definition of nanomaterials of 18 October 2011:*

"Nanomaterials": a natural, incidental or manufactured material containing particles in an unbound state or as an aggregate or an agglomerate and where at least 50% of the particles in the size distribution by number, in one or more external dimensions, are in the size range of 1-100 nm.

***nano titanium dioxide is not considered to be a pigment.*

****this applies to conventional synthetic amorphous silicate in bulk form. May not contain surface-treated silica.*

*****this applies to fillers covered by Annex V Point 7 of REACH.*

☒ Declaration from producer/supplier of chemical product (except for polymer emulsion, pigment and synthetic amorphous silicate) that the product does not contain nanomaterial as defined by the requirement. Appendix 7 may be used.

Background for the requirement

The requirement has been reworded in this version of the criteria and it is specified that polymer emulsions are not considered to be nanomaterial, or in the case of an exemption from the requirement.

There is still great uncertainty as to how nanoparticles affect health and the environment[39].
Based on the precautionary principle, Nordic Ecolabelling wishes to take a restrictive attitude to the use of nanoparticles in ecolabelled products.

Nanometals include nanosilver, nanogold and nanocopper. Nanometals such as nanosilver and nanocopper are a special problem, as they are present in many products for their antibacterial effect. Substances such as nanosilver are regarded by the US Environmental Protection Agency (EPA) as a biocide. There is a specific concern that discharge of nanosilver to run-off water or other dispersion may eliminate desirable bacteria and cause resistance in some bacteria. In this product group there are examples of nanomaterials being used for surface coatings of construction panels, etc. It is therefore relevant to lay down the requirement for the product group. A general ban on

[38] http://mst.dk/virksomhed-myndighed/kemikalier/regulering-og-regler/faktaark-om-kemikalielovgivningen/dmf/
[39] European Council, Recommendation 2017 (2013), Provisional version, Nanotechnology: balancing benefits and risks to public health and the environment

nanoparticles is not controllable enough, as there are also materials of less than 100 nm which are not regarded as problematic. Hence, the requirement contains the following limitation:

Polymer emulsions are not regarded as a nanomaterial and an exemption from the requirement is granted for the following:

- Pigment
- Synthetic amorphous silicate
- Naturally occurring inorganic fillers

The requirement may be documented by such means as a description of how nanoparticles are bound to the product and thus not released to the environment (both during and after use) or the user (both during and after use).

This requirement means that more recent nanomaterials which intentionally contain nanoparticles cannot be included. Examples of such nanoparticles are fullerenes, carbon nanotubes, nanosilver, nanogold and nanocopper. However, traditional fillers may be included. Pigment is exempted from the requirement, i.e. TiO_2 may be included in pigment form.

Stating the particle size of inorganic fillers from the raw material suppliers may be a problem. Naturally occurring inorganic fillers such as chalk, marble and lime are exempted from registration in accordance with ANNEX V, § 7 of REACH, see below, as long as these fillers have only been physically treated (ground, screened etc.) and not chemically modified. They are also exempted from registration with the Danish Environmental Protection Agency in accordance with the Statutory Order for the register of mixtures and items containing nanomaterials and producers' and importers' notification duty to the register.

In the EU Commission's Follow-up Report on the second "Regulatory Review on Nanomaterials" of 2012[40], it is stated that solid nanomaterials dispersed in a liquid phase (colloid) must be regarded as nanomaterials in accordance with the EU Commission's recommendation. On the other hand, nanoemulsions are not covered by the definition. Polymers/monomers may occur in different phases and sizes, and so it has been decided to explicitly state that polymers are exempted from this nano requirement.

Nordic Ecolabelling does not require a test for all raw materials in relation to nanoparticles. Polymer emulsions, pigments, dyes, natural minerals and metals (with the exemptions in the requirement text) are not covered by the nano requirement. The requirement is based on the EU definition of nanoparticles. Here there is also a requirement that raw materials covered by the EU definition of nanoparticles state this on the product datasheet, making this knowledge available to the chemical producer.

The requirement stipulates a declaration from the supplier of chemical products not covered by the exemption. The declaration must state that the chemical product does not contain nanomaterials as defined by the requirement. The declaration is made to the best of the signatory's knowledge and according to the knowledge held at the time, based on tests and/or declarations from raw materials producers/suppliers. Reservation is made

[40] Communication from the Commission to the European Parliament, the Council and the European Economic and Social Committee, Second Regulatory Review on Nanomaterials, COM(2012) 572 final

for new developments and knowledge. If such new knowledge should come to light, the signatory is obliged to submit an updated declaration to Nordic Ecolabelling.

Apart from the exempted raw materials described above, there will also be raw materials which are not defined as particles, agglomerates or aggregates and which are thus not covered by the requirement.

Page 40 Par. 4 of the COMMISSION'S RECOMMENDATION of 18 October 2011 on the definition of nanomaterials (2011/696/EU) states the following:

"With regard to Par. 2, "particle", "agglomerate" and "aggregate" are defined as follows:

a) "particle": a very small piece of material with well-defined physical boundaries.

b) "Agglomerate": a collection of loosely bound particles or aggregates in which the area of the resulting external surface corresponds to the sum of the surface area of the individual components.

c) "Aggregate": a particle consisting of closely bound or fused particles.

O24 Environmentally harmful substances in the construction panel (not surface treatment)

The total quantity of added chemical substances in the construction panel which are classified as environmentally harmful according to Table 20 has been restricted and must comply with a required level of maximum 2 wt.% environmentally harmful substances by means of the following formula:

100*H410 + 10*H411 + H412 ≤ 2 wt.% environmentally harmful substances

or

100*(R50/53) + 10*(R51/53) + (R52/53) ≤ 2 wt.% environmentally harmful substances

where:

H410 is the total concentration of substances classified as H410 (and the same for R50/53) as a percentage of the panel

H411 is the total concentration of substances classified as H411 (and the same for R50/53) as a percentage of the panel

H412 is the total concentration of substances classified as H412 (and the same for R50/53) as a percentage of the panel

The requirement relates to the chemical products used in the panel (e.g. adhesives) with the chemical composition they have when mixed in the panel material. Ammonia in a concentration of over 24% is exempted and not counted here.

Table 20 Environmental hazard statements and risk phrases covered by the requirement

Hazard class	Hazard code and hazard statement according to CLP Regulation 1272/2008	Indication of danger and R-phrase according to EU Dangerous Substances Directive (67/548/EC)
Hazardous to aquatic life	Chronic 1 with H410	N; R50-53
	Chronic 2 with H411	N; R51-53
	Chronic 3 with H412	R52-53

☒ Declaration from producer/supplier of chemical product showing the content of environmental hazard classified substances covered by the requirement, stated specifically for each indication of danger/R phrase. Appendix 8 may be used.

☒ Calculation from panel manufacturer showing the panel's content of environmentally hazardous substances in relation to the requirement. Here information from Appendix 8 should be used.

O25 Environmentally harmful substances in surface treatment of construction panel

Chemical products used in the panel's surface treatment system (e.g. coating, oil, paint and lacquer) must satisfy one of the two following alternatives.

a) No chemical product in the surface treatment may be classified as environmentally harmful according to Table 21 below.

or

b) The total amount of environmentally harmful substances applied (indicated in Table 21) in the surface treatment system must not amount to more than 40 g/m² calculated in wet condition. One of the following formulae must be used to calculate the weight percentage of constituent environmentally harmful substances in the surface treatment system (to be done for each chemical product in the surface treatment):

100*H410 + 10*H411 + H412 = wt. % environmentally harmful substances

or

100*(R50/53) + 10*(R51/53) + (R52/53) = wt. % environmentally harmful substances

H410 is the concentration of substances classified as H410 (and the same for R50/53) as a percentage

H411 is the concentration of substances classified as H411 (and the same for R50/53) as a percentage

H412 is the concentration of substances classified as H412 (and the same for R50/53) as a percentage

All environmentally hazardous substances in unhardened chemical products must be included in the calculation.

Table 21 Environmental hazard statements and indications of danger covered by the requirement

Hazard class	Hazard code and hazard statement according to CLP Regulation 1272/2008	Indication of danger and R-phrase according to EU Dangerous Substances Directive (67/548/EC)
Hazardous for aquatic life	Aquatic acute 1 with H400	N; R50
	Aquatic chronic 1 with H410	N; R50-53
	Aquatic chronic 2 with H411	N; R51-53
	Aquatic chronic with H412	R52-53

The amount of applied environmentally hazardous substances (g/m²) is then calculated as:

Applied amount $\left(\frac{g}{m^2}\right)$ x weighted % environmentally hazardous substances in total surface treatment

For tone systems, a worst case calculation is made for the surface treatment with the most tone in the basic colour containing the most environmentally hazardous substance under the weighted formula for the classifications.

☒ For alternative a), a declaration is required from the producer/supplier of each chemical product that the product is not classified as environmentally hazardous under the above table. Appendix 7 may be used.

☒ For alternative b) Declaration from producer/supplier of chemical product showing the content of environmental hazard classified substances covered by the requirement. The concentration of substances must be stated specifically for each indication of danger/R phrase. Appendix 8 may be used. Confidential information from the chemicals supplier may be sent directly to Nordic Ecolabelling.

☒ The calculation from the manufacturer of the finished panel showing the number of coats of surface treatment, the application method and the applied amount per coat indicated as g/m² panel. And the weighted calculation of environmentally hazardous substances as shown by the requirement. Here information from Appendix 8 should be used.

Background for requirement (both requirements O24 and O25)

Environmentally harmful substances are substances which are toxic in small quantities, which are persistent and/or may accumulate in living organisms (bioaccumulate). In other words, these substances should be used and supplied as little as possible, especially because their long-term effects on health and the environment are often unknown. Nordic Ecolabelling uses the official environmental hazard classification for chemical substances and products.

Both requirements have been changed by weighting the different environmental hazard classifications differently depending on the actual environmental danger which the classified substances pose. This weighting skews restrictions towards substances classified as H410/R50/53.

The factors for environmental hazard classification in the criteria for chemical building products have been included in this requirement. These weighting factors derive from the chemicals legislation and are a good way of balancing the different environmental

risks: H410 has been weighted with factor 100 as it is the most environmentally hazardous; H411 has been weighted with factor 10; and H412, the least hazardous for the environment, has been weighted with factor 1, i.e. no weighting has been applied.

Requirement O24

The requirement level has been set on the basis of knowledge of the chemical products used in the panel. The requirement relates to the total weighted quantity per kg panel, rather than the chemical product used. Thus, the requirement reflects the potential environmental impact of the actual panel. The requirement also allows the panel manufacturer the flexibility to select chemicals which give an overall reduced environmental impact.

Ammonia or ammonia water is used as a part-component in the binders of certain construction panels. The requirement includes an exemption for ammonia, which is classified as R50 due to its high pH value (concentration of 25% or more is classified with R50). At concentrations of 24% or less the classification disappears again. Ammonia or ammonia water is thus irrelevant for calculating the potential environmental risk of the finished panel.

Requirement O25

As in the previous version of the criteria, the requirement has been formulated with the flexibility of two requirement alternatives. The manufacturer may choose to document that only chemical products without any of the indicated environmental hazard classifications in the requirement have been used. Alternatively, the manufacturer may choose to document the use of a surface treatment system with an overall low content of environmentally hazardous substances per functional unit (m^2 surface of panel).

The different panel types are often surface-treated to ensure a durable and easily cleaned surface. The surface treatment may be intended to ensure a durable surface and thus a long service life for the panel. Surface treatment is mainly in the form of water-based coatings. These include primers, sealers, undercoats and top coats, either alone or together in systems.

The criteria for chemical building products have recently been revised and extended to include industrial powder paints and wet paints and lacquers. It is hoped that an ecolabelled paint will be used and accepted as a surface treatment product in the manufacture of ecolabelled panels. Hence, it is relevant to harmonise the requirements between the two product groups. However, there is an important difference, which prevents identical requirements for the product groups. A chemical building product such as paint must comply with the contents requirements as an individual coating product. But with ecolabelled construction panels, the whole quantity of the coating system must fulfil the requirement. Surface treatment of a construction panel often involves coating with more than one product and several coats of different volumes. This makes it impossible to make a straight comparison. In extreme cases, a Nordic ecolabelled paint with a low content of some environmentally hazardous substance may be applied in such large quantities that the construction panel criteria for the requirement for environmentally harmful content cannot be reached. The opposite could also occur. In other words, a paint which does not meet the requirement for ecolabelling is used in such small quantities that it is possible for a surface treatment system to comply with the requirements of the construction panel criteria.

In conclusion, Nordic Ecolabelling declares that as the requirement has been changed and now weights environmentally hazardous content with factors 1, 10 and 100, the requirement level for the applied quantity has been set to 50g/m^2. At first sight, the value may appear high, but it must **not** be compared with the limit of 5 g/m^2 in the earlier version of the criteria, which did not weight the environmental hazard. The proposed value of 50 g/m^2 is however, associated with some uncertainty. We should evaluate separately the hearing responses for the limit proposal.

O26 Volatile organic compounds (VOC) in adhesives

Volatile organic compounds* including volatile aromatic hydrocarbons (VAH), must not be present in the adhesive by more than 3 wt. %. Of these, VAHs (volatile aromatic hydrocarbons) may not amount to more than 0.1 wt. % of the adhesive.

** Volatile organic compounds are here defined as:*

Organic compounds with a steam pressure exceeding 0.01kPa, at 20°C.

For products under EU Directive (2004/42/EC) in which steam pressure is not indicated:

Organic substances with an initial boiling point that is lower than or equal to 250°C measured at a normal pressure of 101.3 kPa.

✉ Declaration from the producer/supplier of the chemical compound that the requirement has been fulfilled. Appendix 9 may be used.

Background for the requirement

The requirement has not been changed since the last version, but has been given a separate requirement number. The requirement is particularly relevant for wood-based panels. Here adhesive is usually present at 6-8% in chipboard, approx. 10% in MDF and 2-3% in OBS[41]. The adhesives are usually water-based but contain small quantities of VOC such as formaldehyde. The purpose of the requirement is to ensure that the VOC content has been reduced to the minimum possible. The commonest adhesives are described briefly here:

Table 22 Adhesives in wood-based panels[42]

Adhesive type	Application	Contents	Additives
Urea formaldehyde adhesive	Chipboard and plywood	Urea, Formaldehyde (typically under 1%). Hardeners: ammonium chloride, ammonium peroxodisulphate, aluminium sulphate, weak acids.	Organic and inorganic fillers, e.g. coconut shell powder, gypsum, titanium dioxide. Additives as for PVAc adhesive.
MUF, melamine-urea-formaldehyde and MUPF, melamine-urea-phenol-formaldehyde adhesives	Chipboard and MDF	Melamine, Urea, Phenol (MUPF only) and Formaldehyde. Hardener: Resorcinol, formic acid.	Organic and inorganic fillers, e.g. ethylene glycol, blood albumen, casein, gluten. May contain wood preservative containing boric acid and

[41] Draft report for BREF for the production of wood-based panels 2013
[42] Sector analysis of environmental aspects of the wood and furniture industry MST 2000

			monoethanolamine (MUPF) and colourant with acetic acid. Additives as for PVAc adhesive.
Phenol and Phenol resorcinol adhesive	Plywood	Phenol, Resorcinol, Hardener: Paraformaldehyde	Organic and inorganic additives, e.g. coconut shell powder, tannin, potassium carbonate, methanol, ethanol, sodium hydroxide. Additives as for PVAc adhesive.

According to the EU VOC Directive 1999/13/EC, volatile organic compounds are defined as compounds that at 293.15°K have a steam pressure of at least 0.01 kPa, or that have equivalent volatility in special application conditions. It is important to note that it is not a simple matter to calculate the steam pressure of a mixture from the steam pressure of the individual components. In composite products of this type, the steam pressure may be both lower and higher than the individual components of the product. However, for simplicity, environmental labelling criteria calculate the steam pressure of a mixture from the individual components.

The group of VOCs contains thousands of different chemical substances. Examples of typical volatile organic compounds are isocyanates (hardeners) and formaldehyde. Volatile organic compounds in which one or several benzene rings are included are called volatile aromatic hydrocarbons (VAH), and are very stable. The expression "aromatic hydrocarbons" among other things describes benzene, toluene, mixed xylenes, orthoxylene, paraxylene and metaxylene (commonly known as BTX). Benzene is used to make styrene, cumene and cyclohexane. Most toluene is used to make benzene, phenol and toluene diisocyanate. The requirement for VAH is set out under the VOC requirements for the individual product groups, as VAH is a subgroup of VOC.

The reason for laying down a requirement for VOC is Nordic Ecolabelling's goal of reducing ozone formation near the Earth's surface. In addition, certain organic solvents contribute to the greenhouse effect, and some to depletion of the ozone layer . The working environment and indoor climate can also give grounds for concern when using the panels. Volatile organic compounds give particular grounds for concern because of their innate properties. "Organic solvents may be absorbed via the lungs and skin, and damage a number of organs. The damage may be acute or chronic. Acute injury after inhaling gases presents as e.g. headache, tiredness, etc. Organic solvents may also irritate the mucous membranes in the eyes, nose and throat. Organic solvents dry out the skin and can lead to eczema. After longer exposure organic solvents can lead to chronic damage to the brain and nervous system. Symptoms may be memory loss, nervousness and irritability and, as time goes by, more serious mental changes, e.g. depression. Certain organic solvents lead to other irreparable damage such as cancer and damage to reproduction (foetal damage)"[43].

[43] Environmental Guidance Dictionary 2009

O27 VOC in surface treatment

The content of volatile organic substances (VOC) in the chemical products in the surface treatment system must be either

a) below 5 wt.% for each chemical product, or

b) a maximum of 10 g/m² surface of panel for the total surface treatment system

The requirement relates to the chemical products used in surface treatment with the chemical composition they have in wet form. If the product is to be diluted, the calculation must be based on the content of the ready-diluted product.

Volatile organic compounds are here defined as:

Organic substances with an initial boiling point that is lower than or equal to 250°C measured at a normal pressure of 101.3 kPa.

✉ Declaration from the producer/supplier of each chemical product in the surface treatment. The declaration must state the content of VOC in the product. If necessary, VOC information from the producer of the chemical product may be sent directly to Nordic Ecolabelling. Appendix 9 may be used.

✉ When using alternative b), the applicant must submit a calculation showing the total amount of VOC in the surface treatment system in g/m² panel. The calculation must be based on the declared VOC content of each chemical product and the amount present in the surface treatment system.

Background for the requirement

The requirement has hardly been changed compared to the previous version, as evaluation has shown that the requirement is still a strict one. Here the definition of VOC for paint and lacquer is that used in the EU Directive (2004/42/EC) which specifically covers this area. A different definition of VOC is here used than in the EU VOC Directive.

As in the previous version of the criteria, the requirement has been formulated with the flexibility of two requirement alternatives. The producer may choose to document the requirement in relation to the VOC content of the individual chemical products used. Alternatively, the manufacturer may choose to document the use of a surface treatment system with an overall low content of VOC per functional unit (m^2 surface of panel).

In the process industry solvent-based surface-treatment systems can still be found, mainly used together with recycling systems. In the Nordic region, great strides have been made, thanks to the trade unions and trade organisations, which have urged the phasing out of solvent-based surface treatment systems. Water-based surface treatment products often have a VOC content of 0-10%. For ecolabelled construction panels, the requirement has been set at max. 5 wt.% and the criteria thus encourage surface treatment systems with a reduced VOC impact, both on the environment and the working environment.

For further background on VOC, see the background text to Requirement O26.

O28 Content of free formaldehyde in chemical products

The requirement does not apply to resin used for impregnation in HPL and laminate production. HPL and laminate production must instead comply with Requirement O30 Emissions from HPL production.

The content of free formaldehyde in chemical products used for production of the product may be up to 0.2 wt.% (2000 ppm), except for adhesive products mixed with hardener. For adhesive products mixed with hardener, up to 0.2 wt.% (2000 ppm) of free formaldehyde is permitted in the ready-to-use mixture.

The content of free formaldehyde in chemical products used for stone wool may be no more than 0.5 wt.% (5000 ppm).

✉ Declaration from the producer of the chemical products used in the construction panel. Appendix 7 may be used.

Background for the requirement

The requirement has not been changed in this revision as it was tightened in the previous revision from 0.3 wt.% to 0.2 wt.% of the chemical product or mixture (for 2-component adhesives). The evaluation of version 5 of the criteria has shown that the requirement limit is still a tough one. Formaldehyde is further regulated in Requirement O32 in relation to the final formaldehyde emissions from the construction panel. However, in certain cases these two formaldehyde requirements can work against each other. This happens when the formaldehyde catcher used (which reduces the formaldehyde emissions from the finished panel) contains amounts of free formaldehyde which exceed the requirement for 0.2% free formaldehyde. However, no reports have been discovered which describe this. The requirement has been set to a level at which it is still possible to use formaldehyde catchers with a low content of free formaldehyde, making it possible to achieve low formaldehyde emissions from the finished panel.

Formaldehyde is a toxic and allergenic substance which also has carcinogenic effects and should therefore be avoided or reduced as much as possible. For wood-based panels, the content of free formaldehyde in the employed chemical products will depend on factors such as which adhesive system is being used. Generally speaking, all the adhesives are water-based, rather than solvent-based.

Resins used for impregnation in HPL and laminate production have a high formaldehyde content. Free formaldehyde may be present at around 1 wt. %. Also, formaldehyde oligomers (synthetic polymer) may be present with a weight percent of over 50. Normally the resins are used in open water-based baths, so it has been decided to lay down a specific requirement for emissions from HPL production. See Requirement O30.

4.3.6 Emissions

O29 Emissions to water in wet processes

The requirement covers processes in panel production. For panels manufactured with wet processes, the COD emission to water may be no more than 20 g COD/kg product (unfiltered sample).

✉ The sampling programme, including measurement method, measurement results for the last 12 months, and measurement frequency. For processing and analysis methods, see Appendix 1.

Background for the requirement

The requirement is identical with the previous version of the criteria. The requirement governs contamination from effluents to water in the form of dissolved organic material from wood and bark. In this requirement, this fraction is stated as the content of oxygen-consuming substances, COD. The organic matter is broken down by microorganisms 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.

Debarking in the wet process generates a large quantity of waste water with a high tannin content which is difficult to remove. The tannins contribute to COD impact and discolour the waste water. Wet debarking has a high water consumption, and if steam is necessary, this also contributes to higher energy consumption.

The process water can be reused by the factory or recycled for other purposes on site. The quantity of process water reused varies from 0 to 100%. In recycling internal process water, the focus is on removing suspended solid substances (SS) and COD, and this is achieved by mechanical and physical methods such as simple filtering, clarification, sedimentation, coagulation/flocculation and micro-filtering, while the resulting slurry is removed with a filter presses and screw conveyors. The quality of the treated water will depend on the planned use of the recovered water. The slurry is often incinerated on site.

O30 Emissions 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 wt. % 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^3

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

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^3

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

Air measurement must be executed as an exposure measurement, in which an evaluation is made of the exposure of each worker to the pollution. Measurement equipment carried on the person should be used for these measurements. Hence, in taking samples during exposure measurement, it must be ensured that, e.g.

samples are generally taken in the inhalation zone of persons at work.

sample taking is conducted under normal operating conditions with normal ventilation

the high-emission phases of the different work processes are included.

the sampling time is long enough to show a representative average value

when planning sample-taking, a survey is made of any concentration variations during the work process or the working day.

☒ 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.

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^3 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 23 shows both EU and Nordic national limit values.

Table 23 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**
EU*	None	None	2 ppm or 8 mg/m^3	None
Denmark**	0.3 ppm or 0.4 mg/m3	0.6 ppm or 0.8 mg/m3	1 ppm or 4 mg/m^3	2 ppm or 8 mg/m^3
Sweden***	0.3 ppm or 0.37 mg/m3	0.6 ppm or 0.74 mg/m3	1 ppm or 4 mg/m3	2 ppm or 8 mg/m3

Norway****	0.5 ppm or 0.6 mg/m3	1 ppm or 1.2 mg/m3	1 ppm or 4 mg/m3	3 ppm or 12 mg/m3
Finland*****	0.3 ppm or 0.37 mg/m3	1 ppm or 1.2 mg/m3	2 ppm or 8 mg/m3	4 ppm or 16 mg/m3

** 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*

O31 Dust emissions from panel 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 dust emission levels have not been exceeded.

The following limit values for emissions to air must not be exceeded during the manufacture of panels in relation to the working environment. The requirement relates to panels in which the content of mineral raw materials or wood raw materials accounts for more than 10 wt.% of the panel:

Mineral dust, inert: 10 mg/m^3

Mineral dust, inert, breathable: 5 mg/m^3

Mineral wool: 1 fibre/cm^3

Wood dust, breathable: 2 mg/m^3

Organic dust, total: 5 mg/m^3

☒ Dust measurements according to the requirement 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 because the criteria now contain several further types of panel production where it is of relevance to health to reduce dust emissions during panel production. This applies to products such as cement-based panels and plasterboards and panels in mineral wool fibre. Mineral wool fibres such as fibreglass, slag wool fibre and stone wool fibre are classified as Carc 3 or as carcinogen category 2 in Annex VI of the CLP Regulation[44].

Production in countries where the official mandatory emission requirements are at the same or a stricter level than this requirement is exempted from the requirement. No limit values have been defined for the indicated emission types in the EU Commission directives (Commission Directive 2000/39/EC, Commission Directive 2006/15/EC, Commission Directive 2009/161/EU) of relevance to the area. On the other hand, all working environment authorities in the Nordic countries have defined limit values for mineral dust, wood dust and organic dust generally, which are relevant for panel production systems in the product group. In Denmark, these limit values are covered by

[44] Order on limit values for substances and materials, Appendix 2

the mandatory "Order on limit values for substances and materials". The limit values in Norway are not mandatory but may become so by order of the Labour Inspection Authority.

Such strict requirements are not to be expected in the rest of the world. For example, magnesium oxide panels are imported into the Nordic Region from manufacturers in Asia. This requirement will thus ensure that working conditions in relation to dust emissions are acceptable regardless of where the panel was manufactured.

	Mineral dust, inert **limit value (8h)**	Mineral dust, inert, breathable **limit value (8h)**	Mineral wool **limit value (8h)**	Wood dust, breathable **limit value (8h)**	Organic dust **limit value (8h)**
EU*	None	None	None	EU value	None
Denmark**	10 mg/m^3	5 mg/m^3	1 fibre/cm^3	1 mg/m^3	3 mg/m^3
Sweden***	10 mg/m^3	5 mg/m^3	1 fibre/cm^3	2 mg/m^3	5 mg/m^3
Norway****	10 mg/m^3	5 mg/m^3	1 fibre/cm^3	1 mg/m^3	5 mg/m^3
Finland*****	10 mg/m^3	10 mg/m^3	1 fibre/cm^3	1 mg/m^3 (new plant)	5 mg/m^3

*** Danish Working Environment Authority, *** Swedish Work Environment Authority, **** Norwegian Labour Inspection Authority: Regulations, Order no. 704, *****Finnish Occupational Safety and Health Administration*

O32 Formaldehyde emissions from construction panels

The requirement covers all panels which are not marketed as pure facade panels. For panels which contain formaldehyde-based additives, or where the surface treatment includes formaldehyde, one of the two following requirements must be met:

1) The average content of free formaldehyde must not be more than 5 mg formaldehyde/100 g dry substance for MDF panels or 4 mg/100 g dry substance for all other panels as determined according to the current version of EN-120 or similar methods approved by Nordic Ecolabelling (see section in Appendix 1).

The requirement applies to panels in wood with a moisture level of H = 6.5%.

If the panels have a different moisture level within the range 3-10%, the analysed perforator value must be multiplied by a factor F, derived with the following formula:

For chipboard: F=-0.133 H + 1.86 For MDF: F = -0.121 H + 1.78

2) The average emission of formaldehyde must not exceed 0.08 mg/m^3 air for MDF panels or 0.07 mg/m^3 air for all other panels as determined according to the current version of EN 717-1 or similar methods approved by Nordic Ecolabelling (see description in Appendix 1).

✉ Analysis report including measurement methods, measurement results and measurement frequency. It must be clearly stated which method has been used, who carried out the analyses and that the testing institution is an independent third party.

Background for the requirement

The background for the requirement is that the use of formaldehyde must be limited because it is harmful to health and can cause health problems during both manufacture and use of the products. Formaldehyde is a toxic and sensitising substance with a

carcinogenic effect, and must therefore be limited as far as possible. Pure formaldehyde is classified as R23/R24/R25, R34, R40 and R43.[45]

Wood-based panels often contain adhesive systems with formaldehyde. The trend is to reduce formaldehyde emissions from the finished panel. However, one study has shown that there is a tendency for newly built houses, especially large ones, to contain formaldehyde in the indoor air. In two out of 20 homes examined, formaldehyde concentrations exceeded the limit value set by the World Health Organisation (WHO)[46].

Resins used for impregnation in HPL and laminate production have a high formaldehyde content. Free formaldehyde may be present at around 1 wt.%. Also, formaldehyde oligomers (synthetic polymer) may be present with a weight percent of over 50.

Formaldehyde emissions from construction panels are communicated in the EU by the classification system defined in the harmonised standard for wood-based panels EN 13986, in which the current lowest emissions class is E1 with a level of 0.124 mg/m^3 and 0.09 ppm. The technical committee TC112 has proposed a new class E1 plus for the harmonised standard for wood-based panels EN 13986, with the following emission levels: 0.08 mg/m^3 and 0.065ppm. However, this class has not yet been finally accepted in the discussions between the standards organisations and the European Commission, as it conflicts with the national legislation in many countries[47].

In the previous revision of the Nordic Ecolabelling criteria for construction panels, the requirement from E1 was at first halved to ½ E1 for both EN-120 and EN 717-1 test methods. ½ E1 is 0.062 mg/m3 for testing with EN 717-1. This proved to be technically possible but required an expensive process, and meant that the supply of these panels was very small, as the demand for ½E1 panels was limited.

The requirement level for formaldehyde emissions from panels has been harmonised to cover the Nordic Ecolabelling criteria for construction panels, furniture, outdoor furniture and play equipment, but particularly within the furniture industry it was impossible to find furniture panels of the required quality for the different functions of the product group which at the same time complied with the ½ E1 formaldehyde requirement. The emissions level was therefore adjusted in version 5 of construction panels by the use of EN 717-1 chamber methods. When using the perforator method, the ½ E1 level has been maintained. The reason for the difference between the two standards is that a correlation between the perforator method in EN 120 and the chamber method in EN 717-1 shows greater uncertainty for the perforator method.

On this basis, together with Nordic Ecolabelling's experience of formaldehyde emission levels from wood-based panels, it is assessed that the requirement levels for MDF can be tightened from 0.124 mg/ m^3 to 0.08 mg/m^3 when using EN 717-1. For other panel types, the already stringent level of 0.07 mg/m^{3}is retained. Both requirement levels are tight, but regarded as realistic.

The limit value for the other panels (<0.07 mg/ m^3 according to the chamber method) was considered tough enough not to require further tightening when the criteria document is revised for version 6.0. To illustrate how the Nordic Ecolabelling limit value

[45] Swedish Chemicals Agency Regulations EC-harmonised binding classification and labelling, KIFS 2005:5, p. 192
[46] Senior Researcher Lars Gunnarsen and Ph.D graduate Ásta Logadóttir at Danish Building Research Institute (SBi), Aalborg University
[47] Personal contact, Gonçalo Ascensão, Program Manager, CEN

relates to other limit values of interest, the table below shows the relationship between the corresponding limit values both according to the E1 standard and the CARB P2 Regulations. Nordic Ecolabelling's proposed limit values for both MDF and other panels are 64% of the corresponding CARB P2 values and 56% of CARB P2 for thin MDF panels. Nordic Ecolabelling requirements are also between 58% (other panels such as chipboard) and 75% (MDF panels) of the E1 limit values.

Table 24 Overview and comparison of Nordic Ecolabelling requirements and CARB P2 and E1 standard

Panel type	Nordic Ecolabelling requirement, version 6.0 with EN 717-1 test	CARB P2 (converted to mg/m³)*	E1 standard
MDF	0.08 mg/m³	0.14 mg/m³ (0.11 ppm) for >8mm panels 0.16 mg/m³ (0.13 ppm) for thin panels	0.12 mg/m³
Other panel types (e.g. chipboard)	0.07 mg/m³	0.11 mg/m³ (0.09 ppm)	0.12 mg/m³

** converted using equation [ppm = (mg/m3 * 24.47) / molecular weight of formaldehyde]*

O33 Emission requirements for the construction panel

The construction panel must be tested in accordance with CEN/TS 16516, ISO 16000-3/-6/-9/-10 or equivalent test method. Testing must be carried out by an accredited third party.

Panels which are exclusively marketed as facade panels are exempt from this requirement.

Emissions from Nordic Ecolabelled construction panels must comply with emission levels expressed either in mg/m²h or in mg/m³ according to the following table.

Substance groups	Limit value after 28 days in mg/m²h*	Limit value after 28 days in mg/m³h*
TVOC (C6-C16)	< 0.2	0.16
Carcinogens**	< 0.005	0.004

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

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

Other analysis methods are acceptable if considered equivalent by an independent competent body.

✉ The test report showing that the limit values in the table above have been satisfied. Valid certificate from subsequent indoor climate labelling scheme may be used as documentation: M1 after 01.07.2014. It must be clearly stated which test standard is being used, which laboratory has carried out the analysis and that the analysis laboratory is accredited by an independent third party, see Appendix 1.

✉ The certificate and underlying test report from other indoor climate labelling schemes, e.g. Danish Indoor Climate Labelling, may be used as verification/documentation if an independent expert can confirm that the certificate from the indoor climate labelling scheme fulfils the requirements.

Background for the requirement

Among the different parameters contributing to a good indoor climate is the use of low-emission building materials. Construction panels for indoor use in this context are characterised by their large surface areas, and limiting the emissions (evaporation) of harmful substances from construction panels is therefore important. The concerns relate to various chemical substances with properties such as CMR-classified or allergenic, an unpleasant odour or emitting a generally high content of foreign substances to the air.

The relevance of setting health and environmental requirements for substances causing emissions from construction panels is generally seen as high. But whether an additional requirement in Nordic Ecolabelled products provides an higher health benefit is uncertain, as Nordic Ecolabelling already sets strict requirements for constituent chemicals, individual substances and formaldehyde emissions. It can also be documented that Nordic Ecolabelling prohibits more CMR substances than those measured in many indoor climate labelling schemes, and there is no information that CMR substances are formed during production. A limitation of VOC in chemicals used in Nordic Ecolabelled products will mean a reduction in TVOC and SVOC emissions.

Emissions from construction panels may come from the following sources:

- Products used for surface treatment (lacquer, oils)
- Raw materials in the panel, such as plastic, wood, decor paper, additives in the raw material, etc.
- Other chemicals used, e.g. adhesives in wood fibre panels.

It is possible for manufacturers to replace harmful substances with less harmful substances and thereby reduce emissions. However, certain materials and chemicals are essential for producing construction panels of a satisfactory quality. Manufacturers may choose various materials and chemicals for their construction panel products and there is therefore a definite potential for achieving a better indoor climate.

Common emission parameters in existing indoor climate labelling schemes are: formaldehyde, volatile organic compounds (TVOC, SVOC and, in some schemes, individual VOCs), total CMR substances, ammonia, NH_3, (less common) and odour (less common). TVOC and SVOC are umbrella terms for volatile organic compounds and semi-volatile organic compounds, and also include, for example, natural terpenes from pine. One challenge is that the emission requirements in the different schemes are often somewhat unlike, both in the parameters tested and in the limit values. Nordic Ecolabelling has made a list of the different indoor environmental requirements laid down in the different certification schemes for buildings[48].

The requirement is new and ensures a documented minimum of selected emissions from the construction panel. Emission requirements of this type are directly reassuring for the end user. The requirement may be important for manufacturers who wish to adopt a high health profile, especially in relation to vulnerable user groups such as asthmatics, allergy-sufferers and children.

[48] This document is in Norwegian and can be obtained from Nordic Ecolabelling by sending a mail to sara.bergman@svanen.se

The requirement is based on the M1 scheme because this is widely used in the Nordic Region, is referred to in several certification schemes for buildings and has simpler criteria than many of the other schemes. The acceptance of other recognised indoor climate labelling schemes is also possible, if it can be documented that the requirement has been met and this is confirmed by an independent expert. One difference from the M1 scheme is that the formaldehyde requirement in these criteria is laid down as a separate requirement and thus not included in O33.

Different indoor climate labels indicate emissions as the emissions rate in mg/m^2h or as the concentration in a reference room in mg/m^3. In the requirement, the levels are therefore indicated in both ways, in order to permit use of different test certificates as a basis for assessment. After 1 July 2014, the M1 method stipulates that the limit values must be given as both emission rate and concentration in the reference room.

The majority of the existing indoor climate labelling schemes are based on EN ISO 156000:2006, the international standard for determining volatile organic substances from construction products[49]. However, there is a difference in how the indoor climate labels evaluate and present the results. In 2013, the following standard was also developed and published under the EU Construction Products Regulation, 89/106/EEC[50]: CEN/TS 16516:2013, "Construction products - Assessment of release of dangerous substances. Determination of emissions into indoor air". This is a new harmonised testing method for indoor air quality studies, and relates to the ISO 16000 series. Hence, the requirement refers both to the ISO 16000 series and CEN/TS 16516:2013.

The requirement allows for alternative analysis methods to be accepted if they are judged as equivalent by an independent competent body. The differences between the various tests are relatively complicated, and Nordic Ecolabelling therefore wishes the comparison to be made by competent laboratories or the like. For example, the Danish Indoor Climate Label (DIM) is a much used and reputable label in the Nordic Region. Its certificate states a so-called "indoor climate relevant time value" which in simple terms states how long it takes from when a product is installed in a building until emissions have reduced to an acceptable level from a health point of view.

Requirement O33 states a limit value for TVOC rather than limit values for individual VOCs. The main reason for this is that as yet no common international limit values for individual VOCs exist. Work is proceeding on the development of international levels, LCI values (Lowest concentration of interest), but no date has been set for concluding this work. In the next revision of the criteria, it must be assessed whether to alter the emission requirement to fall more in line with the EU recommendation of setting requirements for individual VOCs via LCI values, if the values have become internationally standardised.

Nordic Ecolabelling has chosen not to lay down requirements for ammonia and odour. Only the M1 scheme tests for ammonia. BREEAM-NOR does not require an ammonia test if the producer of the construction product confirms that ammonia is not relevant or that the product does not contain substances which can liberate ammonia. Currently,

[49] Report No 27 Harmonisation framework for indoor material labelling schemes in the EU, The European Commission Joint Research Centre, 2010
[50] Eurofins, VOC emissions from products, at website http://www.eurofins.com/product-testing-services/information/compliance-with-law/european-directives-and-laws/construction-products/voc-emissions-under-cpr.aspx (visited 31 January 2014)

according to Eurofins, the odour tests are not directly comparable[51]. However, quite recently, a standard for odour testing (ISO 16000-28) has been published. Hence, it may be relevant in the next revision to consider expanding the requirement to cover odour, if odour testing becomes more comparable.

4.3.7 Quality, properties and maintenance of construction panel

O34 Quality and properties of panel

For construction panels covered by a harmonised standard, the properties and functions with which the panel is marketed must be documented by a declaration of performance (DoP). As documentation, an example of CE marking and declaration of performance pursuant to the Construction Products Regulation (305/2011/EC) should be submitted.

For products not covered by a harmonised product standard, the construction panel's properties and functions may be declared either by a CE mark and declaration of performance pursuant to an ETA (European Technical Assessment).

Or alternatively, rather than an ETA, the construction panel's properties may be declared by a suitable third-party verification of the product's performance. In this case, the third-party verification must be approved by Nordic Ecolabelling.

☒ For products covered by a harmonised product standard, it should be stated which product standard(s) cover the product and the declaration of performance should be submitted.

☒ For products not covered by a harmonised standard, a description of why the panel is not covered by a harmonised standard should be given, and a declaration of performance should be submitted in accordance with an ETA for the Nordic Ecolabelled product or another third-party verification approved by Nordic Ecolabelling.

Background for the requirement

The requirement is new for the product group.

For construction panels covered by a harmonised product standard, it is a requirement of the EU Construction Products Regulation (CPR) that the CE marking of the panel must be accompanied by a Declaration of Performance (DoP). The contents of the DoP are described in Article 6 and Annex III of the CPR.

The aim of this requirement is to secure conformity between the properties and the functions with which the panels are marketed and the performance declaration drawn up in relation to the Construction Product Regulation. At the same time the requirement must ensure that panels not covered by a harmonised product standard also have documentation for the properties and functions with which the panel is marketed on the basis of standardised test results.

[51] Correspondence with Eurofins, November 2013

Harmonised standards

Harmonised standards is the term for standards deriving from EU legislation. In principle, the standards are voluntary, but in practice they are the easiest way of proving compliance with a Directive's requirements, as compliance with the standards gives a presumption of compliance with the Directive. In practice, the standards thus become an integrated part of the legislation. The harmonised standards (hEN) are drawn up for known product groups. For construction products covered by harmonised product standards, CE marking is mandatory.

According to the EU Construction Product Regulation, innovative products are all types of products and construction systems not covered by a harmonised standard. The innovative aspect implies that there are no previously laid-down standards or specifications for evaluating and verifying the product's properties. In the case of innovative products, a declaration of performance can instead be issued under an ETA approval (European Technical Assessment).

Voluntary standards

The EAD (European assessment document) is for innovative products. CE marking under an EAD is voluntary. The process for achieving CE marking on the basis of an ETA (European Technical Assessment) is the same as for a harmonised standard. ETA is a voluntary scheme for construction products which are not covered by the harmonised standards. It functions as a basis for a declaration of performance. The manufacturer must document that the product currently being marketed conforms to the requirements in the standard or is identical with the product described in the approval.

The European Technical Assessment is issued by a Technical Assessment Body (TAB) on the basis of a European Assessment Document (EAD) adopted by the European Organisation for Technical Assessment (EOTA)[52].

O35 Information about the product

The manufacturer/supplier must inform the consumer about how best to use, maintain and store the product. The information must be given in the official language of the country in which the Nordic Ecolabelled product is marketed.

The product must be accompanied by written instructions which state:

- The area of use for which the product is intended.
- How the product is to be stored on the building site.
- Assembly and instructions for any surface treatment
- How the product is to be maintained, which maintenance products are suitable for the product (paint, oils, etc.) and how often these maintenance products must be used.

✉ Copy of information material which accompanies the construction panel.

[52] http://ec.europa.eu/enterprise/sectors/construction/declaration-of-performance/assessment-documents/index_en.htm

Background for the requirement

The construction board achieves its optimum performance when used in accordance with the intended use and maximum product life through maintenance and proper storage. Reduced lifetime of the product results in an overall increase in environmental impact of the building board and it is therefore important that information on proper maintenance and use of the building board are disclosed.

4.3.8 Quality and official requirements

To ensure that the Nordic Ecolabel requirements are met, the following procedures must be implemented.

If the manufacturer has a certified environmental management system in accordance with ISO 14 001 or EMAS in which the following procedures are implemented, it is sufficient for the accredited auditor to confirm that the requirements are being implemented.

O36 Legislation and regulations

The licensee must guarantee adherence to safety regulations, working environment legislation, environmental legislation and conditions/concessions specific to the operations at all sites where the Nordic Ecolabelled product is manufactured.

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

✉ Declaration from the licensee that the requirement is met, and details of the regulatory authority.

O37 Person responsible for the Nordic Ecolabel

One person at the enterprise must have responsibility for ensuring that the Nordic Ecolabel requirements are fulfilled, and one person must act as a contact with Nordic Ecolabelling.

✉ Organisational structure showing those responsible for the above.

O38 Documentation

The licence holder must be able to produce a copy of the application and data and calculation material (including test reports, documents from subcontractors and the like) for the documentation submitted in connection with the application.

🔑 To be checked on site.

O39 Product quality

The licence holder must guarantee that the quality of the Nordic Ecolabelled construction panel will not deteriorate during the period of validity of the licence.

✉ Procedures for receiving and, where necessary, dealing with claims/complaints concerning the quality of the Nordic Ecolabelled products.

O40 Planned changes

Planned product and market changes that affect the Nordic Ecolabel requirements must be reported in writing to Nordic Ecolabelling.

✉ Procedures showing how planned product and market changes are to be handled.

O41 Unforeseen non-conformities

Unforeseen non-conformities that affect the Nordic Ecolabel requirements must be reported in writing to Nordic Ecolabelling and logged.

✉ Procedures showing how unforeseen non-conformities are to be handled.

O42 Traceability

The licence holder must be able to trace the Nordic Ecolabelled product in the production process.

✉ Description/procedures for how the requirement is to be met.

O43 Take-back system

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

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

O44 Marketing

The marketing of Nordic Ecolabelled construction panels must comply with "Rules on Nordic Ecolabelling" 22 June 2011 or later versions.

✉ Completed and signed copy of Appendix 10.

Requirements O36 to O43 are general quality assurance requirements for ensuring that the ecolabelled products fulfil the requirements and comply with legislation and regulations such that the products maintain the environment quality which is the purpose of the requirements. Most of these requirements are general and apply to all production of ecolabelled products. Individual requirements are not justified in greater detail here.

5 Changes compared to previous version

Table 25 Changes compared to previous version of the criteria

Revised criteria (6.0)	Previous criteria (5.0)	Comment
O1 Information	R1	The requirement has been reformulated with a new materials table
O2 Heavy metals	R8	The limit values in the requirement have been tightened since the previous version
O3 Dust emissions	R9	The requirement level has been changed since the previous version
O4 Radioactive substances	R10	The requirement level has been tightened since the previous version from 1 to 0.5. A new specification of raw materials covered by the requirement has been added.
O5 Paper, cardboard and pulp	New requirement	A requirement for certified or recycled fibre has been added, as several panel types contain paper, especially the new HPL panel type.
O6 Solid wood, veneer and bamboo - origin and traceability	R2	The requirement has been updated to harmonise with Nordic Ecolabelling's latest wording of the requirement for origin and traceability. At the same time, the requirement has been extended to include bamboo.
O7 Certified solid wood, veneer and	R4	The requirement has been updated to harmonise with Nordic Ecolabelling's latest wording. The requirement has been

Revised criteria (6.0)	Previous criteria (5.0)	Comment
bamboo		tightened since the previous version, from 50% to now 70% certified wood.
O8 Biocides in connection with felling	R3	The requirement has not been changed compared to the previous version.
The requirement has been omitted.	R5 Bleaching of paper and cardboard	The requirement has been removed, as RPS analysis has shown that this is not where the greatest environmental relevance, potential and controllability for the product group lie.
O9 COD emission from paper	R6	The requirement has been updated with differentiated requirement levels according to the type of pulp or paper used. Has both been tightened and relaxed, depending on the pulp type.
The requirement has been omitted.	R7 Tensides for cleaning recycled fibres	The requirement has been removed, as RPS analysis showed that this is not where the greatest environmental relevance, potential and controllability for the product group lie.
O10 Resource requirements for plasterboards	New requirement	The requirement is new since the previous version of the criteria.
O11 Resource requirements for mineral wool panels	New requirement	The requirement is new since the previous version of the criteria.
O12 Resource requirements for cement-based panels	New requirement	The requirement is new since the previous version of the criteria.
O13 Energy requirements for paper and pulp production	New requirement	The requirement has been added as several panel types contain paper, especially the new HPL panel type. Applies in cases with more than 20 wt.% paper/pulp in the panel.
O14 Energy requirements for HPL panel production	New requirement	The requirement has been added as the product group now includes HPL panels
O15 Energy requirements for wood-based panels	R19	The requirement has been changed to a pure energy requirement without weighting with other parameters such as certified, reused and renewable raw materials.
O16 Energy requirements for plasterboards	R19	The requirement has been changed to a pure energy requirement without weighting with other parameters such as certified, reused and renewable raw materials.
O17 Energy requirements for mineral wool panels	R20	The requirement has been changed to a pure energy requirement without weighting with other parameters such as certified, reused and renewable raw materials.
Requirement omitted	R21 Emission to air	The requirement has been omitted, as the focus in the new energy requirements is on primary energy. For cement-based panels a CO_2 weighting has been included in the energy requirement
O18 Energy requirements for cement-based panels	New requirement	A new requirement has been added specifically for cement-based panels.
O19 Classification of the chemical product	R11	Requirement level unchanged. The requirement has been updated to accommodate CLP and the new product types in the product group.
Requirement omitted	R12 Cleaning chemicals	The requirement has been removed, as RPS analysis showed that this is not where the greatest environmental relevance and potential for the product group lie.
O20 CMR	Was included	Has received its own requirement number and has been

Revised criteria (6.0)	Previous criteria (5.0)	Comment
classification of constituent substances	as part of R13	updated to match CLP, otherwise unchanged.
O21 Excluded substances in chemical products	Was included as part of R13	The requirement has now been clearly limited to cover only the chemical products used for the production of construction panels. The requirement has been extended to include isocyanates (apart from one exemption), Candidate List substances, potential endocrine disruptors in Category 1 or 2 on the EU Priority List and PBTand vPvBsubstances. Certain substance groups have been taken out of the requirement and given their own requirement number.
O22 Biocides	Was included as part of R13	The requirement for preservatives in chemical products has been formulated as a separate requirement in this version. The requirement for isothiazolinone has now been differentiated, with a specific level for outdoor paint and lacquer.
O23 Nanoparticles	R15	The requirement has been reworded in this version of the criteria and it is specified that polymer emulsions are not considered to be nano material, or in the case of an exemption from the requirement.
O24 Environmentally harmful substances in the panel	R16	The requirement has been changed by weighting the different environmental hazard classifications differently depending on the actual environmental hazard which the classified substances pose.
O25 Environmentally harmful substances in the surface treatment	R17	The requirement has been changed by weighting the different environmental hazard classifications differently depending on the actual environmental hazard which the classified substances pose.
O26 VOC in adhesive	Was included as part of R13	VOC level unchanged. Requirement for VAH tightened from 1 wt.% to 0.1 wt.%.
O27 VOC in surface treatment	R18	The requirement level is unchanged compared to the previous version, as evaluation has shown that the requirement is still a strict one.
O28 Free formaldehyde	R14	The requirement has not been changed in this revision.
O29 COD Emission to water	R6	The requirement has not been changed in this revision.
O30 Emissions from HPL production	New requirement	New requirement added because of expansion of product group to include HPL panels
O31 Dust emissions from panel production	New requirement	The requirement is new and included because the criteria now contain several further types of panel production where this is relevant
O32 Formaldehyde emission	R23	The requirement levels for MDF panels have been tightened from 0.124 mg/m3 to 0.08 mg/m^3 with the use of EN 717-1. The remainder of the requirement is unchanged
O33 Emission requirement	The requirement is new.	The requirement is new for the product group and must be seen as a supplement to the chemical requirements for constituent substances which already ensure a low VOC content and that no carcinogens are used. The requirement has been included as indoor climate certification schemes are widespread in construction panels and used as documentation within sustainable construction.
O34 Quality and properties	New requirement	The requirement is new for the product group. The aim of this requirement is to secure conformity between the properties and the functions with which the panels are marketed and the performance declaration drawn up in relation to the Construction Product Regulation.
O35 Information about the product	R26	The requirement has been reformulated and a requirement for stating the area of use has been added.

Revised criteria (6.0)	Previous criteria (5.0)	Comment
O36-O43	R28-R34	The requirements are unchanged.

6 New criteria

- Looking at the opportunity for tightening requirements in favour of higher share of recycled materials, e.g. in plasterboards
- Examining the potential for energy requirements for production of resin and other adhesives, with special focus on energy for raw materials.

Appendix 1 Other labelling schemes

Green Building Council (GBC)

About 90 countries throughout the world are members of GBC, which is a network for national Green Building Councils. Green Building Councils are membership-based organisations which collaborate with businesses and the authorities. It is for national GBCs to choose the sustainable construction schemes which they wish to represent. Green Building Councils have been established in Sweden, Norway, Finland and Denmark, but with different certification schemes for sustainable construction. Further descriptions of the different labelling schemes are given below.

Labelling schemes in the Nordic Green Building Councils[53]:

- GBC-NO has selected a Norwegian version of BREEAM,
- GBC-SE represents BREEAM, LEED, Swedish Green Building Council and GREENBUILDING.
- GBC-DK has chosen to implement a Danish version of the German scheme DGNB
- GBC-FI has a policy of neutrality, but both LEED and BREEAM are used in Finland.

As these sustainability schemes have different environmental criteria, the construction panel manufacturers in the Nordic Region are subject to different requirements for environmental documentation, depending on the scheme being applied. As described below, BRE (British Building Research Establishment), which is also responsible for BREEAM, has developed a classification system for building products.

BREEAM

BRE Environmental Assessment Method or BREEAM was introduced in 1990 as one of the first certification schemes for sustainability in the UK. Today the certification scheme is also used outside the UK, and Norway has adopted a Norwegian version, BREEAM NOR, in which a large part of the Norwegian building industry contributed to adapting the standard to Norwegian conditions. Ecolabelling Norway has been involved in the development of BREEAM NOR, and has ensured that Nordic Ecolabelled products earn points in the chapters on use of materials and indoor climate (and in some cases for responsible purchase of wood, etc.) The use of Nordic Ecolabelled products can also be used as documentation that the products do not contain substances banned by the Norwegian authorities on the Norwegian Environment Agency (formerly KLIF) "Priority List".

[53] The Nordic GBC websites

BRE classification system

BREEAM has compiled a "Green Guide" which awards points on a sliding scale for the use of building materials with defined classifications. The Green Guide is based on the BRE Global Environmental Profiles Scheme for Type III Environmental Product Declarations (EPD) for building products[54].

In cooperation with the British government and 24 trade associations in the building sector, BRE has developed a standard methodology for life cycle assessment of all forms of building products in respect of 13 different environmental categories [55]. The total environmental impact of a specific product or a specific process is measured in "ecopoints". The total number of ecopoints derives from the result of the different impact categories and is calculated by multiplying the normalised impact by its percentage weighting. The average environment impact of a typical UK resident is here used as a reference value and corresponds to 100 ecopoints. The higher the ecopoint figure, the greater the environmental impact.

For example, on the basis of a life cycle analysis, ROCKPANEL has received a BRE EPD (Building Research Establishment Environmental Product Declaration) which ranks the products among the best in categories A+ and A for different constructions[56].

In this way BRE environmental product declarations are used as a form of environmental label, but on the basis of Type III environmental labels! The advantage of this is that it provides both LCA information for a possible LCA and the ecopoint ranking gives a guideline as to what is environmentally favourable or poor. The disadvantage is that the system is not transparent. It is not clear what specific environmental performance has been achieved and what is necessary to achieve label A+.

LEED

LEED (Leadership in Energy and Environmental Design) is an American certification scheme. The development of LEED began in 1993 with the establishment of the American Green Building Council, USGBC, and the first LEED version 1.0 was launched in 1998. LEED has been used for a considerable number of projects, mainly in the USA, but also in a number of other countries.

DGNB

DGNB (German Sustainable Building Certificate) is a German certification scheme developed by DGNB (German Sustainable Building Council). Alone among the Nordic countries, Denmark has implemented a Danish version of DGNB, Standard DGNB-DK.

Environmental labels Type I

Environmental labelling is a voluntary scheme for showing the environmental properties of a product or service. This is done via certification according to a number of previously determined requirements (criteria). Nordic Ecolabelling's "Swan" label and similar

[54] http://www.bre.co.uk/page.jsp?id=1578
[55] http://www.rockpanel.dk/anvendelse/holdbarhed/bre
[56] http://www.rockpanel.dk/anvendelse/holdbarhed/bre

environmental labels are so-called Type I environmental labels (cf. Standard ISO 14024) and demonstrate the following:

- that the requirements are based on a selection of the most important environmental aspects of the whole life cycle
- that the requirements have been determined in an open and transparent process, in which all stakeholders have the opportunity to participate
- that an independent third party has checked that the product/service complies with the laid-down criteria

The requirements for a product area have been set to an environmental level such that only the environmentally best products on the market can be awarded an environmental label.

LEED, BREEAM and DGNB are all schemes which are life-cycle based, multi-criteria based and third-party controlled. However not all are Type I environmental labels, cf. ISO 14024, as some of the schemes are not transparent with definitely fixed requirement levels.

Alongside the Nordic Ecolabel, the following environmental label type I criteria exist for construction panels:

- Blaue Ängel, German environmental label administered by the Federal Environmental Agency (FEA)[57]. It has criteria for "Low-emission Composite Wood Panels RAL-UZ 76" (11 licences)
- EcoLogo[58], a Canadian environmental label administered by Environment Canada. It has criteria for: "Construction Framing Materials and Assemblies" (0 licences, 02.01.2009), "Gypsum Wallboard" (1 manufacturer has a licence with approx. 200 trade names, 02.01.2009) and "Fibreboard from Recycled Resources" (0 licenses, 02.01.2009).

In addition, there are criteria in Japan, Korea, Australia and Taiwan, etc., but these national environmental labels do not appear to be much used in the Nordic market.

Environmental Product Declarations (EPDs)

An EPD (Environmental Product Declaration) is a verified environmental product declaration for a product. An EPD is a Type III environmental label as defined in Standard EN 14025 and under this standard must contain information about the most important environmental properties of a product during the whole of its life cycle. The scheme is mainly aimed at B2B manufacturers and EPDs are much used in the building sector for different construction products.

[57] "The Blue Angel", the official German environmental label, accessible from http://www.blauerengel.de/en/index.php (02.01.2008)
[58] EcoLogo, the official Canadian environmental label, Accessible from: http://www.ecologo.org/en/ 02/01/2008

Here, no environmental requirements are laid on the products, so all products can be given an environmental product declaration regardless of how much or how little they impact the environment. Assessing an environmental product declaration thus requires a good deal of knowledge on the part of the reader.

To a certain extent it has been ensured that the information is gathered and calculated in the same way, so it is theoretically possible to compare EPDs for competing products in a product group. However, until now the challenge has been that there are different "Product Category Rules" (PCR) in different countries for the same product group. The PCRs lay down the premisses for formulation of the EPDs. If there are EPDs for the same product group from several countries which are based on different PCRs, they are not necessarily directly comparable as they may make different assumptions or have different bases. Some Norwegian EPDs bear the words: "EDPs from other program operators than the Norwegian EPD Foundation may not be comparable". This makes it hard for consumers (and environmental consultants) to compare the EPDs for the products. There can also be a difference in how many phases of the product's life cycle are included in the different EPDs. This is thus another area to be aware of in making comparisons.

Often EPDs contain no specific information about chemicals classified as harmful to health or an environmental hazard which are used in production or present in the product.

The Standard "EN 15804:2012 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products" describes the general product category rules (PCR) for developing EPDs for construction products. It is now the intention to develop product-specific PCRs. There are several examples of businesses developing EPDs on the basis of EN 15804 if there is no PCR for the product group.

Procurement requirements (GPP)

There are EU GPP criteria for wall panels (gypsum and wood-based) and for construction work which also includes building materials[59]. The Swedish Environmental Management Council[60] has procurement criteria for new build and rehabilitation, but not specifically for construction panels. DIFI (Norwegian Agency for Public Management and eGovernment)[61] has guidelines for the building process. In October 2010, the Danish Ministry of the Environment established the Forum on Sustainable Procurement. The Forum's aim is to promote environmentally conscious and sustainable procurement by professional buyers of goods and services - both in public and private organisations. This is done by means of newsletters, conferences, after-hours meetings and much more. The Forum includes a construction group.

[59] http://ec.europa.eu/environment/gpp/pdf/toolkit/construction_GPP_product_sheet_da.pdf

[60]Swedish Environmental Management Council Information on procurement criteria. Retrieved April 8, 2012 from: http://www.msr.se/

[61]DIFI Norway. Norwegian Agency for Public Management and eGovernment Information about public procurement. Retrieved April 8, 2012 from: http://www.anskaffelser.no/tema/2009/06/miljokriterier

Indoor climate labels

For the construction panels product group, different emission and indoor climate labels are used. For wood-based panels, there is a big focus on formaldehyde emission, while for all construction products generally, including construction panels used inside the climate screen, the focus is on the product's influence on the indoor climate of the building, as defined by parameters such as emission of VOC, carcinogens (including formaldehyde) and odour.

International emission test

EN ISO 16000: 2006 is the international test for determining volatile organic substances from construction materials. Several indoor climate labels use EN ISO 16000 as a test, but there are differences in how the results are evaluated and presented. A simple version of this test may consist of just TVOC (the total VOC emission), reported as its toluene equivalent. More advanced versions may compare individual TOC results with one or more limit values. The following list of limit values for LCI, CLI, NIK and CREL is used by the different indoor climate labels to evaluate VOC emissions in respect of the indoor climate[62].

As the different volatile substances have different limit values due to the difference in their harmful effect on health, it makes sense that the tested substances are not weighted equally. For this reason, several indoor climate labelling schemes do not only have a limit value for TVOC but also specific limit values called LCI values (LCI= Lowest concentration of interest) for individual substances. Efforts are currently ongoing at the international level to develop international limit values (LCI= Lowest concentration of interest). This will enable the different indoor climate labelling schemes to have the same reference values and make them more comparable. However no date has been set for when these values are expected to be ready.

M1 (Finnish indoor climate labelling scheme)

The Finnish indoor climate labelling scheme (M1) was developed by the Finnish Society of Indoor Air Quality and Climate (FiSIAQ) in 1995. M1 uses the ISO 16000 series and lays down requirements for the following emissions: TVOC, formaldehyde, ammonia, carcinogens and odour. Emission class M1 corresponds to the best quality while emission class M3 covers materials with the highest emission rates. Classified materials must fulfil the criteria 28 days after production.

Danish Indoor Climate Labelling Scheme

The Danish Indoor Climate Labelling Scheme also uses EN ISO 16000 as a basis for the scheme. It lays down requirements for having analyses carried out until the emission rate converted to concentration in a standard room is below half of the irritation threshold (IT) for the individual substances, with the limit value taken from VOCBase (Jensen. B, 19996). It assesses the results in relation to the surface area of the product in contact with the room air, cf. Danish Indoor Climate Label definition of a standard room for the product type in question. The time value measured must be lower than or equal to a predetermined limit value, cf. VOCBase for the specific product type, in order to receive the Indoor Climate Label. Currently, Danish Indoor Climate Labelling uses limit values

[62] http://www.eurofins.com/product-testing-services/services/testing/safety---chemicalelectricalfire/chemical-safety/voc-emissions-into-indoor-air/indoor-air-limit-values-.aspx visited on 21/8 2012

from VOCBase, which is a Danish database[63], but is mainly based on international limit values. However, the database is not being updated, as Danish Indoor Climate Labelling awaits the international LCI values. In addition, Danish Indoor Climate Labelling lays down requirements for carcinogens, a requirement of max. 75 µg/m^3 formaldehyde emission (after 60 days) and an odour test.

AgBB

AgBB (Committee for Health-Related Evaluation of Building Products) is a German indoor climate labelling scheme for building products, with a focus on volatile organic compounds. This uses LCI (Lowest Concentration of Interest) values as one of its parameters for health-related evaluation of emissions of individual substances from building materials. The LCI values from AgBB are updated approximately every two years and are based on OEL values (Occupational Exposure Limits)[64]. The latest list dates from 2012 and is available on http://www.umweltbundesamt.de/produkte-e/bauprodukte/agbb.htm .

This lays down requirements for substances such as TVOC, SVOC, selected carcinogenic VOCs, aldehydes and substances with LCI values.

AFSSET (now ANSES)

The French AFSSET Agency (now called ANSES) developed the AFSSET Protocol 2009 guideline to limit VOC emissions in indoor air. The test method used is ISO 16000 (parts 3, 6, 9, 10 and 11). AFSSET 2009 can be used for many different building products, and requirements are laid down for the following emissions:

- Carcinogens after 3 and 28 days
- Formaldehyde limit
- Total VOC (TVOC) after 3 and 28 days
- VOC with a defined CLI limit value after 28 days (some 160 limit values are specified)

There is no official "AFSSET" label, as these are only guidelines, and it is important not to confuse these guidelines for the French rules for VOC emissions (A+).

Harmonisation of indoor climate labelling schemes in EU

In 2010, the European Collaborative Action (ECA) prepared a "draft report", Report No 27, Harmonisation framework for indoor material labelling schemes in the EU. The report is available here:
http://www.eurofins.com/media/1744366/ECA_report_no_27_final%20draft.pdf

The report gives the following summary of important European indoor climate labelling schemes for building products:

[63] Jensen, B. and Wolkoff, P. VOCBASE, 1996
[64] Harmonisation framework for indoor material labelling schemes in the EU, ECA Report no. 27, 2010.

Table 4. Consensus reached for the measurement methods, the core and the optional criteria

Requirements / Parameter	M1 Finland	DICL Denmark	AgBB Germany	AFSSET France	Consensus
Measuring method / Chamber	ISO 16000 series	ISO 16000 series	ISO 16000 series	ISO 16000 series	Harmonised CEN Standard (based on ISO 16000 series)
Measuring points (days)	28	3, 10 and 28	3 and 28	3 and 28	3 and 28
Core criteria					
Single VOCs evaluated ($R = \sum Ci/LCI < 1$))	No	comparison with irritation threshold	R < 1 165 LCIs (2010)	R < 1 164 LCIs (2009)	R < 1 Harmonised list of LCIs
Carcinogens evaluated according to Concentration admitted	IARC class 1 SERa < 5 µg/m³h	IARC class 1	EU classes 1 and 2 56 listed compounds Sum < 1 µg/m³	EU classes 1 and 2 2 listed compounds < 1 µg/m³	Harmonised list of EU carcinogens classes 1 and 2 compounds to be checked
TVOC measured	SERa < 200 µg/m³h	No	1000 µg/m³	1000 µg/m³	200-1000 µg/m³
Formaldehyde measured	SERa < 50 µg/m³h	75 µg/m³ (after 60 days)	No[1]	10 µg/m³ (LCI)	Value to be discussed
Optional criteria					
Compounds without LCI assessment	No	No	Sum < 100 µg/m³	Sum < 100 µg/m³	Sum < 100 µg/m³
Other compounds evaluated	Ammonia				
TSVOC measured	No	No	< 100 µg/m³	No	Await validation TC 351
Sensory evaluation	Acceptability untrained panel 15 persons	Acceptability and intensity;untrained panel 20 persons	No (Draft for intensity measurement developed)	No	Await ISO 16000-28

[1] Fomaldehyde measurement required for approval application at DIBt

The report describes the consensus achieved for a harmonised framework for labelling schemes in Europe. The work was carried out by representatives of Danish Indoor Climate Labelling (DIM), the Finnish (M1) indoor climate labelling scheme and the German and French evaluation systems for indoor climate (AgBB and AFSSET respectively). The framework in the final column above summarises the important shared criteria for testing and evaluation methods for the indoor climate test.

I was interested in hearing how far the work had progressed. He told me that a working party had been set up and developed various guidelines for producing joint EU LCI values. This work was completed in Dec 2012, but subsequently no action was taken by the Commission, to the surprise of those involved. The German Environment Agency has now started to press the Commission for further progress.

The plan is that the various indoor climate labelling schemes will work towards making their schemes resemble the consensus reached in ECA Report no. 27. However, no progress can be made without the common LCI values. In principle, Danish Indoor Climate Labelling could easily make some of the other changes, such as introducing a TVOC requirement, but they do not wish to make a mass of small changes to their criteria and are therefore awaiting the common LCI values before taking action.

At the same time, in relation to CE marking, work is progressing on a horizontal standard for release of gases from building products (TS16516). The idea is that when it is finished it must be implemented in the different product standards in relation to the CE marking of building products (this will be done over several years). This test standard should also be of use with regard to the recommended indoor climate parameters in Report no. 27. But for the time being, the ISO 16000 series is used[65].

[65] Telephone conversation with Thomas Witterseh from Danish Indoor Climate Labelling on 6/8 2013

CARB Phase 2 certificate

Apart from the E1 certificates, the CARB Phase 2 certificate is often used for formaldehyde emissions from wood-based construction panels. California Air Resources Board (CARB) issues third-party verified certificates for various types of wood panels. These require a formaldehyde test in accordance with standards ASTM E1333 or ASTM D6007.

LEED system for Indoor environmental quality

In LEED projects outside North America, testing and evaluation is may be carried out with the CDPH standard method or the German AgBB Testing and Evaluation Scheme (2010) 15 together with ISO 16000 parts 3, 6, 9 and 11 or the DIBt test method, or the 2013 implementation of CEN/TC351 is acceptable. American projects must follow the CDPH standard method. TVOC is measured after 14 days under the CDHP standard method.

In the following intervals: less than or equal to 0.5 mg/m3, between 0.5 and 5.0 mg/m3, greater than or equal to 5.0 mg/m3. Products which in principle do not emit VOC sources - especially stone, ceramics, powder-coated metals, coated metal or anodised metals, glass, concrete, light brick and unfinished/untreated solid timber, are regarded as fully compatible without a VOC emissions test, unless they contain integral organically-based surface coatings, binders or jointing compounds.

BREEAM NOR

For wood-based construction panels, BREEAM in Norway lays down emission requirements in the form of an E1 formaldehyde test (EN 717-1), and also that the VOC emission must comply with the values of Annex C of standard EN 15251 (2007 version), which is identical with the Finnish M1 labelling scheme. Here requirement levels for "low-pollutant materials" and "extremely low-pollutant materials" are given for the following compounds: TVOC, formaldehyde, ammonia, carcinogenic compounds (IARC) and odour. The requirement levels are given in mg/m2h[66].

Raw materials labelling and traceability systems

Within the construction panels product group, sustainability labels for wood are of particular relevance. There are certifiable forestry standards such as PEFC and FSC, as referred to by Nordic Ecolabelling (but with a requirement for national implementation of the standard), in all the criteria for which sustainable wood raw materials are relevant. Bamboo may either be certified under a standard for sustainable forestry or as organically cultivated.

[66] http://www.eurofins.com/product-testing-services/information/sustainable-buildings/breeam/breeam-norway.aspx