ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	Sonae Arauco, S.A.
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-SON-20230518-IBA1-EN
Issue date	10.01.2024
Valid to	09.01.2029

Medium density fibreboard (MDF), uncoated

Sonae Arauco, S.A.

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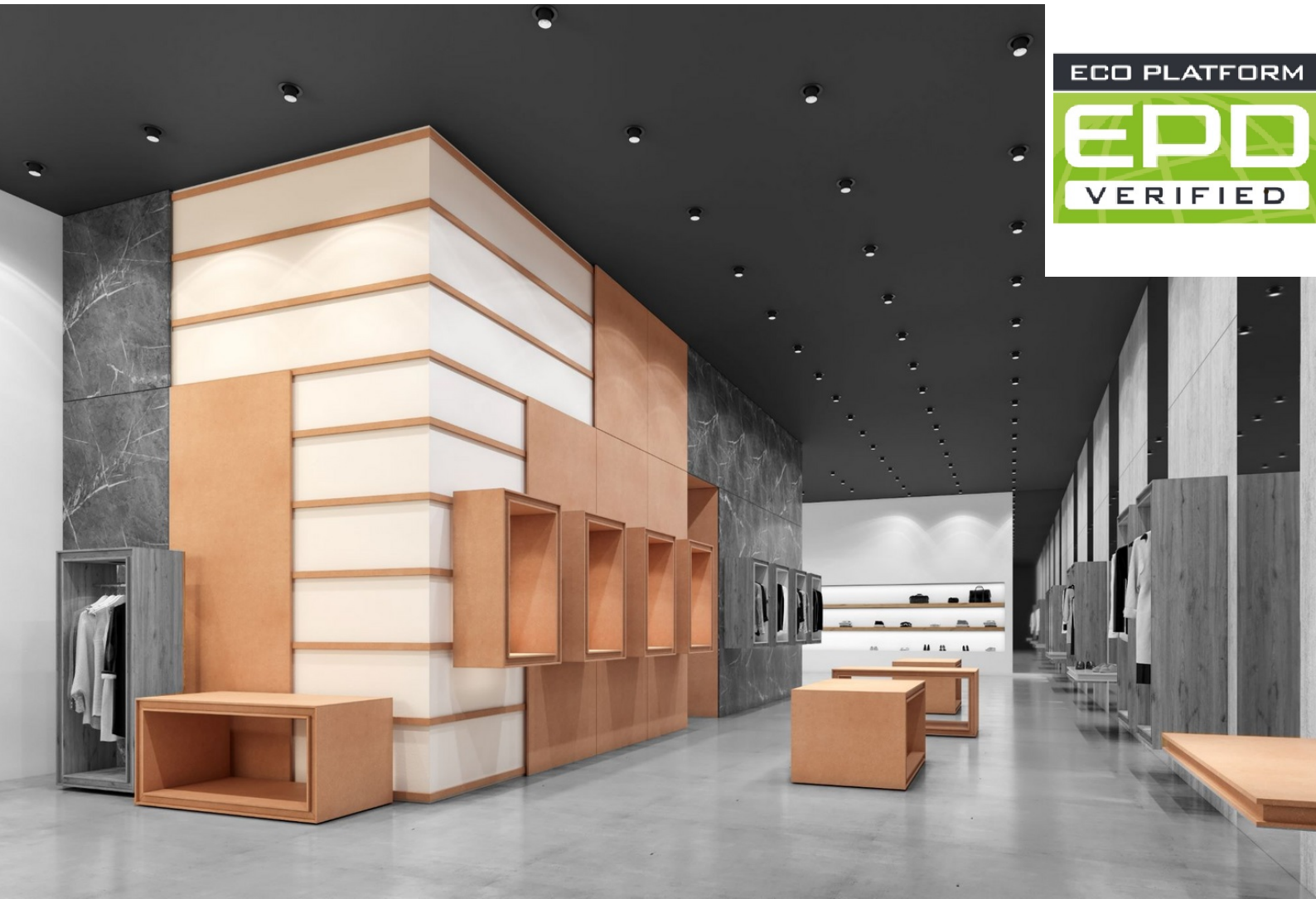


1. General Information

Sonae Arauco, S.A.

Programme holder

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number

EPD-SON-20230518-IBA1-EN

This declaration is based on the product category rules:

Wood-based panels, 01.08.2021
(PCR checked and approved by the SVR)

Issue date

10.01.2024

Valid to

09.01.2029

Dipl.-Ing. Hans Peters
(Chairman of Institut Bauen und Umwelt e.V.)

Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

Medium density fibreboard (MDF), uncoated

Owner of the declaration

Sonae Arauco, S.A.
Calle Ulises 26-18
28043 Madrid
Spain

Declared product / declared unit

Medium density fiberboard, uncoated, per m^3

Scope:

This document refers to MDF manufactured in the following plants of the Sonae Arauco Group:

- Sonae Arauco Beeskow GmbH, Radinkendorfer Strasse 71, 15848 Beeskow, Germany
- Soena Arauco Deutschland AG, Grecostr. 1, 49716 Meppen, Germany
- Sonae Arauco Portugal, SA, Água Levada Apartado 168, 3534-956 Mangualde, Portugal
- Sonae Arauco South Africa (Pty) Ltd, Heidelberg Road, Rocky Drift, White River, Republic of South Africa
- Sonae Arauco, S.A., Calle de Los Titulos, 29, 47009 Valladolid, Spain

The production volume of these plants covers 100 % of the total production of MDF by Sonae Arauco group.
The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard EN 15804 serves as the core PCR			
Independent verification of the declaration and data according to ISO 14025:2011			
☐	internally	☒	externally

Mr Olivier Muller,
(Independent verifier)

2. Product

2.1 Product description/Product definition

Medium density fibreboard (MDF) is a panel-shaped wood-based material in accordance with *EN 316* that is manufactured in a dry process by means of compression under heat of wood fibres with adhesive. Uncoated MDF boards can be unsanded, sanded and/or profiled.
Due to their various densities and adhesive systems, they can display a variety of material properties and qualities like moisture resistance, fire retardant, load-bearing or others.
For the placing on the market in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland), *Regulation (EU) 305/2011* applies. When applicable, the products need a Declaration of Performance (DOP) taking into consideration *EN 13986:2004+A1:2015 Wood-based panels for use in construction - Characteristics, evaluation of conformity and marking* and the CE-marking.
For the application and use the respective national provisions apply.

2.2 Application

The area of application for uncoated MDF primarily involves decorative interior furnishings and furniture construction but also interior construction such as trade fair stands and shop design.
Apart from an extensive basic range, special MDF variants are also available, e.g. fire-retardant MDF as well as MDF with increased resistance to moisture.

2.3 Technical Data

Due to the large variability of product properties and quality grades, the table below only shows the range of technical characteristics for standard boards.

Special boards as well as customized products have different technical characteristics from the ones shown.

Name	Value	Unit
Gross density according to EN 323	680 - 860	kg/m^3
Bending strength (longitudinal) according to EN 310	17 - 23	N/mm^2
E-module (longitudinal) according to EN 310	1900 - 2700	N/mm^2
Tensile strength rectangular according to EN 319	0.5 - 0.9	N/mm^2
Thickness swelling according to EN 317	8 - 45	%
Moisture content according to EN 322	5 - 9	

Performance data of the product in accordance with the declaration of performance with respect to its essential characteristics according to:
EN 316, Wood fibre boards
EN 622-1, Fibreboards
EN 622-5, Fibreboards
EN 13986 Wood-based panels for use in construction
ISO 16895-1, Wood-based panels
ISO 16895-2, Wood-based panels

Declaration of Performance (DoP)

For more details on technical information, please see the respective products' Declaration of Performance (DoP) available at:
www.sonaearauco.com

2.4 Delivery status

MDF ranging in thicknesses from 2 to 45 mm can be purchased as uncoated boards. The boards are offered in standard formats. Fixed formats are also available, and selected formats are offered with a tongue and groove profile.

The following values include minimum and maximum dimensions for the boards supplied worldwide. Some of the combinations for sizes may not be available in all markets.

Thickness 2 - 45 mm
Width 500 - 2850 mm
Length 1025 - 6250 mm

For updated information on available dimensions, please refer to:
www.sonaearauco.com

2.5 Base materials/Ancillary materials

Raw MDF bonded with urea-formaldehyde/melamine-urea-formaldehyde (UF/MUF) consist of (dimensions as % by mass):

- Wood chips: approx. 80 %
- Water: 4 – 11%
- UF glue / MUF glue (urea resin, melamine urea resin): 9 % – 25%
- Paraffin wax emulsion: 0.5 % – 3 %

Raw MDF bonded with polymeric diphenylmethane diiscocyanate (PMDI) consist of (dimensions as % by mass):

- Wood chips: approx. 90 %
- Water: 4 – 8 %
- PMDI glue (polymer 4.4' diphenyl methane diisocyanate): 3.5%
- Paraffin wax emulsion: 0.5 – 3%

Wood from indigenous, largely regional forest plantations is used for manufacturing raw MDF. This wood is typically procured from forests within an average radius of 250 km of the plants' locations.
Furthermore, sawmill residues are also used as raw materials in the production of MDF.

The entire range can be made available on request as FSC® certified or PEFC (program for the endorsement of forest certification) certified products.
Additionally, the complete range includes CE-marked products.

This product contains substances listed in the *ECHA candidate list* (date: 08.06.2021) exceeding 0.1 percentage by mass:
· no

This product contains other carcinogenic, mutagenic, reprotoxic (CMR) substances in categories 1A or 1B which are not on the *ECHA candidate list*, exceeding 0.1 percentage by mass:
· no

Biocide products were added to this construction product or it has been treated with biocide products (this then concerns a treated product as defined by the (EU) *Regulation on biocidal products No. 528/2012*:
· no

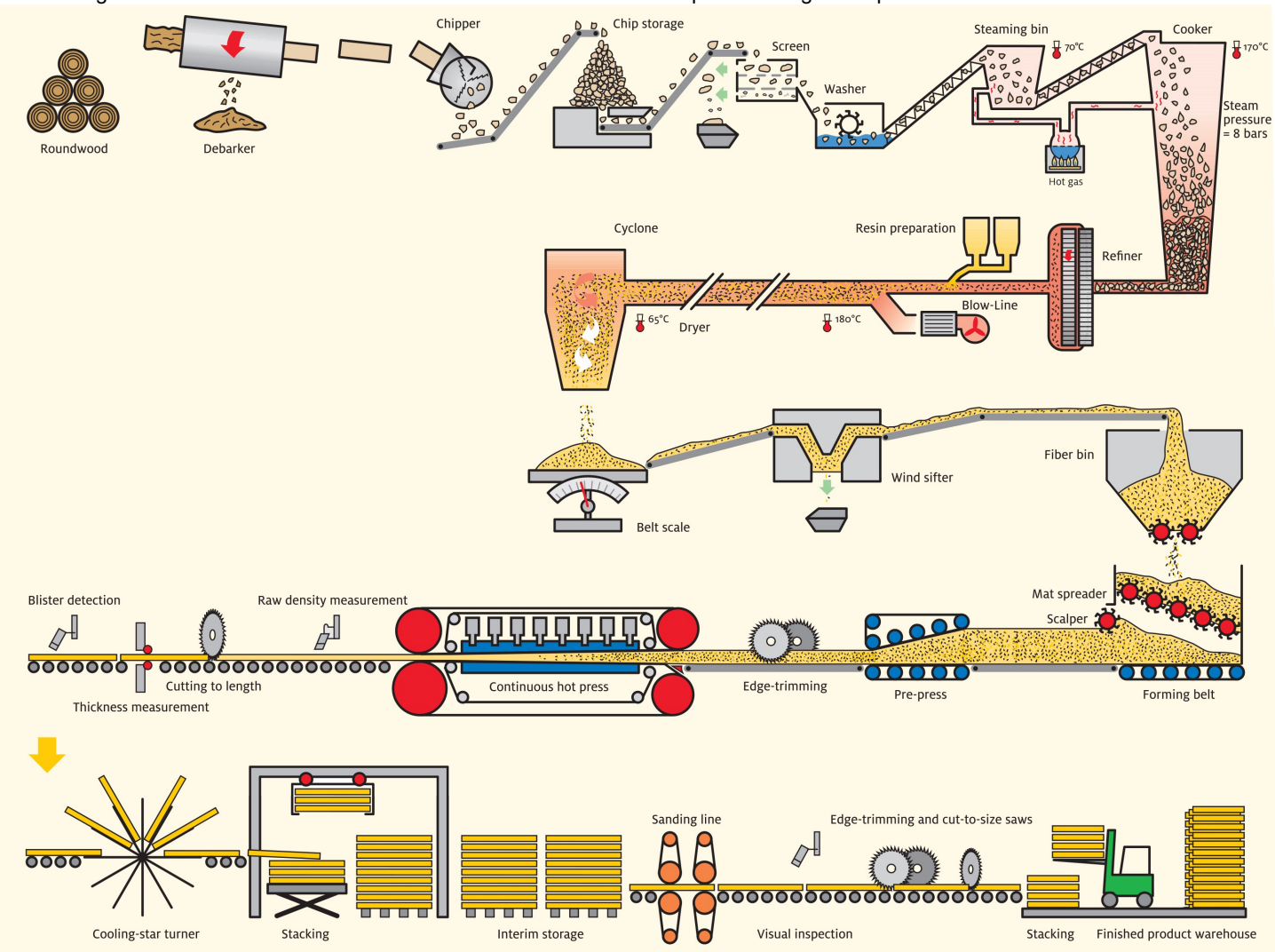
2.6 Manufacture

The manufacturing of MDF comprises the following steps:

1. Debarking the logs
2. Chipping the wood to chips of approx. 3 x 3 cm in size
3. Boiling the chips

4. Defibring in the refiner
5. Glueing the fibres with resin
6. Drying the fibres to a residual moisture content
7. Scattering the glued fibre on a forming belt
8. Pressing the fibre mat in a continuous hot press under high pressure
9. Cutting the continuous mat into raw board formats
10. Cooling the raw boards in star coolers
11. Stacking
12. Sanding the top or underside after the air-conditioning phase

Leftovers incurred during board manufacture are typically redirected to be used as fuel to supply the energy needs of the manufacturing process on site.
A process diagram is presented below.



The production sites are certified according to the following standards:

- *ISO 9001*
- *ISO 45001*
- *ISO 50001:2011 (European sites).*

2.7 Environment and health during manufacturing

Health protection: Due to the manufacturing conditions, no special health protection measures over and beyond the regulatory guidelines are required. The reference occupational exposure limit values are complied with.

Emissions into air: Waste air generated during production is cleaned in accordance with regulatory requirements. Emissions have to comply with the values specified by the operation licenses of the different sites, specified according to national laws.

Emissions into water/soil: No normal process contamination of water or soil exists. Waste water generated in the process is treated onsite and/or directed into the municipal sewage system following pre-treatment. Sludges generated within the water treatment can be used in agriculture as a fertiliser.

Noise: Noise surveys are required and are performed for each site according to respective national regulations. Noise-intensive plant areas such as chipping are encapsulated or protected appropriately by structural measures.

Whenever necessary (close to non-encapsulated areas), the use of ear protection is required (PPE, Personal Protective Equipment) within Sonae Arauco sites, as an additional safety measure.

The production sites are all *ISO 14001* certified.

2.8 Product processing/Installation

Sonae Arauco MDF can be sawn, milled, planed, sanded and drilled using standard machinery or (electric) power tools. Carbide-tipped tools should be given preference, especially on circular saws. Respiratory protection should be worn when using hand-held equipment without suction devices.

Please refer to the respective devices' datasheets for further processing recommendations.

2.9 Packaging

Sonae Arauco MDF is supplied on squared timber bound by plastic or metal bands and covered with corrugated cardboard and, on the bottom, with a cover board.

MDF and steel or PET packing bands for transport packaging can be sorted and directed to the recycling circuits. If re-use or recycling is impractical, the packaging should not be landfilled, but rather directed towards energy recovery.
Packaging disposal information is available at:
www.sonaearauco.com

2.10 Condition of use

The components making up uncoated MDF correspond with the base material compositions as outlined in Clause 2.6. During hot pressing, the binding agent is linked irreversibly by means of poly-condensation and firmly bonded with the wood. The binding agents are chemically and stably bound to the wood.

VOC emissions: Sonae Arauco MDF is labelled as class A+, A or B according to the French regulation on the labelling of emissions of volatile pollutants from construction and decoration products (with reference to the wall scenario, as a worst case).

Sonae Arauco MDF at an average density of 760 kg/m^3 stores 1140 kg CO_2 equivalent over its service life.

2.11 Environment and health during use

Environmental protection: According to current information, water, air and soil are not exposed to any dangers when the respective products outlined above are used as designated.

Health protection: According to current information, no damage to or impairment of health can be anticipated when MDF is used as designated.

With the exception of low volumes of formaldehyde for UF/MUF-bonded MDF, VOC emissions from products are negligible, and are natural wood ingredients.

2.12 Reference service life

Due to the wide range of applications of Sonae Arauco MDF, no reference service life is declared.
Description of the influences on the ageing of the product when applied in accordance with the rules of technology.

2.13 Extraordinary effects

Fire
Fire retardant classification is done according to *EN 13986*. Fire retardant classes are defined in accordance with *EN 13501-1*. The fire classification of MDF with a raw density of ≥ 600 kg/m³ and a thickness ≥ 9 mm is D-s2, d0. The boards with lower density or thickness are in class E.
Fire retardant boards are classified as B-s1, d0 and B-s2, d0.

Fire safety (for standard MDF boards)

Name	Value
Building material class	D/E
Smoke gas development	S2
Burning droplets	d0

Water
No ingredients are washed out which could be hazardous to water. MDF is not resistant to permanent exposure to water.

Mechanical destruction
Mechanical destruction of MDF boards can result in sharp edges on the broken panel edges (risk of injury).

2.14 Re-use phase

Recycling: Sonae Arauco MDF from construction can be collected separately and utilised in the manufacture of MDF or other types of wood-based boards. This is based on the condition that the wooden boards are not fully glued.

Energy recovery: Due to the high heating value of approx. 16.5 MJ/kg at 20 % moisture content assumed for post-consumer boards, MDF can be used for energy recovery and the generation of heat and electricity (e.g. in CHP plants), following the cascading principle for wood.

2.15 Disposal

Sonae Arauco MDF leftovers and residual materials incurred as a result of demolition measures on the building sites should be primarily directed towards material recycling. If this is not possible, they must be directed toward energy recovery instead of landfilling.

Waste code according to the *Regulation on the European Waste List*: 17 02 01

2.16 Further information

Further information such as technical datasheets, etc. can be downloaded under:

www.sonaearauco.com

3. LCA: Calculation rules

3.1 Declared Unit

The declared unit for the LCA is 1 m^3 of average uncoated Sonae Arauco medium density fibreboard.

Information on the declared unit

Name	Value	Unit
Declared unit	1	m^3
Mass reference	760	kg/m^3

The weighted average was calculated based on production volumes from the plants in all countries where Sonae Arauco was operating in 2021 (some plants 2020).

3.2 System boundary

Type of the EPD: cradle-to-gate with modules C1 to C4 and module D (A1 – A3, C and D)

Modules A1 – A3 of the production stage cover the manufacturing of the products, including raw material extraction and processing, energy generation, the production of ancillary products and packaging materials, transport, as well as all waste treatment processes. Eventual benefits of recycling or energy recovery are neglected.
The resource aspects of wood were inventoried via material inherent properties such as resource extraction of CO_2 from the atmosphere and the lower heating value as the use of renewable energy. Material inherent properties are subject to co-product allocation as ruled in *EN 15804*.

Module A4 covers the transport of the product from the production site to the construction site by a lorry over a default distance of 460 km.

Module A5 covers the transport of the packaging material from

the construction site and its disposal. Default end-of-waste states for the packaging materials from the packed products at the construction site are defined in analogy for wastes occurring in modules A1 – A3. Eventual further inputs for the installation of the products are not considered due to the broad applicability of the assessed products.
The substituted primary material from the net amount of recycled material and from recovered energy exported from the product system in Module A5 is declared in Module D.

Module C1 manual deconstruction is assumed. The declared values are thus 0.

Module C2 includes the transport of the de-constructed product to a recycling centre by over 50 km.

Module C3 covers the preparation of the post-consumer board to become a secondary fuel; the end-of-waste status for recycled wood-based boards is defined as the point where they have been sorted and chipped, ready to be used as secondary fuels.
In line with *EN 16485*, the export of the biogenic carbon stored in the board, expressed in CO_2-equivalent is also reported in module C3.

Module C4 is not relevant for the assumed end-of-life scenario. The declared values are thus 0.

Module D compiles all the benefits and burdens associated with the secondary fuels, secondary materials and exported energy leaving the production system in the modules A5 and C3. Therefore, module D covers the avoided burdens from recycling and from energy recovered from the waste treatment in module A5 as well as the transport of the obsolete boards to a biomass combustion plant, the combustion process itself and the loads and benefits of the substitution of fossil fuels and/or electricity. Substitution effects in module D are always calculated for the net amount of secondary material or secondary fuel of the product system in line with *EN 16485*.

3.3 Estimates and assumptions

For the quantification of the net flows of recycled wood (input of post-consumer wood used as a fuel minus post-consumer wood exiting the product system into module D for energy recovery), it was assumed that all inputs of post-consumer wood are used as a fuel; inputs of post-consumer wood beyond the need of wood fuel used in production was considered to be used as a recycled material input.
Beyond that, no relevant estimates or assumptions had to be made beyond the information provided in this EPD.

3.4 Cut-off criteria

All data were taken into account that resulted from the data collection procedure in the plants, e.g. related to fuels, raw material input, use of ancillary materials, waste flows, emissions into the air, water use, waste water, transport means and transport distances, etc..
Expenses for the general management, research & development, administration and marketing – if known – were not taken into account.
The production of eventual packaging of ancillary material or other inputs used during production (and some of the reported wastes) were generally neglected; in most cases reusable bins or containers are used. In addition, the amounts of reported (unspecific) wastes are so small that their production can be considered not relevant for the life cycle assessment. Additional plant specific information can be found in the respective chapters for each plant.
Beyond that some plants reported ancillary materials that were cut off due to very small amounts and as inputs not directly related to production processes but to the maintenance of infrastructure, e.g. acetylene and oxygen for soldering, etc. With this approach mass and energy flows below 1 percent of total mass and energy flows caused by the declared products were included in the assessment.
Beyond that, no material or energy flows were neglected that would have been known by the persons responsible for the project and that could have been expected to contribute significantly to the environmental indicators declared. It can thus be assumed that the total contribution of the neglected processes is not higher than 5 % of the declared impact categories.

3.5 Background data

Datasets from *ecoinvent v3.8* (cut-off by classification) were used as background data exclusively. Therefore, the latest update of the background data took place in 2021.

3.6 Data quality

The requirements on the data quality and the background data correspond to the provisions in *EN 15804*:

- Data are as current as possible. Datasets used for calculations were updated within the last 10 years for generic data and within the last 5 years for producer-specific data;
- Datasets are based on 1-year averaged data as a general rule;
- The time period over which inputs to and outputs from the system are accounted for is 100 years from the year for which the data set is deemed representative;
- The technological coverage reflects the physical reality of the declared products;
- The background datasets comply with the quality guidelines of *ecoinvent v.3*; deviations from the methodological prescriptions of EN *15804* cannot be excluded but are considered not significant in the context of this EPD.

3.7 Period under review

The company data gathered for this EPD represents the year 2020/21.

3.8 Geographic Representativeness

Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: Europe

3.9 Allocation

The inventories for the wood inputs were taken from *ecoinvent v3.8*. In ecoinvent, the forestry processes are modelled on a mass-basis and sawmilling processes are allocated based on revenues of the different co-products of a joint co-production process.
Waste generated by edge-trimming and cut-size saws is used internally for energy generation. Some plants sell minor quantities of bark or electricity from co-generation. No impacts are allocated to these outputs.
Biogenic carbon (content) is modelled manually thus reflects the real physical flows; this is not the case for primary energy, implying that the content of primary energy in products and packaging is allocated as the main inputs/outputs of a unit process.
In the case of sites where several products were produced and no product-specific information was available, all inputs and outputs related to production processes were attributed based on a total mass of production; packaging material was attributed based on a total volume of the production. Inputs and outputs for coating processes that could not be separated from the data on plant level were conservatively attributed to the

production of MDF.
Post-consumer secondary wood is used as an input to produce particleboard; for this input as well as for the end-of-life scenario, the end-of-waste status was defined after the sorting and chipping of the wood-based board in line with *EN 16485* (see also clause 3.2). In analogy, MDF leaving the product system at the end-of-life is considered a secondary fuel; its combustion and the benefits of energy recovery are declared in module D.
Waste packaging in module A5 was considered not to reach the end-of-waste state as a fuel. Its incineration is reported in A5, the benefits of energy recovery in module D. The benefits of the recycling of minor amounts of packaging materials are disregarded.
No co-product allocation was made in the modelling of the foreground data of the life cycle assessment underlying this EPD.

3.10 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account.
ecoinvent v3.8 (cut-off by classification) has been used as the background database.

4. LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon
Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO_2.

Information on describing the biogenic carbon content at factory gate

Name	Value	Unit
Biogenic carbon content in product	311	kg C
Biogenic carbon in packaging	24,7	kg C

The following technical information is a basis for the declared modules or can be used for developing specific scenarios in the context of a building assessment if modules are not declared (MND).

Transport to the construction site (A4)
The product is transported from the production site to the construction site by a lorry (15 % emissions class EURO 5; 85 % emissions class EURO 6) over a default distance of 460 km.

Installation into the building (A5)
Eventual further inputs for the installation of the products are not considered due to the broad applicability of the assessed products.
An average transport distance of 30 km was assumed for packaging waste from the construction site to the recycling plant or to the municipal waste incineration plant. The municipal waste incineration plant is assumed to have an overall energy efficiency of 53 % related to the lower heating value of the waste input; 92 % of the recovered energy is heat, 8 % is electricity (according to specifications of MWI plants in *ecoinvent v3.8*).

Deconstruction (C1)
Manual deconstruction is assumed. The declared values are thus 0.

Transport to waste treatment (C2)
This module includes the transport of the de-constructed product to a recycling centre by a lorry (15 % emissions class EURO 5; 85 % emissions class EURO 6) by over 50 km.

Waste treatment (C3)
917 kg of uncoated MDF are chipped and exported from the product life cycle into module D, assuming a moisture content of 20 % and a lower heating value of 18.0 MJ/kg. The biogenic carbon stored in the product and the content of primary energy are exported from the product system as material inherent properties.

Disposal (C4)
This module is not relevant for the assumed end-of-life scenario. The declared values are thus 0.

Reuse, recycling, recovery potential (D)
According to default assumptions in other IBU EPDs, post-consumer wood is used as a secondary fuel for energy recovery in a biomass combustion plant with an overall energy efficiency of 93 % related to the lower heating value of the fuel input; 91 % of the recovered energy is heat, 9 % is electricity.

5. LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	X	X	MND	MND	MNR	MNR	MNR	MND	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: Medium density fibreboard (MDF), uncoated, per m³

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	-5.75E+02	5.84E+01	2.67E+01	0	8.3E+00	1.15E+03	0	-5.93E+02
GWP-fossil	kg CO_2 eq	5.87E+02	5.84E+01	2.02E+00	0	8.29E+00	7.45E+00	0	-5.93E+02
GWP-biogenic	kg CO_2 eq	-1.16E+03	0	2.47E+01	0	0	1.14E+03	0	0
GWP-luluc	kg CO_2 eq	1.62E+00	2.33E-02	1.76E-04	0	3.92E-03	1.71E-02	0	-2.96E-01
ODP	kg CFC11 eq	6.91E-05	1.35E-05	1.83E-07	0	1.87E-06	3.74E-07	0	-1.09E-04
AP	mol H^+ eq	3.95E+00	1.77E-01	9.24E-03	0	2.49E-02	3.98E-02	0	-8.59E-01
EP-freshwater	kg P eq	2.45E-02	4.15E-04	5.7E-06	0	6.77E-05	7.72E-04	0	-1.31E-02
EP-marine	kg N eq	7.25E-01	3.87E-02	4.11E-03	0	5.22E-03	5.4E-03	0	-9.52E-02
EP-terrestrial	mol N eq	9.56E+00	4.3E-01	4.62E-02	0	5.82E-02	6.17E-02	0	-1.05E+00
POCP	kg NMVOC eq	3.93E+00	1.56E-01	1.38E-02	0	2.11E-02	1.74E-02	0	-4.49E-01
ADPE	kg Sb eq	6.04E-03	2.06E-04	1.62E-06	0	3.8E-05	2.05E-05	0	-3.27E-04
ADPF	MJ	1.02E+04	8.85E+02	1.08E+01	0	1.24E+02	1.55E+02	0	-1.42E+04
WDP	m^3 world eq deprived	6.54E+02	2.69E+00	9.11E-02	0	4.12E-01	1.8E+00	0	-1.88E+01

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential)

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: Medium density fibreboard (MDF), uncoated, per m³

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PERE	MJ	3.3E+03	1.24E+01	3.25E+02	0	2.06E+00	2.7E+01	0	-4.67E+02
PERM	MJ	1.21E+04	0	-3.24E+02	0	0	-1.18E+04	0	0
PERT	MJ	1.54E+04	1.24E+01	1.69E-01	0	2.06E+00	-1.18E+04	0	-4.67E+02
PENRE	MJ	8.14E+03	8.86E+02	2.83E+01	0	1.24E+02	1.57E+02	0	-1.41E+04
PENRM	MJ	2.03E+03	0	-1.76E+01	0	0	-2.01E+03	0	0
PENRT	MJ	1.02E+04	8.86E+02	1.08E+01	0	1.24E+02	-1.85E+03	0	-1.41E+04
SM	kg	0	0	0	0	0	0	0	0
RSF	MJ	1.07E+03	0	0	0	0	0	0	1.05E+04
NRSF	MJ	0	0	0	0	0	0	0	2.01E+03
FW	m^3	1.58E+01	9.37E-02	9.23E-03	0	9.23E-03	9.48E-02	0	-1.17E+00

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: Medium density fibreboard (MDF), uncoated, per m³

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
HWD	kg	1.35E-02	2.31E-03	8.74E-06	0	3.33E-04	7.22E-05	0	-1.54E-02
NHWD	kg	1.19E+02	4.65E+01	2.59E-01	0	5.32E+00	1.03E+00	0	1.06E+01
RWD	kg	4.81E-02	1.28E-02	1.43E-04	0	1.78E-03	2.04E-03	0	-4.51E-02
CRU	kg	0	0	0	0	0	0	0	0
MFR	kg	3.02E+00	0	1.09E+00	0	0	0	0	0
MER	kg	0	0	0	0	0	8.42E+02	0	0
EEE	MJ	6.01E-01	0	1.11E+01	0	0	0	0	0
EET	MJ	6.92E+00	0	1.28E+02	0	0	0	0	0

HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: Medium density fibreboard (MDF), uncoated, per m³

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C4	D
PM	Disease incidence	3.15E-05	3.74E-06	1.3E-07	0	4.57E-07	1.21E-07	0	-1E-06
IR	kBq U235 eq	2.24E+01	3.84E+00	4.31E-02	0	5.4E-01	1.37E+00	0	-2.58E+01
ETP-fw	CTUe	1.61E+04	6.94E+02	1.77E+01	0	1.01E+02	8.81E+01	0	-1.21E+03
HTP-c	CTUh	4.29E-06	2.24E-08	4.83E-09	0	3.67E-09	4.18E-09	0	1.25E-07
HTP-nc	CTUh	9.25E-06	7.06E-07	2.03E-08	0	9.88E-08	7.57E-08	0	-2.23E-07
SQP	SQP	8.48E+04	6.16E+02	2.18E+00	0	7.34E+01	2.39E+01	0	-4.38E+02

PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

Disclaimer 1 – for the indicator "Potential Human exposure efficiency relative to U235". This impact category deals mainly with the eventual impact of low-dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators "abiotic depletion potential for non-fossil resources", "abiotic depletion potential for fossil resources", "water (user) deprivation potential, deprivation-weighted water consumption", "potential comparative toxic unit for ecosystems", "potential comparative toxic unit for humans – cancerogenic", "Potential comparative toxic unit for humans - not cancerogenic", "potential soil quality index". The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high as there is limited experience with the indicator.

6. LCA: Interpretation

Figure 1 illustrates the contribution of each life cycle stage to the overall indicator results of the impact assessment (impact from module A1 – C4 = 100 %) for uncoated medium density fibre board (MDF).

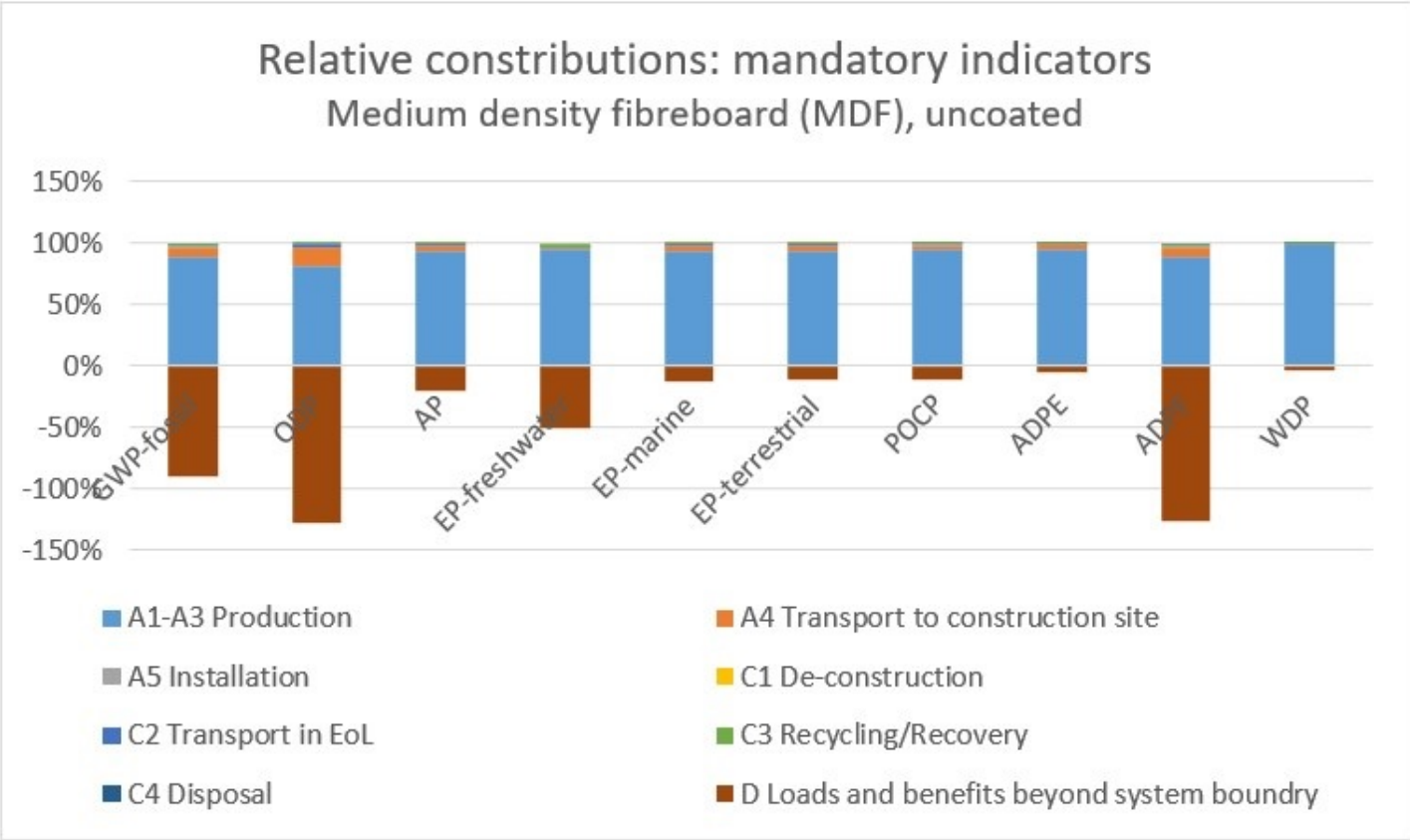


Figure 1: Environmental impacts of uncoated medium density fibreboard (MDF) along its life cycle (impacts from production modules A1 – C4 = 100 %)

Figure 1 illustrates that the environmental profile of uncoated MDF is dominated by the production phase (modules A1 – A3). Minor contributions stem from transport to the construction site whereas the contributions from other modules of the life cycle are negligible.
Loads and benefits beyond the life cycle (module D) are negative (benefits > loads) whereas major contributions occur for the ODP, the GWP-fossil and for the ADPF; these benefits basically stem from the use of the MDF as secondary fuel and

its related substitution of natural gas and electricity from the grid from the recovered energy.

Figure 2 illustrates that the biogenic carbon stored in the uncoated MDF, expressed as CO_2-equivalent, is higher than the CO_2 emissions from fossil sources, leading to a negative GWP for the production module A1 – A3. The potential substitution effect in mod-ule D almost offsets the GHG emissions during the production phase (module A1-A3).

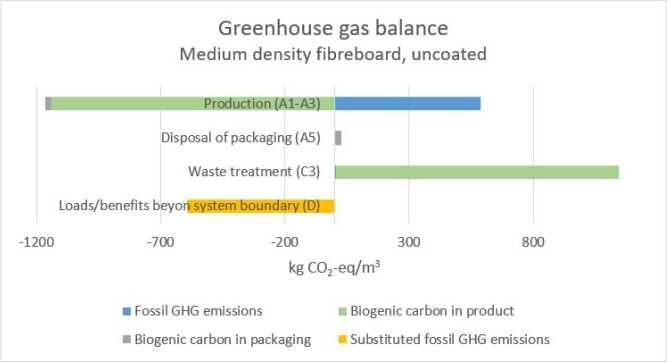


Figure 2: Greenhouse Gas balance of uncoated medium density fibreboard (MDF)

The GWP is dominated by CO_2 emissions and removals. [...]

7. Requisite evidence

7.1 Formaldehyde

For UF/MUF bonded boards:

Measuring agency: Aidimme Technology Institute, Valencia, Spain
Test report, date: no. 221.I.2303.329.EN.01 issued on the 15.03.2023
Result: Formaldehyde emission testing according to *ASTM D6007-14* was performed using *EN 717* for formaldehyde concentration determination. A value of 0,074 ppm was determined.

Measuring agency: MPA Eberswalde, Materialprüfanstalt Brandenburg GmbH, Germany
Test report, date: No. 31/23/4267/01/QT issued on the 17.04.2023
Result: Determination of formaldehyde release of wood-based panels according to:
CARB final regulation order of "Airborne toxic control measure to reduce formaldehyde emission from composite Wood products" and EPA TSCA Title VI 40 CFR Part 770.
Formaldehyde analysis by photometry by acetyl/acetone method according to *EN 717-1*.
The requirement of CARB and EPA TSCA VI was met.

7.2 Checking for the pre-treatment of the substances used

No post-consumer wood is used in the production of Sonae Arauco MDF .

7.3 VOC emissions

Measuring agency: Eurofins Denmark
Test report, date: 392-2019-00286101_A_EN issued in 30.09.2019
Result: VOC emissions were tested for MDF according to several regulations.
A classification of A was achieved for French VOC regulation (Regulation of March and May 2011 DEVL1101903D and DEVL1104875A)
AgBB/ABG requirements were complied (Anforderungen an bauliche Anlagen bezüglich de Gesundheitsschutzes (AGB). Entwurt 31.08.2017/August 2018 (AgBB))

Overview of Results (28 days)

Name	Value	Unit
TVOC (C6 - C16)	27	µg/m³
Sum SVOC (C16 - C22)	< 5	µg/m³
R (dimensionless)	0.59	-
VOC without NIK	< 5	µg/m³
Carcinogenic Substances	< 1	µg/m³

AgBB overview of results (3 days [µg/m³])

Name	Value	Unit
TVOC (C6 - C16)	230	µg/m³
Sum SVOC (C16 - C22)	< 5	µg/m³
R (dimensionless)	0.88	-
VOC without NIK	0.033	µg/m³
Carcinogenic Substances	< 1	µg/m³

7.4 PCP/Lindane

Measuring agency: MPA Eberswalde, Materialprüfanstalt Brandenburg GmbH, Germany
Test report, date: 31/21/2228/01PL issued at 15.04.2021
Result: Neither PCP nor Lindan content were detected. This means that neither PCP nor Lindan were present in a quantity above the the method limit of quantification.

8. References

Product category rules of IBU

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IBU (2021): General Instructions for the EPD Programme of the Institut Bauen und Umwelt e.V. (General Instructions for the IBU EPD Programme). Version 2.0, Institut Bauen und Umwelt, Berlin.

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IBU (2021): PCR Part A: Calculation rules for the life cycle assessment and requirements for the project report according to EN 15804+A2:2019. Version 1.3, Institut Bauen und Umwelt, Berlin.

IBU (2023)
IBU (2023): PCR Part B: Requirements on the EPD for wood-based panels. Version 2023/04, Institut Bauen und Umwelt, Berlin.

Standards and legal documents

ASTM D6007
ASTM D6007-14, Standard Test Method for Determining Formaldehyde Concentrations in Air from Wood Products Using a Small-Scale Chamber.

EN 310
EN 310:1993, Wood-based panels – Determination of modulus of elasticity in bending and of bending strength.

EN 316
EN 316:2009, Wood fibre boards – Definition, classification and symbol.

EN 319
EN 319:1993, Particleboards and fibreboards – Determination of tensile strength perpendicular to the plane of the board.

EN 322
EN 322:1993, Wood-based panels – Determination of moisture content.

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EN 323:1993, Wood-based panels – Determination of density.

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EN 324-1:1993, Wood-based panels – Determination of dimensions of boards – Determination of thickness, width and length.
EN 324-2:1993, Wood-based panels – Determination of dimensions of boards – Determination of squareness and edge straightness.

EN 622
EN 622-1:2003, Fibreboards – Specifications – Part 1: General requirements.
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EN 717-1
EN 717-1:2005-01, Wood-based panels – Determination of formaldehyde release – Formaldehyde emission by the chamber method.

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EN 16485
EN 16485:14-07, Round and sawn timber – Environmental Product Declarations – Product category rules for wood and wood-based products for use in construction.

ISO 9001
ISO 9001:2015, Quality management systems – Requirements.

ISO 14001
ISO 14001:2015, Environmental management systems – Requirements with guidance for use.

ISO 14025
ISO 14025:2006-07, Environmental labels and declarations – Type III Environmental declarations – Principles and procedures.

ISO 14044
EN ISO 14044:2006-07, Environmental management – Life cycle assessment – Requirements and guidance (ISO 14044:2006); German and English versions EN ISO 14044:2006.

ISO 16000
ISO 16000-11:2006, Indoor air – Part 11: Determination of the emission of volatile organic compounds from building products and furnishing – Sampling, storage of samples and preparation of test specimens.

ISO 16895
ISO 16895-1:2008, Wood-based panels – Dry-process fibreboard – Part 1: Classifications.
ISO 16895-2:2010, Wood-based panels – Dry-process fibreboard – Part 2: Requirements.

ISO 45001
ISO 45001:2018-06, Occupational health and safety management systems – Requirements with guidance for use.

ISO 50001
ISO 50001:2018, Energy management systems – Requirements with guidance for use.

ChemVerbotsV
Verordnung über Verbote und Beschränkungen des Inverkehrbringens und über die Abgabe bestimmter Stoffe, Gemische und Erzeugnisse nach dem Chemikaliengesetz (Chemikalien-Verbotsverordnung - ChemVerbotsV);

Ausfertigungsdatum: 20.01.2017.

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COUNCIL REGULATION (EU) No 333/2011 of 31 March 2011 establishing criteria determining when certain types of scrap metal cease to be waste under Directive 2008/98/EC of the European Parliament and of the Council.

ECHA candidate list
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REGULATION (EU) No 528/2012 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 22 May 2012 concerning the making available on the market and use of biocidal products.

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Publisher

Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

+49 (0)30 3087748- 0
info@ibu-epd.com
www.ibu-epd.com

Programme holder

Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

+49 (0)30 3087748- 0
info@ibu-epd.com
www.ibu-epd.com

Author of the Life Cycle Assessment

Dr. Frank Werner - Umwelt & Entwicklung
Kammelenbergstrasse 30
9011 St. Gallen
Switzerland

+ 41 (0)44 241 39 06
frank@frankwerner.ch
http://www.frankwerner.ch/

Owner of the Declaration

Sonae Arauco, S.A.
Calle Ulises 26-18
28043 Madrid
Spain

(+34) 918 070 701
products@sonaearauco.com
www.sonaearauco.com