ENVIRONMENTAL PRODUCT DECLARATION

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

Owner of the Declaration	Rubner Holding AG - S.p.A.
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-RUB-20230229-IBC1-EN
Issue date	27.06.2023
Valid to	26.06.2028

Structural finger jointed solid timber (Update)

Rubner Holding AG - S.p.A

Institut Bauen und Umwelt e.V.

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RUBNER

1. General Information

Rubner Holding AG - S.p.A

Programme holder

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

Declaration number

EPD-RUB-20230229-IBC1-EN

This declaration is based on the product category rules:

Solid wood products, 01.08.2021
(PCR checked and approved by the SVR)

Issue date

27.06.2023

Valid to

26.06.2028

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

Dipl.-Ing. Hans Peters
(Managing Director Institut Bauen und Umwelt e.V.)

Structural finger jointed solid timber (Update)

Owner of the declaration

Rubner Holding AG - S.p.A.
Handwerkerzone 2
39030 Kiens
Italy

Declared product / declared unit

1 m³ of solid structural timber [KVH] with an average density of 465 kg/m³

Scope:

This EPD is based on a declared unit of 1 m³ of solid structural timber (moisture of 10 % at a raw density of 465 kg/m³) produced at the RUBNER production site in Ober-Grafendorf (Austria).

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

Matthias Schulz,
(Independent verifier)

RUBNER

2. Product

2.1 Product description/Product definition

RUBNER structural finger jointed solid timber is a homogenized unidirectional wood-based material that is used in engineered structural timber constructions as well as in residential and office buildings. RUBNER structural finger jointed solid timber consists of single squared structured timber made from softwood according to *EN 1912*. The single structural timber components with rectangular cross-section are arranged longitudinally by means of finger joints to achieve a rigid interconnected structural timber with a rectangular cross-section with theoretically infinite length. Due to its longitudinal assembling characteristics combined with the technically supported strength and stiffness classification of the raw materials, RUBNER structural finger jointed solid timber is characterized by a high product quality. As a result of the industrial manufacturing process, RUBNER structural finger jointed solid timber exhibits steady mechanical characteristics. RUBNER structural finger jointed solid timber has a high dimensional stability and can be characterized as a largely crack-minimized building material.

For the placing on the market of the product in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) Regulation (EU) No. *305/2011 PCR* applies. The product meets the requirements of *EN 15497* and the CE-marking.
For the application and use, the respective national provisions apply.

2.2 Application

RUBNER structural finger jointed solid timber is mainly used as a structural component for buildings and bridges.

2.3 Technical Data

The performance data of the product are in accordance with its essential characteristics according to *EN 15497*.
RUBNER structural finger jointed solid timber is produced in accordance with *EN 15497* with different strength classes. For the strength class C24, which is mainly used the following applies:

Constructional data

Name	Value	Unit
Wood types by trade names acc. to EN 1912	spruce, pine, larch, Douglas fir	-
Wood moisture acc. to EN 13183-1	< 15	%
Use of wood preservatives (the wood preservative test mark to DIN 68800-3 must be indicated)	Where other preservative means are insufficient	-
Bending strength acc. to EN 338	24	N/mm²
Compressive strength parallel acc. to EN 338	21	N/mm^2
Compressive strength rectangular acc. to EN 338	2.5	N/mm^2
Tensile strength parallel acc. to EN 338	14.5	N/mm^2
Tensile strength rectangular acc. to EN 338	0.4	N/mm^2
Modulus of elasticity acc. to EN 338	11000	N/mm^2
Shear strength acc. to EN 338	4	N/mm^2
Shear modulus acc. to EN 338	690	N/mm^2
Dimensional deviation	depending on geometrical dimensions	mm
Length	< 50	m
Width (min. - max.)	0.06 to 0.28	m
Height (min. - max.)	0.06 to 0.28	m
Gross density acc. to EN 338	420	kg/m^3
Surface quality (Possible characteristic features must be indicated)	n.r.	-
Risk class acc. to DIN 68800-3	4	-
Thermal conductivity acc. to EN 12664	0.12	W/mK
Specific heat capacity acc. to EN 12664	1.6	kJ/kgK
Calculation value for thermal conductivity	n.r.	W/mK
Water vapor diffusion equivalent air layer thickness acc. to ISO 12572	n.r.	m
Water vapour diffusion resistance factor acc. to ISO 12572	20-50	-
Formaldehyde emissions acc. to EN 15497	< E1	$µg/m^3$

RUBNER structural finger jointed solid timber is manufactured in accordance with *EN 15497* from coniferous species, with priority being given to spruce. Other coniferous species are permissible but not typical.
RUBNER structural finger jointed solid timber is produced from kiln-dried coniferous wood with an average wood moisture content of around 10 % to 11 % (max. < 15 %) at delivery.
For bonding, only approved modern low-emission adhesives according to chapter 2.5 are used. The mechanical characteristics of RUBNER structural finger jointed solid timber are in accordance with strength classes specified in *EN 338*.
The dimensional tolerances are defined in accordance with *EN 15497*.
The products are manufactured in domestic visual quality, visual quality or industrial quality.

Use of preventive chemical wood preservatives in accordance with *DIN 68800-3* is unusual and permitted only if other preservative measures given in *DIN 68800-2* are not sufficient on their own.

2.4 Delivery status

RUBNER structural finger jointed solid timber is produced with the dimensions according to chapter 2.3 and is delivered in domestic visual quality, visual quality or industrial quality. The tolerances according to *EN 15497* are met.

2.5 Base materials/Ancillary materials

RUBNER structural finger jointed solid timber comprises kiln-dried coniferous structural timber with rectangular cross-section according to *hEN 14081*.

The following types of adhesive systems are used for bonding the individual components (finger jointing):

- Melamine-urea-formaldehyde adhesives (MUF)

RUBNER structural finger jointed solid timber contains the following proportions of ingredients per m³ on average:

- Coniferous wood (atro), mainly spruce approx. 90 %
- Water approx. 9-10 %
- Adhesive < 0.5 %

The product has an average density of 465 kg/m³.

This product/article/at least one partial article contains substances listed in the *candidate list* (date: 17.01.2023) exceeding 0.1 percentage by mass: **no**.

This product/article/at least one partial article contains other carcinogenic, mutagenic, reprotoxic (CMR) substances in categories 1A or 1B which are not on the *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) *Ordinance on Biocide Products* No. 528/2012): **no**.

2.6 Manufacture

RUBNER structural finger jointed solid timber is manufactured from sustainable sawn timber (PEFC, FSC) sourcing from sustainable forestry. Wet sawn timber is kiln dried to a moisture content of about 10 % (max < 15 %) and subsequently pre-planed. To ensure the characteristic values of the RUBNER structural finger jointed solid timber, all individual structural timber components are visually- or machine-graded regarding strength and stiffness. Weak parts of components, which reduce the strength and stiffness properties due to the natural growth characteristics of wood, are cut out depending on the grading class. The graded pieces are subsequently bonded by finger jointing to endless laminations. These laminations with infinite length and a cross section up to 60 * 280 mm² are subsequently planed and cut to the required length for further production. The blanks are planed to achieve the final cross section. If necessary, the blanks are cut to their final complex shapes. To ensure the product quality, a treatment with weathering or wood preservatives may be required for transport to the construction site, storage, and during assembly.

2.7 Environment and health during manufacturing

During production, there are no negative impacts on water and soil. The resulting process wastewater is fed into the local sewage system and cleaned according to legal regulations. The resulting exhaust air is cleaned according to the legal regulations.
Noise emissions from industrial plants are reduced by structural measures and comply with the legal requirements.
The production facility has a quality management system *ISO 9001*.
The employee protection in the manufacturing process complies with the respective country-specific requirements, employees are provided with personal protective equipment.

2.8 Product processing/Installation

RUBNER structural finger jointed solid timber can be processed with commercially available tools. The instructions for occupational safety/assembly are to be observed.

2.9 Packaging

Polyethylene foils are used in small quantities during transportation.

2.10 Condition of use

The composition of RUBNER structural finger jointed solid timber corresponds to the composition according to Section 2.5 for the entire period of use.

2.11 Environment and health during use

Environmental protection: According to current knowledge, the intended use of RUBNER structural finger jointed solid timber does not present any hazards or impairments to water, air and soil.
Health protection: Under normal conditions of use, RUBNER structural finger jointed solid timber is not expected to cause any damage or impairments to health.
RUBNER structural finger jointed solid timber subsequently releases formaldehyde during its life cycle.
RUBNER structural finger jointed solid timber bonded with MUF-based adhesives has low emissions of formaldehyde, due to the low level of adhesive in its internal structure and due to its particular use. Measured against the limit value of 0.1 ml/m³ (0.124 mg/m³) of the Reach Regulation *1907/2006/EC*, the measured values in accordance with *EN 717-1* can be classified as low.
RUBNER structural finger jointed solid timber with melamine-based adhesive system (MUF) has surface-specific emission rates in the range of untreated timber.

2.12 Reference service life

The production processes for RUBNER structural finger jointed solid timber correspond to the processes that are also used in the production laminations for RUBNER glued laminated timber. Glulam has been used in structural timber construction for more than 100 years. When used as designated, no end of durability must be expected due to its natural durability (protection against moisture). When used as designated, the lifetime of RUBNER structural finger jointed solid timber is equal to the duration of use of the building.

2.13 Extraordinary effects

Fire

RUBNER structural finger jointed solid timber is classified in accordance with *EN 15497* as follows:

Fire protection

Name	Value
Building material class	D
Burning droplets	d0
Smoke gas development	s2

Water

No ingredients are washed out which could be hazardous to water.

Mechanical destruction

The fracture behavior of RUBNER structural finger jointed solid

timber is appearance typical for solid wood.

2.14 Re-use phase

In the event of selective de-construction, RUBNER structural finger jointed solid timber can easily be re-used after the end of the structure's service life.
The preferred use of RUBNER structural finger jointed solid timber is in the form of reuse based on the applicable country-specific requirements.
If it is not re-used, it will be subjected to thermal utilization for the production of heat and electricity due to the high calorific value of approx. 16.5 MJ/kg (at a humidity of u = 12 %) in compliance with the applicable country-specific requirements.

2.15 Disposal

If the residues are not used for any other cascading use, waste wood is disposed according to the applicable country-specific requirements. Disposal represents a possible but unusual case. RUBNER structural finger jointed solid timber is assigned to waste code 17 02 01 in the European list of waste *2014/955/EU*. (Treated Rubner structural finger jointed solid timber is assigned to waste code 17 02 04).

2.16 Further information

More detailed information is available at: www.rubner.com

3. LCA: Calculation rules

3.1 Declared Unit

This EPD refers to a declared unit of 1 m³ of solid structural timber produced by the RUBNER group. The declared unit refers to an average density of 465 kg/m³ and a wood moisture at delivery of 10 %.

Declared unit

Name	Value	Unit
Declared unit	1	m^3
Gross density	465	kg/m^3
Wood moisture at delivery	10	%

The analysed products represent an average of RUBNER solid structural timber produced at the site in Ober-Grafendorf (AT).

The declared unit was calculated on a volume-weighted basis. This EPD refers to an average product manufactured at one site. All products undergo the same processing steps. A possible variability is only expected due to the use of different wood species. The upstream chain for spruce is considered representative. The robustness of the declared LCA values can thus be classified as high.

Ober-Grafendorf not only produces solid structural timber but also glued laminated timber. The allocation of product-specific material and energy flows is based on physical relationships when possible. Where necessary, the allocation is based on the production volumes of each product line manufactured at Ober-Grafendorf.

3.2 System boundary

The life cycle assessment of average solid structural timber produced by RUBNER refers to a cradle-to-gate analysis of the environmental impacts with modules C1–C4 and module D (A1–A3 + C + D). The following life cycle phases are part of the analysis:

Module A1–A3 | Production stage
The production stage includes the upstream burdens of raw materials (lamellae, adhesive system, etc.) and the corresponding transports to the RUBNER production site in Ober-Grafendorf (Austria). As the production site in Rohrbach delivers lamellae to the other RUBNER sites, resulting environmental impacts refer to RUBNER's specific production process including drying. Direct emissions from drying are based on worst-case approximations and are included in the study. Upstream emissions from the use of adhesive systems rely on supplier-specific data.
RUBNER produces thermal energy in its own biomass boilers. Electricity is provided by the own photovoltaic system as well as 100 % green electricity.

Module C1 | Deconstruction and demolition
After the removal of building components overlying the product, the joints can simply be loosened by screwing or sawing and lifted by cranes to the place of removal. Required energy demand can be neglected. The actual energy demand depends on the installation of the products and can therefore vary greatly in the building context.

Module C2 | Transport to disposal
Module C2 includes the transport to waste treatment. In this case, transport by truck over a transport distance of 50 km is assumed.

Module C3 | Waste processing
In Module C3, the chipping after the removal of the products is considered. The wooden products and with them the material-inherent properties leave the product system as secondary combustibles in module C3.

Module C4 | Disposal
The applied scenario declares the energetic recovery of the wooden products, therefore no environmental impacts are to be expected from waste processing of the products in C4.

Module D | Benefits and loads beyond the system boundary
Applying an European average scenario, module D describes the energetic recovery of the product at the end of life including the corresponding energy substitution potentials.

3.3 Estimates and assumptions

All assumptions are verified through detailed documentation and correspond to the best possible representation of reality based on the available data. Background data for wood logs refer to generic data for spruce logs in bark derived from *GaBi* database. Spruce represents the majority of wood processed at RUBNER. The used dataset represents an approximation for all other species.
Regional applicability of the used background data refers to average data under European or German conditions taken from the *GaBi* database. German data were used for the Austrian market whenever European or regionalised average data were not available.

Emissions from wood drying were included in the calculations according to *Rüter & Diederichs 2012*.

3.4 Cut-off criteria

The LCA model covers all available input and output flows, which can be represented based on robust data and from which a significant contribution can be expected. Data gaps are filled with conservative assumptions of average data or generic data if available and are documented accordingly.
Only data with a contribution of less than 1 % were cut off.

Thus, no data were neglected, of which a substantial impact is to be expected. All relevant data were collected comprehensively. Cutoff material and energy flows were chosen carefully based on their expected quantitative contribution as well as potential environmental impacts. Thus, it can be assumed that the sum of all neglected input flows does not account for more than 5 % of the total material, water and energy flows. Environmental impacts of machines, plant and infrastructure were not included.

3.5 Background data

This study uses generic background data for the evaluation of upstream environmental impacts from *GaBi* database 2022.2 as well as recognised literature such as *Rüter & Diederichs 2012*.

The main share of lamellae processed for solid structural timber is delivered by the RUBNER RHI located in Rohrbach. Thus, the supply chain for lamellae input is based on primary data. The representation of adhesives used for the production is based on primary data from RUBNER's suppliers. Where necessary, this information was complemented with estimates ensuring the completeness of the component's representation in the LCA.

3.6 Data quality

Data collection is based on product-specific questionnaires. It follows an iterative process of clarifying questions via e-mail, telephone calls or in personal/web meetings. Intensive discussions between the RUBNER group and Daxner & Merl result in an accurate mapping of product-related material and energy flows. This leads to a high quality of foreground data collected. Data collection relies on a consistent process according to *ISO 14044*.

The representation of the main raw materials used for the production of solid structural timber is based on supplier-specific primary data (lamellae, adhesive systems) leading to a high data quality.
The technological, geographical and time-related representativeness of the database was kept in mind when selecting background data. Whenever specific data were missing, either generic datasets or representative average data were used instead. The implemented *GaBi* background datasets refer to the latest versions available and are carefully chosen.

The assessment of the robustness of the average can be found in Section 3.1.

3.7 Period under review

Foreground data were collected in the 2022 production year, and the data are based on the volumes produced on an annual basis.

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: Austria

3.9 Allocation

Carbon content and primary energy content of the products were assessed based on their material
inherent properties according to underlying physical relationships.

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.

The *GaBi* background database was used to calculate the LCA (*GaBi* 10; 2022.2).

4. LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon

During tree growth, the wood assimilates carbon dioxide and stores biogenic carbon. The carbon stored in the product is declared in the following table.

Information on describing the biogenic Carbon Content at factory gate

Name	Value	Unit
Biogenic carbon content in product	211	kg C

Installation into the building (A5)

The end of life of the product packaging is not declared in module A5.

Name	Value	Unit
Packaging (polyethylene)	0.409	kg

The end-of-life scenario used in this LCA study is based on the following assumptions:

End of life (C1-C4)

Name	Value	Unit
Energy recovery	465	kg

Reuse, recovery and/or recycling potentials (D), relevant scenario information

Name	Value	Unit
Processing rate	100	%
Efficiency of power plant	68	%

The product reaches the end-of-waste status after removal from the building, transport to processing and chipping of the product. For the end of life of the solid structural timber product, energy recovery as secondary fuel in a biomass power plant is assumed. As the main sales market for the solid wood products is concentrated in the European region, plant-specific characteristic values correspond to a European average scenario (EU). The scenario considers a reprocessing rate of 100 % for the solid wood products after removal from the building. This assumption has to be adjusted accordingly when applying the results in the building context. At the end of life of the product, the equilibrium moisture is comparable to the moisture content at delivery. This value can vary depending on the storage of the product before energy recovery.

RUBNER

5. LCA: Results

The following table contains the LCA results for a declared unit of 1 m³ of solid structural timber produced by the RUBNER group (465 kg/m³).

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; ND = 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	MND	MND	MND	MND	MNR	MNR	MNR	MND	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 m³ solid structural timber (465 kg/m³)

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
Global Warming Potential total (GWP-total)	kg CO_2 eq	-7.07E+02	0	1.47E+00	7.84E+02	0	-4.28E+02
Global Warming Potential fossil fuels (GWP-fossil)	kg CO_2 eq	6.71E+01	0	1.4E+00	3.43E+00	0	-3.86E+02
Global Warming Potential biogenic (GWP-biogenic)	kg CO_2 eq	-7.75E+02	0	6.1E-02	7.8E+02	0	-4.18E+01
Global Warming Potential luluc (GWP-luluc)	kg CO_2 eq	3.17E-01	0	9.41E-03	7.25E-04	0	-4.62E-02
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC11 eq	2.82E-09	0	1.37E-13	5.02E-11	0	-2.99E-09
Acidification potential of land and water (AP)	mol H^+ eq	8.26E-01	0	4.66E-03	7.53E-03	0	3.2E-01
Eutrophication potential aquatic freshwater (EP-freshwater)	kg P eq	5.42E-03	0	4.99E-06	1E-05	0	-6.03E-04
Eutrophication potential aquatic marine (EP-marine)	kg N eq	3.28E-01	0	2.13E-03	1.69E-03	0	6.94E-02
Eutrophication potential terrestrial (EP-terrestrial)	mol N eq	2.93E+00	0	2.39E-02	1.77E-02	0	8.22E-01
Formation potential of tropospheric ozone photochemical oxidants (POCP)	kg NMVOC eq	9.32E-01	0	4.19E-03	4.57E-03	0	2.94E-01
Abiotic depletion potential for non fossil resources (ADPE)	kg Sb eq	3.96E-05	0	1.41E-07	9.35E-07	0	-6.41E-05
Abiotic depletion potential for fossil resources (ADPF)	MJ	8.55E+02	0	1.83E+01	6.23E+01	0	-6.68E+03
Water use (WDP)	m^3 world eq deprived	3.4E+01	0	1.56E-02	7.82E-01	0	-2.2E+01

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 m³ solid structural timber (465 kg/m³)

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
Renewable primary energy as energy carrier (PERE)	MJ	5.51E+03	0	1.27E+00	7.83E+03	0	-2.06E+03
Renewable primary energy resources as material utilization (PERM)	MJ	7.8E+03	0	0	-7.8E+03	0	0
Total use of renewable primary energy resources (PERT)	MJ	1.33E+04	0	1.27E+00	3.46E+01	0	-2.06E+03
Non renewable primary energy as energy carrier (PENRE)	MJ	8.25E+02	0	1.84E+01	7.74E+01	0	-6.68E+03
Non renewable primary energy as material utilization (PENRM)	MJ	3.28E+01	0	0	-1.51E+01	0	0
Total use of non renewable primary energy resources (PENRT)	MJ	8.58E+02	0	1.84E+01	6.23E+01	0	-6.68E+03
Use of secondary material (SM)	kg	0	0	0	0	0	0
Use of renewable secondary fuels (RSF)	MJ	0	0	0	0	0	7.8E+03
Use of non renewable secondary fuels (NRSF)	MJ	0	0	0	0	0	1.51E+01
Use of net fresh water (FW)	m^3	1.4E+00	0	1.47E-03	3.3E-02	0	-1.4E+00

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 m³ solid structural timber (465 kg/m³)

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
Hazardous waste disposed (HWD)	kg	4.71E-07	0	9.73E-11	5.39E-09	0	-8.27E-07
Non hazardous waste disposed (NHWD)	kg	4.65E+00	0	3E-03	4.69E-02	0	2.31E-01
Radioactive waste disposed (RWD)	kg	1.42E-02	0	3.41E-05	9.95E-03	0	-5.91E-01
Components for re-use (CRU)	kg	0	0	0	0	0	0
Materials for recycling (MFR)	kg	0	0	0	0	0	0
Materials for energy recovery (MER)	kg	0	0	0	4.65E+02	0	0
Exported electrical energy (EEE)	MJ	0	0	0	0	0	0
Exported thermal energy (EET)	MJ	0	0	0	0	0	0

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1 m³ solid structural timber (465 kg/m³)

Parameter	Unit	A1-A3	C1	C2	C3	C4	D
Incidence of disease due to PM emissions (PM)	Disease	ND	ND	ND	ND	ND	ND

	incidence						
Human exposure efficiency relative to U235 (IR)	kBq U235 eq	ND	ND	ND	ND	ND	ND
Comparative toxic unit for ecosystems (ETP-fw)	CTUe	ND	ND	ND	ND	ND	ND
Comparative toxic unit for humans (carcinogenic) (HTP-c)	CTUh	ND	ND	ND	ND	ND	ND
Comparative toxic unit for humans (noncarcinogenic) (HTP-nc)	CTUh	ND	ND	ND	ND	ND	ND
Soil quality index (SQP)	SQP	ND	ND	ND	ND	ND	ND

The additional and optional impact categories according to *EN 15804+*A2 are not declared, as the uncertainty of these indicators is to be classified as high.

Disclaimer 1 – for the indicator 'Potential Human exposure efficiency relative to U235'.
This impact category deals mainly with the eventual impact of lowdose 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, from 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.

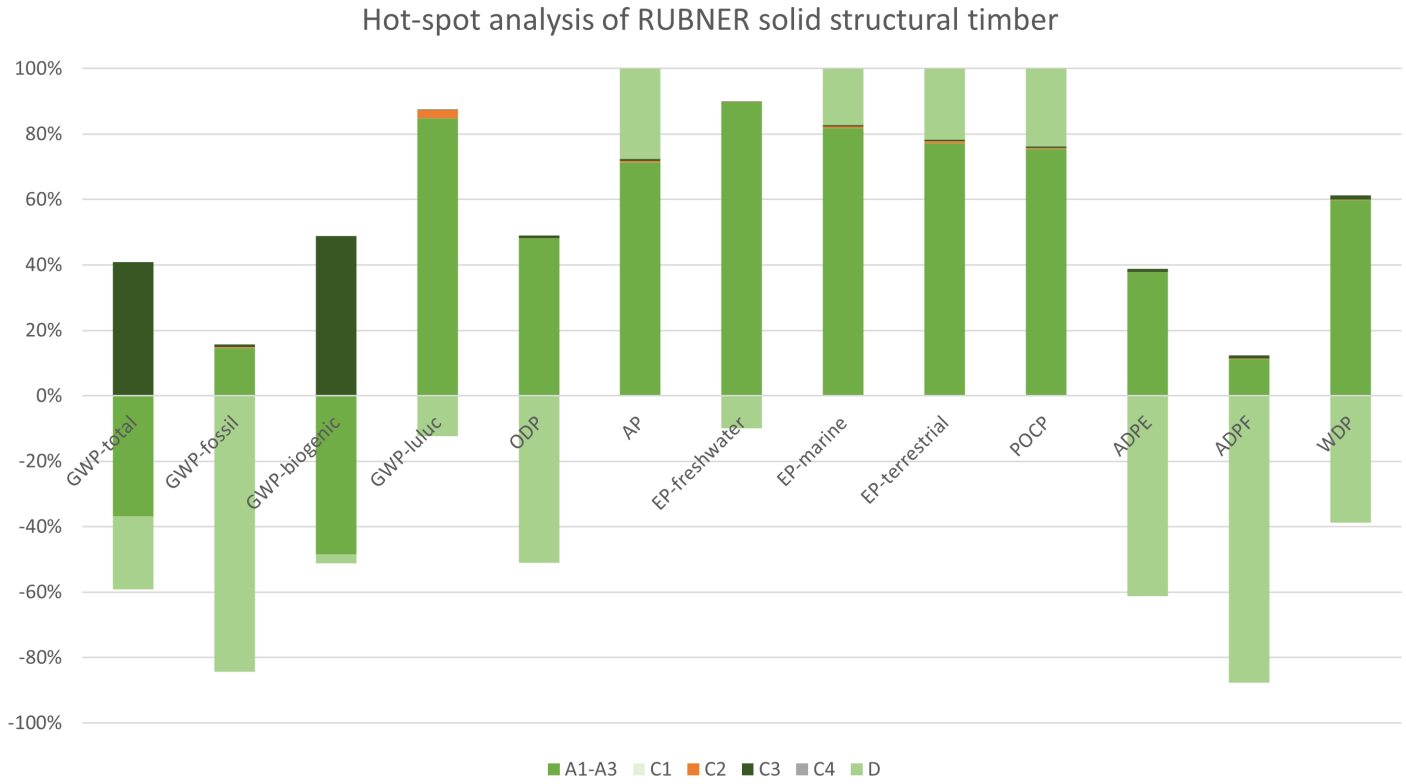
6. LCA: Interpretation

The following interpretation contains a summary of the LCA results referenced to a declared unit of 1 m³ of solid structural timber.

The global warming potential (**GWP**) of solid structural timber shows negative values in the production phase (modules A1–A3). These negative impacts result from the use of wood as raw material. Wood sequesters biogenic carbon during tree growth. The sequestered carbon does not contribute to global warming as long as it is stored in the biomass.

After its use in the building, the product is assumed to be incinerated in a biomass power plant. As a result, the incorporated carbon is emitted again to the atmosphere representing biogenic carbon dioxide emissions (module C3).

The negative values in the end-of-life (module D) result from the energetic treatment of the product. As the energy produced at the biomass power plant can substitute (mainly fossil) fuels, an environmental net benefit is generated.



Potential global warming (**GWP**) due to the production of solid structural timber mainly stems from the provision of round wood and associated impacts due to forestry. The processing of the products includes the use of all wooden residues for heat production. Its thermal treatment is taken into account as carbon neutral, as the wood is derived from sustainably managed forests.

In all environmental impact categories considered (with the exception of ODP), the upstream chain of the supplied lamellae

represents the main factor in the LCA. What's more, the provision of thermal energy from on-site biomass boilers and transports are further drivers.

Due to the use of green electricity in the production, the external supply of electricity at the site represents a minor factor in the environmental profile of the product.

The results of the previous EPD (EPD-RUB-20180059-IBB1-EN) are not directly comparable with the present updated version due to the update of the underlying methodology according to *EN 15804*+A2.

7. Requisite evidence

The following evidence of environmental and health relevance was provided.

7.1 Formaldehyde

The emissions (melamine-based adhesive systems) listed in section 2.11 are based on test results of emission measurements in accordance with *EN 717-1* at a temperature of 23 °C, a relative humidity of 45 % and an air change rate of 1.0 per hour. The test results all meet the requirements of emission class E1 according to *EN 15497* of 0.124 mg/m³.
The test report (E-CMP / KT T410 405, 2016) defines a formaldehyde emission of 0.011 mg/m³ for Rubner glulam made of spruce with melamine-based adhesive. The listed value represents an upper limit value due to the significantly lower adhesive content, RUBNER structural finger jointed solid timber contains only 10 % adhesive compared to Rubner glulam. Based on these facts formaldehyde emission of RUBNER structural finger jointed solid timber is significantly below 0.01 mg/m³. Due to the arbitrary position of the finger joints, no product representative test specimen can be defined, therefore no representative test can be done.
There is one test report for proof of occupational exposure (Dräger Kurzzeitröhrchen) (date 16. June 2015) available, the maximum allowed workplace concentration of 0.246 mg/m³ is significantly higher than the measurements, no discolouration of the tubes was noted.

7.2 MDI

In the context of production, no such substances are added to the wood. Thus, a MDI emission from the finished RUBNER structural finger jointed solid timber is not possible.

7.3 Fire gas toxicity

Due to the heterogeneous structure of structural finger jointed solid timber, combined with the non-applicability of the test standard *DIN 53436*, no relevant measurement results are available, the test specimen geometry is not able to represent the real gas composition for a representative cross-section.

7.4 VOC emissions

For the verification of VOC emissions, one test report (51005-001 III, 2016) of an emission analysis according to *AgBB-Scheme 2015* for Rubner glulam is available. Analysis was performed in accordance with *ISO 16000-3* and *ISO 16000-6*. The listed values represent upper limit values due to the significantly lower adhesive content of RUBNER structural finger jointed solid timber compared to Rubner glulam. RUBNER structural finger jointed solid timber contains less than 0.5 % adhesive. Based on these facts, VOC emissions from the glue of RUBNER structural finger jointed solid timber is significantly lower. Due to the arbitrary position of the finger joints no product representative test specimen can be defined, therefore no representative test can be done.

VOC emissions

Name	Value	Unit
Overview of Results (28 days)	-	µg/m³
TVOC (C6 - C16) acc. to AgBB 2015	70	µg/m³
Sum SVOC (C16 - C22) acc. to AgBB 2015	< 5	µg/m³
R (dimensionless) acc. to AgBB 2015	0.17	-
VOC without NIK acc. to AgBB 2015	<5	µg/m³
Carcinogenic Substances	<1	µg/m³

For the verification of VOC emissions, one test report (51005-002 III B, 2016) of an emission analysis according to *AgBB-Scheme 2015* for pure wood is available. Analysis was performed in accordance with *ISO 16000-3* and *ISO 16000-6*. The listed values represent lower limit values.

VOC emissions: pure wood

Name	Value	Unit
Overview of Results (28 days)	-	µg/m³
TVOC (C6 - C16) acc. to AgBB 2015	10	µg/m³
Sum SVOC (C16 - C22) acc. to AgBB 2015	<5	µg/m³
R (dimensionless) acc. to AgBB 2015	0.086	-
VOC without NIK acc. to AgBB 2015	<5	µg/m³
Carcinogenic Substances	<1	µg/m³

8. References

Standards

DIN 53436
DIN 53436:2015, Generation of thermal decomposition products from materials for their analytic-toxicological testing.

DIN 68800-2
DIN 68800-2:2012-02, Wood preservation – Part 2: Preventive constructional measures in buildings.

DIN 68800-3
DIN 68800-3:2012-02, Wood preservation – Part 3: Preventive protection of wood with wood preservatives.

EN 338
DIN EN 338:2016-07, Structural timber - Strength classes.

EN 717-1
DIN EN 717-1:2005-01, Wood-based panels – Determination of Formaldehyde release – Part 1: Formaldehyde emission by the chamber method.

EN 1912
EN 1912: 2013-10-15, Structural timber - Strength classes - Assignment of visual grades and species.

EN 12664
EN 12664:2001, Thermal performance of building materials and products - Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Dry and moist products with medium and low thermal resistance.

EN 13183-1
EN 13183-1:2002, Moisture content of a piece of sawn.

EN 15497
DIN EN 15497:2014-07, Structural finger jointed solid timber - Performance requirements and minimum production requirements.

EN 15804
DIN EN 15804:2012+A2:2019+AC:2021, Sustainability of construction works Environmental product declarations Core rules for the product category of construction products.

hEN 14081
hEN 14081-1:2016-06-01, Timber structures - Strength graded structural timber with rectangular cross section - Part 1: General requirements.

ISO 9001
EN ISO 9001:2015, Quality management systems - Requirements.

ISO 12572
EN ISO 12572:2016, Hygrothermal performance of building materials and products - Determination of water vapour transmission properties - Cup method.

ISO 14025
DIN EN ISO 14025:2011-10, Environmental labels and declarations Type III environmental declarations Principles and procedures.

ISO 14044
DIN EN ISO 14044:2006-10, Environmental management - Life cycle assessment - Requirements and guidelines.

ISO 16000-3
ISO 16000-3:2011 Indoor air - Part 3: Determination of formaldehyde and other carbonyl compounds in indoor air and test chamber air - Active sampling method.

ISO 16000-6
ISO 16000-6:2011 Indoor air - Part 6: Determination of volatile organic compounds in indoor and test chamber air by active sampling on Tenax TA® sorbent, thermal desorption and gas chromatography using MS or MS-FID.

Further references

AgBB-Scheme 2015
German Committee for HealthRelated Evaluation of Building Products (AgBB): Approach to health assessment of emissions of volatile organic compounds (VOCs and SVOCs) from building products.

Candidate List
List of substances of very high concern considered for approval (status 17.01.2023) according to Article 59 para. 10 of the REACH Regulation. European Chemicals Agency.

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GaBi 10, Software-System and Database for Life Cycle Engineering. 2022.2. Stuttgart, Echterdingen: Sphera, 1992-2022. Available at: https://sphera.com/product-sustainability-gabi-data-search/

IBU 2021
Institut Bauen und Umwelt e.V.: General Programme Instructions for the Preparation of EPDs at the Institut Bauen und Umwelt e.V. (IBU). Version 2.0, Berlin: Institut Bauen und Umwelt e.V., 2021. www.ibuepd.com

Ordinance on Biocide Products
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.

PCR part A
Product category rules for building-related products and services. Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report according to EN 15804+A2:2019. Version 1.3. Berlin: Institut Bauen und Umwelt e.V., 2022.

PCR: Solid wood products
Product category rules for building-related products and services. Part B: EPD requirements for solid wood products. Version v2, Berlin: Institut Bauen und Umwelt e.V., 31.05.2023.

PCR 305/2011 (EU)
REGULATION (EU) No 305/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC.

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Ökobilanz-Basisdaten für Bauprodukte aus Holz. Work report from the Institut für Holztechnologie und Holzbiologie Nr. 2012/1. Hamburg: Johann Heinrich von Thünen-Institut.

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