About Nordic Swan Ecolabel

Durable wood for outdoor use

Generation 3.0 • 12 September 2024 – 15 November 2024

Consultation

Nordic Ecolabelling

Content

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Contact information

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

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1 Environmental communication guideline for Nordic Swan Ecolabel Durable wood for outdoor use

Nordic Swan Ecolabel biological durable wood has a reduced environmental and climate impact throughout its lifecycle. It meets strict requirements for raw materials, chemicals and quality, promoting circular economy.

Nordic Swan Ecolabel biological durable wood:

- Consists of traceable and legally harvested wood. At least 70% of the wood is sourced from certified forestry.
- Has not been impregnated with heavy metals.
- Meets strict requirements for chemicals used in production and for surface treatment. For example, only paint certified with the EU Ecolabel or the Nordic Swan Ecolabel may be used for any surface treatment.
- Has a reduced climate impact, achieved by meeting requirements for energy consumption without using fossil oil or coal.
- Meets requirements for biological durability according to its intended use e.g., façade cladding or terrace decking – and has at least a 15-year warranty.
- Promotes circular material flows by highlighting reuse as a potential end-of-life treatment.
- Can be easily recycled without special processing.

Why choose the Nordic Swan Ecolabel?

- The manufacturer of biological durable wood may use the Nordic Swan Ecolabel trademark for marketing. The Nordic Swan Ecolabel is a very well-known and well-reputed trademark in the Nordic region.
- The Nordic Swan Ecolabel is a cost-effective and simple way of communicating environmental work and commitment to customers and suppliers.
- Reducing environmental impact often creates scope for lowering costs, such as by cutting the consumption of energy and chemicals.
- Environmentally suitable operations prepare the manufacturer for future environmental legislation.
- Environmental issues are complex. It can take a long time and extensive resources to gain an understanding of a specific area. Nordic Ecolabelling can be seen as aid in this work.
- The Nordic Swan Ecolabel not only covers environmental issues but also quality requirements, since the environment and quality often go hand in hand. This means that a Nordic Swan Ecolabel licence can also be seen as a mark of quality.

2 What can carry the Nordic Swan Ecolabel?

Natural and modified solid wood with long biological durability may be Nordic Swan Ecolabelled. Biological durable wood is primarily intended for outdoor use

e.g., cladding, decking, fencing and outdoor furniture but may also be used in special indoor constructions such as sauna.

Nordic Swan Ecolabelled durable wood may be:

- Natural solid wood with long biological durability.
- Chemically/thermally/impregnated modified wood with long biological durability
- Surface treated with Nordic Swan- or EU Ecolabelled products, but the wood must meet the durability requirements (test) without the use of any surface treatment.
- Pressure impregnated with fire-retardant chemicals to improve fire classification. However, the product may not be marketed only as Nordic Swan Ecolabelled fire-retardant treated wood as these criteria focus on biological durability, not durability of fire performance.
- Natural and thermally modified wood intended for indoor use in saunas that has not been impregnated or surface treated.

Nordic Swan Ecolabelled durable wood **does not** include the following products:

- Wood which is impregnated with heavy metals.
- Wood which is impregnated with biocides in concentrations above 120 g/m^3 or 300 ppm in the final wood.
- wood that is surface treated with non-Ecolabelled products (for example stained or painted)*.
- Wood plastic composites (WPC). These can be labelled according to the criteria for Nordic Swan Ecolabelling for panels for exterior use.
- Wood impregnated solely for fire resistance purposes, and not biological durability.

** Dyed through wood as a part of the modification process is not considered surface treatment. It may not be a separate operation.*

Background to definition of the product group

The definition of the product group has been adjusted compared to generation 2. As in generation 2 of the criteria, natural and chemically/thermally modified wood with long biological durability, may be Nordic Swan Ecolabelled. It has been clarified that natural and thermally modified wood may be used in special indoor constructions such as sauna. However, the natural and thermally modified wood must not be impregnated or surface treated as chemical substances can be released to the environment and lead possible health issues due to large temperature diffeneces in saunas.

A new proposal for allowing a small amount of biocides in concentrations below 120 g/m^3 or 300 ppm in the final wood[1]. Acceptance of small amount of biocides conflict with an essential requirement (no use of biocides) in today's criteria generation, but it also add positive properties such as good durability, relative low energy use in the production phase and the small amount of biocides does not give problems in the end-of-life phase. Nordic Ecolabelling still make an environmental difference compared to traditional impregnated wood due to the

[1] The propoced concentration is based on dialog with stakeholders.

prohibition of the use of heavy metals and acceptance of a small amount of biocides. Heavy metals do not disappear either in incineration or landfill.

Wood impregnated with heavy metals cannot be Nordic Swan Ecolabelled. One negative side-effect of using toxins (heavy metals and biocides) is that the substances often have adverse health and environmental properties that can affect humans and the environment through leaching over time during the use and waste phases (incineration or landfill leading to potential leaching of chromium, copper, and arsenic)[2]. A studie from Sweden[3] reports that traditional pressure impregnated wood gives rise to large amounts of released copper to nature (between 36.000 kg – 72.000 kg alone in Sweden per year).

A new proposed requirement for surface treatment of durable wood if the paint/varnish is Nordic Swan- or EU Ecolabelled. Ecolabelled paint or vanish complies with strict requirements for ingoing substances classified as CMR and environmentally hazardous. Pressure impregnated fire resistance treated biological durable wood can also be Ecolabelled provided compliance with the chemical requirements. Durable wood must meet the obligate durability requirements (tests) without the use of any surface treatment or pressure impregnation with fire-retardant chemicals. Wood impregnated solely for fire resistance purposes, and not biological durability, cannot be Ecolabelled.

3 How to read this criteria document

Each requirement is marked with the letter O (obligatory requirement) and a number. All requirements must be fulfilled to be awarded a licence.

The text describes how the applicant shall demonstrate fulfilment of each requirement. There are also icons in the text to make this clearer. These icons are:

✉ Enclose

⇪ Upload

🡅 Upload

🡇 Download

State data in electronic application

Requirement checked on site

4 Summary

Draft criteria for Nordic Ecolabelling criteria for biological durable wood has been revised to generation 3.

The focus has been on implementing clearer and stricter requirements for biological durability according to use class. Focus has also been on introducing a

[2] Livscyklusvurdering af behandling af imprægneret træaffald, Miljøstyrelsen, miljøprojekt nr. 1938, maj 2017.
[3] Rapport U 6481 - Förstudie – kopparurlakning från impregnerat virke jämfört med övriga kopparflöden i Sverige. IVL Svenska Miljöinstitutet 2021

new absolute requirement for energy use as well as promote the use of non fossil energy in production. The requirements for chemicals and wood raw materials have been revised to reflect the most updated requirements on these areas of Nordic Ecolabelling. New requirement for a minimum guaranty period support a long product life which has a direct positive effect on the products environmental impact.

Most important changes within this revision are presented below:

- Acceptance of a small amounts of wood precervatives in pressure-treated wood.
- New proposed requirement for surface treatment of durable wood if the paint/varnish is Nordic Swan- or EU Ecolabelled.
- Chemical requirements are aligned with the most updated requirements in Nordic Ecolabelling e.g., the list of prohibited substances now also includes substances on EUs endocrine disruptor list III.
- Requirements regarding the quality of the durable wood have been improved, introducing a requirement for minimum durability class according to use class. Fire-retardant treated wood must document the durability of its performance.
- New absolute requirement for energy use as well as excluding and/or limiting use for fossil fuels.
- New requirement for a minimum guaranty period.

5 Requirements and justification of these

This chapter includes requirements and background information for the specific requirements.

5.1 Overview of the requirements

The criteria are divided into 7 main areas. Each main area consists of one to several obligate requirements. The table below provides an overview of the requirements that must be met:

Requirement area	Requirement	Number of requirements	Responsible for documentation
Description of the product			
	Description of the product	O1	Product manufacturer
Wood raw materials			
	Prohibited and restricted tree species	O2	Product manufacturer/supplier of wood
	Traceability and certification	O3	Product manufacturer
Chemicals			
Chemicals used in production/surface treatment	Ecolabelled products – surface treatment	O4	Product manufacturer
	Classification of chemical products	O5	Manufacturer/supplier of chemical product
	Classification of ingoing substances	O6	Manufacturer/supplier of chemical product

	Prohibited substances	O7	Manufacturer/supplier of chemical product
	Nanomaterials	O8	Manufacturer/supplier of chemical product
	Preservatives/biocides	O9	Manufacturer/supplier of chemical product
	VOC in chemical products	O10	Manufacturer/supplier of chemical product
	Occupational exposure limit	O11	Product manufacturer
	Chemical residues in the final product	O12	Product manufacturer
Quality			
	Biological durability	O13	Product manufacturer
	Documentation of fire classification	O14	Product manufacturer
Climate and Energy			
Energy consumption and use of fossil fuels	Energy consumption	O15	Product manufacturer
	Fossil fuels	O16	Product manufacturer
Customer information			
	Product specification, instruction and maintenance	O17	Product manufacturer
	Guarantee	O18	Product manufacturer
Licence maintenance			
	Customer complaints	O19	Product manufacturer/licensee
	Traceability	O20	Product manufacturer/licensee

5.2 Definitions

Terms and definitions used in this document.

Abbreviation and terms	Definition
Biological durability	Inherent resistance of a wood species or a wood-based material against biological agents. The resistance may be due to the presence of natural components in the wood and/or wood modified to enhance biological durability.
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora. CITES is an international convention for the control of trade (across borders) in wild fauna and flora at risk of extinction.
CoC	Chain of Custody – certification that ensures traceability in the supply chain.
CMR substances	Substances classified as Carcinogenic, Mutagenic, or toxic for Reproduction (CMR substances).
Durability Class	Durability class defined according to EN 350: Durability Class 1 (DC 1): Very durable Durability Class 2 (DC 2): Durable Durability Class 3 (DC 3): Moderately durable Durability Class 4 (DC 4): Slightly durable Durability Class 5 (DC 5): Not durable
FSC	Forest Stewardship Council Certification scheme for forestry and traceability in the supply chain (CoC).
IFL	Intact Forest Landscape Continuous propagation of natural ecosystems within the zone with current forest spread, showing no sign of significant human activity. The area is large enough to maintain all-natural biodiversity, including viable populations of widespread species.

In-can preservatives	Biocide used to prevent growth of microorganisms during storage of a water-based coating material or stock solution. Active substances within the meaning of Article 3(1)(c) of Regulation (EU) No 528/2012 of the European Parliament and of the Council (the "Biocide Regulation"), intended for use in Product Type 6 (PT 6) as described in Annex V to that Regulation.
IUCN	International Union for Conservation of Nature IUCN's Red List is the world's most comprehensive overview of the global conservation status of the planet's species, including trees.
LPG	Liquid Petrolium Gas
Modified wood	Wood modification is a generic term describing the application of chemical, physical or biological methods to achieve greater resistance to wood destroying organisms. By modified wood is meant chemically-, thermally or impregnated modified wood.
PEFC	Programme for the Endorsement of Forest Certification Certification scheme for forestry and traceability in the supply chain
Use Class	Use classes defined according to EN335: **Use class 1 (UC 1)**: Situations in which the wood or wood-based product is inside a construction, not exposed to the weather and wetting. **Use class 2 (UC 2)**: Situations in which the wood or wood-based product is under cover and not exposed to the weather (particularly rain and driven rain) but where occasional, but not persistent, wetting can occur. **Use class 3 (UC 3)**: Situations in which the wood or wood-based product is above ground and exposed to the weather (particularly rain). **Use class 3.1 (UC 3.1)**: In this situation the wood and wood-based products will not remain wet for long periods. Water will not accumulate. **Use class 3.2 (UC 3.2)**: In this situation the wood and wood-based products will remain wet for long periods. Water may accumulate. **Use class 4 (UC 4)**: A situation in which the wood or wood-based product is in direct contact with ground and/or fresh water. **Use class 5 (UC 5)**: A situation in which the wood or wood-based product is permanently or regularly submerged in salt water (i.e. sea water and brackish water).
VOC	Organic compounds with a steam pressure exceeding 0.01kPa, at 20°C. For products under EU Directive (2004/42/EC) in which steam pressure is not indicated: Organic substances with an initial boiling point that is lower than or equal to 250°C measured at a normal pressure of 101.3 kPa.
Wood preservatives	Product containing a biocide with primary purpose intended to inhibit the development of wood destroying and/or wood-staining organisms in the wood to which it is applied. Active substances within the meaning of Regulation (EU) No 528/2012 intented for use in Product Type 8 (PT8) wood preservatives.

5.3 Description of the product

This chapter contains product specifications such as a description of the product, production methods and any treatment techniques.

O1 Description of the product

Applicants must provide the following information about the product:

- Trade name/brand.
- A description of the product/products.
- Declaration of performance (DoP) in accordance with the Construction Products Regulation (EU/305/2011)
- A description of all chemical products used for impregnation, modification, surface treatment or any other treatment of the wood.

- The intended use classes for the product must be stated according to EN 335, including the sub-classes of use class 3.
- A description of production methods/treatment techniques. Suppliers must be described with the name of their business, production site, contact person and the production steps carried out.

✉ A detailed description of the points above. Product data sheets can be sent in as part of the documentation.

✉ A flowchart to describe the production process.

✉ Safety data sheet, in compliance with current European legislation (Annex II of REACH, Regulation (EC) No. 1907/2006). for all chemical products used in the durable wood.

Background to requirement O1 Description of the product

The requirement has been adjusted compared to generation 2. The purpose of this requirement is to give a general understanding of the product, its intended use and how it is marked in accordance with the Construction Products Regulation (EU/305/2011)[4]. This includes chemicals (formerly separate requirement in generation 2) and production processes that are used. The information is important in obtaining a good overview and ensuring efficient evaluation of applications. A description of any suppliers is also important in achieving a true and complete picture.

5.4 Wood raw materials

The requirement in this chapter concerns requirements for wood raw materials used in the durable wood.

O2 Prohibited and restricted tree species

Nordic Ecolabelling's list of tree species* consists of virgin woods listed on:

a) CITES (Appendices I, II and III)

b) IUCN Red List, categorised as CR, EN and VU

c) Rainforest Foundation Norway's tree list:

d) Siberian larch (from forests outside the EU)

Use of tree species listed on a) CITES (Appendices I, II and III) is not permitted.

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

- the tree species does not originate from an area/region where it is on the IUCN Red List, categorised as CR, EN or VU
- the tree species does not originate from an Intact Forest Landscape (IFL), as defined in 2002 http://www.intactforests.org/world.map.html.
- the tree species shall originate from FSC or PEFC certified forests/plantations and shall be covered by a valid FSC/PEFC Chain of

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

Custody (CoC) certificate documented/controlled as FSC or PEFC 100% through the FSC transfer method or PEFC physical separation method.

- tree species grown in plantations shall in addition not originate from plantations established on areas converted from forest after 1994.

** https://www.nordic-swan-ecolabel.org/pulp-paper-declaration-portal/what-can-be-declared/forestry-requirements/forestry_requirements_2020/*

✉ Enter the names of the tree species included in the product.

✉ Declaration from the applicant/manufacturer/supplier that tree species listed on a)–d) are not used in the product.

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

✉ Valid FSC/PEFC Chain of Custody certificate from supplier/applicant/manufacturer covering the specific tree species and documenting that the wood is controlled as FSC or PEFC 100% through the FSC transfer method or PEFC physical separation method.

✉ The applicant/manufacturer/supplier shall document full traceability back to the certified forest unit and document the following:

- the wood does not originate from an area/region where it is on the IUCN Red List, categorised as CR, EN or VU.
- the tree species do not originate from an Intact Forest Landscape (IFL), as defined in 2002: http://www.intactforests.org/world.webmap.html
- for plantations, the applicant/manufacturer/supplier must document that the tree species does not originate from plantations established on areas converted from forest after 1994.

Background to requirement O2 Prohibited and restricted tree species

The requirement concerning tree species that are banned or restricted is new and part of Nordic Ecolabelling's general forestry requirements.

The requirement only applies to virgin wood and not wood defined as recycled material in accordance with ISO 14021.

A number of tree species are not allowed to be used or are allowed only under certain conditions. The tree species are shown on a list, and the species on the list are based on tree species that are relevant to the Nordic Ecolabelling criteria, i.e., wood that may be relevant to use in Nordic Swan Ecolabelled products. Listed tree species are indicated by the scientific name and most common trade names. The scientific name/trade name is not always sufficient, as there may be more than one scientific name/trade name for the listed tree species, not all of which feature on the list.

Criteria for tree species on the list:

a) Species listed in CITES Appendices I, II and III.

b) IUCN Red List, categorised as Critically Endangered (CR), Endangered (EN) and Vulnerable (VU).

c) Rainforest Foundation's list of tropical tree species

d) Siberian larch (derived from forests outside the EU)

Use of species on the CITES list in Nordic Swan Ecolabelled durable wood is prohibited. CITES is an international convention for the control of trade (across borders) in wild fauna and flora. Depending on how endangered they are, the tree species in CITES are listed in Appendix I, II or III. Species listed in Appendix are critically endangered and trading in these species is completely forbidden. Special permits for import and export are required for species in Appendices II and III. Trees with valid CITES permits are considered to be legally harvested under the EUTR (EU Timber Regulation). The Nordic Swan Ecolabel's ban on the use of tree species listed in CITES (Appendix I, II or III) goes beyond EU legislation. CITES regulates trade in endangered species, and there are also challenges concerning corruption in trade with wild animals and plants. Nordic Ecolabelling therefore does not wish to approve species on any of the appendices.

IUCN's Red List is the world's most comprehensive overview of the global conservation status of the planet's species, including trees. IUCN has established clear criteria to assess the risk of extinction according to the origin of tree species. These criteria cover all countries and all species in the world. Nordic Ecolabelling is aware that the IUCN Red List system focuses only on the extinction risk of species and is therefore not designed for an overall assessment of whether a tree can be of sustainable origin. However, the list is updated continuously and is thus an important tool to estimate the conservation status of a specific tree species globally. The Nordic Swan Ecolabel seeks to prohibit tree species listed as endangered (categories CR, EN and VU).

The Rainforest Foundation is an NGO in Norway that works to protect the world's remaining rainforests. At the moment, the Rainforest Foundation does not see any credible certification schemes operating in the tropics, and therefore recommends not buying tropical woods. The Rainforest Foundation has developed a list of tropical tree species based on tree species that are found on the Norwegian market. This list serves as a guide in complying with Norwegian guidelines for not using tropical wood in public-sector construction projects. Nordic Ecolabelling considers this to be a pragmatic approach for handling tropical wood in the Nordic market.

Siberian larch (with origins in forests outside the EU) is also on the tree list. Siberian larch is a sought-after type of wood in the construction industry due to its high quality. Species of this tree are widespread in the Eurasian North Boreal climate zone, with the species Larix sibirica, Larix gmelinii, Larix cajanderi and Larix sukaczewii particularly widespread in the large areas of Intact Forest Landscapes (IFL) in Russia. Siberian larch should be seen as an indicator species for boreal IFL areas that need to be kept intact.

Exemptions:

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

Many of the trees on the list grow in countries that still have large Intact Forest Landscapes (IFL). It is important to protect these for the sake of biodiversity and the climate. Several of these countries are at high risk of corruption, and national legislation relating to the environment, human rights and land ownership is

often weak and/or not enforced by the authorities. There are different views on whether certification is good enough to meet the challenges of forest management in countries with a high risk of corruption and illegal logging. For example, relevant challenges related to this were published by Danwatch in several articles in 2018[5],[6] and by redd-monitor.org in 2019[7]. Greenpeace International has terminated its membership of FSC because the certification body no longer fulfils its goals of protecting forests and human rights[8]. Other environmental organisations like WWF support certification as an important tool for sustainable forestry in these countries. Due to the uncertainty that FSC and PEFC certification systems are good enough to protect important areas of biodiversity and ethical aspects such as human rights and land ownership in areas with a high risk of corruption, Nordic Ecolabelling takes a precautionary approach and seeks further documentation about the tree species and its origins.

To document full traceability of the tree species, the applicant/manufacturer/supplier must present a valid FSC/PEFC Chain of Custody certificate covering the specific tree species and demonstrate that the wood is controlled as FSC or PEFC 100%, through the FSC transfer method or PEFC physical separation method. This means that the FSC percentage or credit control system and the PEFC percentage system are not approved. Full traceability of the wood back to the forest/certified forest unit makes it possible to document that the tree species does not come from an area/region where it is on the IUCN Red List, categorised as CR, EN or VU. Full traceability also makes it possible to document that the tree species does not come from an Intact Forest Landscape (IFL), as defined by Intactforest.org in 2002[9]. Intact forest has monitored IFL areas since 2000 and has developed an updated online map tool that shows the scope of IFLs back to 2002. The monitoring results show that the world's IFLs are disappearing at an alarming rate, which is why Nordic Ecolabelling refers to 2002.

Plantations: Nordic Ecolabelling believes that responsibly managed forest plantations can play a role in preserving natural IFLs by reducing the pressure to cut down the world's remaining natural forests. To ensure that the plantation has not replaced original ecosystems (forests/grasslands) over the last 25 years, tree species must come from FSC or PEFC certified plantations that were established before 1994. 1994 follows FSC's international forest management standard (version 5.2), while PEFC works with 2010.

O3 Traceability and certification

The requirement applies to wood raw material and bamboo used in the product.

[5] https://danwatch.dk/undersoegelse/dokumentfalsk-og-millionboeder-danske-byggemarkeder-saelger-trae-forbundet-til-ulovlig-hugst-i-amazonas/
[6] https://danwatch.dk/undersoegelse/baeredygtighedsmaerke-er-ingen-garanti-for-baeredygtigt-trae/
[7] https://redd-monitor.org/2019/08/29/evicted-for-carbon-credits-new-oakland-institute-report-confirms-forced-evictions-for-green-resources-plantations-in-uganda/
[8] https://www.greenpeace.org/international/press-release/15589/greenpeace-international-to-not-renew-fsc-membership/
[9] http://www.intactforests.org/world.webmap.html, accessed January 2020

Species name

The applicant/manufacturer must state the name (species name) of the wood raw material/bamboo used in the product.

Chain of Custody certification

All wood raw material and bamboo used in Nordic Swan Ecolabelled products must be covered by a valid Chain of Custody certificate in accordance with FSC/PEFC schemes.

The applicant or product manufacturer must have Chain of Custody certification under the FSC/PEFC schemes.

Certified wood raw material, bamboo, and cork

A minimum of 70% by weight/volume of the wood raw material and bamboo used in the Nordic Swan Ecolabelled product must come from forests that are managed in accordance with sustainable forestry management principles established by FSC and PEFC.

The remaining proportion of wood raw material in all durable wood must be covered by FSC/PEFC's control schemes (FSC controlled wood/PEFC controlled sources) or be recycled material.

The applicant/manufacturer must create a designated product group for Nordic Swan Ecolabelled products in their accounting system to control and meet the required certified content in Nordic Swan Ecolabelled products.

✉ The names (species names) of the wood raw material, bamboo and cork that are used.

✉ The applicant/manufacturer must provide valid FSC/PEFC CoC certification that includes all wood raw material, bamboo and cork used in the Nordic Swan Ecolabelled product.

✉ The applicant/manufacturer shall provide audited accounting documents showing that at least 70% of the material in the Nordic Swan Ecolabelled product or production line is from forests or areas that are managed in accordance with sustainable forestry management principles that meet the requirements of the FSC or PEFC scheme. If the product or production line includes uncertified material, evidence must be provided that the content of uncertified material does not exceed 30% and is covered by a verification system that ensures that it is legally harvested and meets any other requirements laid down by FSC or PEFC regarding uncertified material.

Background to requirement O3 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. The certified share has increased to 70%, while the remainder must be covered by the CoC system and be controlled wood/from controlled sources.

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 peoples, 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.

5.5 Chemical requirements

What do the chemical requirements cover?

The chemical requirements cover all chemical products used for impregnation, modification, surface treatment or other treatment of the wood. The requirements apply to the chemicals used by the manufacturer and those used by any supplier.

Definitions

The requirements in the criteria document apply to all ingoing substances in the chemical product. Impurities are not regarded as ingoing substances and are therefore exempt from the requirements. Ingoing substances and impurities are defined as below unless stated otherwise.

- Ingoing substances: All substances in the product, including additives (e.g., preservatives and stabilisers) in the raw materials. Substances known to be released from ingoing substances (e.g., formaldehyde, arylamine, in situ-generated preservatives) are also regarded as ingoing substances.

- Impurities: Residues from production, incl. raw material production, which remain in the chemical product at concentrations below 1000 ppm (0.1000% by weight).

Examples of impurities are reagent residue incl. residues of monomers, catalysts, by-products, "scavengers" (i.e., chemicals used to eliminate/minimise undesirable substances), cleaning agents for production equipment and "carry-over" from other/previous production lines.

O4 Ecolabelled products - surface treatment

Nordic Swan Ecolabel or EU Ecolabel* paint or varnish **must** be used for any surface treatment (incl. any fire-retardant surface treatment) of durable wood. Ecolabelled products fulfil all requirements in section 5.5.

** Valid license according to Nordic Swan Ecolabel Paint and varnishes gen. 4 or EU Ecolabel EU44 2014/312 - or later valid generations.*

✉ Nordic Swan Ecolabel or EU Ecolabelled paint or varnish: Submit name of product, manufacturer, and license number.

Background for requirement O4 Ecolabelled products – surface treatment

A new proposed requirement for surface treatment of durable wood has been introduced. If the wood is surface treated, the paint or varnish must be either be Nordic Swan Ecolabelled or EU Ecolabelled. Ecolabelled paint or vanish complies with strict requirements for ingoins substances classified as CMR and environmentally hazardous. Moreover, Ecolabelled paint and varnish meet strict quality requirements to promote long-lasting, durable, and efficient paints and varnishes, which therefore leads to automatic compliance (if used) with all requirements in section 5.5.

O5 Classification of chemical products

Chemical products used in the impregnation, modification or any other treatment of wood must not be classified according to the table below.

CLP Regulation 1272/2008		
Hazard statement	**Hazard class and category**	**Hazard code**
Toxic to the environment	Aquatic Acute 1 Aquatic Chronic 1 Aquatic Chronic 2 Ozone	H400 H410 H411 H420
Acute toxicity	Acute Tox 1 or 2 Acute Tox 1 or 2 Acute Tox 1 or 2 Acute Tox 3 Acute Tox 3 Acute Tox 3	H300 H310 H330 H301 H311 H331
Specific target organ toxicity – single exposure/repeated exposure	STOT SE 1 STOT RE 1	H370 H372
Carcinogenic[1]	Carc. 1A or 1B Carc. 2	H350 H351
Germ cell mutagenic[1]	Mut. 1A or 1B Mut. 2	H340 H341

Reproductive toxicity[1]	Repr. 1A or 1B Repr. 2 Lact.	H360 H361 H362

[1] *Including all combinations of stated exposure route and stated specific effect.*

For example, H350 also covers the classification H350i.

Note that responsibility for correct classification lies with the manufacturer.

Exempted are products with the classifications:

- H361, H400, H410, H411 and H420 due to the presence of biocides.
- H351 due to the presence of furfuryl alcohol (CAS 98-00-0)
- H372 and H373 due to the presence of maleic acid anhydride (CAS 108-31-6).
- H330 due to the presence of acetic acid anhydride (CAS 108-24-7).

Such products may be used on condition that the requirements in O11 and O12 are fulfilled.

✉ A declaration from the chemical manufacturer or supplier. Appendix 3 may be used.

✉ A safety data sheet for the product in compliance with current European legislation (Annex II of REACH, Regulation (EC) No. 1907/2006).

Background to requirement O5 Classification of chemical products

The requirement has been adjusted to also include the classifications Toxic to the environment (Ozone) H420). The adjustment reflects Nordic Swan Ecolabelling's general requirement for the classification of chemical products. 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 the highest concern.

Exemptions are given for the following reasons:

- Furfuryl alcohol is used in the chemical modification method of furfurylation, where furfuryl alcohol is polymerised during hardening after penetration of the wood. Furfurylated wood is therefore generally judged to be a more eco-friendly alternative than ordinary impregnated wood. The exemption only applies if the requirements O11 and O12 are fulfilled.
- Maleic acid anhydride is used in a process where it is mixed with water, reacts and forms maleic acid which has no classification in conflict with the criteria.
- Acetic acid anhydride is an essential reagent used for acetylation. The exemption only applies if the requirements O11 and O12 are fulfilled.
- Biocides are of nature often toxic to the environment and even small amounts can lead to classifification of the product. The majority of biocides on the PT-8, wood preservative list (EU/528/2012) are also classified Repr. 1 H360 or Repr. 2 H361. To allow the use of biocides in durable wood an exemption has been made for chemicals classified as Repr. 2 H361, due to present of biocides. Biocides must comply with PT-8

according to the Biocidal Product Regulation (EU/528/2012) in requirement O9.

O6 Classification of ingoing substances

Ingoing substances in the chemical product used in production must not be classified as in the table below.

CLP Regulation 1272/2008		
Hazard statement	**Hazard class and category**	**Hazard code**
Carcinogenic[1]	Carc. 1A or 1B Carc. 2	H350 H351
Germ cell mutagenic[1]	Mut. 1A or 1B Mut. 2	H340 H341
Reproductive toxicity[1]	Repr. 1A or 1B Repr. 2 Lact.	H360 H361 H362
Endocrine disruption for human health	ED HH 1 ED HH 2	EUH380 EUH381
Endocrine disruption for the environment	ED ENV 1 ED ENV 2	EUH431 EUH431
Persistent, Bioaccumulative and Toxic properties Very Persistent, Very Bioaccumulative properties	PBT vPvB	EUH440 EUH441
Persistent, Mobile, and Toxic properties Very Persistent, Very Mobile properties	PMT vPvM	EUH450 EUH451

[1] *Including all combinations of stated exposure route and stated specific effect. For example, H350 also covers the classification H350i.*

Exemptions apply for:

- furfuryl alcohol (CAS 98-00-0) classified as Carc 2, H351.
- biocides classificed as Repr. 2, H361.

✉ A declaration from the chemical manufacturer or supplier. Appendix 3 may be used.

✉ A safety data sheet for the product in compliance with current European legislation (Annex II of REACH, Regulation (EC) No. 1907/2006).

Background to requirement O6 Classification of ingoing substances

The Nordic Swan Ecolabel has included the new CLP classifications to align with the European Green Deal's goal of a toxic-free environment. The requirement regarding the use of substances that are carcinogenic, mutagenic and toxic for reproduction (CRM) are identical to generation 2.

This inclusion of new classifications 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.

An exemption is made for furfuryl alcohol (CAS 98-00-0) classified Carc 2, H351. The exemption only applies if the requirements concerning workplace limits (O11) and chemical residues in the product (O12) are fulfilled. An exemption also applies to biocides classified as Repr. 2, H361. The exemption only applies if the requirement for biocides (O9) is fulfilled.

O7 Prohibited substances

The chemical product used in production must not contain the following substances:

- Substances on the Candidate List*
- Substances that have been judged in the EU to be PBT (Persistent, Bio accumulative and Toxic) or vPvB (very Persistent and very Bio accumulative)**
- Halogenated organic compounds.
    - Exemptions applies to preservatives in O9. However, not per- and polyfluoroalkyl substances (PFASs)
- Per- and polyfluoroalkyl substances (PFASs), e.g., PFOA and PFOS
- Butylhydroxytoluene (BHT, CAS No. 128-37-0)
- Aziridine and polyazidirines
- Bisphenols and bisphenol derivatives
    - 34 bisphenols* that have been identified by ECHA for further EU regulatory risk management that are known or potential endocrine disruptors for the environment or for human health, or that can be identified as toxic for reproduction

      **Assessment of regulatory needs: Bisphenols. ECHA – 16 December 2021: Section 2.1: Bisphenols for which further EU RRM is proposed – restriction https://echa.europa.eu/documents/10162/c2a8b29d-0e2d-7df8-dac1-2433e2477b02*
- APEO (alkylphenol ethoxylates) and APD (alkylphenol derivatives/alkylphenols) ***
- Phthalates****
- Pigments and additives based on lead, tin, cadmium, chromium VI and mercury, and their compounds
- Endocrine disruptors: Substances on the EU member state initiative “Endocrine Disruptor Lists”, List I, List II and List III, see following links:

List I: https://edlists.org/the-ed-lists/list-i-substances-identified-as-endocrinedisruptors-by-the-eu

List II: https://edlists.org/the-ed-lists/list-ii-substances-under-eu-investigationendocrine-disruption

List III: https://edlists.org/the-ed-lists/list-iii-substances-identified-asendocrine-disruptors-by-participating-national-authorities

Substances that are transferred to one of the corresponding sub-lists “Substances no longer on list” and that no longer feature on Lists I–III are not prohibited.

However, this does not apply to the substances listed in Sub-List II that were evaluated based on regulations or directives that do not have provisions for identifying endocrine disruptors (e.g., the Cosmetics Regulation). These substances may have endocrine disrupting properties. Nordic Ecolabelling will assess these substances on a case-by-case basis, based on the background information provided in Sub-List II.

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

*** PBT and vPvB in accordance with the criteria in Annex XIII of REACH*

**** Alkylphenol derivatives are defined as substances that release alkylphenols when they break down.*

***** Phthalates are esters of 1,2-benzenedicarboxylic acid (orthophthalic acid).*

- ✉ A declaration from the manufacturer/supplier of the chemical product. Appendix 3 may be used.
- ✉ A safety data sheet for the product in compliance with current European legislation (Annex II of REACH, Regulation (EC) No. 1907/2006).

Background to requirement O7 Prohibited substances

The requirement has been stringent compared to generation 2. The following prohibited substances has been added to the requirement: Per- and polyfluoroalkyl substances (PFASs), butylhydroxytoluene (BHT, CAS No. 128-37-0), aziridine and polyazidirines, phthalates, bisphenols and bisphenol derivatives. The requirement concerning endocrine disruptors now also includes substances on list III.

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 considered to be 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 very 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.

Endocrine disruptors:

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

Changes in the hormone balance can have 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[10]. Nordic Ecolabelling excludes identified and potential 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

[10] 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).

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. Exemptions applies to preservatives/biocides in O9 (however, not PFASs).

Per- and polyfluoroalkylsubstances (PFASs), 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 body[11]. 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 system[12]. 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[13].

BHT

Butylhydroxytoluene (BHT, CAS No. 128-37-0) is new to the list of prohibited substances. BHT does not have an official harmonized classification. BHT is included in the EU member state initiative "Endocrine Disruptor Lists", List II Substances under evaluation for endocrine disruption under EU legislation. Nordic Ecolabelling introduces an exemption for UV curing chemical products. BHT has an important function in such products and can be difficult to replace. Nordic Ecolabelling does not want to prohibit the use of UV curing chemical products as they have other positive properties such as low VOC content. If BHT receives a harmonized official classification that is not allowed in these criteria, then the exemption is no longer valid.

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

[11] Borg, D., Tissue Distribution Studies And Risk Assessment Of Perfluoroalkylated And Polyfluoroalkylated Substances (PFASS), Doctoral Thesis, Institute Of Environmental Medicine (IMM) Karolinska Institute, Stockholm, Sweden 2013
http://publications.ki.se/xmlui/bitstream/handle/10616/41507/Thesis_Daniel_Borg.pdf?sequence=1
12 Heilmann, C. et al, Persistente fluorbindelser reducerer immunfunktionen, Ugeskr Læger 177/7, 30.3.2015 OSPAR 2005: Hazardous Substances Series, Perfluorooctane Sulphonate (PFOS), OSPAR Commission, 2005 (2006 Update), MST, 2005b: Miljøprojekt nr. 1013, 2005, More Environmentally Friendly Alternatives to PFOS-compounds and PFOA, Danish Environmental Protection Agency, 2005.
13 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

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 gain to be made by substitution since they break down rapidly and the degradation product nonylphenol, with its endocrine-disrupting effects, is avoided.

Bisphenols and bisphenols derivatives

Several bisphenols with the general bisphenol structure and 'bisphenol derivatives' which have constituents with structural properties common to bisphenols are now prohibited. Based on the potential for widespread use and available information on potential endocrine disruptors, reproductive toxicity and PBT/vPvB properties, 34 substances[14] were identified in need for further regulatory risk management in EU[15].

Phthlalates

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.

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 not on the list for generation 2 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.

[14] Assessment of regulatory needs: Bisphenols. ECHA – 16 December 2021: Section 2.1: Bisphenols for which further EU RRM is proposed – restriction https://echa.europa.eu/documents/10162/c2a8b29d-0e2d-7df8-dac1-2433e2477b02

[15] 2] Annex XV restriction report https://echa.europa.eu/documents/10162/450ca46b-493f-fd0c-afec-c3aea39de487

O8 Nanomaterials

The chemical product must not contain nanomaterials*.

Exemptions apply for:

- Pigments. This exemption does not include pigments added for purposes other than colouring.
- Naturally occurring inorganic fillers**.
- Synthetic amorphous silica (SAS)***.
- Polymer dispersions.

** Nanomaterials/-particles are defined according to the EU Commission Recommendation on the Definition of Nanomaterial (2022/C 229/01).*

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

**** This applies to non-modified synthetic amorphous silica and surface-treated pyrogenic silica, as long as the silica particles form aggregates or agglomerates in the end product. For surface treated nanoparticles, the surface treatment must meet the chemical requirements in O6 (Classification of ingoing substances) and O7 (Prohibited substances).*

✉ A declaration from the chemical manufacturer that the chemical product does not contain any nanomaterial. Appendix 3 may be used.

Background to requirement O8 Nanomaterials

The requirement has been updated according to Nordic Swan Ecolabelling's general requirement for 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 potentially harmful effects on health and the environment[16],[17],[18],[19],[20],[21]. Coatings and other modifications may also alter the

[16] 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

[17] 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=aHR0cDovL2Fzc2VtYmx5LmNvZS5pbnQvbncveG1sL1hSZWYvWDJILURXLWV4dHIuYXNwP2ZpbGVpZD0xOTczMCZsYW5nPUVO&xsl=aHR0cDovL3NlbWFudGljcGFjZS5uZXQvWHNsdC9QZGYvWFJlZi1XRC1BVC1YTUwyUERGLnhzbA==&xsltparams=ZmlsZWlkPTE5NzMw

[18] 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.

61 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

[19] 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

[20] 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

[21] 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

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)[22].

Most nanomaterials on the market today have either been in use for decades or have recently been manipulated into nanoforms of existing materials[23]. For example, carbon black nanoparticles and amorphous silicon dioxide (SiO_2) have been used in previous centuries. Titanium dioxide (TiO_2) has long been used as a dye in bulk form but is now manufactured as a nanomaterial for other purposes[24]. Other types of engineered nanomaterials are expected to enter the market in the future[25].

In the biological durable wood product group, nanomaterials are used, among other things, to impregnate, in order 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, nano size pigments are exempted. Although clear conclusions on the safety of nano pigments cannot be drawn[26], release by decomposition of facades is very limited and the nanoparticles are probably mainly embedded in the paint matrix rather than released as individual nanoparticles[27],[28]. 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 nano size, include carbon black, and iron oxides[29]. Carbon black used in paints is very finely ground and has a particle size of approximately 10–30 nm[30]. Iron oxide

[22] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32022H0614(01)&from=EN
[23] 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
[24] 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
[25] 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
[26] 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.
[27] 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
[28] 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
[29] Industrial Organic Pigments; W. Herbst, K. Hunger; Third edition 2004; pp. 120–124
[30] Coatings Handbook; Thomas Brock, Michael Groteklaes, Peter Mischke; 2000; p. 128

pigments can include only nano size particles, or only a fraction of the particles may be nano. Inorganic nano pigments are also added to products for a number of 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 REACH, as long as these fillers are only physically processed (ground, sieved and so on) and not chemically modified. An exemption for inorganic fillers has been added as long as 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[31]. Silica plays an important 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 with regard to human health or environmental risks[32].

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.

O9 Biocides

Only preservatives/biocides used for in-can preservation compliant with PT-6 (in-can) and PT-8 according to Regulation (EU)528/2012 (The Biocidal Products Regulation) can be used in chemical products.

- The amount of biocides/combination of biocides (PT-8) in the final product must not exceed 300 ppm or 120 g/m^3 wood.
- The amount of preservative/combination of preservatives (PT-6) in the chemical products is limited according to table below.

If the chemical product is diluted before use, please state the final concentration in the product.

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

Preservative	Concentration limit
Isothiazolinone compounds in total*	500 ppm (0.05% w/w)
BIT (CAS no. 2634-33-5)	500 ppm (0.05% w/w)
CIT/MIT (CAS no. 55965-84-9)	15 ppm (0.0015% w/w)
MIT (CAS no. 2682-20-4)	15 ppm (0.0015% w/w)

** Note that dithio-2,2'-bis-benzmethylamide (DTBMA) is to be included in the total amount of isothiazolinones.*

✉ Declaration from the manufacturer/supplier of the chemical product that the requirement is met. If no chemicals are used, this must be stated in the process description (see O1).

✉ Calculation clearly showing that the requirement concerning biocides/preservatives is fulfilled.

Background to requirement O9 Biocides

A new proposal for allowing a small amount of biocides in concentrations below 120 g/m^3 or 300 ppm in the final wood has been introduced in the requirement. Acceptance of small amount of biocides conflict with an essential requirement (no use of biocides) in todays criteria generation, but it also add positive properties such as good durability, relative low energy use in the production phase and the small amount of biocides does not give problems in the end-of-life phase[33]. Nordic Ecolabelling still make an environmental difference compared to traditional impregnated wood due to the prohibition of the use of heavy metals and acceptance of a small amount of biocides. Heavy metals do not disappear either in incineration or landfill[34].

It is Nordic Ecolabelling's opinion that allowing a small amount of biocides has several environmental advantages compared with conventional impregnation:

- Traditional pressure impregnated wood primarily uses the impregnation agents which contains both copper compounds, boric acid and small amounts of up to several biocides.
- The quantity of impregnation agents in pressure impregnation is approximately 30 times higher[35] than alternative impregnated wood (3-5 kg/m^3 compared to 120 g/m^3 in superwood).
- The potential leaking of biocides in the use-face is assumed to be low due to small amounts of biocides in the final product.
- Contrary to traditional pressure impregnation, the Superwood uses no heavy metals, and the wood must be disposed of as ordinary wood after use[36].

Preservatives used for in-can preservation compliant with PT 6 (in-can) according to Regulation (EU)528/2012 (The Biocidal Products Regulation) can as in

[33] https://mst.dk/media/4bwlzqas/vejledende-udtalelse-vedr-haandtering-af-impraegneret-traeaffald.pdf
[34] Rapport U 6481 - Förstudie – kopparurlakning från impregnerat virke jämfört med övriga kopparflöden i Sverige. IVL Svenska Miljöinstitutet 2021
[35]https://www.ippc.int/static/media/files/publications/en/2014/09/04/17_ewgwoodhandicrafts_2014_sep.pdf
[36] https://mst.dk/media/4bwlzqas/vejledende-udtalelse-vedr-haandtering-af-impraegneret-traeaffald.pdf (visited April 2024)

generation 2 still be used in small amounts (see table in requirement) in chemical products.

O10 Volatile organic compounds

Volatile organic compounds (VOC, see Definitions), including volatile aromatic compounds (VAH), may be present in the chemical product to a maximum of 3% by weight.

Any solvents that polymerise in the wood may be used if the degree of polymerisation is at least 95%.

If there is any polymerisation of solvent in the wood, submit a report documenting that the degree of polymerisation is at least 95%.

✉ Overview of the organic solvents included in the chemicals, stating the boiling point and aromatic content.

Background to requirement O10 Volatile organic compounds

The limits requirement is slightly stricter compared to the previous generation (from 5% to 3%). Volatile organic compounds (VOC), including VAH, 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 chemical products.

The capacity for solvents to dissolve other substances and their volatility make them extremely useful, but they can also be highly harmful to health and can create a health issue in the workplace. Solvents that evaporate pollute the air that is inhaled and are then carried onward from the lungs and the blood. They can cause dizziness, headaches and lasting damage to the nervous system.

O11 Occupational exposure limit

If the production of durable wood involves the use of furfuryl alcohol (CAS 98-00-0) or acetic acid anhydride (CAS 108-24-7), the air pollution in the production premises must not exceed:

- 1 ppm for furfuryl alcohol or
- 0.6 ppm for acetic acid anhydride

The limit value of 1 ppm (furfuryl alcohol) or 0.6 ppm (acetic acid anhydride) states the highest acceptable limit value over an eight-hour shift and may be exceeded by a maximum of 200% for periods of 15 minutes.

The classification shall be according to the CLP Regulation (No) 1272/2008 with subsequent amendments and adaptations.

Sampling and analysis methods must comply with the instructions given for national measurements in the administrative standards issued by the authorities. The analysis laboratory/test institute must fulfil the general requirements for analysis laboratories, see Appendix 1.

✉ Test results from measurements showing compliance with the limit value.

Background to requirement O11 Occupational exposure limit

The requirement has been rewritten in generation 3, but the content is unchanged. It is still considered an appropriate level and has not been tightened during this revision.

Furfuryl alcohol, classified as Carc 2 H351, may be used on condition that the production fulfils this requirement (O11) concerning workplace limits and the requirement on chemical residues in the product (see O12 below). The workplace limit is set at 1 ppm in the workplace atmosphere during the production of Nordic Swan Ecolabelled durable wood. This is half the limit value in Finland, which is the strictest in the Nordic region. The limit value states the highest acceptable limit value over an eight-hour shift and may be exceeded by a maximum of 200% for periods of 15 minutes, which is partly based on the Norwegian authority's acceptable exceedances.

There is a limit value of 0.6 ppm for acetic acid anhydride based on the exemption from the classification H330 in requirement O4. The limit value has been added to this requirement to secure a safe working environment or workplace conditions while using the chemical product. It is assessed that risks associated with the classification H330 (Fatal if inhaled) is a working environment aspect. This must be handled by the manufacturers via regulatory requirements handling hazardous substances. The limit value of 0.6 ppm in this requirement is set 8 times lower than the Norwegian occupational exposure limit value which is 5 ppm[37].

O12 Chemical residues in the final product

If the production of the durable wood involves the use of furfuryl alcohol (CAS 98-00-0) or acetic acid anhydride (CAS 108-24-7) the final product can contain:

- a maximum of 0.2% (2000 ppm) by weight of furfuryl alcohol or
- maximum 0.1% (1000 ppm) by weight of acetic acid anhydride.

The amount must be calculated in relation to wood is pre-dried.

The analysis laboratory/test institute must fulfil the general requirements for analysis laboratories, see Appendix 1.

✉ Test report showing that the average values fulfil the requirement.

Background to requirement O12 Chemical residues in the final product

The requirement has been rewritten in generation 3, but the content is unchanged. It is still considered an appropriate level and has not been tightened during this revision.

The finished modified wood may contain a maximum of 0.2% furfuryl alcohol by weight. The amount is to be calculated in relation to wood that has been pre-dried. The requirement intends that residues of a substance classified as Carc 2 H351 will not leach out during the use of the modified wood, or that they will leach out in such small quantities that they do not constitute a risk to health or the environment. A previous leaching test has shown that moisture from brand-new furfurylated wood is more toxic to algae and crustaceans than untreated

[37] Guidance on Administrative norms for pollution of the working atmosphere, Directorate of Labour Inspection (Norway) 15th Edition, December 2011.

wood, but that moisture from wood that was furfurylated 1 year earlier showed no difference compared with untreated wood. It could not be ruled out that the toxicity was due to the low pH of the moisture that leached out.

Furfuryl alcohol is readily soluble in water, and according to the industry organisation's datasheet, it is assumed to be readily degradable in water, and not bioaccumulative[38]. Bioaccumulative potential is measured as log(oil/water) = 0.28. The degradation products are less toxic than the furfuryl alcohol itself.

There is also a limit of 0.1% by weight of acetic acid anhydride in the final product due to the exemption for classification H330 in O4. When using acetic anhydride in the acetylation process acetic acid is formed as a by-product. When the reaction/acetylation is complete, the acetic acid anhydride and the acetic acid are extracted from the wood product[39]. Although an extraction is carried out in the process, a limit value for the eventual residual content of acetic anhydride in the end product is required. The limit value is set to <0.1% by weight as acetic acid anhydride is exempted from the hazard statement of H330 in requirement O4.

5.6 Quality

O13 Biological durability

To ensure adequate quality for the intended use, the use class must as a minimum fulfil the corresponding durability class and test methods in the table below. The test(s) must be performed by an accredited laboratory, and be accompanied by a separate statement or certificate that confirms the achieved durability class of the product(s).

Wood protection method	Use class as per EN 335	Minimum durability class	Required documentation of durability
Wood with natural durability (may not be treated with wood preservatives)	UC 3.1	DC 2	Durability class DC 2 (durable) as per EN 350 (Table B.1).
	UC 3.2	DC 1	Durability class DC 1 (very durable) as per EN 350 (Table B.1).
Thermally and chemically modified wood not classified in accordance with NTR	UC 3.1	DC 2	Testing by accredited laboratory: - EN 113-2 excluding testing with Coriolus versicolor after separate accelerated ageing in line with EN 73 and EN 84. - EN 12037:2022 or EN 330
	US 3.2	DC 1	Testing by accredited laboratory: - EN 113-2 excluding testing with Coriolus versicolor after separate accelerated ageing in line with EN 73 and EN 84. - EN 12037:2022 or EN 330

[38] ATP to the CLP Regulation (the EU's new regulation on the classification of chemicals). Amendment to EU Directive 67/548/EEC of 15 January 2009 (2009/2/EC). Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:011:0006:0082:EN:PDF (25 January 2009)
[39] Consultation comment from Accsys Technologies (2014)

	UC 4	DC 1	Testing by accredited laboratory: - EN 113-2 including testing with Coriolus versicolor after separate accelerated ageing in line with EN 73 and EN 84. - ENV 807 - EN 252 for at least five years in three locations, two of which are in a Nordic country.
	UC 5	DC 1 DC D for marine organisms	Testing by accredited laboratory: - EN 113-2 including testing with Coriolus versicolor after separate accelerated ageing in line with EN 73 and EN 84. - ENV 807 - EN 275 for at least five years in a Nordic country.
Thermally and chemically modified, and preservative-treated wood classified in accordance with NTR	UC 3.1	DC 2	NTR Bmod
	UC 3.2	DC 1	NTR ABmod
	UC 4	DC 1	NTR Amod

✉ Analysis report showing test result according to table above.

✉ A separate statement or certificate showing the durability class of the product.

Background to requirement O13 Biological durability

This requirement has been revised. The requirement aims to ensure that products have adequate biological durability in accordance with the use class, as well as further harmonize the requirement with other product groups.

One of the greatest challenges in developing alternative products to conventionally impregnated wood has been achieving sufficient durability. The largest volume of wood on the current market is used in UC 3.2 according to EN 335 and as described in the requirement, i.e., parts that remain wet for long periods or where water can accumulate. It is therefore in this segment that the greatest environmental gains can be made by switching from traditionally impregnated wood to more environmentally aware wood. One of the most important properties of the newly developed alternatives is that they have similar biological durability to traditionally impregnated wood. Durability in this setting is primarily focused on improved durability against fungal attack to ensure a long service lifetime.

Chemically modified wood and impregnated wood have the highest durability and can be used both above ground and in contact with the ground. Thermal treatment of wood changes the construction properties. Durability is a very important factor in assessing the environmental impact of wood protection treatment methods as these are closely linked to the lifespan of the products and are thus important factors in the life cycle assessment.

Wood treated through impregnation with wood preservative is divided by the Nordic Wood Preservation Council (NTR) into four classes: NTR M, NTR A, NTR

AB and NTR B. The classification is based on EN 351-1 and is linked to the use classes defined in EN 335. Normally wood impregnated with small amounts of biocides does not achieve the same durability as heavily impregnated wood but performs well on vertical surfaces outdoors.

NTR's system for modified wood (thermal and chemical) is similar to its system for wood treated with chemical wood preservatives. Here, the wood protection classes are NTR Mmod, NTR Amod, NTR ABmod and NTR Bmod, in line with the use classes defined in EN 335. Since 2017, it has been possible to produce thermally or chemically modified wood according to the NTR standard. It is also possible to test the wood in line with established EN standards for the appropriate user class as described in the requirement.

O14 Documentation of fire classification

Wood that is pressure impregnated with fire-retardant products must document the following:

- Fire classification according to EN 14915.

Products that are not treated with fire-retardant chemicals are exempted from this requirement.

The fire-retardant chemicals may only be applied by a pressure impregnation process, superficial process is not accepted.

The durability of reaction to fire performance is today documented according to EN 16755. EN 16755 is expected to be updated in the period 2024-2026, as today's version is not adequate according to the industry. Nordic Ecolabelling will update the requirement with the new version of the standard when it's ready, which will require that all relevant products must be documented with a test report within a specified timeframe. There will be a notification period before the updated requirement is introduced.

✉ Documentation according to EN 14915.

✉ Test report documenting the durability according to EN 16755.

Background to requirement O14 Documentation of fire classification

This is a new requirement aimed at confirming the durability of fire-retardants, ensuring that the fire class withholds over time. Customers who purchase Nordic Swan Ecolabelled products can be assured of their safety for many years. This only applies if efforts are made to enhance the product's fire resistance properties through pressure impregnation.

At the time of criteria development, the EN 16755 is under revision as the industry does not find today's version of the standard adequate. Their recommendation has been to solely refer to the new standard, expected in 2024-2026, as the existing version has multiple flaws in the described testing method. When the new standard is published, Nordic Ecolabelling will require a test according to this standard within a specified timeframe.

The criteria only allow superficial treatment if the product applied is Ecolabelled. In the current criteria of 096, Paints and varnishes, it is not possible to Nordic Swan Ecolabel a paint whose properties is a fire retardant. It is not expected that this is to be included in the next version, and therefore not included as an

alternative in these criteria. If there is an Ecolabelled surface treatment on the product, the durability of the fire retardant properties must not be tested. The durability of these properties will rely heavily on the maintenance of the product.

5.7 Energy and climate

This chapter contains requirements for the energy consumption in the production of biological durable wood.

The energy consumption is calculated as MJ/m^3 product produced (final product), and encompasses all energy used from gate to gate (phase A3 in EPDs) at the production site. Energy use for any pre-drying of wood or transport before the production (chemical/thermal modification process) is not part of the requirement. Processes included in the calculation: wood modification process, drying, cooling, cutting, trimming, sanding, surface treatment and packaging.

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 Nordic Swan Ecolabelled durable wood (production line) or for the company's total annual production at the production site.

O15 Energy consumption – production of durable

Energy consumption in the production of durable wood (final product) must not exceed the following limit values:

Durability class (DC) as per EN 350	Energy consumption MJ/m^3 durable wood
DC 1	2500 MJ/m^3
DC 2	2200 MJ/m^3

✉ Calculation showing compliance with the requirement. The calculation must contain information about the quantity produced, electricity and fuel consumed, and which fuel sources have been used.

Background to requirement O15 Energy consumption – production of durable

The requirement has been changed from a requirement for information on energy use/consumption in generation 2 to a new requirement for absolute energy consumption in generation 3.

The MECO analysis and the various life cycle analyses of durable wood show that energy consumption in the raw material and production phases often accounts for a substantial amount of the product's environmental impact[40],[41],[42]. The process of both chemical- and thermal wood modification requires high tempeture/steam/pressure and the relevance for reducing energy consumption is therefore high. Energy savings have an important role to play in reducing environmental impact and thus also global warming and climate change.

[40] Candelier K. and Dibdiakova J.: A review on life cycle assessments of thermally modified wood, published online August 14, 2020 (https://doi.org/10.1515/hf-2020-0102
[41] Hill, C., Hughes, M., & Gudsell, D. (2021). Environmental Impact of Wood Modification. Coatings, 11(3), Article 366. https://doi.org/10.3390/coatings11030366
[42] www.thermowood.fi (visited March 2024)

Production of modified wood is characterized by a need of energy for both preliminary drying of wood and the modification process itself. The process of preliminary drying of wood constitutes a large proportion of the total energy consumption (e.g., up to 50% in production of thermowood[43]), and is often carried out by subcontractors. Due to the limited steerability to influence the energy consumption by subcontractors, the energy requirement only applies to the actual production of durable wood. The energy consumption is calculated as MJ/m^3 product produced, and encompasses all energy used from gate to gate (phase A3 in EPDs) at the production site.

There is a general difference between energy consumption in the various technologies for the production of modified wood. Chemical modification (acetylated and furfurylated wood) appears to have a slightly higher energy use compared to thermal wood, which in turn is higher than the technology of both impregnation with supercritical CO_2 and pressure-treated wood. The energy consumption requirement has therefore been developed based on the woods durability class, i.e. that wood in durability class 1 can use slightly more energy than wood in durability class 2. The proposed energi-limits are based on data from licensees, EPDs, LCA-repports, Thermowood Association and dialog with stakeholders. Being a new requirement the intention behind the proposed limits is only to affect the very most energy-consuming production sites.

O16 Energy consumption – fossil fuels

Fossil oil and coal are **not** allowed to use in the production of durable wood (from gate to gate (phase A3 in EPDs) at the panel production site).

If natural-/LPG gas is used for production of heat, steam or pressure the applicant must work actively with energy savings by:

- Being certified according to ISO 50001 or
- Being certified according to ISO 14001 (must contain an energy review corresponding to part 6.3 of ISO 50001 upon recertification) or
- Have undergone an audit according to EN 16247 within the last 3 years.

✉ Declaration from the manufacturer for durable wood that no fossil oil or coal are used in the production of durable wood.

✉ If natural-/LPG gas is used in the production of of durable wood: documentation for certification according to ISO 50001, ISO 14001 (including extended energy review corresponding to part 6.3 of ISO 50001 upon recerfitication or audit according to EN 16247 within the last 3 years).

Background to requirement O16 Energy consumption – fossil fuels

New requirement in generation 3. Burning fossil fuels like coal, oil and natural gas results in carbon carbon dioxide emissions, which contributes to climate

[43] elier K. and Dibdiakova J.: A review on life cycle assessments of thermally modified wood, published online August 14, 2020 (https://doi.org/10.1515/hf-2020-0102

change as well as air and water pollution[44]. Excluding and/or limiting the use of fossil fuels supports EUs climate policy to achieve climate neutrality by 2050[45].

Dialog and data received from manufactures of modified wood shows that natural gas is still a widely used energy source. A ban on the use of natural- and or LPG gas will have major consequences for the ability to produce Nordic Swan Ecolabelled durable wood. Manufactures who use natural gas must therefore work actively with energy savings by either being certified according to ISO 50001, ISO 14001 (including extended energy review corresponding to part 6.3 of ISO 50001 upon recertification or audit according to EN 16247 within the last 3 years).

5.8 Customer information

O17 Product specification, instruction for use and maintenance

The product specification/instructions for use shall, as a minimum, contain information and recommendations related to the following topics:

- Areas of use (Use class).
- Biological durability class.
- Declaration of performance (DoP).
- Instructions for installation. The installation process must recommend methods to support later reuse. The use of chemical fasteners should be avoided.
- Recommended maintenance and possible surface treatment* during the use phase.
- Recommendations for end-of-life treatment of the durable wood, also including scrap and surplus materials. Reuse must always be at least one of the recommended treatments.

** If surface treatment is recommended to extend the product's service life, Nordic Swan Ecolabelled products shall be recommended to be used as much as possible.*

✉ Product specification/instructions for use containing the points above.

Background to requirement O17 Product specification, instruction for use and maintenance

The requirement has been adjusted and expanded to also require instructions for installation, information regarding waste disposal and to encourage reuse. This requirement aims to ensure that the customers receive adequate information to ensure a prolonged lifetime of their product.

A long lifetime is dependent on instructions for installation, correct maintenance and reuse instead of disposal. A lot of the wood in the Nordic countries is today burned to recover energy. According to the waste hierarchy, this is a low-grade use of the product. Material recovery of chemically and thermally modified wood,

[44] https://www.greenpeace.org/usa/8-reasons-why-we-need-to-phase-out-the-fossil-fuel-industry/ (visited April 2024)
[45] https://www.consilium.europa.eu/en/press/press-releases/2023/10/16/cop28-council-sets-out-eu-position-for-un-climate-summit-in-dubai/

being slightly higher on the hierarchy, varies some in the Nordic countries. The trend is that wood fibres are undesirable for producers utilising wood from the waste stream. Nordic Ecolabelling wants to encourage producers to have a clear recommended end-of-life treatment, and reuse should be prioritized as far as possible. Where reuse is not suitable, or possible, the information regarding correct waste management is important to avoid that the durable wood is handled as hazardous waste.

As the producer does not have steerability regarding how customers install, maintain and treat products at their end-of-life, they should instead inform the customers and have a clear recommendation.

O18 Guarantee

The supplier must provide a guarantee* against soft rot and/or fungi attack. The guarantee period depends on the type of the use class of wood, but must as a minimum be according to the following list:

- Natural long durability with UC 1-5: 15 years.
- Chemically and thermally modified, and impregnated with small amounts of biocides with UC 1-3: 25 years.
- Chemically and thermally modified, and impregnated with small amounts of biocides with UC 4-5: 20 years.

The guarantee period and terms must be communicated clearly to the customer.

** By guarantee it implies that if the wood fails to perform as expected, the manufacturer must, within a reasonable timeframe, provide a replacement product to the consumer. The guarantee can be provided, given that the product is used and maintained according to manufacturers' recommendations.*

✉ Description of the guarantee from the supplier of the product.

✉ Documentation showing how the guarantee period and terms are communicated to the customer (purchase agreement, website, etc.).

Background to requirement O18 Guarantee

This is a new requirement. To contribute to a circular economy, the Nordic Swan Ecolabelled products must have a long service life.

As there is still potential for a better waste management flow of wood products, it is important to ensure a long lifetime. The producers must already document a durability class and clearly state the intended use. An extended minimum guarantee period gives further reason to trust the properties of a product, as they are marketed. The customer must have the right to a replacement if the product fails to perform as expected against rot.

The guarantee period is decided based on what is used by some of the leading companies within the field of biological durable wood. The use classes that imply the use above/ground and exposed to the weather must have a longer durability period, as they are expected to not be replaced. This is reflected in the minimum guarantee period. Use classes that are sheltered from the weather require a lower durability period as they are expected to be easier to replace if damaged.

5.9 Licence maintenance

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

O19 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 O19 Customer complaints

Nordic Ecolabelling requires that your company has implemented a customer complaint handling system. To document your company's customer complaint handling, 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 customer complaint handling, it is possible to upload a description of how your company perform these activities. During the on-site visit, Nordic Ecolabelling will check that the customer complaint handling is implemented in your company as described. The customer complaints archive will also be checked during the visit.

O20 Traceability

The licensee must be able to trace the Nordic Swan Ecolabel products in the production. A manufactured / sold product should be able to trace back to the occasion (time and date) and the location (specific factory) and, in relevant cases, also which machine / production line where it was produced. In addition, it should be possible to connect the product with the actual raw material used.

You can upload your company's routine or a description of the actions to ensure traceability in your company.

✉ Please upload your routine or a description.

Background to requirement O20 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, it is possible to upload a description of how your company perform these activities. During the on-site visit, Nordic Ecolabelling will check that the product traceability is implemented in your company as described.

6 Environmental impact of durable wood

The relevant environmental impacts found in the life cycle of Nordic Swan Ecolabelled durable wood are set out in a MECO scheme (Appendix 2). A MECO describes the key areas that have impact on the environment and health throughout the life cycle of the product – including consumption of materials/resources (M), energy (E), chemicals (C) and other impact areas (O).

Nordic Ecolabelling sets requirements concerning the topics and processes in the life cycle that have a high environmental impact – also called hotspots. Based on the MEKO analysis, an RPS tool is used to identify where ecolabelling can have the greatest effect. R represents the environmental relevance; P is the potential to reduce the environmental impact and S is the steerability on how compliance with a requirement can be documented and followed up. The criteria contain requirements in those areas in the life cycle that have been found to have high RPS, since there is potential to achieve positive environmental gains.

Table 1: Summary of result of the RPS analysis. The aspects assessed to have high or medium relevance are those covered by requirements in the criteria.

Lifecycle 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 durable wood has a high RPS. From a life cycle perspective, forestry is a key part of wood products' environmental impact, and it is also important that wood as a renewable raw material is grown / harvested and used in a sustainable way. Much of the world´s forest loss is driven by conversion of natural forest to other land uses such as cattle farming, palm oil and soy plantations. Deforestation and degradation from illegal and unsustainable logging, fires and fuelwood harvesting can harm wildlife, jeopardize people´s livelihoods and intensify climate change. Credible forest management certification contributes to a more sustainable wood / timber product industry by helping create market conditions that support forest conservation. Requirements for hight share of certified wood raw materials and certified traceability ensures more sustainable forestry.
Production/distribution		
	Chemicals used in manufacturing of modified wood R: High P: Medium/high S: High	Chemicals used in the manufacturing of panels and possible surface treatment contain many difference substances, such as heavy metal, preservatives, and fungicides, with many different harmful effects on the environment and health[46]. The potential for excluding the use of toxic substances and promote the use of less toxic chemicals in the process of wood modification/producing durable wood with a low need for maintenance, is considered to be high. A leaching experiment from 2011 with Danish and Norwegian impregnated pine with Wolmanitt CX-8 showed that appr. 18% copper and boric acid was leached out[47]. Another study from 2010 estimated that between 8 to 15% copper and 30% boron was leached during a period of 20 years[48].

[46] Plesser, Thale Sofie Wester et al., Miljøanalyse av trefasader, SINTEF Byggforsk, ISBN 978-82-536-1339-0, 2013

[47] Kängsepp, K. et al. 2011. Leaching of commonly used impregneation agents affected by wood properties.

[48] Morsing et. Al, 2010.: "Comparison of laboratory and semi-field tests for the estimation of leaching rates from treated wood - part 1: above ground (UC 3). IRG/WP 10-50274.

		Steerability in reducing the use of toxic chemicals is judged to be high in professional manufacturers of durable wood, which are also able to easily control work environment conditions at the factory. For wood where the end user must carry out much of the chemical application/ maintenance, steerability is lower.
	Energy – production of durable wood R: High P: Low/medium S: Medium/high	High/medium RPS has been identified in relation to energy impact for production of durable wood (drying- and modification of wood)[49], [50]. The process of both chemical- and thermal wood modification requires high tempeture/steam/pressure and relevance for reducing energy consumption is therefore high. Initial drying of wood before the wood modification process is also energy intensive. However, this produess is often carried out by subcontractors and the portential to influence this process is therefore reduced (low medium). Energy savings have an important role to play in reducing environmental impact and thus also global warming and climate change. All manufactures of durable wood are focusing on reducing their energy consumption and therefore the potential for introducing strict absolute energy requirements are medium. The steerability (S) to measure energy consumption is high.
Use phase		
	Optimal use and long durability of the durable wood R: High P: High S: High	High RPS for securing conformity between the properties (durability) and the function (Use class/field of application) for which the product is marketed. The durability/product lifetime of different products has a huge effect on the overall environmental impact[51], [52], [53], [54] of durable wood. Test for both use classes and biological durability ensures that only wood with documented long durability can be Ecolabelled (steerability).
	Guarantee R: High P: Medium/high S: Medium	A requirement for a guarantee against rot is related to the importance of durable wood to have good quality and long durability, see above. Guarantee is a factor that signals the product's lifetime/expectations to customers, but also stimulates manufacturers to produce products of high quality. In order to increase the steerability a requirement should only focus on a guarantee against rot.
	Quality and properties R: High P: High S: High	High RPS for securing conformity between the properties and the functions for which the durable wood is marketed, and the performance declarations drawn up in relation to the CE marking.
End of life		
	Disposal/waste R: High P: High S: Medium/high	RPS for excluding durable wood that are classified as "hazardous waste" in any of the Nordic countries. Traditional presure impregnated wood contain many difference substances, such as heavy metals and preservatives and

[49] Candelier K. and Dibdiakova J.: A review on life cycle assessments of thermally modified wood, published online August 14, 2020 (https://doi.org/10.1515/hf-2020-0102
[50] Hill, C., Hughes, M., & Gudsell, D. (2021). Environmental Impact of Wood Modification. Coatings, 11(3), Article 366. https://doi.org/10.3390/coatings11030366
[51] Larsson Brelid P.: Benchmarking and State of the Art for modified wood, SP Technical Research Institute of Sweden, SP report 2013:54 ISSN 0284-5172
[52] Candelier K. and Dibdiakova J.: A review on life cycle assessments of thermally modified wood, published online August 14, 2020 (https://doi.org/10.1515/hf-2020-0102)
[53] Erlandsson M. et al (2018).: LCA on NTR treated wood decking and other decking materials, Report nr. 715202 IVL report C302.
[54] Hill, C., Hughes, M., & Gudsell, D. (2021). Environmental Impact of Wood Modification. Coatings, 11(3), Article 366. https://doi.org/10.3390/coatings11030366

		therefore handled as “hazardous” waste in both DK[55] and Fin. Impregnated wood that only contains copper salts (since 2002) is not defined as hazardous waste by the Swedish, Danish or Norwegian authorities as hazardous waste but has to be taken to a recycling centre[56] for incineration. Incineration of traditional impregnated wood does not remove heavy metals and the ash therefore still constitutes a potential environmental problem[57].

7 Changes compared to previous generation

Figure 1 Overview of changes to in generation 3 compared with generation 2.

Generation 3	Generation 2	Same req.	Change	New req.	Comment
O1 Description of the product	O1		x		Adjusted, no significant changes
Raw materials					
O2 Prohibited and restricted tree species	O11		x		Updated with Nordic Ecolabelling’s requirement concerning tree species that are prohibited or restricted (exept for recycled wood material).
O3 Traceability and certification	O13		x		Updated with Nordic Ecolabelling’s requirement concerning certified wood.
Chemicals in production and surface treatment					
O4 Ecolabelled products – surface treatment				x	New requirement for surface treatment.
O5 Classification of chemical products	O4		x		Prohibition of chemicals classified as environmentally hazardous has been added.
O6 Classification of ingoing substances	O5		x		Updated, e.g. a new classification has been added. Some exemptions are updated.
O7 Prohibited substances	O6		x		Updated, e.g. referring the requirement for endocrine disruptors to other lists, and the substances that are prohibited have also been expanded
O8 Nanomaterials	O7		x		SAS is added as an exemption.
O9 Preservatives/biocides	O3		x		New requirement that accept a small amount of biocides in the final wood product.
O10 Volatile organic compounds	O8		x		Adjusted and maximum level of VOC is updated.
O11 Occupational exposure limit	O9	x			Levels of exposure are still relevant
O12 Chemical residues in the final product	O10	x			Levels of chemical residues are still relevant
Quality					

[55] https://mst.dk/erhverv/groen-produktion-og-affald/affald-og-genanvendelse/affaldshaandtering/affaldsfraktioner/impraegneret-trae (visited March 2014)
[56] Norwegian Environment Agency: www.miljodirektoratet.no
[57] Livcycklusvurering af bahandling af imprægneret træaffald, Miljøstyrelsen, miljøprojekt nr. 1938, maj 2017

Generation 3	Generation 2	Same req.	Change	New req.	Comment
O13 Biological durability	O14		x		Introducing minimum durability class according to use class. Preservative-treated wood added.
O14 Documentation of fire classification				x	New requirement to document durability of fire performance
Energy and climate					
O15 Energy consumption	O15			x	Introduction of new absolute requirement for energy use
O16 Fossil fuels				x	Introduction of new requirement for excluding and/or limiting use of fossil fuels
Costumer information					
O17 Product specification, instruction for use and maintenance	O16		x		Updated for further focus on a circular material flow at the end-of-life.
O18 Guarantee				x	New requirement
Licence maintenance					
O19 Customer complaints				x	New requirement
O20 Traceability	O23		x		Updated and partly rewritten.
Removed requirement from gen. 2					
Chemicals used	O2				Implemented in O1.
Biocides	O12				Removed
Waste management	O17				Removed
Nordic Swan Ecolabel licence person	O18				Removed
Documentation	O19				Removed
Quality of durable wood	O20				Removed
Planned changes	O21				Removed
Unforseen non-conformities	O22				Removed
Take-back system	O24				Removed
Laws and regulations	O25				Removed

8 Future criteria generation

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

- Product definition – new types/technologies for durable wood
- Chemicals used in production and any surface treatment of durable wood
- Energy consumption in production of durable wood
- Use class and durability class
- End of life

9 Criteria version history

Nordic Ecolabelling adopted version 3.0 of the criteria for Durable wood on DAY MONTH YEAR. The criteria are valid until DAY MONTH YEAR.

10 How to apply and regulations for the Nordic Ecolabelling

Application and costs

For information about the application process and fees for this product group, please refer to the respective national web site. For contact information see first in this document.

The application consists of an application form/web form and documentation showing that the requirements are fulfilled.

Licence validity

The Nordic Swan Ecolabel licence is valid providing the criteria are fulfilled and until the criteria expire. The validity period of the criteria may be prolonged or adjusted, in which case the licence is automatically prolonged, and the licensee informed.

Revised criteria shall be published at least one year prior to the expiry of the present criteria. The licensee is then offered the opportunity to renew their licence.

On-site inspection

In connection with handling of the application, Nordic Ecolabelling normally performs on-site inspection visit/-s to ensure adherence to the requirements. For such an inspection, data used for calculations, original copies of submitted certificates, test records, purchase statistics, and similar documents that support the application must be available for examination.

Queries

Please contact Nordic Ecolabelling if you have any queries or require further information. See contact info first in this document. Further information and assistance (such as calculation sheets or electronic application help) is available. Visit the relevant national website for further information.

Follow-up inspections

Nordic Ecolabelling may decide to check whether biological durable wood fulfils Nordic Ecolabelling requirements during the licence period. This may involve a site visit, random sampling, or similar test.

The licence may be revoked if it is evident that the product does not meet the requirements.

Random samples may also be taken in-store and analysed by an independent laboratory. If the requirements are not met, Nordic Ecolabelling may charge the analysis costs to the licensee.

Regulations for the Nordic Ecolabelling of products

When the Nordic Swan Ecolabel is used on products the licence number shall be included.

More information on graphical guidelines, regulations and fees can be found at www.nordic-swan-ecolabel.org/regulations

Appendix 1 Laboratories and methods for testing and analysis

General requirements for test and analysis laboratories

Tests must be carried out in a correct and competent way. The analysis laboratory/test institute must be impartial and professional.

If accreditation is not separately required, the test and/or analysis laboratory must comply with the general requirements of the EN ISO 17025 standard for the quality control of test and calibration laboratories or have official GLP status.

The applicant's laboratory can be approved if it is accredited and complies with the requirements of the standard EN ISO 17025.

When testing quality and performance properties, the applicant's own laboratory can be approved even if it is not accredited. The following applies:

- The laboratory has a certified quality system (ISO 9001) which includes testing, and
- The laboratory can show that the test results obtained are similar to the results from an accredited test laboratory through initial tests performed as parallel tests. Parallel tests must as a minimum be performed when test standards are updates, and
- The laboratory performs the tests in accordance with an established plan for the current test standard and documents the selection of products in a product series for worst case tests, and
- An independent inspection body shall, on the basis of test reports, confirm that the manufacturer's test results are consistent with the results of an accredited laboratory. This can, for example, be evaluated as part of an inspection of the laboratory's quality system carried out by the inspection body for certification of the quality system.

Appendix 2 MECO analysis

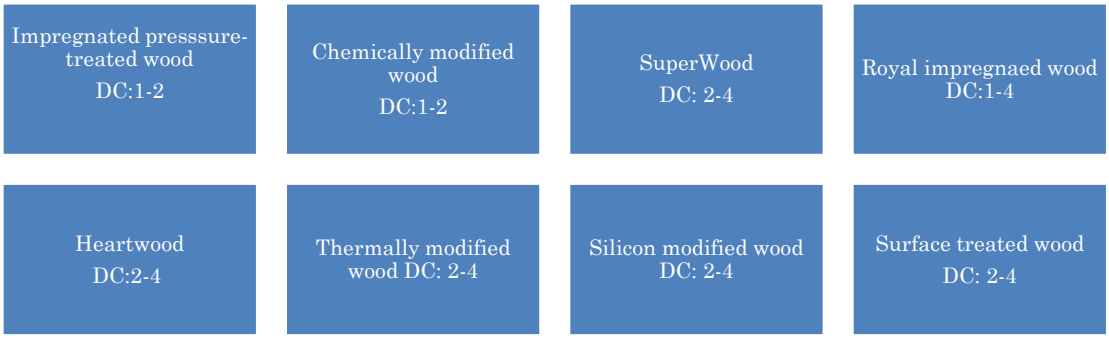
A qualitative MECO analysis (an assessment of Materials, Energy, Chemicals and Other) is presented in the table and text below. The purpose of the analysis is to show where in the life cycle the environmental impact occurs for different types of durable wood and wood-plastic composites and to assess whether there is any potential to reduce that environmental impact. The analysis is general and shows some of the most common materials and processes used. The analysis covers products inside and outside the product group as defined in the criteria for the Nordic Swan Ecolabelling of Durable wood.

The data presented in the MECO analysis is based on LCA studies, EPD's, production data from stakeholders and industry associations. A practical study (Environmental analysis of wood facades) conducted in Norway as a collaboration between SINTEF Byggforsk, the Norwegian Institute of Wood Technology and the Norwegian Forest and Landscape Institute[58] is also included in the analysis. The study focuses specifically on building facades, which is one of many areas of use for durable wood. The facade materials were assessed with regard to potential global warming, human and ecological toxicology.

The text below provides a summary of the environmental impact in the different phases of the products' life cycle. For underlying data and qualitative assessments, also see the MECO table at the end of the appendix.

General information about products, materials and durability
There are a wide range of products on the market with different degrees of durability. The durability of different products is an important factor in any life cycle analysis[59, 60, 61,62] and is therefore a requirement in the Nordic Ecolabelling criteria. In the criteria, durability is divided into three classes in line with the NTR system[63]: M (marine environment), A (in contact with the ground) and AB (above ground). These equate to the classes M=1, A=2, AB=3-4 as set out in EN-350-1. The figure below gives some products and their typical associated durability classes (DC). Some of these products such as impregnated pressure treated wood and silicon moditied wood are excluded from Nordic Ecolabelling's product definition for durable wood.

[58] Plesser, Thale Sofie Wester et al.: Miljøanalyse av trefasader, SINTEF Byggforsk, ISBN 978-82-536-1339-0, 2013
[59] Larsson Brelid P.: Benchmarking and State of the Art for modified wood, SP Technical Research Institute of Sweden, SP report 2013:54 ISSN 0284-5172
[60] Candelier K. and Dibdiakova J.: A review on life cycle assessments of thermally modified wood, published online August 14, 2020 (https://doi.org/10.1515/hf-2020-0102)
[61] Erlandsson M. et al (2018).: LCA on NTR treated wood decking and other decking materials, Report nr. 715202 IVL report C302.
[62] Hill, C., Hughes, M., & Gudsell, D. (2021). Environmental Impact of Wood Modification. Coatings, 11(3), Article 366. https://doi.org/10.3390/coatings11030366
[63] https://dansktraebeskyttelse.dk/ntr/ (visited March 2024)



When assessing the environmental impact of durable wood, area of use and durability are important factors, since they are linked to the lifetime of the products. The environmental factors should be seen against this background. The products with the highest durability are chemically modified wood and impregnated wood[64]. For this reason, these products will also have the broadest possible areas of use, since they are suitable for use in contact with water and the ground, as well as use above ground. Heartwood from natural durable wood and thermally modified wood have different degrees of durability, depending on the type of wood, and the type of thermal treatment (see background to requirement O13).

Raw material phase

In the raw material phase, the environmental impact relates primarily to: forestry (sustainable or not), harvesting, debarking and processing (debarking) the wood at the sawmill (including drying). In addition to this, there is the issue of transport for all materials.

Drying sawn timber entails the greatest energy consumption, and in the Nordic region it accounts for around 90% of the environmental impact from processing. In the raw material phase, the drying process in the Nordic region makes up around 90% of an energy consumption that stands at around 1700 MJ/m^3 [65]. The climate impact tends to be low, however, since the energy source in the Nordic region is based chiefly on renewable materials such as bark and wood chips. Extraction and transport usually account for around 10% of the energy consumption involved before finishing in the Nordic region. The environmental impact from transport can vary considerably depending on transport distance, while the climate impact may range from 1% to approx. 20% of the total climate impact over the life cycle[66] (see MECO table).

Impregnated wood and chemically modified wood generally have around the same energy/climate impact in the raw material phase, but transport can be a significant factor in increasing the environmental impact.

Raw material extraction for the chemicals used in impregnation or modification may increase the environmental impact through increased energy consumption (10-20% cradle to gate) and higher greenhouse gas emissions (10-50% cradle to gate).

[64] EN 3050-1
[65] Silje Wærp et al., Livsløpsanalyser av norske treprodukter, MIKADO, SINTEF Byggforsk, 2009. Norway.
[66] Erlandsson M. et al (2018).: LCA on NTR treated wood decking and other decking materials, Report nr. 715202 IVL report C302.

Production phase

The greatest environmental impact during the production phase is associated with the chemicals used to treat the wood (potential emissions to the outdoor environment and working environment), and with the energy used during production.

The production phase can differ greatly for different products and the environmental impact varies significantly in this part of the life cycle. Unsurprisingly, solid wood products with natural durability (such as heartwood) generally fare best, since no chemicals are added, and the products do not undergo any form of thermal or pressure treatment. If a surface treatment, in the form of a stain or paint, is applied to the finished sales product, this will, however, increase the environmental impact considerably in the production phase[67]. Impregnated pressure treated wood (Cu impregnation) generally have a low climate and energy impact in the production phase, since this technology does not usually use heat in production. Various EPDs[68] suggest a very low energy consumption of 400-600 MJ/m^3 (large production volumes, figure uncertain) but there is data for less efficient processes, where the energy consumption may be ten times greater (figure uncertain). In the production phase, thermally modified wood usually has a somewhat higher energy consumption than impregnated wood due to the nature of the process[69] (figures uncertain). Chemical modification using known technology such as furfurylation or acetylation has a much higher energy consumption compared with impregnated wood and thermally modified wood. Energy consumption can be 4-5 times as high (figures uncertain, little data) compared with thermally modified wood. Wood-plastic composites have even higher energy consumption in the production phase, with data suggesting up to twice the energy consumption of chemically modified wood where virgin plastic is used (figure is uncertain, little data).

When it comes to the carbon footprint of durable wood in the production phase, this is, as in the raw material phase, primarily determined by the kind of energy source used. In general terms, manufacturers in the Nordic region mainly use electricity in combination with propane or natural gas in the production phase. This often leads to a high carbon footprint where fossil energy sources are used in production. There is considerable potential here for a reduction in greenhouse gas emissions by switching to bio-based energy sources (bark, wood chips, pellets, etc).

A study[70] of wood facades conducted by SINTEF Byggforsk in 2013 shows that greenhouse gas emissions vary a great deal for different treatment methods. Maintenance (type of chemicals and frequency) also plays a substantial role in emissions of greenhouse gases, see figure below.

[67] Hill, C., Hughes, M., & Gudsell, D. (2021). Environmental Impact of Wood Modification. Coatings, 11(3), Article 366. https://doi.org/10.3390/coatings11030366

[68] Silje Wærp et al., Livsløpsanalyser av norske treprodukter, MIKADO, SINTEF Byggforsk, 2009. Norway.

[69] Executive summary – ThermoWood: Life cycle assessment (LCA) of Finnish thermally modified wood cladding, Finnish ThermoWood Association, Publishing House Koivuniemi Ltd., Finland. 2008

[70] Silje Wærp et al., Livsløpsanalyser av norske treprodukter, MIKADO, SINTEF Byggforsk, 2009. Norway.

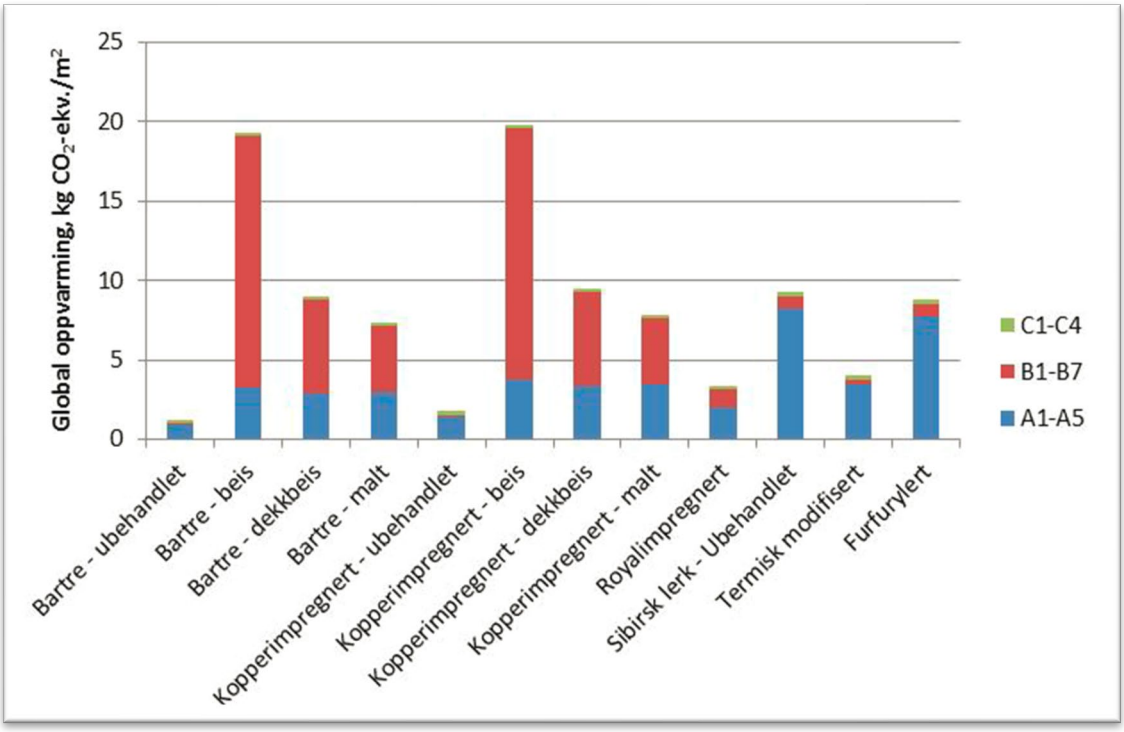


Figure 1: Emissions of greenhouse gases for each type of cladding. Total for the production, installation and use phases. The figures are from the report "Miljøanalyse av trefasader" (Environmental analysis of wood facades – SINTEF Byggforsk, the Norwegian Institute of Wood Technology and the Norwegian Forest and Landscape Institute)[71]. Phases A1-A5 include raw material extraction, production and installation of the cladding including transport. Phases B1-B7 include the use phase (emissions from the surface treatment and maintenance). Phases C1-C4 include demolition and waste management. According to the report, the results for Royal impregnated wood are too low, since energy use during impregnation with oil is not taken into account due to lack of data.

Use phase

In the use phase, the leaching of impregnation agents from the wood and the need for maintenance, particularly surface treatment, account for the greatest environmental impact. The fact that durable wood lasts a long time is very important since the material does not have to be replaced as often. For pressure impregnated wood, around 10-15% of copper and at least 30% boron are leached out over the course of a service life of 20–30 years[72,73,74]. Leaching is not a problem for thermally modified wood since it does not use chemicals. It is also not a problem for furfurylated or acetylated wood, where the polymer is permanently bound into the wood.

The environmental impact from surface treatment over the life cycle of wood is documented in the report from SINTEF Byggforsk et al., as mentioned above. The study shows the significance of surface treatment on untreated wood,

[71] Plesser, Thale Sofie Wester et al., Miljøanalyse av trefasader, SINTEF Byggforsk, ISBN 978-82-536-1339-0, 2013
[72] Kängsepp, K. et al. 2011. Leaching of commonly used impregnation agents affected by wood properties.
[73] Morsing et. al. 2010: "Comparison of laboratory and semi-field tests for the estimation of leaching rates from treated wood - part 1: above ground (UC 3). IRG/WP 10-50274.
[74] Rapport U 6481 - Förstudie – kopparurlakning från impregnerat virke jämfört med övriga kopparflöden i Sverige. IVL Svenska Miljöinstitutet 2021

compared with impregnated wood and a range of other durable facade products. The types of chemicals and the frequency of the treatment are decisive factors in the environmental impact, including climate impact of different claddings.

In the majority of cases, untreated wood and impregnated wood will be given a number of surface treatments over the course of the use phase.

Traditional impregnated wood does not need any surface treatment for the purpose of durability, but surface treatment is many times done for decorative purposes. Durable wood like acetylated and furfuryl alcohol treated wood are surface treated in a lesser extent, something that can give an environmental benefit.

The report also clearly shows the significance of emissions to soil, air and water in the form of ecotoxicity and human toxicity. It is here, in particular, that many of the environmental gains offered by durable wood become apparent. Sintef Byggforsks comments below in chapter 4.2 in their report[75]:

"Focusing on greenhouse gas emissions and energy consumption can make other equally important environmental aspects of products and processes such as emission of harmful chemicals into the air, water and soil as well as the impact of these emissions on all living beings, less in prioritized. These are issues that traditionally belong to the core area of environmental consideration, but have, in relation to the construction sector and building materials, received less attention than energy use and greenhouse gas footprint".

One benefit that should be mentioned for wood-plastic composites in the use phase is that they do not require surface treatment.

Disposal/waste phase

The environmental aspects of the waste phase are primarily associated with the treatment of end-of-life wood due to the chemical substances in the wood. In addition, the possibility of recycling the materials is an important aspect.

Impregnated wood that only contains copper salts (since 2002) is not defined by the Swedish or Norwegian authorities as hazardous waste but has to be taken to a recycling centre[76] for incineration in furnaces with sufficient flue gas cleaning technology. Copper can act as a catalyst in the formation of dioxins and furans during incineration. It is therefore important that the plant which will be destroying the wood has optimised the process to prevent this happening. Ash with metal content must also be processed correctly. After wood impregnated with copper, chrome and arsenic was banned, theoretically the waste problem from pressure impregnated wood was reduced. Unfortunately, it is often not possible to tell the difference between Cu impregnated wood and other types that are hazardous waste, and therefore all types of pressure impregnated waste are generally treated as hazardous waste. This issue is also valid for modified wood. In Finland, copper impregnated wood is still treated as hazardous waste, and in Denmark it is collected and sent for incineration in Germany (it was previously sent to landfill).

The durable wood alternatives (thermally modified and chemically modified) have the advantage that they can be processed in the same way as ordinary

[75] Plesser, Thale Sofie Wester et al., Miljøanalyse av trefasader, SINTEF Byggforsk, ISBN 978-82-536-1339-0, 2013

[76] Norwegian Environment Agency: www.miljodirektoratet.no (March 2014)

untreated wood and can be recycled into new products or sent for energy recovery.

Figure 2 Qualitative MECO analysis of durable wood and wood plastic composites (WPC)

Type of durable wood (DW)*	Raw material extraction	Production	Use	Waste	LCA (total)
* CM = Chemically Modified with furfuryl alcohol (FA), acetylation, silicon treatment and linseed impregnation (Royal Træ), TW = ThermoWood, Thermally modified wood, IW = Impregnated Wood (copper impregnation), SW=supercritical CO_2 impregnation with biocides.					
Materials	CM, TW, SW and IW = pine/spruce/maple/ashes Felling, debarking, sawing, drying, processing.	CM, IW =various chemicals/heavy metals	Surface treatment in use phase can have major impact. Fuel for transport of wood from forest to sawmill and then to manufacturer.	End-of-life DW can be incinerated or have material recovered. In practice, most DW sent to the recycling centres is incinerated.	Materials based on solid wood have a low footprint, See point on climate.
Energy MJ/m³** ** The figures are generally highly uncertain, and many factors cause a major bias. The choice of energy mix in the electricity supply, for example, will be a decisive factor for CO_2 emissions.	Raw material extraction – solid wood[77] (transport +): approx. 200 MJ/m³ Drying of solid wood[78],[79],[80],[81],[82]: approx. 1100 -1500 MJ/m³ CM, WPC, SW, IW: Raw material extraction – chemicals:	CM: FA = approx. 2500-300 MJ/m³ depending on wood type[85], gas (propane) accounts for almost 90% and electricity just over 10%. TW[86],[87] = approx. 2000 - 2500 MJ/m³ for all production and transport. Gas (LPG) accounts for 80% and electricity 20% in production. It is assumed that drying is included in the figure, and	Indications are that for solid wood products use and waste may account for just over 10% of the life cycle. Surface treatment and other maintenance is not normally included in the LCA, and may be significant over the lifetime of the product, depending on the quantity of the chemical	Energy from incineration or energy saved in production through recycling. In general, conventional wood and durable wood can be recycled, and this has a positive effect on the life cycle, but in practice durable wood is often processed as specialist waste.	For solid wood products, energy use relates mainly to drying and processing the wood. Energy consumption is approx. 2000 MJ/m³ over the life cycle. For Norwegian exterior cladding surface treated with water-based paint, energy consumption over the life cycle is approx. 6000 MJ/m³.

[77] http://www.klimatre.no/uploads/KlimaTre/Presentasjoner/101111%20Fagdag%20biprodukter/101111%20Henning%20Horn.pdf
[78] Silje Wærp et al., Livsløpsanalyser av norske treprodukter, MIKADO, SINTEF Byggforsk, 2009. Norway.
[79] Jungmeier, G. et al, Allocation in Multi Product Systems – Recommendations for LCA of Wood-based Products
[80] Andersson, B-I, (1996) Environmental declaration for sawn timber, Trätek.
[81] Jarnehammar, A. (2000): LCA for multi-layer parquet flooring in Life Sys Wood. Trätek.
[82] Adebahr, 1995, Energy consumption for roof building related to 1 m³ structural timber
[85] Correspondence with manufacturer. March 2024.
[86] Executive summary – ThermoWood: Life cycle assessment (LCA) of Finnish thermally modified wood cladding, Finnish ThermoWood Association, Publishing House Koivuniemi Ltd., Finland. 2008.
[87] Candelier K. and Dibdiakova J.: A review on life cycle assessments of thermally modified wood, published online August 14, 2020 (https://doi.org/10.1515/hf-2020-0102)

Type of durable wood (DW)*	Raw material extraction	Production	Use	Waste	LCA (total)
* CM = Chemically Modified with furfuryl alcohol (FA), acetylation, silicon treatment and linseed impregnation (Royal Træ), TW = ThermoWood, Thermally modified wood, IW = Impregnated Wood (copper impregnation), SW=supercritical CO_2 impregnation with biocides.					
	FA[83],[84]= 661 MJ/m^3 IW = 255-400 MJ/m^3	that energy for drying amounts to approx. 1500 MJ/m^3 of the total. SW = approx. 900 MJ/m^3 [88] IV = approx. 400 - 600 MJ/m^3 (Figures uncertain). Thermally modified wood with linseed oil = approx. 500 MJ/m^3 [89] Royal impregnated wood = approx. 2200 MJ/m^3 [90]	product and frequency of use. Must be assessed separately. The MIKADO study indicates that where water-based paints are applied to exterior cladding, the use phase may account for 67% of energy consumption.	According to the manufacturers, WPC can be recycled into new composite, but this has not been documented.	Chemical modification has relatively high energy consumption. Wood-plastic composite has high energy consumption, but if hollow boards are used, the impact will be almost halved if the functional unit for energy is set per kg of product.
Climate** **The figures are generally highly uncertain, and many factors cause a major bias. The choice of energy mix in the electricity supply, for example, will be a decisive factor for CO_2 emissions.	CM: Transport of wood (0.06) + chemicals FA (0.07) + production of FA and auxiliary chemicals (0.22) = Total 0.36 kg CO_{2eq}/ kg	The energy sources in production account for the vast majority of the climate impact. It is still common in the Nordic region to use propane/natural gas alongside electricity. There is potential to	Surface treatment and other maintenance is not normally included in the LCA, and may be significant over the lifetime of the product, depending on the quantity of the chemical	In general, conventional wood and durable wood can be recycled, and this has a positive effect on the life cycle, but in practice durable wood is often processed as specialist waste.	CM (FA)= 0.5-0.7 kg CO_{2eq}/kg CM (Ac)[91],[92] = 0.4-1.1 kg CO_{2eq}/kg

[83] Christian Rostock, Nicole Lambert. Carbon footprints of Ipê vs. Kebony Southern yellowpine – A comparative study. Published: Oslo, NORWAY /September 2010. Bergfald Miljørådgivere, Kongens gate 3 NO-0153 Oslo.
[84] Christian Rostock, Nicole Lambert. Carbon footprints of Burmese teak versus Kebony Maple – A comparative study Published: Oslo, NORWAY/April 2010. Bergfald & Co as, Kongens gate 3 0153 Oslo, NORWAY.
[88] EPD (https://www.superwood.dk/app/uploads/2022/09/NEPD-3703-2649_Exterior-cladding-of-Superwood-Fully-impregnated-.pdf) and dialog with manufacturer. April 2014 and march 2024.
[89] Correspondence with manufacturer. April 2014.
[90] Correspondence with manufacturer. April 2014.
[91] Vogtländer, J.G. Life Cycle Assessment of Accoya, Final 21 March 2010.
[92] https://www.accoya.com/app/uploads/2022/05/Environmental-Product-Declaration-Accoya-wood-EN-15804-A2.pdf, visited March 2024

Type of durable wood (DW)*	Raw material extraction	Production	Use	Waste	LCA (total)
* CM = Chemically Modified with furfuryl alcohol (FA), acetylation, silicon treatment and linseed impregnation (Royal Træ), TW = ThermoWood, Thermally modified wood, IW = Impregnated Wood (copper impregnation), SW=supercritical CO_2 impregnation with biocides.					
		switch to bio-based energy sources.	product and frequency of use. Must be assessed separately. Surface treatment with a stain, decking stain or paint increases the climate impact by a factor of 10, 5 and 4 respectively (see figure 4, section 4).	.	SW[93] = IV = ± 0.05 kg CO_{2eq}/kg
Chemicals and emissions	Chemical raw material extraction and associated emissions. See climate impact in row above.	Biocide, furfuryl, acetylation, silicon treatment and other additives.	Leaching of chemicals from impregnated wood in particular. Stain and paint in the use phase. Emissions of greenhouse gases and particulates.	Leaching of chemicals.	
Other	Sustainable forestry, biodiversity.	Working environment. Closed-loop process.	Ease of cleaning has impact on quality.		

[93] EPD (https://www.superwood.dk/app/uploads/2022/09/NEPD-3703-2649_Exterior-cladding-of-Superwood-Fully-impregnated-.pdf)

Appendix 3 Chemicals used in production of durable wood

To be used in conjunction with an application for a licence for the Nordic Swan Ecolabel of durable wood.

The declaration is made by the chemical manufacturer or supplier based on the best of their knowledge at the given time and available knowledge on the chemical product with reservations for new advances/knowledge. Should such new knowledge arise, the undersigned is obliged to submit an updated declaration to Nordic Ecolabelling.

This declaration shall be filled for chemical products used in the production of the Nordic Swan Ecolabelled durable wood, such as impregnation fluids.

Name of chemical product:

Function of the chemical product:

Ingoing substances in the raw material/ingredient (chemical name, CAS-number, amount in weight-%):

The requirements in the criteria document and accompanying appendices apply to all ingoing substances in the Nordic Swan Ecolabelled product. Impurities are not regarded as ingoing substances and are exempt from the requirements. Ingoing substances and impurities are defined below, unless stated otherwise in the requirements.

Ingoing substances*: all substances in the chemical product regardless of amount, including additives (e.g., preservatives and stabilisers) from the raw*

materials. Substances known to be released from ingoing substances (e.g., formaldehyde, arylamine, in situ-generated preservatives) are also regarded as ingoing substances.

***Impurities**: Residues from production, incl. raw material production, which remain in the chemical product at concentrations below 1000 ppm (0.1000% by weight).*

Examples of impurities are residues of reagents include residues of monomers, catalysts, by-products, scavengers (i.e. chemicals that are used to eliminate/minimise undesirable substances), detergents for production equipment and carry-over from other or previous production lines.

O5 Classification of chemical products used in the production	**YES**	**NO**
Does the chemical product contain substances classified with any of the hazard phrases below? Including all combinations of stated exposure routes and stated specific effect. For example, H350 also covers classification H350i.		
H400 – Toxic to the environment Aquatic Acute 1		
H410 – Toxic to the environment Aquatic Chronic 1		
H411 – Toxic to the environment Aquatic Chronic 2		
H420 – Toxic to the environment Ozone		
H300 – Acute toxicity; Acute Tox 1 or 2		
H310 – Acute toxicity; Acute Tox 1 or 2		
H330 – Acute toxicity; Acute Tox 1 or 2		
H301 – Acute toxicity; Acute Tox 3		
H311 – Acute toxicity; Acute Tox 3		
H331 – Acute toxicity; Acute Tox 3		
H370 – Specific organic toxicity, STOT SE 1		
H372 – Specific organic toxicity, STOT RE 1		
H350 – Carcinogenic, Carc. 1A or 1B		
H351 – Carcinogenic, Carc. 2		
H340 – Germ cell mutagenic, Mut. 1A and 1B		
H341 – Germ cell mutagenic, Mut. 2		
H360 – Reproductive toxicity, Repr. 1A or1B		
H361 – Reproductive toxicity, Repr 2		
H362 – Reproductive toxicity, Lact.		
The following are exempted from the requirement: - H361, H400, H410, H411 and H420 due to the presence of biocides. - H351 due to the presence of furfuryl alcohol (CAS 98-00-0) - H372 and H373 due to the presence of maleic acid anhydride (CAS 108-31-6). - H330 due to the presence of acetic acid anhydride (CAS 108-24-7). - UV curing products are exempted from classification H411 under the following conditions: There must be a controlled closed process where no discharge to recipient takes place. Spillage and general waste (e.g., cleaning residue) must be collected in containers approved for hazardous waste and handled by a waste contractor.		

If yes, please state the CAS No., chemical name, and level (in ppm, % by weight or mg/kg). Also state whether the substance is contained in the form of an impurity or an added substance or if the above-mentioned exceptions apply.

O6 Classification of ingoing substances	**YES**	**NO**
Does the chemical product contain substances classified with any of the hazard phrases below? Including all combinations of stated exposure routes and stated specific effect. For example, H350 also covers classification H350i.		
H350 – Carcinogenic, Car 1A and 1B		
H351 – Carcinogenic, Carc. 2		
H340 – Germ cell mutagenic, Mut. 1A or 1B		
H341 – Germ cell mutagenic, Mut. 2		
H360 – Reproductive toxicity, Repr. 1A and 1B		
H361 – Reproductive toxicity, Repr. 2		
H362 – Reproductive toxicity, Lact.		
EUH380 - Endocrine disruption for human health, ED HH1		
EUH381 - Endocrine disruption for human health, ED HH2		
EUH431 - Endocrine disruption for the environment, ED ENV 1		
EUH431 - Endocrine disruption for the environment, ED ENV 2		
EUH440 - Persistent, Bioaccumulative and Toxic properties, PTB		
EUH411 - Very Persistent, Very Bioaccumulative properties, vPvB		
EUH450 - Persistent, Mobile and Toxic properties, PMT		
EUH451 - Very Persistent, Very Mobile properties, vPvM		
The following are exempted from the requirement: - furfuryl alcohol (CAS 98-00-0) classified as Carc 2, H351. - biocides classificed as Repr. 2, H361.		

If yes, please state the CAS No., chemical name, and level (in ppm, % by weight or mg/kg). Also state whether the substance is contained in the form of an impurity or an added substance or if the above-mentioned exceptions apply.

O7 Prohobited substances	**YES**	**NO**
Does the chemical product contain any of the following substance groups?		
Substances on the Candidate List The Candidate List can be found on the ECHA website: http://echa.europa.eu/candidate-list-table		
Substances that have been judged in the EU to be PBT (Persistent, Bioaccumulative and Toxic) or vPvB (very Persistent and very Bioaccumulative) PBT and vPvB in accordance with the criteria in Annex XIII of REACH		
Halogenated organic compounds - Exemptions applies to preservatives in O9. However, not PFASs.		
Per- and polyfluoroalkyl substances (PFASs), e.g., PFOA and PFOS		

O7 Prohobited substances	YES	NO
Butylhydroxytoluene (BHT, CAS No. 128-37-0)		
Aziridine and polyazidirines		
Bisphenols and bisphenol derivatives - Bisphenol A used in the production of epoxy acrylate is not covered by the requirement. - Assessment of regulatory needs: Bisphenols. ECHA- 16 December 2021: Section 2.1: Bisphenols for which further EU RRM is proposed – restriction https://echa. Europa.eu/documents/10162/c2a8b29d-0e2d-7df8-dac1-2433e2477b02		
APEO (alkylphenol ethoxylates) and APD (alkylphenol derivatives/alkylphenols) Alkylphenol derivatives are defined as substances that release alkyphenols when they break down.		
Phthalates - Phthalates are esters of 1,2-benzenedicarboxylic acid (orthophthalic acid).		
Pigments and dditives based on lead, tin, cadmium, chromium VI and mercury, and their compounds.		
Endocrine disruptors: Substances on the EU member state initiative “Endocrine Disruptor Lists”, List I, List II and List III, see following links: List I: https://edlists.org/the-ed-lists/list-i-substances-identified-as-endocrine-disruptors-by-the-eu List II: https://edlists.org/the-ed-lists/list-ii-substances-under-eu-investigation-endocrine-disruption List III: https://edlists.org/the-ed-lists/list-iii-substances-identified-as-endocrine-disruptors-by-participating-national-authorities Substances that are transferred to one of the corresponding sub-lists “Substances no longer on list” and that no longer feature on Lists I–III are not prohibited. However, this does not apply to the substances listed in Sub-List II that were evaluated on the basis of regulations or directives that do not have provisions for identifying endocrine disruptors (e.g., the Cosmetics Regulation). These substances may have endocrine disrupting properties. Nordic Ecolabelling will assess these substances on a case-by-case basis, based on the background information provided in sub-List II.		

If yes, please state the CAS No., chemical name, and level (in ppm, % by weight or mg/kg). Also state whether the substance is contained in the form of an impurity or an added substance or if the above-mentioned exceptions apply.

O8 Nanomaterials	YES	NO
Does the chemical product contain nanomaterials/-particles? Nanomaterials/-particles are defined according to the EU Commission Recommendation on the Definition of Nanomaterial (2022/C 229/01): ‘Nanomaterial' means a natural, incidental, or manufactured material consisting of solid particles that are present, either on their own or as identifiable constituent particles in aggregates or agglomerates, and where 50% or more of these particles in the number-based size distribution fulfil at least one of the following conditions: a) one or more external dimensions of the particle are in the size range 1 nm to 100 nm; b) the particle has an elongated shape, such as a rod, fibre or tube, where two external dimensions are smaller than 1 nm and the other dimension is larger than 100 nm; c) the particle has a plate-like shape, where one external dimension is smaller than 1 nm and the other dimensions are larger than 100 nm.		
The following are exempted from the requirement: - Pigments. This exemption does not include pigments added for purposes other than colouring. - Naturally occurring inorganic fillers in accordance with annex V point 7 in REACH. - Synthetic amorphous silica (SAS). This applies to non-modified synthetic amorphous silica and surface-treated pyrogenic silica, as long as the silica particles form aggregates or agglomerates in the end product. For surface treated nanoparticles, the		

O8 Nanomaterials	YES	NO
surface treatment must meet the chemical requirements in O31 (Classification of ingoing substances) and O32 (Prohibited substances). - Polymer dispersions		

If yes, please state the CAS No., chemical name, and level (in ppm, % by weight or mg/kg). Also state whether the substance is contained in the form of an impurity or an added substance or if the above-mentioned exceptions apply.

O9 Preservatives		YES	NO
Please state if content of preservatives exceeds the limit values below			
Biocides (PT-8)	**Limit value**		
.	The amount of biocides/combination of biocides (PT-8) in the final wood product must not exceed 300 ppm or 120 g/m^3 wood		
Preservative (PT-6)	**Limit value**		
Isothiazolinone compounds in total (dithio-2,2'-bis-benzmethylamide (DTBMA) is to be included in the total amount of isothiazolinones)	500 ppm (0.05% w/w)		
BIT (CAS no. 2634-33-5)	500 ppm (0.05% w/w)		
CIT/MIT (CAS no. 55965-84-9)	15 ppm (0.0015% w/w)		
MIT (CAS no. 2682-20-4)	15 ppm (0.0015% w/w)		

If yes, please state the CAS No., chemical name, and level (in ppm, % by weight or mg/kg). Also state whether the substance is contained in the form of an impurity or an added substance or if the above-mentioned exceptions apply.

O10 Volatile organic compounds	YES	NO
Does the chemical product contain more that 3% VOC, including VAH, by weight?		
Any solvents that polymerise in the wood may be used if the degree of polymerisation is at least 95%.		

If yes, please state the CAS No., chemical name, and level (in ppm, % by weight or mg/kg). Also state whether the substance is contained in the form of an impurity or an added substance or if the above-mentioned exceptions apply.

Signature of chemical product manufacturer

Date	Company
Signature by contact person	
Name of contact person	Phone