Nordic Ecolabelling for Exterior panels and cladding

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Nordic Ecolabelling

Contents

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1 Summary

The Nordic Ecolabelling criteria for panels and cladding for exterior use have been revised to generation 2. Nordic Swan Ecolabelled panels and cladding for exterior use have a reduced environmental and climate impact throughout their lifecycle, achieved through the procurement of controlled renewable and mineral raw materials and reduced energy consumption. The environmental impact is also reduced by using chemicals that meet strict requirements during both production and surface treatment. Good quality and a long product lifespan have a direct positive effect on the environmental impact. The possibility of recycling panels further minimises negative environmental impacts when the products reach the end of their life.

The extraction of both renewable and mineral raw materials can have significant impacts, particularly on biodiversity and the landscape. In the draft version of the new criteria, the requirements for the use of certified virgin renewable materials and documented recycled materials have been strengthened. A new requirement has also been introduced for the responsible sourcing of mineral raw materials, such as stone, volcanic rocks, silica, and sand.

Energy-efficient production of products is crucial for reducing environmental and climate impact. Therefore, the requirements on energy consumption have been tightened and specified for each type of panel, including wood-based panels, HPL, wood plastic composite (WPC), solid wood for cladding, and cement-based panels. Cement production, which is essential for cement-based panels, consumes significant amounts of energy and is a major source of carbon dioxide emissions. As a result, specific energy requirements have been introduced for cement production. Reducing the impact of cement production helps lower the overall environmental impact of cement-based panels.

The adhesives and resins typically used in the production of wood-based panels and HPL contain formaldehyde, a toxic chemical substance that Nordic Ecolabelling aims to limit, along with substances such as per- and polyfluoroalkyl substances (PFAS) and halogenated flame retardants. New innovation requirements also encourage the use of chemical products free from substances classified as SVHC (substances of very high concern) or CMR (carcinogenic, mutagenic or toxic for reproduction), as well as adhesives that are not based on urea-formaldehyde.

The criteria have also been updated from a circular economy perspective. New requirements have been introduced for a minimum share of renewable raw materials in various types of materials, as well as for the durability and guarantee of the panels. Manufacturers must provide a system for taking back old, used panels, defective products, or panels not used in the construction process.

The criteria have been expanded to include wood plastic composite (WPC), as this offers several advantageous façade properties, such as a long lifespan and limited maintenance needs, along with surface-treated solid wood. Cross-laminated timber (CLT) has been moved to the criteria for panels for interior use.

As in the previous version of the criteria, Nordic Swan Ecolabelled products must comply with the requirements of the Construction Products Regulation (EU/305/2011), concerning the documentation of the properties and functions with which the product is marketed.

For a full description of the changes in the revised generation 2, see the table chapter in section 6.

1.1 Background to the product group definition

It has been clarified that the definition of the product group primarily includes panels or cladding designed to provide protection against weather condition (rain, sunlight, frost, aka outer climate shield) of a building. Also, these panels are usually designed to be mounted on to the outside of the building construction and are therefore not part of the wall construction itself. If panels or cladding are sold together with a unique fitting system or installation bracket (often aluminium) this fitting system is covered be the criteria. Panels designed for use in production of outdoor furniture, playgrounds and exterior design are also part of the criteria.

The product group definition specifies various panels made from different types of materials that can be labelled. A maximum of 10% by weight of the product may consist of materials that are not required by the criteria. This allows panels to contain a limited amount of materials for which there are no requirements.

The mechanical properties of wood-based panels vary with moisture content, which depends on the environment in which the panel is used[1]. Therefore, only wood-based panels suitable for service class 3 according to EN 13986 (exterior use – fully exposed) are part of the criteria.

The product group definition has been expanded with wood plastic composite panels (WPC) and surface treated solid wood used for cladding. The definition of mineral wool façade panels has been made clearer. Cross laminated timber (CLT) has been removed to criteria for panels for interior use.

Wood plastic composite panels according to EN 15534 is characteristic of a high share of recycled raw materials mixed with resin or polymer binders which results in a long lifespan and minimal need for maintenance which is important in a circular perspective. Requirements for take-back system as well as a general use of recycled raw materials promotes circular economy.

Surface treatment (painting) of solid wood is often necessary to extend the surface life of the wood. Solid wood with naturally long durability (no surface treatment), chemically or thermally modified wood is already part of Nordic Swan Ecolabelling criteria for durable wood but does not include surface treated wood. The product group durable wood is intended for various applications, such as cladding, decking or fencing. Surface treatment of solid wood is often applied to cladding, and therefore, it is included in these criteria. Surface treated solid wood must comply with EN 14915 suitable for use class 3. The surface treatment (primer or paint) must be carried out by the manufacture of wood cladding. The paint or primer needs to comply with the chemical requirements alternative be ecolabelled.

[1] https://hanson-plywood.co.uk/wp-content/uploads/2017/06/Specification-and-use-of-wood-based-panels-in-exterior-situations-1.pdf, visited September 2023

Pressure-impregnated solid wood with both biocides and metals is not part of the criteria. The purpose is to limit the use of chemical wood preservatives containing heavy metals.

Cement is used as a binder in both cement- and wood-based panels. Cement must comply with the definition in EN 197–1. The cellulose component varies widely in the different types of panels. Common to all types of cement-based panels are strict requirements for certified wood raw materials and energy use both for the actual production of cement and the production of the various types of panels.

Fully prefabricated wall elements, such as wall systems complete with structural framing, water/air/vapor barrier(s), insulation, and interior/exterior panels, are not included in the criteria. This is primarily due to the difficulty of comparing wall elements with multiple functions. The same applies to sandwich panels, as the core often serves as a heat, cooling or thermal insulation.

Aluminium- and steel panels are not part of the criteria as the production is energy-intensive and the potential for gaining an effect by increasing the share of recycled metal is low. The development of manufacturing glass façades from recycled glass is still exceptionally low and therefore there is no potential to include glass panels/façades in today's criteria.

Masonry units defined in the EN 771 series and clay façade tiles defined in EN 1304 are not part of the criteria as these can be part of the wall or roof construction.

2 Requirements and justification of these

This section presents requirements, and explains the background to the requirements, the chosen requirement levels, and any changes since generation 1. The appendices referred to in the requirements can be found at the end of the criteria document.

2.1 Overview of the requirements

The criteria are mainly divided into requirement areas where some of the requirements apply to all panel types, while others only apply to certain panel types. The table below provides an overview of the requirements that must be met for the different panel types.

Requirement area	Requirement	Number of requirements	Responsible for the documentation
Description of product and production process	General requirements	O1	Product manufacturer
Quality			
Product requirements	Quality and properties	O2	Product manufacturer
Raw materials			
Wood raw materials	Wood, cork, and bamboo	O3 O4	Product manufacturer/Subcontractor Product manufacturer
	Recycled wood raw material	O5	Product manufacturer/Subcontractor
Lignocellulose raw materials	Lignocellulose raw materials	O6	Product manufacturer/Subcontractor
Paper	Ecolabelled paper	O7	Product manager
	Raw materials, chemicals, and emissions in manufacturing of pulp and paper	O8-O11	Product manufacturer/Subcontractor
Wood Plastic Composite	Wood fibre and plastic	O12	Product manufacturer
	Chemicals and additives in plastic	O13-O14	Product manufacturer/supplier of recycled plastic
Mineral raw materials	Responsible sourcing	O15	Product manufacturer
	Heavy metals	O16	Supplier of mineral raw materials
Cement-based and mineral wool-based panels	Recycled raw materials	O17	Product manufacturer
	Chemicals in recycled mineral wool?	O18	Product manufacturer/supplier of recycled mineral wool
Metal	Aluminium	O19	Supplier of aluminium
Chemicals			

Chemicals in production	Classification of chemical products	O20	Manufacturer/supplier of chemical products
	Classification of ingoing substances	O21	Manufacturer/supplier of chemical products
	Prohibited substances	O22	Manufacturer/supplier of chemical products
	Nanomaterials	O23	Manufacturer/supplier of chemical products
	Preservatives	O24	Manufacturer/supplier of chemical products
	VOCs in adhesives	O25	Manufacturer/supplier of chemical products
	Free formaldehyde	O26	Manufacturer/supplier of chemical products
Chemicals - surface treatment	Plastic foiling	O27	Product manufacturer
	Ecolabelled products	O28	Product manufacturer
	Classification of chemical products	O29	Manufacturer/supplier of chemical products
	UV curing surface treatment system	O30	Manufacturer/supplier of chemical products
	Classification of ingoing substances	O31	Manufacturer/supplier of chemical products
	Prohibited substances	O32	Manufacturer/supplier of chemical products
	Nanomaterials	O33	Manufacturer/supplier of chemical products
	Preservatives	O34	Manufacturer/supplier of chemical products
	Free formaldehyde	O35	Manufacturer/supplier of chemical products
Chemicals - application method	Application method and quantity applied – surface treatment	O36	Supplier/performer of surface treatment
	Volatile organic compounds (VOC)	O37	Supplier/performer of surface treatment
Emissions			
Emissions from production - COD Emissions from production – working environment	Emissions of COD from wet processes	O38	Product manufacturer
	Emissions to air from production – HPL and compact laminate	O39	Product manufacturer

	Emissions of dust	O40	Product manufacturer
Climate and energy			
Pulp and paper	Pulp and paper production included in HPL and compact laminate	O41	Manufacturer of pulp and paper
Laminate	Laminate	O42	Laminate manufacturer
Wood-based panels	Wood-based panels	O43	Panel manufacturer and wood suppliers (drying process)
Panels made from lignocellulose raw materials	Panels - other lignocellulose raw materials	O44	Product manufacturer
Solid wood used for cladding	Solid wood used for cladding	O45	Product manufacturer
Wood Plastic Composite (WPC)	Wood plastic composite	O46	Product manufacturer
Mineral wool-based panels	Mineral wool-based panels	O47	Product manufacturer
Cement	Cement	O48	Manufacturer of cement
Cement-based panels	Cement-based panels	O49	Product manufacturer
Circularity			
Warranty	Warranty	O50	Product manufacturer
Information to costumer	Information	O51	Product manufacturer
Take back system	Take back system	O52	Product manufacturer
Innovation			
Innovation in production	Innovation requirements	O53	Product manufacturer
Other requirements			
	Maintenance of the Nordic Swan Ecolabel licence	O54-O55	Product manufacturer/licensee

2.2 Product information

This chapter contains product specification such as description of the product, material composition and production methods/processes.

Background to requirement O1 Description of the product

The purpose of the requirement is to give information on the product, material composition, description of the production method, treatment techniques and how it is marked in accordance with the Construction Products Regulation (EU/305/2011)[2]. Panels can serve various functions and be produced from different materials, using different techniques, and

[2] https://single-market-economy.ec.europa.eu/sectors/construction/construction-products-regulation-cpr_en (visited March 2024)

at various production sites. To provide traceability for the Nordic Swan Ecolabelled panel, all activities must be described. Product data sheets or equivalent information must be included in the application.

2.3 Quality

Background to requirement O2 Quality and properties

The purpose of the requirement is to ensure a correlation between the features and functions that the product is marketed, and the declaration of performance prepared in accordance with the Construction Products Regulation[3]. At the same time, the requirement must ensure that construction panels and other products not covered by a harmonised product standard can document the features and functions with which the product is marketed, based on standardised test results.

2.4 Raw materials

The requirements in this chapter concern requirements for raw materials used in panels.

The requirements only apply to raw materials that are included by **more than 5 wt%** of the panel.

Panels consisting of different types of raw materials need to comply with the specific raw material requirements. For example, a cement-based panel must comply with requirements for wood raw materials and cement.

2.4.1 Wood raw materials

Background for O3 Prohibited and restricted tree species

Several tree species are restricted or not permitted for use in Nordic Swan Ecolabel products. Many of the restricted tree species are grown in countries which still have large areas of Intact Forest Landscape (IFLs). These are important to protect due to biodiversity and climate. A lot of these countries also have a high risk of corruption, and the national legislation related to environment, human rights and ownership to land are weak and/or not controlled by the authorities. Applying a precautionary approach, the use of listed restricted tree species must comply with strict requirements on origin, traceability and certification.

The list of prohibited species contains species on the CITES list while the list of restricted species contains species on the IUCN red list (categorized as critically endangered (CR), endangered (EM) and vulnerable (VU)), Rainforest Foundation Norway list and Siberian Larch (originated outside the EU). Restricted species can be used in Nordic Swan Ecolabelled products if certain strict conditions on origin, certification and traceability are met.

[3] https://single-market-economy.ec.europa.eu/sectors/construction/construction-products-regulation-cpr_en (visited March 2023 such as specific frequency tuning or reverberation time for use in e.g. sound studios, concert halls, theatres, cinemas, conference room and classroom)

The requirement only applies to virgin wood and not wood defined as recycled material in accordance with ISO 14021. For more information about Nordic Swan Ecolabelling's approach on forest, click here.

Backgroud to O4 Traceability and certification

The requirement has been tightened and it is now required that the manufacturer of the Nordic Swan Ecolabelled product must hold Chain of Custody certification (or only use recycled raw material). The certified share has increased to 70%, while the remainder must be covered by the CoC system and be controlled wood/from controlled sources. Alternatively, recycled material can be used.

Nordic Ecolabelling's requirements concerning raw material based on wood, bamboo or cork focus on sustainable forestry and traceability of raw materials.

The many benefits that sustainably managed forests deliver to society include wood for materials and energy, protection against global warming, homes and livelihoods for local communities and indigenous people, support of biodiversity and protection of water and soil from pollution and erosion. By setting a requirement that wood raw material must originate from certified, sustainable managed forests, Nordic Ecolabelling is supporting the move towards more sustainable forestry practices.

Nordic Ecolabelling requires a declaration of the species of wood contained in the Nordic Swan Ecolabelled product. This makes it possible to check the validity of Chain of Custody certificates in the supply chain. The requirement for CoC certification improves the traceability of materials in the supply chain within the guidelines and control systems of the FSC and PEFC. The company's CoC certification proves how certified wood is kept separate from other wood during production, administration and storage and is inspected annually by independent certification bodies.

The manufacturer of the product must be CoC certified, and there is a requirement that certified raw material must be assigned/allocated to the Nordic Swan Ecolabelled product in the accounts for certified/non-certified material. This ensures that FSC/PEFC credits are used for the Nordic Swan Ecolabelled production and that the credits are "used up" and not sold twice. This will stimulate increased demand for certified wood raw material because more certified wood raw material must be purchased if the manufacturer wants to label other products, and not just the Nordic Swan Ecolabelled products, with the FSC/PEFC logo. This also means that it is possible to label the finished product with the FSC/PEFC logo and that a Nordic Swan Ecolabelled product can carry both the Nordic Swan Ecolabel logo and the FSC/PEFC logo. It should be noted that Nordic Ecolabelling approves both the percentage system and the credit system for accounting and sale of certified material.

Backgroud to O5 Chemicals - recycled material in wood-based panels

The requirement is set to have better control over the type of recycled materials used and to ensure that materials containing undesirable substances are not used. The requirement is the same as that set out in Nordic Ecolabelling's Criteria for panels for interior use (generation 7). Compliance with this standard is relatively good in the EU but it is important to ensure that production outside the EU also complies with the requirements of the standard. Requirements are imposed on the content of several heavy metals, fluorine,

chlorine and PCB. It has been clarified that creosote is regarded a substance used for wood preservation. If it can be documented that the requirements of the German Waste Wood Ordinance regulation, 2002 or later are met, this will also be approved as documentation. Alternatively, testing can be done on the final product/panel.

2.4.2 Lignocellulose raw materials (other than wood)

This requirement concerns panels made from lignocellulose raw materials such as straw, flax, or hemp.

Backgroud to O6 Lignocellulose raw materials (other than wood)

Nordic Ecolabelling supports the use of renewable materials but requires information about the species used and their geographical origin. It is crucial that renewable raw materials come from sustainable sources and are not suitable for other important uses, such as human food or animal feed. Therefore, there is a requirement that lignocellulose raw materials must be waste or residual products from other production processes.

2.4.3 Paper and cellulose fibre

The requirements in this chapter comprise raw materials, chemical and emissions in production of pulp and paper used in panels. Pulp and paper are used in several types of panels such as kraft- and decor paper in HPL/ compact laminate.

Background to O7 Ecolabelled paper

Nordic Swan Ecolabel and EU Ecolabel are so called type 1 ecolabels and both schemes assess the entire lifecycle of the paper and target requirements at the stages in the lifecycle that have relevance and potential.

Background to O8 Prohibited and restricted tree species (pulp and paper)

See requirement O4.

Background to O9 Traceability and certification of wood raw materials (pulp and paper)

The requirement has been tightened and it is now required that the manufacturer of the Nordic Swan Ecolabelled product must hold Chain of Custody certification (or only use recycled raw material). The certification share has increased to 70%, while the remainder must be covered by the Chain of Custody system and be controlled wood/from controlled sources. Alternatively, recycled material can be used.

Background to 010 Chemicals in the manufacture of pulp and paper

Nordic Ecolabelling has extensive experience in setting requirements for paper production. These requirements to have recently been revised, resulting in the chemical module generation 3 for pulp and paper. The chemical module includes, among other things, requirements for the classification of chemicals, specific limits for classified residual monomers, and a ban on GMOs in starch. For more background information, please see the

background document for the Chemicals module, available on the Nordic Ecolabelling website.

Background to O11 COD emissions from the production of paper and pulp

The requirement was also included in generation 6 of the criteria and remains unchanged. All pulp and paper production generate wastewater with organic content expressed as chemical oxygen demand (COD). Microorganisms consume oxygen to break down the organic matter. This may lead to low oxygen concentrations in the water and, in some cases, anaerobic conditions. The Nordic Swan Ecolabel's basic module for paper also contains requirements concerning other emissions, such as emissions of nitrogen and phosphorus. However, requirements are only set for COD. COD emissions also correlate with other emissions. If the emission of COD is low, emissions of other substances to water are thus also expected to be low.

2.4.4 Wood-plastic composite material (WPC)

Background to O12 Wood fibre and plastic

Wood-plastic composite (WPC) is a new material that has been added to these criteria, generation 2.

Wood-plastic composite (WPC) are composite materials made from wood fibre/wood flour and thermoplastics such as polythene (PE), polypropylene (PP) and polyvinyl chloride (PVC).

For the environmental impact of the composite material, the plastic component is crucial. In general, the plastic raw material can be recycled or newly produced. If the plastic raw material is recycled, energy use and climate impact are reduced. But it also has great significance if the recycled raw material is post-consumer or just pre-consumer.

There are differing views on whether the WPC has a place in the circular economy. WPC can be considered a dead end because plastic and wood are mixed and cannot be easily separated at the waste phase. While WPC can be recycled into new WPC products, the challenge lies in the fact that WPC can be made from various types of polymeric materials. This means the specific WPC product must be returned to its original manufacturer, which poses logistical difficulties. Therefore, including a material like WPC in the criteria for panels and cladding for exterior use could be viewed as a step in the wrong direction.

On the other hand, WPC provides the opportunity to use recycled post-consumer plastic collected from households, which is currently difficult to find outlets for. WPC is maintenance-free, resulting in virtually no environmental impact during the use phase. Additionally, WPC that meets Nordic Ecolabelling's requirements is free from substances hazardous to health and the environment, and it has a long service life.

The requirement stipulates that feedstock used in recycled raw material must be fully traceable. Without proper traceability, it is difficult to verify that the material is truly recycled. Documentation of traceability should be provided, such as a certificate from a third-party certification system, such as the Global Recycled Standard. Alternatively, the manufacturer of the recycled plastic can document the traceability by declaring the specific amounts of

recycled plastic used. This requirement aligns with the Nordic Swan Ecolabelling criteria for outdoor furniture, gen. 4.

Background to O13 Chemicals in recycled plastic used in WPC

This is a new requirement in generation 2.

The requirement applies to chemicals contained in the recycled plastic raw material and not chemicals that are added through regranulation. There are separate requirements for additives, see O14. The requirement must be documented with a test report using X-ray fluorescence (XRF), GC-MS or equivalent methods or traceability to the source that substantiates that the specified substances are not included. The aim of the requirement is to capture the “worst substances”. The documentation requirement is identical to criteria for Nordic Swan Ecolabelling of flooring and furniture. 8 specific polycyclic aromatic hydrocarbons (PAH) are now part of the requirement. All 8 PAHs is listed in annex XVII in REACH due to concerns risks to human health. PAHs have been found in plastic packaging made of recycled PCR plastic (PE and PP)[4].

Although this will entail extra documentation work, it shows that it is possible to set such a requirement. Using recycled plastic is good as it helps reduce resource use and stimulates a circular economy. At the same time, there is no wish to recycle chemicals that are harmful to health and the environment.

Background to O14 Additives - prohibited substances

This is a new requirement in generation 7. The requirement covers ingoing substances in additives that are added to the polymer raw material in the master batch or compound. Substances that arise from the actual polymer production are therefore not covered by this requirement. Recycled plastic raw materials are counted as polymer raw materials, where additives that are added to a new master batch or compound are covered by requirements.

The list is based on the general principles from Nordic Swan Ecolabelling regarding undesirable compounds in combination with corresponding requirements for other Nordic Swan Ecolabelled products. For more information see chapter 3.7 Chemicals.

2.4.5 Mineral raw materials

The requirement in this chapter covers sourcing of virgin mineral raw materials and content of heavy metals in the mineral raw materials. The requirements apply to virgin minerals such as natural stones, limestone, volcanic rocks, and silica used in panels such as cement-based and mineral wool-based panels.

Background to O15 Responsible sourcing of virgin mineral raw materials

This is a new requirement in generation 2 of the criteria. The latest assessment of the State of Nature in the EU, published in 2022, shows that we are unfortunately still losing nature as too many protected species continue to decline. The new European Biodiversity Strategy

[4] https://www2.mst.dk/Udgiv/publications/2023/04/978-87-7038-507-7.pdf, visited September 2023

provides Biodiversity provides a real opportunity to put Europe's biodiversity on a pact to recovery by 2030[5].

The extraction of minerals, particularly by surface methods, inevitably results in changes to the characteristics of the land and local biodiversity where it takes place[6]. Many source ecosystems harbour endemic species and highly diverse communities that are crucial for ecosystem functioning and services supply, including food and clean water provision, and land stability. Mining poses serious, often irreversible, and far-reaching impacts, to those ecosystems, for example through erosion, shrinking deltas, salinization, pollution, and traffic disturbances. However, these changes are often temporary, and if carefully managed, is possible to protect species/biotope both during active operations and after end use-phase[7].

The licensee must have a supply chain policy/code of conduct for responsible sourcing of mineral raw materials The policy must concern biodiversity and deforestation risks – reducing impact to biodiversity along the whole supply chain. Addressing biodiversity risks involves, for example, understanding your supply chain, engaging with suppliers, implementing strong purchasing standards, and establishing monitoring mechanisms, all while ensuring transparency. The policy must be both publicly available and communicated throughout the supply chain.

Virgin mineral raw materials used in panels must come from mining operations (quarries) with documented biodiversity management and rehabilitation plans. This means that the licensee must have full traceability to the specific mining operations (quarries) where the minerals are extracted from. The European mineral mining industry such as Cembureau[8], Eurogypsum[9] and UEPG[10] have been working with biodiversity for several years and have been developing guidelines for biodiversity management and rehabilitation plans for mining operation (quarries).

Background to O16 Heavy metals

New requirement in generation 2. 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. Different raw materials may contain higher quantities of heavy metals compared to the background levels, for example in soil. These include natural gypsum, gypsum from cleaning of smoke gas (FDG industrial gypsum), fibreglass from collected glass and mineral wool from stone. It is important that the heavy metal content is low enough to avoid causing issues during the use phase or hindering the reuse of product materials.

[5] EU Biodiversity Strategy for 2030; https://environment.ec.europa.eu/strategy/biodiversity-strategy-2030_en, visited March 2023
[6] Torres A et al: Unearthing the global impact of mining construction minerals on biodiversity, 2022
[7] https://ec.europa.eu/environment/nature/natura2000/management/docs/NEEI%20case%20studies%20-%20Final%20booklet.pdf, visited March 2023.
[8] The European Cement Association
[9] European Gypsum Industry
[10] The European Aggregates Association

2.4.6 Cement based- and mineral wool façade panels

The requirements in this chapter comprise cement based- and mineral wool façade panels/cladding.

Background to O17 Cement based- and mineral wood façade panels

The requirement has been strengthened for mineral wool-based panels compared to generation 1.

In OECD countries, the built environment is responsible for around 30% of raw materials usage and up to 40% of solid waste generation[11],[12]. In Europe, 57% of the insulation market is dominated by mineral wool[13], which is the general term for stone wool and glass wool. Mineral wool waste is generated both from mineral wool production and construction activities. Waste from the production stage is easier to recycle in the production company, while the waste from construction is often not recycled due to its unknown composition and is instead landfilled or incinerated as mixed construction waste[14].

Mineral wool façade panels are prefabricated compressed mineral wool products with thermosetting binders. They are traditionally made from volcanic rock (basalt) and of different types of recycled material and finished with cured coating[15]. The recycled materials consist of post consumed/industrial recycled mineral wool, pre-consumer recycled mineral wool (cut offs, waste from production) and by products from other industries such as slags, alumina, wool waste and cement. The requirement for the minimum share of recycled materials in mineral wool-based panels has been tightened from 30% to 40% in generation 2, based on dialogue with stakeholders.

Cement-based panels consist primarily of 3 ingredients; cement, silica/limestone, and wood/cellulose, of which cement constitutes the largest share followed by silica/limestone and wood/cellulose. A high content of cement (according to EN 197–1) in the panels leads to an overall high energy impact which is handled in section 3.9 Climate and energy. Parts of the 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) are often also included, often in varying amounts depending on panel type (between 3 and 20%). 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.

[11] https://www.oecd.org/environment/waste/OECD-G20-Towards-a-more-Resource-Efficient-and-Circular-Economy.pdf
[12] https://environment.ec.europa.eu/topics/waste-and-recycling/construction-and-demolition-waste_en (visited March 2023)
[13] Sohn, J.L., Kalbar, P.P., Banta, G.T. and Birkved, M., 2017. Life-cycle based dynamic assessment of mineral wool insulation in a Danish residential building application. Journal of cleaner production, 142, pp.3243-3253.
[14] Müller, A., Leydolph, B. and Stanelle, K., 2009. Recycling mineral wool waste: technologies for the conversion of the fibre structure, Part 1. Interceram, 58(6), pp.378-381.
[15] Juho Yliniemi et al: Characterization of mineral wool waste chemical composition, organic resin content and fibre dimensions. Elsevier, 2021: https://www.sciencedirect.com/science/article/pii/S0956053X21003573, visited December 2023

A potential has been identified for ensuring a high use of recycled raw materials (recycled fibres) and waste products such as fly ash, industrial slag and cement containing recycled/waste as materials in the panel. The requirement for the minimum share of recycled materials has been adjusted from min. 30% to 15% in generation 2. The requirement level is based on dialogue with several stakeholders and a review of EPDs.

Background to O18 Chemicals in recycled mineral wool

The requirement applies to chemicals contained in the recycled mineral wood and not chemicals that are added subsequent in the recycling process.

The requirement must be documented with a test report using X-ray fluorescence (XRF) or equivalent methods or traceability to the source that substantiates that the specified substances are not included. The aim of the requirement is to capture the “worst substances”.

It is important that the heavy metal content is not too high that it creates problems in the user phase or for reuse of product materials.

2.4.7 Metal - aluminium

The requirement in this chapter applies to aluminium used in fitting system/installation bracket used for fixing panels on façades. Only relevant if the panel is sold together with a unique fitting system/installation bracket in aluminium. Screws, bolts, small mounting brackets, clips and similar is not part of the criteria.

Background of O19 Production of aluminium

This is a new requirement in generation 7. Metal is normally not used in panels for interior use, but aluminium can be included in frames in certain types of acoustic panels. Nordic Ecolabelling has not seen examples of the use of other metals such as steel, and the requirement therefore only covers aluminium.

Using recycled metal significantly reduces the environmental impact and provides a significant climate benefit. Among other things, this is highlighted in the taxonomy work in the EU[16]. Nordic Ecolabelling is aware that the availability of recycled aluminium and traceability can be a challenge. But in a world with an increasing focus on circular economy, Nordic Ecolabelling believes that there will be an increased focus on this in the future. Traceability in the production chain is also valuable and important for several reasons, such as enabling the selection of suppliers based on factors like environmental practices, working conditions, and quality. Demand for traceability will hopefully contribute to the industry also placing increased focus on this. For Aluminium, Hydro has launched its own traceability certification with a minimum of 75% recycled Al, Hydro Circal[17]. The industry average for EU-produced aluminium is approx. 50% recycled, while for Al outside the EU it is approx.

[16] Taxonomy report, technical annex, EU technical expert group on sustainable finance, March 2020
[17] https://www.hydro.com/en/products-and-services/low-carbon-aluminium/hydro-circal-75r/ (available 2022-10-17)

40%. The big environmental benefit comes from the use of post-consumer recycled aluminium.

The requirement model mandates that aluminium producers perform an energy and greenhouse gas calculation with defined reduction targets. Nordic Ecolabelling views certification with ASI as a positive step towards more sustainable production. ASI is an independent certification system that focuses on economic, social, and environmental aspects. For aluminium, the requirement can also be met by documenting direct greenhouse gas emissions and energy efficiency in the electrolysis process, with limits based on values from the EU taxonomy report. Direct emissions are to be calculated according to the methodology applied to EU-ETS benchmarks. Please note that these values may change depending on the outcome of the EU taxonomy work.

2.5 Chemicals

The requirements in this chapter apply to chemical products, used in the production of the Nordic Swan Ecolabelled product, such as adhesives, resins, and waxes, surface treatments and surface treatment system. The chapter is divided into 3 sub-sections:

- Requirements concerning chemicals in the production of the Nordic Swan Ecolabelled product, such as adhesives, resins and waxes
- Requirements concerning chemical products used for surface treatment
- Requirements concerning surface treatment systems

2.5.1 Chemicals used in the production of panels

The requirements in this chapter concern chemicals used in the production of the Nordic Swan Ecolabelled product itself such as adhesives, resins, or additives.

Background to O20 Chemicals used in the production of panels

Nordic Ecolabelling is generally committed to restricting the use of chemicals that are harmful to health and the environment, and the classification requirement prohibits the products of highest concern.

The requirement has been amended to also include the classifications Toxic to the environment (H400, H410, H411 and H420). The previous generation of the criteria contained a requirement limiting the amount of environmentally hazardous ingoing substances in the chemical products used in the production of the Nordic Swan Ecolabelled product. This requirement has been replaced by a complete ban on the presence of chemical products in any of the environmentally hazardous classifications listed in the requirement.

Exemptions:

An exemption is made for adhesive products containing methylene diphenyl diisocyanate (MDI). There are currently no substitute products that are widely available in the market.

The exemption for adhesives containing formaldehyde is only granted if later requirements concerning the content of free formaldehyde in adhesives and emissions from the finished product are fulfilled.

Resins containing phenol, formaldehyde, methanol or melamine, are used in the production of several types of laminates to impregnate the paper. Since it is not possible to produce laminate without these resins, an exemption is made for these substances. A maximum of 10% by weight of phenol and methanol is permitted in the finished resin – the same limit value as was used in the previous generation of the criteria. To ensure that the resins have hardened properly, a subsequent requirement is made concerning emissions from the laminate in its finished form.

The exemption for melamine was introduced during the validity period of the previous criteria, since at that time several suppliers began to self-classify it as H361 (Repr. 2). At the end of 2020, ECHA's Risk Assessment Committee (RAC) also agreed that melamine should be given the harmonised classifications H351 (Carc. 2) and H373 (STOT RE 2). The harmonised classifications will become binding on 23 November 2023. The classification H361 will not be a harmonised classification, but there may still be producers who use this self-classification alongside the harmonised classifications once they come into effect. Nordic Ecolabelling gives an exemption for both the classifications H351 and H361, as there is no substance that can replace melamine at this moment in time.

An exemption has also been introduced for UV curing products that can be used to impregnate the top paper layer. The UV curing technique is used to achieve a surface with good durability and quality, while at the same time having the advantage that the chemicals have low VOC levels.

Background to O21 Classification of ingoing substances

A ban on CMR Category 2 substances has also been added to the requirement. Nordic Ecolabelling would like to restrict the use of substances that are carcinogenic, mutagenic, and toxic for reproduction (CMR) to the greatest extent possible. This requirement now represents a further restriction on the classification requirement since it applies to ingoing substances in the chemical product.

Exemptions are also needed in this requirement for methylene diphenyl diisocyanate (MDI), formaldehyde, phenol and melamine. See more background about this in the previous requirement.

In addition, there are exemptions for titanium dioxide (CAS No. 13463–67–7) and 1.1,1-Trimethylolpropane (TMP, CAS No. 77–99–6). Titanium dioxide is a white pigment that is used in many different types of products. 1,1,1-Trimethylolpropane (TMP) is used to coat titanium dioxide to make the titanium dioxide particles disperse more easily. About 90% of all titanium dioxide is coated with TMP.

The Nordic Swan Ecolabel has included the new CLP classifications to align with the European Green Deal's goal of a toxic-free environment. This inclusion reflects the need to establish hazard identification for endocrine disruptors and addresses criteria for environmental toxicity, persistency, mobility, and bioaccumulation. By incorporating these classifications, Nordic Swan Ecolabel ensures that the criteria relate to up-to-date scientific understanding and regulatory compliance. Additionally, the inclusion of PMT and vPvM substances is crucial due to their persistence, mobility, and potential impact on water quality. The Nordic Swan Ecolabel aims for comprehensive hazard identification and protection of the environment and human health.

Background to O22 Prohibited substances

The requirement is essentially the same as in generation 6 of the criteria but is tightened in certain respects. For example, bisphenols are generally banned (and not just Bisphenol A). In addition, the requirement concerning endocrine disruptors has changed.

Candidate List Substances and PBT, vPvB

The ban on substances on the Candidate List, substances that are PBT (Persistent, Bioaccumulative and Toxic) and vPvB (very Persistent and very Bioaccumulative) and the ban on substances that are potential endocrine disruptors in category 1 or 2 on the EU's priority list of substances for further evaluation of their role in endocrine disruption are new in this revision. The Candidate List contains substances of exceedingly high concern, so-called SVHC substances. SVHCs (Substances of Very High Concern) meet one or more of these criteria:

- Very harmful to health: carcinogenic, mutagenic, toxic for reproduction (CMR substances, category 1A and 1B), set out in REACH, Article 57 a, b, c.
- Very harmful to the environment: persistent, bio-accumulative and toxic (PBT) or very persistent and very bio-accumulative (vPvB), set out in REACH, Article 57 d, e.
- Serious effects to human health or the environment on another basis than the groups above, but that give equivalent cause for concern (e.g. endocrine disruptors and inhaled allergens), set out in REACH, Article 57 f.

SVHC may be included on the Candidate List with a view to later inclusion on the Authorisation List. This means that the substance becomes regulated (ban, phasing out or some other form of restriction). Nordic Ecolabelling prohibits Candidate List substances due to their hazardous properties. Other SVHC substances are addressed via bans on the use of PBT and vPvB substances, the classification requirements, and a ban on endocrine disruptors.

PBT (and vPvB substances) are substances defined in Annex XIII of REACH, which are generally undesirable in Nordic Swan Ecolabelled products.

Melamine is commonly used in resins with limited opportunities for substitution to alternatives Exemption therefore applies to melamine (CAS No. 108–78–1).

Endocrine disruptors:

Potential endocrine disruptors are substances that can negatively affect the hormonal balance in humans and animals. Hormones control several vital processes in the body and are particularly important for development and growth in humans, animals and plants.

Changes in the hormone balance can have adverse effects, with a particular focus on hormones that affect sexual development and reproduction. Several studies have shown effects on animals that are probably due to changes in the hormone balance. Effluent discharges are one of the major sources of the presence and distribution of endocrine disruptors in aquatic ecosystems[18]. Nordic Ecolabelling excludes identified and potential

[18] Miljøstatus i Norge (2008) (Environmental status in Norway): Endocrine disruptors. http://www.miljostatus.no/Tema/Kjemikalier/Noen-farlige-kjemikalier/Hormonforstyrrende-stoffer/#D (dated 26 February 2009).

endocrine disruptors listed on the “Endocrine Disruptor Lists” at www.edlists.org, which is based on the EU member state initiative. Substances listed in Lists I, II and/or III are excluded.

Licensees are responsible for keeping track of updates to the lists so that their Nordic Swan Ecolabelled products fulfil the requirement throughout the entire validity period of the licence. Nordic Ecolabelling recognises the challenges associated with new substances that are added to Lists II and III. We will evaluate the circumstances and possibly decide on a transition period from case to case.

The requirement applies to substances on the main lists (Lists I, II and III) and not to the corresponding sub-lists called “Substances no longer on list”. Substances that are transferred to one of the sub-lists and that no longer feature on Lists I–III are not prohibited. However, special attention is paid to the substances on List II that have been evaluated under the Cosmetics Regulation, for example, where there are no specific provisions to identify endocrine disruptors. It is still unclear how these substances will be handled at www.edlists.org after the evaluation (safety assessment of the substances included in cosmetics, for example) has been completed. Nordic Ecolabelling will assess the circumstances for the substances on Sub-List II on a case-by-case basis, based on the background information provided in the sub-list. By excluding both identified and prioritised potential endocrine disruptors that are under evaluation, Nordic Ecolabelling ensures a restrictive approach towards endocrine disruptors.

Halogenated organic compounds

Halogenated organic compounds that contain halogens such as chlorine, bromine, fluorine, or iodine must not be present in the chemical products used. This includes halogenated flame retardants, chloroparaffins, perfluoroalkyl compounds and certain organic bleaching chemicals. Halogenated organic compounds have various properties that are not desirable in Nordic Swan Ecolabelled products. They are harmful to human health and the environment, highly toxic to aquatic organisms, carcinogenic or harmful to health in other ways. The halogenated organic compounds do not break down readily in the environment, which increases the risk of harmful effects from the substances.

Per- and polyfluoroalkyl substances (PFAs), e.g. PFOA and PFOS

Fluorosurfactants and other per- and polyfluoroalkyl substances (PFASs) constitute a group of substances that have harmful properties. Certain per- and polyfluorinated compounds can degrade to the very stable PFOS (perfluorooctane sulphonate) and PFOA (perfluorooctanoic acid) and similar substances. These substances are extremely persistent and are easily absorbed by the body10. The substances are found all over the globe, from the large oceans to the Arctic. PFOS have also been found in birds and fish and in their eggs. The substances in this group impact on the biological processes of the body and are suspected to be endocrine disruptors, carcinogenic and to have a negative impact on the human immune system11. PFOA, APFO (ammonium pentadecene fluoro octanoate) and certain fluoride acids are on the Candidate List due to their reprotoxicity, as well as PBT. There are new

research results showing that shorter chains (2-6 carbon atoms) have been discovered in nature[19].

Alkylphenols, alkylphenol ethoxylates and/or alkylphenol derivates

Alkylphenol ethoxylates (APEO) and/or alkylphenol derivatives (APD) are a group of non-readily degradable surfactants that are proven endocrine disruptors. APEOs may be present in binders, dispersing and thickening agents, siccatives, foam inhibitors, pigment pastes, wax, etc. Alternatives to APEOs are available based on alkyl sulphates, alkyl ether sulphates and alcohol ethoxylates. These are readily biodegradable but also have harmful properties, being toxic to aquatic organisms and some may be bioaccumulative. However, there is an environmental benefit to be gained from substitution, as these substances break down rapidly, and the degradation product nonylphenol, which has endocrine-disrupting effects, is avoided.

Bisphenols

Bisphenol A is used as a monomer in epoxies, paints, varnishes, and adhesives. While there was previously a ban on Bisphenol A (BPA), CAS No. 80–05–7), the ban now applies to bisphenols in general. The reason the ban now covers all bisphenols is that other bisphenols, such as Bisphenol F and S, can be used as a replacement for BPA. In the screening programme for environmental toxins in water, sediment and biota in Norway, Bisphenol A, F and S have been found[20]. These are substances that have the same properties as Bisphenol A[21]. Bisphenol A can be released into the environment from the production process. BPA is identified as damaging to the eyes, irritating to the respiratory tract, skin sensitizing and may also affect reproductive performance. The substance may be endocrine-disrupting and is toxic to aquatic organisms. Bisphenol A is used, for example, with Epichlorhydrin to produce Bisphenol-A-(epichlorhydrin) epoxy resin (CAS No. 25068–38–6), which is classified as allergenic and environmentally hazardous. The ban seeks to exclude the use of epoxy resins where BPA is included.

Phthalates

The ban on phthalates has not been changed. Many phthalates are harmful to the environment and human health and should not be used in ecolabelled products for a variety of reasons. Some phthalates are on the EU's priority list of substances for further evaluation of their role in endocrine disruption, and some have already been identified as endocrine disruptors. Some phthalate compounds are also on the Candidate List. All are there because they are classified as toxic for reproduction. Some are also regulated in Annex XVII of REACH, and many phthalates are on the Danish Environmental Protection Agency's "List of Undesirable Substances" and on the Norwegian Environment Agency's "List of Priority Substances".

For precautionary reasons, Nordic Ecolabelling has decided to continue to exclude phthalates as a group.

[19] Perkola, Noora, Fate of artificial sweeteners and perfluoroalkyl acids in aquatic environment, Doctoral dissertation Department of Environmental Sciences, Faculty of Biological and Environmental Sciences, University of Helsinki, Finland 12.12.2014, https://helda.helsinki.fi/bitstream/handle/10138/136494/fateofar.pdf?sequence=1
[20] Screening programme 2013: New bisphenols, organic peroxides, fluorinated siloxanes, organic UV filters and selected PBT substances, Norwegian Environment Agency, Report M-176/2014
[21] https://tema.miljodirektoratet.no/no/Tema/Kjemikalier/Miljogifter/Bisfenol-A/

Aziridines and polyazidirines

Aziridine and polyaziridines are classified as H350 (carcinogenic) and H340 (mutagenic) and are thus included in the ban on CMR substances. However, they are on the list of prohibited substances to make it clear that they are prohibited. The substances were also on the list for generation 6 of the criteria.

Pigments and additives based on lead, tin, cadmium, chromium (VI) and mercury, and their compounds

Nordic Ecolabelling restricts heavy metals because they are toxic to humans and other organisms, both on land and in the aquatic environment. Mercury, cadmium, and lead are toxic to the human nervous system, kidneys and other organs, and the metals can accumulate in living organisms. Chromium (VI) is classified as very toxic, CMR and harmful to the environment.

Background to O23 Nanomaterials

Due to the small size and large surface area of nanoparticles, they are usually more reactive and may have different properties than larger particles of the same material. There is concern among public authorities, researchers, environmental organisations, and others about the lack of knowledge regarding the potential harmful effects on health and the environment[22],[23],[24],[25],[26],[27]. Coatings and other modifications may also alter the properties. Nordic Ecolabelling takes the concerns about nanomaterials seriously and uses the precautionary principle to rule out nanomaterials/particles in the products. Nanomaterials/-particles are defined according to the EU Commission Recommendation on the Definition of Nanomaterial (2022/C 229/01)[28].

[22] UNEP (2017) Frontiers 2017 Emerging Issues of Environmental Concern. United Nations Environment Programme, Nairobi. https://wedocs.unep.org/bitstream/handle/20.500.11822/22255/Frontiers_2017_EN.pdf?sequence=1&isAllowed=y

[23] Parliamentary Assembly of the Council of Europe (2017 (2013)) Nanotechnology: balancing benefits and risks to public health and the environment. http://semantic-pace.net/tools/pdf.aspx?doc=aHR0cDovL2Fzc2VtYmx5LmNvZS5pbnQvbncveG1sL1hSZWYvWDJlLURXLWV4dHIuYXNwP2ZpbGVpZD0xOTczMCZsYW5nPUVO&xsl=aHR0cDovL3NlbWFudGljcGFjZS5uZXQvWHNsdC9QZGYvWFJlZi1XRC1BVC1YTUwyUERGLnhzbA==&xsltparams=ZmlsZWlkPTE5NzMw

[24] Larsen PB, Mørck TAa, Andersen DN, Hougard KS (2020) A critical review of studies on the reproductive and developmental toxicity of nanomaterials. European Chemicals Agency.

[24] SCCS (Scientific Committee on Consumer Safety) (2019) Guidance on the Safety Assessment of Nanomaterials in Cosmetics. SCCS/1611/19. https://ec.europa.eu/health/sites/health/files/scientific_committees/consumer_safety/docs/sccs_o_233.pdf

[25] Mackevica A, Foss Hansen S (2016) Release of nanomaterials from solid nanocomposites and consumer exposure assessment – a forward-looking review. Nanotoxicology 10(6):641–53. doi: 10.3109/17435390.2015.1132346

[26] BEUC – The European Consumer Organisation et. al (2014) European NGOs' position paper on the Regulation of nanomaterials. www.beuc.eu/publications/beuc-x-2014-024_sma_nano_position_paper_caracal_final_clean.pdf

[27] Azolay D and Tuncak B (2014) Managing the unseen – opportunities and challenges with nanotechnology. Swedish Society for Nature Conservation. www.naturskyddsforeningen.se/sites/default/files/dokument-media/rapporter/Rapport-Nano.pdf

[28] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32022H0614(01)&from=EN

Most nanomaterials on the market today have either been in use for decades or have recently been manipulated into nanoforms of existing materials[29]. For example, carbon black nanoparticles and amorphous silicon dioxide (SiO2) have been used in previous centuries. Titanium dioxide (TiO2) has long been used as a dye in bulk form but is now manufactured as a nanomaterial for other purposes[30]. Other types of engineered nanomaterials are expected to enter the market in the future[31].

In the construction panel product group, nanomaterials are used, among other things, to impregnate or seal surfaces, to create hydrophobic, self-cleaning, and antibacterial surfaces. These effects may, for example, come from the addition of nanometals such as silver, gold and copper or titanium dioxide. The requirement has the following exemptions:

Pigments

Pigments are finely ground, insoluble particles that are used to give the products a certain colour. There are no substitutes that can perform the function of pigments such as paint dyes, inks, fabric dyes, masterbatch, etc. and many pigments consist entirely or partially of nanoparticles. Therefore, nanosized pigments are exempted. Although clear conclusions on the safety of nanopigments cannot be drawn[32], release by decomposition of façades are extremely limited and the nanoparticles are probably mainly embedded in the paint matrix rather than released as individual nanoparticles[33],[34]. Paint pigments consist of particles of individual crystals up to aggregates of several crystals. It is generally more effective to use pigments with smaller particles than larger to get the same colour. Inorganic pigments used in the paint industry, which can occur in nanosize, include carbon black and iron oxides[35]. Carbon black used in paints is very finely ground and has a particle size of approximately 10–30 nm[36]. Iron oxide pigments can include only nanosize particles, or only a fraction of the particles may be nano. Inorganic nanopigments are also added to products for several purposes other than colouring. Nano-titanium dioxide, for example, is used to provide a self-cleaning effect in paint.

Naturally occurring inorganic fillers

Traditional fillers are permitted. Naturally occurring fillers, e.g. from chalk, marble, dolomite, and limestone, are exempted from registration in accordance with Annex V, point 7 of

[29] EU observatory for nanomaterials and European Chemicals Agency (2019) What are next generation nanomaterials and why are regulators interested in them? Information note. https://euon.echa.europa.eu/documents/23168237/24095696/190919_background_note_next_gen_materials_en.pdf/b9178324-5a69-2e4b-1f2b-aac2c2845f45

[30] European Commission, COMMISSION STAFF WORKING PAPER, Types and uses of nanomaterials, including safety aspects, Accompanying the [..] second regulatory review of nanomaterials, SWD(2012) 288 final

[31] EU observatory for nanomaterials and European Chemicals Agency (2019) What are next generation nanomaterials and why are regulators interested in them? Information note. https://euon.echa.europa.eu/documents/23168237/24095696/190919_background_note_next_gen_materials_en.pdf/b9178324-5a69-2e4b-1f2b-aac2c2845f45

[32] Hynes J, Novotný T, Nic M, Kocurkova L, Prichystalová R, Brzicová T, Bernatikova S (2018) Literature study on the uses and risks of nanomaterials as pigments in the European Union. European Chemicals Agency.

[33] Mackevica A, Hansen, SF (2016) Release of nanomaterials from solid nanocomposites and consumer exposure assessment – a forward-looking review. Nanotoxicology, 10(6), 641–653. https://doi.org/10.3109/17435390.2015.1132346

[34] Nowack B, Hincapié I, Sarret G, Larue C, Legros S (2013) Environmental fate of nanoparticles from façade coatings. NanoHouse Dissemination report Nº 2013-03. https:// DOI: 10.13140/2.1.2206.3040

[35] Industrial Organic Pigments; W. Herbst, K. Hunger; Third edition 2004; pp. 120–124

[36] Coatings Handbook; Thomas Brock, Michael Groteklaes, Peter Mischke; 2000; p. 128

REACH, if these fillers are only physically processed (ground, sieved and so on) and not chemically modified. An exemption for inorganic fillers has been added if they are covered by Annex V, point 7 of REACH.

Synthetic amorphous silicon dioxide

Synthetic amorphous silica (SAS) is a manufactured silica (SiO2) that has been used in industrial, consumer and pharmaceutical products for decades[37]. Silica plays a significant role in coating formulations; this is true for non-surface treated types as well as surface modified types.

The surface-treated and non-surface-treated forms are expected to have the same (eco)toxicological profile because the influence of surface treatment on dissolution rate and solubility which was demonstrated in various in vitro experiments has not resulted in biologically relevant differences in bioavailability and toxicokinetic nor were there significant differences in (eco)toxicological outcomes of representative materials tested in key in vivo studies. None of the recent available data for surface-treated and non-surface-treated SAS gives any evidence for a mechanism of systemic toxicity that may raise concerns regarding human health or environmental risks.[38]

The synthetic amorphous silica can be manufactured in two ways. One way is the precipitation to receive a precipitated silica, and the other way is the fumed synthesis to receive a pyrogenic silica. Since the definitions of "colloidal" may be ambiguous and the substance used is pyrogenic silica, exemption has been edited and is granted only to surface-treated pyrogenic silica.

Background to O24 Preservatives

The content of the preservatives bronopol, IPBC, CMIT/MIT and MIT is restricted via specific limit values. The content of the total amount of isothiazolinones is also limited. The exemption is the same as in generation 6 for bronopol, isothiazolinones and CMIT/MIT, while IPBC is new to the list. IPBC is a fungicide that has become more commonly used and the limit value is based on consultation comments. Water-based paints and adhesives may contain the preservative bronopol and it is difficult to find substitutes. A limited amount of bronopol is therefore permitted although it is classified as a substance of concern and hazardous to the environment. Isothiazolinones are used as a preservative in many water-based products, where they act as fungicides, biocides, and inhibitors of algal growth. They are toxic to aquatic organisms and can cause varying degrees of allergic reactions. It has proved difficult to avoid the use of these preservatives in water-based products, which is what Nordic Ecolabelling’s criteria for chemicals indirectly promote.

Preservatives also play a significant role in ensuring the shelf-life of the products before they are used. Alternative preservatives to isothiazolinones include formaldehyde and/or formaldehyde-releasing substances, which are carcinogenic. In this respect, isothiazolinone and CMIT/MIT are better, even though they also exhibit hazardous properties. To limit the use of these substances as much as possible, the amount of the substances is restricted.

[37] https://www.asasp.eu/images/Publications/Nano_-_SAS_factsheet_-_201209.pdf
[38] https://echa.europa.eu/de/registration-dossier/-/registered-dossier/15556

Background to O25 Volatile organic compounds in adhesives

The requirement remains unchanged. Volatile organic compounds (VOC) are of particular concern due to their inherent properties. They can be absorbed through the lungs and skin and cause damage to various organs. Prolonged exposure to certain organic solvents can cause chronic damage to the brain and nervous system, while other organic solvents can cause cancer or reproductive damage. Nordic Ecolabelling therefore limits VOC levels in adhesives. Resin used in the production of laminate is exempted from the requirement due to quality issues ensuring that the resin cures properly.

Background ot O26 Free formaldehyde

The limit values for free formaldehyde have been made stricter compared with the previous criteria, generation 1. For chemical products other than adhesives, the limit value has been tightened from 0.2% to 0.02% by weight. The exemption for adhesive mixed with hardener has also been removed to harmonise with the criteria for panels and mouldings for interior use, generation 7. The adhesive must contain no more than 0.2% free formaldehyde by weight, with the requirement applying to the pure adhesive.

Formaldehyde is a toxic and allergenic substance (H317) that has carcinogenic effects (H351) and should therefore be avoided as far as possible. Some free formaldehyde is permitted as an impurity and in adhesive, as it is difficult to avoid this. The purpose of the requirement is to restrict the content of formaldehyde in products to limit formaldehyde emissions. Nordic Ecolabelling does not want to request a specific test for this, because that would be too extensive and costly for each chemical product. Nordic Ecolabelling wants to be able to ask for a test if there is any uncertainty about the declaration.

Most of the formaldehyde present in adhesives occurs as free formaldehyde. However, formaldehyde can also originate from the components in the adhesive (such as preservatives). Adhesives emit formaldehyde during both polymerisation and the curing phase. Free formaldehyde reacts when the adhesive is applied to wood or other components, and when the adhesive has cured/dried formaldehyde can be released through degradation processes. It is possible to control and set requirements for free formaldehyde in the adhesive, in a mixture or in dried glue, but not for what occurs when the adhesive is applied to a surface. This is chiefly because neither the adhesive manufacturer nor Nordic Ecolabelling can control or influence the choice of wood/material to which the adhesive is applied.

Some stakeholders in the industry have been asking why Nordic Ecolabelling has a requirement for maximum content of free formaldehyde in adhesives, when there are later requirements for emission of formaldehyde. Nordic Ecolabelling wishes to retain the requirement, as low levels are generally a good thing, and it can also be important regarding the working environment. In our experience, the requirement has also provided positive environmental and health benefits since there are adhesives on the market that do not meet this.

2.5.2 Surface treatment

Background to O27 Plastic foiling

Panels can be foiled with a thin layer of plastic. This provides a durable surface and can thus extend the life of the product. It can also reduce the use of chemicals for surface treatment. Previously, no requirements were set for such plastic foiling, and the requirement is new for this generation. A ban on PVC is a requirement that Nordic Ecolabelling includes in many criteria. The environmental impact of PVC is associated primarily with waste management, the use of additives and dioxin emissions, for example in the manufacture and incineration of PVC. The latest membrane cell technology is considered to be the most environmentally-sound means of production, but the membranes are coated with PFAS and this represents a potential source of PFAS contamination to the environment. The mercury method is still used to produce chlorine at some plants[39].[40]. For more information on Nordic Ecolabelling's view on PVC, see www.nordic-swan-ecolabelling.org[41].

Background to O28 Ecolabelled products

New requirement in generation 2. Nordic Swan ecolabel or EU Ecolabelled paint or vanish comply with strict requirements regarding environmentally hazardous chemicals and does not contain substances that can cause cancer, damage genes or reproductive capacity. Moreover, ecolabelled paint and varnish meet strict quality requirements to promote long-lasting, durable, and efficient paints and varnishes. As a result, they automatically comply with all requirements in section 3.7.2 when used.

Nordic Swan Ecolabel or EU Ecolabelled paint or vanish must be used for any surface treatment (inc. primer) of solid wood used for cladding. Ecolabelled paint and varnish for outdoor must comply with strict quality requirements (weathering- and fungal growth test) which promote durability.

Background to O29 Classification of chemical products

The requirement has been amended to also include the classifications Toxic to the environment (H400, H410, H411 and H420), H334 and H362. The previous generation of the criteria contained a requirement limiting the amount of environmentally hazardous ingoing substances in the chemical products used in the surface treatment of the Nordic Swan Ecolabelled product. This requirement has been replaced by a complete ban on the presence of chemical products in any of the environmentally hazardous classifications listed in the requirement. Classification H334 (Allergenic, Respiratory sensitisation) has been added for work environment reasons and to harmonise with the Nordic Ecolabelling criteria for Furniture and fitments. H362 is a classification that did not exist when the criteria were previously revised. Nordic Ecolabelling is generally committed to restricting the use of

[39] Chlorine and Building Materials: A Global Inventory of Production Technologies, Markets, and Pollution, Phase 1: Africa, The Americas, and Europe, Healthy Building Network, 2018
[40] Chlorine and Building Materials: A Global Inventory of Production Technologies, Markets, and Pollution, Phase 2: Asia, Healthy Building Network, 2019
[41] https://www.nordic-swan-ecolabel.org/nordic-ecolabelling/environmental-aspects/circular-economy-and-resource-efficiency/pvc/

chemicals that are harmful to health and the environment, and the classification requirement prohibits the products of highest concern.

There is an exemption for UV curing surface treatment products that are classified as environmentally hazardous. UV products have several advantages as they provide a durable surface and contain a low amount of solvents. Later requirements are placed on the amount of VOC applied, which promotes water-based UV products.

UV products contain acrylates, and more acrylates are being classified as environmentally hazardous or given stricter classifications. Acrylates and photo initiators are two vital components for UV products to cure. The acrylates change properties in the hardening and bind to the surface coating, so they do not pose an environmental hazard in the finished product. Setting requirements on, for example, the maximum amount of environmentally hazardous substances applied means that only UV products with a lower concentration of acrylates would meet the requirement. This has negative consequences as it leads to longer curing time and more energy-intensive curing. A surface that has not hardened also becomes less resistant and thus offers poorer quality.

Background to O30 UV curing surface treatment system

The requirement above, limiting the use of chemical products classified as environmentally hazardous, contains an exemption for UV curing products. These kinds of products are often classified as environmentally hazardous due to the content of acrylates. The acrylates change properties in the hardening and bind to the surface coating, so they do not pose an environmental hazard in the finished product. Instead, it is important that no emissions of uncured product that have the environmentally hazardous properties occur. Requirements are therefore set for the application, which must take place in a controlled closed process where no discharges to recipient take place.

Background to O31 Classification of ingoing substances

The requirement has been tightened to now include Category 2 substances. An exemption applies for photo initiators. They may be present in UV products. They are present in lesser amounts but are necessary to speed up the hardening process.

An exemption has also been introduced for the hardener in two-component UV products if it can be documented that workers are not exposed, and application takes place in closed systems. After curing, the hardener no longer has these properties. Nordic Ecolabelling generally wants to limit the use of chemicals with these properties as much as possible, but in some cases, it is difficult to find good substitutes. As these are industrial processes that take place under controlled conditions, the consumer will not be exposed to these substances.

Exemptions have also been added for titanium dioxide (CAS No. 13463–67–7), 1.1,1-Trimethylolpropane (TMP, CAS No. 77–99–6) and mequinol (CAS No. 150–76–5). Titanium dioxide is a white pigment that is used in many diverse types of products, including being used in almost all pigmented surface treatments. 1,1,1-Trimethylolpropane (TMP) is used to coat titanium dioxide to make the titanium dioxide particles disperse more easily. About 90% of all titanium dioxide is coated with TMP. Trimethylolprepane triacrylate (TMPTA) (CAS No.

15625–89–5) have been reclassified as class 2 carcinogen H351. Mequinol is used as a diluent in binders for UV surface treatments.

All three substances are necessary for use in surface treatment products and have recently been classified as CMR category 2, either as a harmonised classification or self-classification. There are currently no good substitutes, and therefore exemptions have been granted. However, the exemption for TMP is time-limited since the industry is working to substitute the substance.

The Nordic Swan Ecolabel has included the new CLP classifications to align with the European Green Deal's goal of a toxic-free environment. This inclusion reflects the need to establish hazard identification for endocrine disruptors and addresses criteria for environmental toxicity, persistency, mobility, and bioaccumulation. By incorporating these classifications, Nordic Swan Ecolabel ensures that the criteria relate to up-to-date scientific understanding and regulatory compliance. Additionally, the inclusion of PMT and vPvM substances is crucial due to their persistence, mobility, and potential impact on water quality. The Nordic Swan Ecolabel aims for comprehensive hazard identification and protection of the environment and human health.

Background to O32 Prohibited substances

The requirement is largely the same as in Section 3.6 except for VAH. In addition, there are now specific exemptions that are relevant for surface treatment products.

Volatile aromatic hydrocarbons (VAH)

The previous generation of the criteria limited the amount of VAH only in adhesive products. The limit has now been changed to also cover chemical products for surface treatment. This is the case in other Nordic Ecolabelling criteria, for example the criteria for furniture and fitments. Volatile aromatic hydrocarbons (VAH) are volatile organic compounds where one or more benzene rings are contained within the molecule, e.g. toluene, benzene, and xylene. VAHs are very stable and have a specific impact on the environment and human health, including damage to DNA. Exposure to these products should be minimised. For this reason, no more than 1% by weight is permitted in the chemical product.

Paint pigments:

Halogenated paint pigments are used in the paint industry and an exemption is made if they meet the EU’s requirements concerning colourant pigments in food packaging under Resolution AP (89) item 2.5. PCBs have been found in analyses of paints containing organic pigments. PCBs are not added but can be formed in the production process by reactions between different chlorinated solvents and the organic pigment. Nordic Ecolabelling does not really want to allow PCBs, but since it is not possible to set a zero limit for the pigments, Nordic Ecolabelling has chosen the same level that is approved in food packaging (Resolution 89 point 2.5). This threshold has been set because it is an established method in the industry and the low threshold allowed in food packaging is considered strict enough for indoor surface treatment products. The exemption for these pigments is necessary to enable the manufacturers to make products with good colour fastness and not use pigments that are even more damaging to the environment.

Epoxy acrylate in UV curing surface treatment products

A side reaction can occur during the manufacture of epoxy acrylate which results in a small amount of chlorine remaining inside the molecule. The chlorine that is bound in the molecule is relatively stable and will not react further while polymerisation continues. The ban on ingoing substances in the form of halogenated organic compounds applies to the chlorine because it becomes part of the molecule. The quantity of oligomers is normally below 1000 ppm. According to the manufacturers of surface finishing products, however, it is not possible to state an exact quantity. Nordic Ecolabelling does not want to ban epoxy acrylate that is used in UV curing surface treatment products, as such products have multiple environmental benefits. The chlorine in the molecules is not added intentionally for a specific purpose and is therefore exempted. Bisphenol A is also used in the manufacture of epoxy acrylate. It has thus been made more explicit that Bisphenol A used in this manufacturing process is exempt from the requirement.

BHT in UV curing lacquers and paints

BHT is included in the EU member state initiative “Endocrine Disruptor Lists”, List II Substances under evaluation for endocrine disruption under EU legislation. BHT has an important function in UV curing lacquers and paints and is difficult to replace, therefore an exemption has been introduced with a maximum limit in the chemical product. Nordic Ecolabelling does not want to prohibit the use of UV curing lacquers and paints, as they have other positive properties. If BHT receives an official harmonised classification that is not permitted in these criteria, the exemption is no longer valid.

Exemption for aziridine/polyaziridines

Aziridines and polyaziridines are on the list of prohibited substances as they are often classified as CMR. Polyaziridines are used as crosslinks in surface treatment systems. Product developments are constantly being made in the field of surface treatment, including the development of new types of aziridines as crosslinks. If it can be documented that the aziridine compound used is not classified as carcinogenic, mutagenic or reprotoxic by any manufacturer or ECHA, it is exempted from the requirement.

Background to O33 Nanomaterials

Due to the small size and large surface area of nanoparticles, they are usually more reactive and may have different properties than larger particles of the same material. There is concern among public authorities, researchers, environmental organisations, and others about the lack of knowledge regarding the potential harmful effects on health and the

environment[42],[43],[44],[45],[46],[47]. Coatings and other modifications may also alter the properties. Nordic Ecolabelling takes the concerns about nanomaterials seriously and uses the precautionary principle to rule out nanomaterials/particles in the products. Nanomaterials/-particles are defined according to the EU Commission Recommendation on the Definition of Nanomaterial (2022/C 229/01)[48].

Most nanomaterials on the market today have either been in use for decades or have recently been manipulated into nanoforms of existing materials[49]. For example, carbon black nanoparticles and amorphous silicon dioxide (SiO2) have been used in previous centuries. Titanium dioxide (TiO2) has long been used as a dye in bulk form but is now manufactured as a nanomaterial for other purposes[50]. Other types of engineered nanomaterials are expected to enter the market in the future[51].

In the construction panel product group, nanomaterials are used, among other things, to impregnate or seal surfaces, to create hydrophobic, self-cleaning, and antibacterial surfaces. These effects may, for example, come from the addition of nanometals such as silver, gold and copper or titanium dioxide. Exemptions, see background under O34.

[42] UNEP (2017) Frontiers 2017 Emerging Issues of Environmental Concern. United Nations Environment Programme, Nairobi. https://wedocs.unep.org/bitstream/handle/20.500.11822/22255/Frontiers_2017_EN.pdf?sequence=1&isAllowed=y

[43] Parliamentary Assembly of the Council of Europe (2017 (2013)) Nanotechnology: balancing benefits and risks to public health and the environment. http://semantic-pace.net/tools/pdf.aspx?doc=aHR0cDovL2Fzc2VtYmx5LmNvZS5pbnQvbncveG1sL1hSZWYvWDJlLURXLWV4dHIuYXNwP2ZpbGVpZD0xOTczMCZsYW5nPUVO&xsl=aHR0cDovL3NlbWFudGljcGFjZS5uZXQvWHNsdC9QZGYvWFJlZi1XRC1BVC1YTUwyUERGLnhzbA==&xsltparams=ZmlsZWlkPTE5NzMw

[44] Larsen PB, Mørck TAa, Andersen DN, Hougard KS (2020) A critical review of studies on the reproductive and developmental toxicity of nanomaterials. European Chemicals Agency.

[44] SCCS (Scientific Committee on Consumer Safety) (2019) Guidance on the Safety Assessment of Nanomaterials in Cosmetics. SCCS/1611/19. https://ec.europa.eu/health/sites/health/files/scientific_committees/consumer_safety/docs/sccs_o_233.pdf

[45] Mackevica A, Foss Hansen S (2016) Release of nanomaterials from solid nanocomposites and consumer exposure assessment – a forward-looking review. Nanotoxicology 10(6):641–53. doi: 10.3109/17435390.2015.1132346

[46] BEUC – The European Consumer Organisation et. al (2014) European NGOs' position paper on the Regulation of nanomaterials. www.beuc.eu/publications/beuc-x-2014-024_sma_nano_position_paper_caracal_final_clean.pdf

[47] Azolay D and Tuncak B (2014) Managing the unseen – opportunities and challenges with nanotechnology. Swedish Society for Nature Conservation. www.naturskyddsforeningen.se/sites/default/files/dokument-media/rapporter/Rapport-Nano.pdf

[48] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32022H0614(01)&from=EN

[49] EU observatory for nanomaterials and European Chemicals Agency (2019) What are next generation nanomaterials and why are regulators interested in them? Information note. https://euon.echa.europa.eu/documents/23168237/24095696/190919_background_note_next_gen_materials_en.pdf/b9178324-5a69-2e4b-1f2b-aac2c2845f45

[50] European Commission, COMMISSION STAFF WORKING PAPER, Types and uses of nanomaterials, including safety aspects, Accompanying the [..] second regulatory review of nanomaterials, SWD(2012) 288 final

[51] EU observatory for nanomaterials and European Chemicals Agency (2019) What are next generation nanomaterials and why are regulators interested in them? Information note. https://euon.echa.europa.eu/documents/23168237/24095696/190919_background_note_next_gen_materials_en.pdf/b9178324-5a69-2e4b-1f2b-aac2c2845f45

Background to O34 Preservatives

The content of the preservatives bronopol, IPBC, CMIT/MIT and MIT is restricted via specific limit values. The content of the total amount of isothiazolinones is also limited. The exemption is the same as in generation 6 for bronopol, isothiazolinones and CMIT/MIT, while IPBC is new to the list. IPBC is a fungicide that has become more commonly used and the limit value is based on consultation comments. Water-based paints and adhesives may contain the preservative bronopol and it is difficult to find substitutes. A limited amount of bronopol is therefore permitted although it is classified as a substance of concern and hazardous to the environment. Isothiazolinones are used as a preservative in many water-based products, where they act as fungicides, biocides, and algal growth inhibitors. They are toxic to aquatic organisms and can cause varying degrees of allergic reactions. It has proved difficult to avoid the use of these preservatives in water-based products, which is what Nordic Ecolabelling's criteria for chemicals indirectly promote. Preservatives also play a significant role in ensuring the shelf-life of the products before they are used. Alternative preservatives to isothiazolinones include formaldehyde and/or formaldehyde-releasing substances, which are carcinogenic. In this respect, isothiazolinone and CMIT/MIT are better, even though they also exhibit hazardous properties. To limit the use of these substances as much as possible, the amount of the substances is restricted.

Background to O35 Free formaldehyde

For further background information about free formaldehyde, see Section 3.7.1.

2.5.3 Surface treatment system

Background to O36 Surface treatment system

The requirement is new since the previous generation of the criteria did not consider the efficiency of the application method. This change has been made to harmonise with other Nordic Ecolabelling criteria, for example Furniture and fitments and Interior panels. Information about applied quantities, number of coats and method of application is required to calculate applied quantities of VOCs in subsequent requirements.

Background to O37 Quantity of applied volatile organic compounds (VOC)

The reason for this requirement is that VOCs contribute to ozone formation and can have adverse health effects in the workplace and indoor climates.

The limit values remain unchanged in the requirement since they are still considered to be strict. One change that has been made is inclusion of the efficiency rate of the application method. This is described in more detail in the background to the previous requirement.

2.6 Emissions

2.6.1 Emissions from the production - COD

Background ot O38 Emissions of COD from wet processes

The energy requirement is unchanged compared to generation 6 of the criteria.

Panel production using a wet process produce emissions to water of oxygen-demanding organic matter (COD). Microorganisms consume oxygen to break down the organic matter. This may lead to low oxygen concentrations in the water and, in some cases, anaerobic conditions. A benefit of panels produced using a wet process is that they usually do not contain any adhesive – as the lignin already in the wood is enough to hold the material together. Nordic Ecolabelling therefore permits panel production using the wet process, but it is important to ensure low levels of COD emissions.

2.6.2 Emissions from the production – working environment

Background to O39 Emissions to air from production of laminate in HPL, compact laminate and panels based on resin binder

Laminate consists of kraft paper and decor paper impregnated with resins containing phenol, formaldehyde, and other substances. During the manufacturing process of the laminate, before the resin has fully cured, emissions to air of phenol and formaldehyde occur. The aim of the requirement concerning hygienic limit values for emissions to air in the workplace is to ensure that the air is measured and that levels are low. This generation of the criteria has a tighter requirement than before concerning emissions of formaldehyde, during both an 8-hour period and a reference period of 15 minutes. The new, stricter limit values are at the same level as the legal requirements in Sweden and Germany, for example, and those set out by the EU Scientific Committee on Occupational Exposure Limits (SCOEL). The limit values for phenol in the previous generation of the criteria already matched the levels identified in the examined legislation, and they have therefore not been tightened.

Background O40 Emission of dust

The requirement remains unchanged. The requirement seeks to ensure that working conditions in relation to dust emissions are acceptable, regardless of where the panel is produced.

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.

2.7 Climate and energy

This chapter contains requirements for the energy consumption in the production of the several types of panels and specific type of raw materials used in the panels.

The energy consumption is calculated as MJ/kg product produced, and encompasses all energy used from **gate to gate** (phase A3 in EPDs) at the panel production site. Energy consumption also needs to be calculated for specific type of raw materials such as pulp/paper, resin/glue, laminate, cement, and mineral wool used in panels.

The requirements must be documented in the form of energy consumed (actual energy used in production) without the use of primary energy factors.

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

System boundary for the requirement: Energy consumption for extraction of raw materials, transports of raw materials or any surface treatment is not part of the energy requirement. The energy requirements do not apply to raw materials that are included by less than **5 wt%** of the panel.

Further descriptions of how the energy calculation should be carried out can be found in Appendices 6.

2.7.1 Panels made from renewable raw materials

The requirements apply to energy consumption in the production of; kraft paper and paper pulp used in HPL, compact laminate, wood-based panels and panels made from other lignocellulose raw materials.

Background to O41 to O45 Panels made from renewable raw materials

The requirement has been tightened in generation 7.

The most environmentally friendly energy is the energy that is not used. Energy-efficient production is generally important in reducing the environmental impact from the use and production of energy. In a complex world where lack of energy might become more prominent in the future, it is important that everyone tries to reduce their own consumption. Energy consumption also directly affects greenhouse gas emissions. Energy-efficient production and lower energy consumption will thus also reduce greenhouse gas emissions. Nordic Ecolabelling is therefore committed to setting requirements concerning maximum use of energy wherever possible. The RPS analysis shows that there is generally high environmental relevance in setting requirements for energy consumption, for both ingoing materials and the panel production itself. Several of the production lines use processes that involve a great deal of heat or pressure. Differentiated energy requirements have been set, as the production processes differ, which thus also results in differences in energy consumption. It will also make it possible to separate out the production lines that perform well on energy within each product type.

For panels based on renewable raw materials, a high proportion of renewable fuels is often used. This may be from waste wood that is not of sufficient quality to be included in the

panels. But there are also manufacturers that use electricity or fossil raw materials in the form of gas or oil.

In panels where paper makes up a high proportion of the material composition, the paper contributes a significant part of the panel's total energy load. There are therefore energy requirements for pulp and paper production for the paper types included in the panel, in addition to energy requirements for the actual panel production. The manufacturer of the pulp and paper must document the energy consumption. The requirement does not cover decor paper, as it is a little further back along the supply chain, making documentation more difficult to obtain. In addition, it constitutes a relatively small proportion of the product's ingoing paper. An HPL panel may contain around 50–60% kraft paper and 2–15% decorative paper. Energy requirements and calculation methods for pulp and paper are taken from Nordic Ecolabelling's Basic Module for paper. The Basic Module does not contain specific requirements for the type of paper used in laminate, kraft paper, and the reference value to produce this paper type has therefore been specifically developed for, and adapted to, this product group.

Energy requirements for solid wood products such as panels and mouldings are new to this generation. Here, energy consumption is mainly related to the drying and processing of wood, such as sawing and planning, with the drying process as the process with the highest consumption. The requirement has been adjusted from 1350 to 1850 MJ/m3 based on updated information from stakeholders. The adjusted requirement limit also includes energy used for any surface treatment.

2.7.2 Panels made from mineral- and non-renewable raw materials

The requirements apply to energy consumption in the production of materials based on wood plastic composite (WPC), mineral wool-based panels, cement, and cement-based panels.

Background to O46 to O49 Panels made from meneral- and non-renewable raw materials

Wood plastic composite:

New requirement in generation 2. The process for manufacturing WPCs includes mixing of wood flour with thermosetting polymers, extrusion, injection moulding, compression moulding or thermoforming (pressing) and any surface treatment. The processes of extrusion (melting of polymers/mixing with other components) and injection/compression moulding are energy-intensive in terms of electricity consumption. Enhancing energy efficiency is important for reducing the overall energy consumption.

The energy consumption in the production of wood plastic composite panels must not exceed 3 MJ/kg panel. The energy limit is based on dialogue with stakeholders and a review of EPDs.

Mineral wool-based panels:

The requirement has been changed compared to generation 1 where it includes both the production of mineral wool as well as the final panel. The share of virgin mineral rock/basalt is 15–20% in the final panel and the requirement for production of virgin mineral wool has therefore been removed in generation 2. The requirement now covers all the energy used

(electricity + heat) at the production site (gate to gate, or phase A3 in EPDs). The production process includes heating and melting (1500 ºC) a mix of virgin basalt (15–20%) and several types of recycled material, spinning om mineral strings/fibres, pressing, cutting, facing of panels, coating, and packaging[52]. The proposed energy limit is based on dialogue with stakeholders and a review of EPDs.

Nordic Ecolabelling wishes to encourage fossil-free manufacturing and has therefore introduced a ban on the use of fossil oil and coal as main fuels for production of process heat in mineral wool factories. However, necessary use of fossil oil, for example in planned maintenance stops, emergency maintenance stops and as a reserve or tip fuel (peak load fuel), is allowed. Use of coal is, however, completely prohibited.

Tip fuel is peak load fuel that is only used for short periods, for example when it is cold. What is meant with reserve fuel can sometimes be a bit unclear. Reserve fuel can for example be defined in mineral wool factories environmental permits issued by the authorities. Therefore, it has not been defined in more detail in the criteria itself, but the use of reserve fuel should be calculated in days.

At this point, it is not possible to exclude all fossil fuels in mineral wool manufacturing. Therefore, use of natural gas and liquefied petroleum gas (LPG) is still allowed.

Cement:

This is a new requirement in generation 7 of the criteria. Portland cement is a key ingredient in several types of cement-based panels but also one of the major sources of greenhouse gases globally. The cement industry accounts for 5% of the global carbon dioxide emissions[53]. According to estimates, 900 grams of CO2 emerge from the manufacturing of 1000 grams of cement, resulting in 3.24 billion tons of CO2 being generated annually[54]. Therefore, requirements are set out to reduce the energy demand, to limit the anthropogenic emissions of CO2[55].

The specific limits for the different types of cement and hydraulic binders are derived from the average value of the top 10% of installations based on the data collected in the context of establishing the EU Emissions Trading System (EU ETS) industrial benchmarks for the period of 2021–2026 and calculated in accordance with the methodology for setting the benchmarks set out in Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC[56].

Use of fossil fuels, see mineral wool above.

[52] https://www.rockpanel.dk/produktfordele/baeredygtighed/produktionsprocessen-for-rockpanel-facadebeklaedning/ (visited September 2023)
[53] The Cement Sustainability Initiative: https://docs.wbcsd.org/2016/12/GNR.pdf (visited 2022-05-30)
[54] Hendriks, C. A., Worrell, E., De Jager, D., Blok, K., & Riemer, P. (1998, August). Emission reduction of greenhouse gases from the cement industry. In Proceedings of the fourth international conference on greenhouse gas control technologies (pp. 939-944). IEA GHG R&D Programme Interlaken, Austria.
[55] Antunes, M., Santos, R. L., Pereira, J., Rocha, P., Horta, R. B., & Colaço, R. (2021). Alternative Clinker Technologies for Reducing Carbon Emissions in Cement Industry: A Critical Review. Materials, 15(1), 209.
[56] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32021R0447&rid=1

Cement-based panels:

The requirement has been changed compared to generation 1 where the energy requirement covered all materials used in the cement-based panel. The main material in cement-based panels is cement. The content of cement in fibre cement flat sheets is around 65–80%[57], [58], [59]. To simplify the requirement, the energy requirement now covers the manufacturing of cement and the production of the panels. As the manufacturing of cement contributes the highest energy impact in the panels' lifecycle it has an impact on the energy consumption in production of panels due to variation in share of cement. The energy consumption in production of mineral wool-based panels must not exceed 2 MJ/kg. The energy limit is based on dialogue with stakeholders and a review of EPDs.

2.8 Circularity

The requirements in this chapter concern resource efficiency that have the function to increase the circularity of panels and cladding. These requirements address durability/expected lifespan, instructions, maintenance, and take-back systems.

Background to O50 Warranty

This is a new requirement in generation 2 of the criteria.

Several lifecycle assessments[60] for façade panels show that durability and expected lifespan are most important for how much the product affects the environment. Longer lifetime often means that less new items are being produced and less raw material is extracted. At the same time, there will be less waste. This means that less resources, energy, and chemicals are needed, and emissions to air, soil and water are reduced.

A Nordic Swan Ecolabel product must be of good quality, and along with durability requirements, the warranty is a factor that signals the product's lifetime and says something about what the customer can expect from the product. However, the warranty should not be equated with longevity alone. Longevity is affected by many factors, including correct installation and correct and sufficient maintenance of the product.

A warranty can be designed in many ways, but Nordic Ecolabelling has set as a minimum requirement that goes beyond the legal guarantee and states which parameters must be included.

The required 15-year warranty period is based on dialogue with stakeholders, consultation responses, and information from manufacturer's webpages. In addition, façade panels/cladding marked as semi-finished products must be able to sustain at least 5 years after installation on the building before a finish paint/topcoat/primer or similar is recommended.

[57] https://www.cedral.world/en/ (visited September 2023)
[58] https://www.swisspearl.com/dk?gclid=EAIaIQobChMIgufh3vLhgwMVD4poCR2g8ASuEAAYASAAEgLST_D_BwE (visited September 2023)
[59] https://www.jameshardie.co.uk/en/cladding/hardieplank (visited September 2023)
[60] Nicolas F. et al: Influence of methodological choice on maintenance and replacement in building LCA, The international Journal of Lifecycle Assessment (2021).

Background to O51 Information for consumers

It is important that instructions concerning storage and assembly are accompanied the product and/or is available for download on the manufacturer’s website to ensure that the panel is handled and used correctly. Information about the materials used is relevant when the product is to be discarded/recycled, as it makes it easier to sort material into the correct waste fractions. Most types of panels in these criteria are covered by harmonised standards, which ensure the panels live up to industry-approved qualities. This information gives the customer assurance of the product's quality.

Background to O52 Take back system

The requirement is new in generation 2. Product take-back systems are fundamental for Circular Economy (CE) and focus on recovering value by taking back products to be recycled, re-manufactured or refurbished. In theory, the expected value from CE in undeniable. However, in practice, product take-back systems are often small-scale, but the interest in CE is growing across the entire panel industry due to several benefits, such as stronger customer relationships, lower cost of goods sold through secondary material supply, alternative sources of critical raw materials, and reduced environmental impacts.

Due to the variety of panels covered by these criteria and the differences in how well they are integrated into existing waste systems, panel manufacturers must offer a take-back system for returning products or be in a process/test/pilot phase to establish such a system. There is no requirement for how the manufacturer uses the collected products, for example remanufacturing them into new, equivalent products. Companies with an established take-back system, where collected products are remanufactured into new equivalent products, can meet the requirement for innovation.

2.9 Innovation

The requirement in this chapter covers various areas where Nordic Ecolabelling sees opportunities to promote manufacturers that contribute to innovation, such as using bio-based raw materials for adhesive production, contributing to the circular economy or reducing greenhouse gas emissions, and implementing measures to support biodiversity. One of the points must be fulfilled, and the manufacturer can choose which measure they wish to meet. This offers flexibility. Nordic Ecolabelling also aims to signal what may become mandatory in the next revision of the criteria.

Background to O53 Innovation in production

This is a new requirement in generation 2. Nordic Ecolabelling views this requirement as a possibility to promote manufacturers who take innovative actions and contribute in various ways to reducing the overall environmental impact of production, whether related to the product itself or the conditions on the production line.

2.10 Licence maintenance

The purpose of the licence maintenance is to ensure that fundamental quality assurance is dealt with appropriately.

O1 Customer complaints

The licensee must guarantee that the quality of the Nordic Swan Ecolabel product or service does not deteriorate during the validity period of the licence. Therefore, the licensee must keep an archive over customer complaints.

Note that the original routine must be in one Nordic language or in English.

- Upload your company's routine for handling and archiving customer complaints.

Background to requirement 054 Customer complaints

Nordic Ecolabelling requires that your company has implemented system for handling customer complaints. To document this, you must upload your company's routine that describes these activities. The routine should be dated and signed, and it is typically part of your company's quality management system.

If your company does not have a routine for handling customer complaints, you can upload a description of how these activities are performed. During the on-site visit, Nordic Ecolabelling will verify that the customer complaint handling is implemented as described. The customer complaints archive will also be reviewed during the visit.

Background to requirement 055 Traceability

Nordic Ecolabelling requires that your company has implemented a traceability system. To document your company's product traceability, you must upload your company's routine describing these activities. The routine should be dated and signed and will normally be part of your company's quality management system.

If your company does not have a routine for product traceability, you can upload a description of how your company perform these activities. During the on-site visit, Nordic Ecolabelling will verify that the product traceability is implemented in your company as described.

3 Environmental impact of the panels and cladding for exterior use

Nordic Ecolabelling assesses environmental impacts throughout the product's lifecycle. This chapter provides a description of the specific environmental impacts of panels, an RPS analysis, and explains how the product group aligns with the UN's Sustainable Development Goals, the circular economy, and biodiversity.

3.1 Environmental impact

This product group consists of various types of panels with different engineering properties, manufactured from different types of material. These panels are primarily used as façade materials for houses and buildings, as well as in the production of outdoor furniture, playgrounds, and exterior design. The overall environmental impact for all types of panels[61],[62],[63],[64],[65] is related to:

- Resources/use of raw materials,
- Energy consumption in the production of panels. Energy savings have an important role to play in reducing global warming and climate change,
- Use for chemicals in the production of panels such as resins and surface treatment,
- Quality and expected lifespan,
- End of life.

3.2 Functional unit

This product group contains a wide variation of material types, production processes, and functions among the different panels. A single functional unit for a 1m2 façade panel would therefore be impractical. It has therefore been decided to make the following general categorisation of functional units in the product group: wood-based panels, HPL panels, compact laminate panels, WPC panels, cement-based panels and mineral wool-based panels. The unit for each is 1 kg of the material/type of panel.

This approach is particularly evident in relation to the energy requirements. Using multiple functional units allow for better control of the requirements. The goal is to identify the most environmentally favourable panels within each panel type, rather than making direct comparisons between different panel types.

[61] Katrine Raunkjær Stubdrup et. al: Best Available Techniques (BAT) reference document to produce wood-based panels, European IPPC Bureau (2016)
[62] Nicolas F. et al: Influence of methodological choice on maintenance and replacement in building LCA, The international Journal of Lifecycle Assessment (2021).
[63] J.D.Silvestre et. all: Building´s external walls in Life-Cycle Assessment research studies, Institute Superior Tecnico, Lisboa, Portugal (2015)
[64] Stylam Industries Limited: EPD, High Pressure Laminate - Compact Panels. EDP Danmark (2023)
[65] Chunheng Z. et.all: Comparative environmental LCA of fibre reinforced cement panel between kenaf and glass fibres

The selection of panel types is based, among other things, on an LCA tool (The Construction Material Pyramid[66]) that assesses and compares the environmental impact of various material used in 1m2 façade panels or cladding. The data is based on EPDs (Environmental product declaration) and covers lifecycle stages A1–A3 (cradle-to-gate). All selected panel/cladding types have an environmental impact of less than 20 kgCO2 eq/m^2.

3.3 RPS

The environmental impact of exterior panels and claddings is linked to the resources/raw materials used, energy and chemicals used in production, the expected lifespan/quality, and end-of-life considerations.

The relevant environmental impacts throughout the lifecycle of panels for exterior use are set out in a MECO scheme. A MECO scheme highlights the key areas that affect the environment and health throughout the product's lifecycle – focusing on materials/resources consumption (M), energy (E), chemicals (C) and other impact areas (O).

Nordic Ecolabelling sets requirements concerning the topics and processes in the lifecycle that have a significant environmental impact – referred to as hotspots. Based on the MECO analysis, an RPS tool is used to identify where ecolabelling can have the greatest effect. 'R' stands for the environmental relevance; 'P' is represents the potential to reduce environmental impact, and 'S' refers to the steerability, which determines how compliance with a requirement can be documented and monitored. The criteria focuses on those areas of the lifecycle identified as having high RPS, where there is potential to achieve positive environmental gains. For more details on the RPS analysis, please refer to the Nordic website[67].

Life cycle stages	Area and assessment of R, P, S (high, medium or low)	Comments
Raw materials		
	Resources - wood raw materials R: High P: High S: High	Wood raw materials used in panels and cladding have a high RPS. From a lifecycle perspective, forestry plays a key role in the environmental impact of wood products. It is crucial that wood, as a renewable raw material, is grown, harvested and used in a sustainable way. A significant portion of global forest loss is driven by the conversion of natural forest to other land uses, such as cattle farming, palm oil and soy plantations. Deforestation and degradation caused by illegal and unsustainable logging, fires, and fuelwood harvesting can harm wildlife, threaten livelihoods and intensify climate change. Credible forest management certification helps promote a more sustainable wood/timber product industry by creating market conditions that support forest conservation. Requirements for a high share of certified wood raw materials and

[66] https://www.materialepyramiden.dk/ (visited October 2023)
[67] https://www.nordic-ecolabel.org/nordic-swan-ecolabel/criteria-process/ (accessed 05.07.2022)

		certified traceability ensure more sustainable forestry.
	Resources - recycled raw materials R: High P: Medium/High S: High	The use of recovered and recycled materials, such as renewable fibres or mineral raw materials, helps reduce the negative environmental impact of all types of panels. Setting requirements for a minimum proportion of recycled materials in panels decreases the need for virgin raw materials, thereby conserving natural resources. The potential for using recycled materials is high in most type of panels, even though recycled wood raw materials are also in demand in the energy sector. A challenge of using recycled materials is the potential presence of harmful substances. Therefore, recycled materials must be tested to minimise the spread of substances of concern and to enhance the potential for future material reuse. Traceability for recycled materials is strong, thanks to widespread certification schemes for recycled raw materials.
	Resources - mineral raw materials R: High P: High S: Medium	The R and P for responsible sourcing of virgin mineral raw materials from quarries are high. The mineral industry has been working with both traceability and biodiversity management and rehabilitation plans for several years. Certification schemes for sustainable mining are however still under development and S has therefore been assessed as medium. The latest assessment of the State of Nature in the EU, published in 2020[68], shows that we are still losing nature as too many protected species continue to decline. The extraction of minerals, particularly by surface methods, inevitably results in changes to the characteristics of the land and local biodiversity where it takes place.
Production/distribution		
	Energy - production of wood-based panels/HPL R: High P: Medium/High S: High	High to medium RPS has been identified to the energy impact of panel production (including the production and/or drying of panels). For panels, the production of adhesives and their input raw materials can also have a significant effect on climate impact, as it is an energy-intensive process. In panels where paper constitutes a large proportion of the material composition, the paper contributes a significant part of the panel's total energy load. Energy savings play a crucial role in reducing environmental impact, and by extension, global warming and climate change. All panel manufactures are focused on reducing their energy consumption, which means the potential for tightening the requirement levels is considered medium.
	Energy - production of wood plastic composite panels R: High P: Medium/High	High to medium RPS has been identified in relation to the energy impact from panel production (including the energy used to melt the polymer (PP, PE, or PVC), mixing materials on

[68] https://www.eea.europa.eu/publications/state-of-nature-in-the-eu-2020

	S: Medium	the production line as well as pressing/drying the panel). The concentration of polymers varies in across panels – polymers constitute around 30% in WPC and 10% in mineral composite panels. Despite this variation, the relevance of restricting energy use in the manufacturing process remains high. The variation in design/function of the different types of panels makes it difficult to set ambitious energy requirements for the individual board type (medium P and S).
	Energy - production of mineral wool façade panels R: High P: Medium/High S: Medium	Mineral raw materials, such as mineral wool and cement, are used in several types of panels/acoustic panels. From a lifecycle perspective, the production of these raw materials (especially mineral wool and cement) has a greater environmental impact than the actual manufacturing of the panels. However, the importance for restricting the energy use in the manufacturing process remains high. The variation in design/function of the different types of panels makes it difficult to set ambitious energy requirements for the individual board type (medium P and S).
	Energy - production of cement R: High P: Medium/High S: High	Portland cement, the key ingredient in cement-based panels and acoustic panels, is a major contributor to greenhouse gas emissions. It accounts for 5% of global carbon dioxide emissions[69], largely due to the significant energy required to heat kilns, resulting in both indirect emissions from energy use and direct emissions from the production process. Nordic Ecolabel sets out requirements to restrict the GWP on the production of cement to limit the anthropogenic emissions of CO2.
	Chemicals used in manufacturing of panels R: High P: Medium/High S: High	Chemicals used in the manufacturing of panels, as well as in potential surface treatments, contain various substances and raw materials with a range of harmful effects on both the environment and health. The chemical requirements apply to all products used in panel production, with particular focus on formaldehyde, VOC, and isothiazolinones in binders due to their high relevance. Ensuring a low content of problematic chemicals in surface treatments, such as flame inhibitors and heavy metals in pigments, is also critical. Additionally, there is a high RPS relevance for limiting the use of nanoparticles, for instance in the surface treatments.
Use phase		
	Quality and properties R: High P: High S: Medium	RPS is high for ensuring that the properties and functions, for which the panels are marketed, align with the performance declarations made in relation to CE marking. There is also high RPS for ensuring that panels not covered by harmonised product standards also have proper documentation for the properties and functions for which they are marketed for.

[69] The Cement Sustainability Initiative: https://docs.wbcsd.org/2016/12/GNR.pdf (visited 2022-05-30)

	Durability R: High P: High S: High	RPS has been found to set requirements for durability (long lifetime) for panels designed for exterior use. The longer the lifetime of a product, without the need for replacement, the lower the environmental impact of the product[70]. The consumption of raw materials and energy is drastically reduced. High steerability is demonstrated not only through compliance with quality standards, but also through product warranties. A long panel lifetime is especially important for reducing the overall environmental impact of the product.
End of life		
	End of life - take back system. R: High P: High/medium S: Medium/low	Product take-back systems are fundamental to the Circular Economy (CE), focusing on recovering value by recycling products. High relevance and potential have been identified in setting end-of-use requirements to increase panel recycling and reduce incineration. However, steerability is challenged by multiple factors such as the choice of the material used in the panels, their recyclability, the long lifespan of panels, and the lack of traceability between installed products and panel manufacturers. As a result, no panel manufacturers currently have a fully operational take-back system for worn-out panels (although wood-based panels are already part of existing waste systems, allowing some materials to be returned to panel production). A requirement is set for panel manufacturers to either offer a take-back system for old, used panels or be in the process of establishing one through a process, test, or pilot phase.

3.4 Circular economy and climate

The Nordic Swan Ecolabel is an effective tool for promoting a circular economy. The entire product lifecycle – from raw materials to production, use, disposal, and recycling – is assessed during the development of the requirements. This holistic approach to the lifecycle is essential for a circular economy. More information about how the Nordic Swan Ecolabel contributes to a circular economy can be found on our website[71]. Factors relating to the circular economy are often intricately linked to factors that contribute to a reduced climate impact. Both aspects are therefore described below for Nordic Ecolabelling's requirements for panels:

- The criteria promote the use of renewable, controlled and recovered raw materials, which leads to more efficient and sustainable use of resources. The use of recycled raw materials reduces the need for virgin raw materials and thus saves natural resources.

[70] Francart et all: Influence of methodological choice on maintenance and replacement in buildings. The international Journal of Lifecycle Assessment (2021)
[71] https://www.nordic-swan-ecolabel.org/official-nordic-ecolabel/life-cycle-perspective/ and https://www.nordic-swan-ecolabel.org/official-nordic-ecolabel/life-cycle-perspective/ (visited March 2023)

- Reduced energy consumption cuts greenhouse gas emissions. The criteria therefore set requirements concerning maximum energy consumption in the production of panels and raw materials such as paper. The use of renewable and recycled raw materials also reduces overall energy consumption indirectly, and the impact on the climate is reduced[72].
- Protecting key habitats for biodiversity also helps to reduce the climate impact; for example, forest areas play a role in regulating the climate. Therefore, there are requirements to ensure sustainable extraction of wood raw materials. Additionally, virgin mineral raw materials be sourced from mining operations (quarries) with documented biodiversity management and rehabilitation plans.
- Strict chemical requirements in both production and surface treatment lead to the substitution of hazardous substances and avoid the recycling of harmful substances.
- Quality requirements and consumer information/maintenance instructions promote a longer service life and reduce the need for new products. This leads to more efficient use of resources and a reduced climate impact.
- Requirement for durability/expected lifespan of at least 50 years reduces the need for new products.
- Requirements for take-back system as well as a general use of recycled raw materials promotes circular economy.

3.5 Biodiversity

Biodiversity refers to the variety of all living organisms on Earth and how they interact. It holds intrinsic value and is crucial to sustain nature’s contributions to people (ecosystem services) and its ability to respond to change.

In 2019 the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) published its first global report, calling for transformative change. The world must bring biodiversity back into the production landscapes in addition to creating more protected areas. In 2022 the UN Convention on Biological Diversity[73] adopted the Kunming-Montreal Global Biodiversity Framework agreeing to conserve and manage at least 30% of the world's lands, inland waters, coastal areas, and oceans.

Nordic Ecolabelling contributes to protecting biodiversity by requiring that renewable raw materials are responsibly sourced. For example, wood raw materials must come from forests managed in accordance with FSC or PEFC sustainable forestry principles. Virgin mineral raw materials must be sourced from mining operations (quarries) with documented biodiversity management and rehabilitation plans. The goal is to counteract loss of species and ecosystem degradation, ensuring that the sourcing of biological raw materials remains in balance with natural regeneration.

[72] Extraction and processing raw resources to make usable materials (paper, plastic, or metal) requires a lot of energy. Recycling often saves energy because the production being recycled usually require much less processing to turn them into usable materials.
[73] https://www.unep.org/un-biodiversity-conference-cop-15 (visited February 2023)

MECO scheme

	Raw material	Production	Use	End of life
Material	**Wood based panel/HPL:** Virgin and rec wood raw materials Adhesives, resins, and surface treatment Land use changes Energy for cultivation. **Cement-based panel:** Cement, wood fibre, sand, silicate, glass fiber, pigments **Stone-/wood plastic composite panel:** Mineral virgin raw materials/rec. mineral wool/plastic/polyester. Binder and mineral oils.	**Use of virgin and recycled wood raw materials** Energy resources for production Emissions to air and water during production. **Cement-based panel:** 10% cellulose, 60% cement, filler Energy resources for production Emissions to air and water during production. **Stone-/wood plastic composite panel:** Energy resources for production of the panel. Emissions to air and water during production.	Design and functions such as strengths and quality. **Cement-based panel:** Design and functions such as strengths and quality. **Stone-/wood plastic composite panel:** Design and functions such as strengths and quality.	Possible recycling of “clean” panels Alternative incineration **Cement-based panel.** Landfill or alternative used as filler in cement industry/possible panels industry. **Stone-/wood plastic composite panel:** Landfill or alternative direct recycling as façade panel
Energy	**Wood based panels/HPL:** Energy resources used for felling, debarking, eventual boiling and sawing. Energy resources used to produce adhesives, fillers, resins and surface treatments. **Cement-based panel:** Energy resources used for felling, debarking, eventual boiling and sawing. Energy resources for production of cement.	Energy resources used for chipping blending, pressing, and drying. **Cement-based panel:** Energy resources for production of cement. Energy resources for production of the panel		Energy resources for mineral recycling. Incineration, energy recovery
Chemicals	**Wood based panels/HPL:** Adhesives, resins, and surface treatment	Formaldehyde, phenol and isocyanates from adhesives and resins. Chemicals used for surface treatments. VOC/SVOC from the material, adhesive, resins and surface treatments. Emissions to air and water during production. **Cement-based panel:** PVDC (binder), Chemicals used for surface treatments. **Stone-/wood plastic composite panel:**	Emissions of formaldehyde and VOC	Risk of passing undesirable chemicals (CMR, adhesives, resins, biocides, additives, etc.) onwards in the lifecycle by recycling/reusing wood.

		Organic pigments, UV stabilisers, dispersing agents, adhesives		
Other	**Wood based panels/HPL/Cement-based panels:** Impact on biodiversity through land use and deforestation. Use of endangered tree species.	Production sides outside Europe (alternative legislation)	Quality, life span of the products, need for maintenance.	Quantity and type of adhesive can hinder recycling process.

Sources for MECO

www.materialepyramiden.dk

HPL

https://www.epddanmark.dk/media/ytjh4j40/md-23143-en_rev1.pdf

https://www.epddanmark.dk/uk/epd-database/fiboas/fibo-wallpanels/

https://banema.pt/fotos/produtos/downloads/environmental_product_declaration_epd_uk_10856576595ffc7e2b4345b.pdf

https://api.environdec.com/api/v1/EPDLibrary/Files/36a80f63-77ba-4ca7-88a5-08dbc3e797a5/Data

https://www.epditaly.it/en/wp-content/uploads/2016/12/Abet-Laminati_ECOEPD-Compact.pdf

https://www.fritzoeengros.no/Files/Files/PDF%20files/1752.pdf

https://www.epddanmark.dk/media/g4fbe5gc/md-23099-en.pdf

Mineral wool-based façade panel

https://www.rockpanel.co.uk/siteassets/documentation/epd/epd_rockpanel_durable_a2_fs-xtra.pdf

WPC

https://api.environdec.com/api/v1/EPDLibrary/Files/5ff39fad-90a9-4a0a-0d2e-08db3c2e10fb/Data

https://api.environdec.com/api/v1/EPDLibrary/Files/c49ddb12-e690-43d2-14db-08dbca69748b/Data

https://api.environdec.com/api/v1/EPDLibrary/Files/025d3d82-eb8e-4710-bc86-08db92ee9d2e/Data

https://api.environdec.com/api/v1/EPDLibrary/Files/7038ff92-072f-49ee-9b4a-08d9fb5a7e14/Data

Wood based panels

Katrine Raunkjær Stubdrup et. al: Best Available Techniques (BAT) reference document for the production of wood-based panels, European IPPC Bureau (2016)

R.sathre et.al: Life cycle assessment of wood based building materials, University of Santiago de Compostela , Spain 2014

https://www.epddanmark.dk/media/k20atkbu/md-20006-en-tr%C3%A6information.pdf

https://www.wisaplywood.com/downloads/certificates-and-labels/.

https://europanels.org/

Cement-based panel

https://etex.azureedge.net/pd12214/original/-1287927949/en_epd_equitone_pictura_natura_pro_2020_2025.pdf

https://etex.azureedge.net/pd12230/original/1824836604/en_epd_equitone-tectiva.pdf

https://api.environdec.com/api/v1/EPDLibrary/Files/d476d60c-c26c-4b3d-8798-08da05ae7168/Data

https://api.environdec.com/api/v1/epdlibrary/files/8db147d4-9d19-4a3f-503d-08dbdfa90a02/data

https://www.cembrit.dk/download/SDK/miljoevaredeklaration-epd/EPD-Fibre-Cement-Facade-rain-screen-claddings

https://private-etex.azureedge.net/pd33522/original/154231821/equitone-msd-textura-da-dk.pdf?authtoken=-QgZwdL3bT6z1Wf-8tIjhyDs9WiXItYVNzg-sr0nx5RI4Bs2SABn-ZeFlxkSzSdQXcCA8JXP-5BuFeuon4JdQZLcW36OGUGiA23h2Iobfw

https://mediacache.davidsen.as/v-638098044613085508/ee/61/ce38-2c2d-436a-a2d0-8fa0539d0d51/35201970611__24__LagerFil__2021-07-14__epd%20fibre%20cement%20fa%C3%A7ade%20rain%20screen%20claddings.pdf

https://stonerex.fi/julkisivulevyt/

4 Changes compared to previous generation

Below is a short list of the key changes compared to the previous version of the criteria:

Figure 1 Overview of changes to criteria for exterior panels and cladding generation 2 compared with previous generation 1

Proposed requirement generation Y	Requirement generation 1	Same req.	Change	New req.	Comments
What can carry the Nordic Swan Ecolabel?			x		WPC panels have been added to the criteria
O1 Description of the product	O1	x			The requirement is unchanged
O2 Quality and properties	O29				The requirement is unchanged
Raw materials					
Wood raw materials					
O3 Tree species – restrictions			*	*	The requirement has been updated with Nordic Ecolabelling's requirements concerning tree species that are prohibited or restricted.
O4 Traceability and certification	O5-O6		*	*	The manufacturer of the product is required to be CoC certified. Min. 70% certified and 30% controlled
O5 Chemicals – recycled wood raw material				*	New requirement for testing of chemicals in recycled wood raw material.
O6 lignocellulose raw materials				*	Requirement introduced for other renewable raw materials such as straw or hemp.
Paper and cellulose fibre					
O7 Ecolabelled paper				*	New requirement for Nordic Swan and EU ecolabelled paper
O8 Tree species - restrictions				*	The requirement has been updated with Nordic Ecolabelling's requirements concerning tree species that are prohibited or restricted. The requirement concerning raw material used in paper production is new.
O9 Traceability and certification	O4		*		The requirement has been tightened, as the

					laminate manufacturer must now be CoC certified, and the limit for certified raw material is set at 70%
O10 Chemicals used in manufacturing of pulp and paper			*	*	Updated according to generation 3, basic module for pulp and paper
O11 Emissions of COD from the production of pulp and paper – HPL and compact laminate	O8		*		Updated according to generation 3, basic module for pulp and paper.
Wood Plastic Composite materials (WPC)					
O12 Wood fibre and plastic				*	Min. 100% recycled plastic - 60% by weight must be post-consumer recycled. % recycled wood fiber raw materials
O13 Chemicals in recycled plastic				*	New requirement for flame retardants and heavy metals
O14 Additives - prohibited substances in plastic				*	Prohibited substances in plastic in production of WPC
Mineral raw materials					
O15 Responsible sourcing of virgin raw materials				*	Supply chain policy and code of conduct for responsible sourcing of virgin mineral raw materials.
O16 Heavy metals	O2		*		Mineral raw materials must be tested for heavy metals – adjustment of some of the limits
O17 Cement- and mineral wool-based façade panels	O9	*	*		From 30% to 40% recycled materials in mineral wool-based panels. From 30% to 15% recycled materials in cement-based panels
O18 Chemicals in recycled mineral wool				*	Requirement added regarding undesirable chemicals in recycled mineral wool
Metal					
O19 Production of aluminium				*	High proportion of recycled aluminium or from responsible aluminium production
Chemicals in production					
O20 Classification of chemical products	O16		*		Prohibition of chemicals classified as toxic to the

					environment has been added.
O21 Classification of ingoing substances	O17		*		Prohibition against CMR category 2, endocrine disruptors and PMT/vPvM has been added
O22 Prohibited substances	O18		*		The requirement has been updated, e.g. referring the requirement for endocrine disruptors list I, II and III
O23 Nanomaterials	O20	*			
O24 Preservatives	O19		*		Requirement limit for MIT has been tightened
O25 Volatile organic compounds in adhesives	O23	*			
O26 Free formaldehyde	O25		*		The requirement limit for formaldehyde content has been tightened.
Chemicals - surface treatment					
O27 Plastic foiling				*	No use of PVC
O28 Ecolabelled products				*	Use of ecolabelled paint or varnish in surface treatment
O29 Classification of chemical products	O16		*		Prohibition of chemicals classified as toxic to the environment has been added.
O30 UV curing surface treatment system				*	
O31 Classification of ingoing substances	O17 and O22		*		Prohibition against CMR category 2, endocrine disruptors and PMT/vPvM has been added
O32 Prohibited substances	O18		*		See O22. Some other exemptions are granted.
O33 Nanomaterials	O20	*			
O34 Preservatives	O19		*		Requirement limit for MIT has been tightened
O35 Free formaldehyde	O25	*			
Chemicals - application method					
O36 Application method and amount				*	
O37 Amount of volatile organic compounds (VOC) applied	O24		*		The requirement limit has not been changed, but the calculation now

					takes the application method into account.
Emissions					
O38 Emissions of COD from wet processes	O26		*		Updated according to pulp and paper basic module gen. 3
O39 Emissions to air from production of HPL, compact laminate and panels based on resin binder	O27	*			
O40 Emissions of dust	O28	*			
Climate and energy					
O41 Kraft paper and pulp included in HPL and compact laminate	O10		*		Updated according to pulp and paper basic module gen. 3
O42 Laminate	O11		*		Requirement limits have been tightened.
O43 Wood based panels	O12		*		Requirement limits have been tightened.
O44 Panels from lignocellulose raw materials				*	New energy requirement
O45 Solid wood used for cladding				*	New energy requirement
O46 Wood plastic composite				*	New energy requirement
O47 Mineral wool-based panels	O13		*		Requirement limits have been tightened.
O48 Production of cement				*	New energy requirement
O49 Cement-based panels	O14		*		Requirement limits have been tightened
Circularity					
O50 Warranty				*	New requirement for min. 15 years product warranty
O51 Information for consumers	O30	*			
O52 Take back system				*	New requirement
Innovation in production					
O53 Innovation in production				*	New requirement
O54-O55 Other requirements	O31-O32	*			The requirements have been updated in accordance with Nordic Ecolabelling's current standard formulation.
Removed requirements in gen. 2					
Dust emissions from production and refining of mineral raw materials	O3				
Use of biocides in tree felling	O7				Handled by FSC or PEFC

Environmental harmful substances in the panel	O21				Part of requirements for chemicals

5 Future criteria generation

As part of any future evaluation of the criteria, it will be relevant to consider the following:

- Product definition - new types of panels and cladding for exterior use.
- Resources/use of raw materials.
- Energy consumption in both production of relevant raw materials and production of panels.
- End of life

6 Criteria version history

Nordic Ecolabelling adopted version 2.0 of the criteria for exterior panels and cladding on November 4, 2024. The criteria are valid until October 31, 2029.