ENVIRONMENTAL PRODUCT DECLARATION

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

Owner of the Declaration	Unilin B.V. Division Panels
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-UNI-20230376-IBJ2-EN
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Valid to	30.10.2028

Unilin Chipboard

Unilin B.V. Division Panels

Institut Bauen und Umwelt e.V.

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1. General Information

Unilin B.V. Division Panels

Programme holder

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

Declaration number

EPD-UNI-20230376-IBJ2-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

31.10.2023

Valid to

30.10.2028

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

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

Unilin Chipboard

Owner of the declaration

Unilin B.V. Division Panels
Ooigemstraat 3
8710 Wielsbeke
Belgium

Declared product / declared unit

1 m³ Unilin chipboard (676 kg/m³)

Scope:

The scope of this EPD extends to all Unilin raw chipboards. The declared values refer to the sales-weighted average product. These chipboards are produced in following manufacturing sites:

- SPANO, Oostrozebeke, Belgium
- BOSPAN, Wielsbeke, Belgium

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

Unilin Chipboards are wood-based panels with 3 layers: two surface layers with a fine structure and a core layer with a coarser structure. The layers consist of wood chips that are bonded by a thermo-harding glue and mixed with additives to add application-specific properties such as fire retardancy or moisture resistance.

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 (CPR)* applies. The product needs a declaration of performance according:

- *EN 13986:2004+A1:2015, Wood-based panels for use in construction – Characteristics, valuation of conformity and marking*
- *EN 16368:2014, Lightweight Particleboards – Specifications*
- *EN 312:2010-12, Particleboards – Specifications*

For the application and use the respective national provisions apply.

The results in this EPD refer to the environmental impact of a raw chipboard with a sales-weighted average. The composition of this product was obtained by averaging Unilin's entire chipboard portfolio using the annual sales volumes as weighing factor. The declared impact is thus representative for the following commercial references:

- Air Ultralight/Extemelight
- Air/Air Light
- Liso (LF/LF+)
- Belspan (LF/LF3/LF+) (TG)
- Qualirack (LF/LF+) (TG)
- SB4 (TG)
- Systemfloor (LF/LF+)
- Systemfloor Plus (LF/LF+) (Basic)
- Systemfloor HD (LF/LF+) (TG)
- Hydrolis (UC) (LF3/LF4/LF/LF+) (TG)
- Durelis (UC) (LF/LF+) (TG)
- Antivlam (LF/LF+) (TG)
- Hydroflam (TG)

The values for specific commercial references can vary from the declared ones. Please contact Unilin's sales team or info.panels@unilin.com for more information.

2.2 Application

Unilin Chipboards are used in structural and non-structural applications for example furniture, interior and building applications :

- LP1: General purpose lightweight boards for use in dry conditions.
- LP2: general purpose (including furniture) lightweight boards for use in dry conditions.
- P1: General purpose boards for use in dry conditions.
- P2: Boards for interior furnishings (including furniture) for use in dry conditions.
- P3: Boards for non-loadbearing purposes for use in humid conditions.
- P4: Boards for load-bearing purposes for use in dry conditions.
- P5: Load-bearing boards for use in humid conditions.
- P6 (and U7-U8-U9): heavy-duty load-bearing boards for use in dry conditions.

The surface variety accommodates the use of a versatile range of finishes and coatings, making the material easy to use in many different designs and applications.

2.3 Technical Data

Technical characteristics vary by product variant and thickness. More detailed product-specific data, technical data sheets and the CE declaration of performance are available on www.unilinpanels.com.

Constructional data

The table below summarizes the technical performance of Unilin's raw chipboard range for some parameters. The values below apply to the product range. More detailed information on these ranges and additional parameters (e.g. swelling, biological durability, etc.) is available at the product's "Declaration Of Performace" on www.unilinpanels.com. Specific properties of the declared sales-weighted product are available in 3.10.

Name	Value	Unit
Gross Density (EN 323)	430 - 760	kg/m³
Bending strength (EN 310)	2 - 20	N/mm²
E-modulus (EN 310)	375 - 3500	N/mm²
Material dampness at delivery (EN 322)	6 - 10	%
Tensile strength (EN 319)	0.14 - 0.7	N/mm²
Thermal conductivity (EN 13986)	0.12 - 0.14	W/(mK)
Water vapour diffusion resistance factor (EN 13986)	12 - 50	
Sound absorption 250 - 500 HZ (EN 13986)	0.10	
Sound absorption 1000 - 2000 HZ (EN 13986)	0.25	
Formaldehyde	E1(*); E0.5 (**); CARB/TSCA Title VI (***);F****(****)	

Different formaldehyde emission standards are available :
(*) E1 - According to *EN 13986+A1:2015* :

- a limit value of 0.1 ppm may not be exceeded by *EN 717-1* emission chamber method OR
- a limit value of 8 mg HCHO/100 g according to *ISO 12460-5*

(**) E0.5 - According to the ChemVerbotsV :

- a limit value of 0.1 ppm according to *EN 16516* OR
- a limit value of 0.05 ppm according to *EN 717-1*

(***) CARB 2/TSCA Title VI - According to California Air Resources Board & the US Toxic Substances Control Act (TSCA Title VI) :

- a limit value of 0.09 ppm according to *ASTM E1333* or *ASTM D6007*

(****) F**** - According to Japanese standard *JIS A 5908*

- a limit value of 0.3 mg/L according to *JIS A 1460* desiccator

Performance data are consistent with the product's declaration of performance with respect to its essential characteristics according to:

- *EN 13986:2004+A1:2015*, *Wood-based panels for use in construction – Characteristics, valuation of conformity*

and marking
- *EN 16368:2014, Lightweight Particleboards – Specifications*
- *EN 312:2010, Particleboards – Specifications*

2.4 Delivery status

Unilin's chipboards are available in a diverse range of dimensions:

- Length: 600 mm - 6700 mm
- Width: 600 mm - 2660 mm
- Thickness: 8 - 54 mm

Please contact Unilin's sales team or info.panels@unilin.com for more information on available dimensions of specific products.

2.5 Base materials/Ancillary materials

The table below details the sales-weighted average composition of the Unilin Chipboard. This chipboard has a density of 676 kg/m³ and consists of recycled and fresh wood, (melamine) urea formaldehyde glue ((M)UF), additives and moisture. The additives added depend heavily on the specific commercial reference (e.g. wax emulsion, fire retardant based on inorganic salts).

Name	Value	Unit
Recycled Wood	78	%
Fresh wood	7	%
(M)UF glue	8	%
Additives	1	%
Moisture	6	%

The chipboard is primarily made up of recycled wood, accounting for 95 % of the total wood composition. 88 % consists of post-consumer recycled wood, while the remaining 7 % is coming from pre-consumer sources. These post-consumer streams are composed of recycled wood, containing legacy fossil-based substances (e.g. glue and other additives), along with other types of demolition waste. Unilin's state-of-the-art recycling unit employs a variety of methods to eliminate these impurities, resulting in chipboards of exceptional quality and safety.

The used fresh wood is 100 % recovered wood, predominantly sourced from sustainable forest management activities and sawmills (residues & co-products), and mainly consists of spruce, oak and pine.

The composition of specific commercial references can differ from the values depicted above and can be obtained by reaching out to info.panels@unilin.com.

Unilin's chipboard range contains no Substances of Very High Concern (SVHCs) or Category 1A or 1B CMR-substances (as defined by ECHA) above 0.1 % by weight: **No**
The chipboards further contain no biocides as defined under the *EU Biocidal Products Ordinance No. 528/2012* nor are the boards treated with such substances.

2.6 Manufacture

1. After roughly cutting, sorting and cleaning, the wood is cut into small chips.
2. The chips are dried to the required moisture content.
3. The dry chips are mixed with a thermohardening glue and additives.
4. The mixture is spread out in a 3 layer cake shaped board and compressed at high pressure and temperature to bind the wood particles and the glue into a solid chipboard.
5. The endless board that leaves the press is cut into large panels and passively cooled.
6. After cooling down, the panels can be sanded, cut to final size, and optionally finished further depending on the intended application.

2.7 Environment and health during manufacturing

Unilin's plant management policy is fully integrated in the daily operation and governance of its production plants. The aim is to adhere to legal requirements, minimize negative environmental effects on its neighbors, co-workers and surroundings, and constantly improve environmental performance. The plants are *ISO 9001* certified.

The implementation of Unilin's One Home Sustainability Strategy and its Zero Harm Safety Policy have further set clear targets to among others reduce the carbon footprint of its production activities, improve the overall resource efficiency and enhance the safety and well-being at its production sites.

2.8 Product processing/Installation

The Unilin Chipboard can be processed (e.g. sawing, milling, drilling) using common utility tools and machinery. It is advised to wear a dust mask when tools are used without dust extraction. More specific processing and health information is available at www.unilinpanels.com.

2.9 Packaging

Product packaging is used to protect the product from damage during transport. Wood-based chipboards, cardboard, stretchfoil and PET packaging straps are used as packaging materials.

2.10 Condition of use

The product's composition remains unchanged during its use and is therefore the same as stated in section 2.5. The glue and additives are permanently bonded to the wood through an irreversible curing process.

2.11 Environment and health during use

Based on current knowledge, using the Unilin Chipboard as intended poses no risks to health, water, air or soil. Small amounts of natural wood constituents could potentially be released, but aside from negligible amounts of formaldehyde, no harmful emissions have been detected.

2.12 Reference service life

The reference service life (RSL) of the product depends significantly on its field of use. Please contact Unilin's sales team or info.panels@unilin.com for more specific information on the product's lifespan in a given set of conditions.

The chipboard's RSL can vary from 10 to 50 years depending on its area of application; according to the *BBSR* table "BNB Nutzungsdauern von Bauteilen (2017)".

2.13 Extraordinary effects

Fire

The fire resistance of the Unilin Chipboard depends heavily on its chemical composition (i.e. presence of fire retardants). The products have the following fire behaviour (according to *EN13501-1*):

CE AVCP Class 4 :

- Standard/Moisture Resistant chipboards (excl. fire retardant): D-s2,d0 (≥ 9mm/ Bulk density > 600 kg/m³)

CE AVCP Class 1 :

- Antivlam: B-s1,d0 (10 - 25 mm)
- Hydroflam: B-s2,d0 (10 - 22 mm)

Fire reaction classes are part of the CE Declaration of Performance available on Unilin Panels website www.unilinpanels.com.

Water
The Unilin Chipboard does not contain substances that may potentially contaminate water through leaching. However, it is important, to ensure that the product is not subjected to continuous exposure to moisture. Prolonged contact with water may result in the degradation of the product.

Mechanical destruction
When subjected to mechanical stress, the product displays a tendency towards brittleness. This could result in the formation of splinters and sharp broken edges, which may pose a risk of injury. The product's ability to withstand mechanical impact is directly related to its respective board type, as indicated in section 2.1.

2.14 Re-use phase

Reuse/recycling
When a building or furniture has reached its end-of-life phase, the Unilin chipboard can easily be abstracted and collected if selective dismantling/sorting takes place. After collection, the end-of-life chipboard can be reused for the same (or different) purpose if possible. The end-of-life material can also be recycled into a new chipboard, replacing fresh wood chips.

Energy Recovery
In line with the cascading use of wood-based products, the reuse/recycling of end-of-life chipboard should be prioritized. However, if this is not feasible, the chipboard can be used as a secondary fuel in approved energy power plants. Its relatively high calorific value enables power plants to effectively produce renewable heat and electricity.

2.15 Disposal

Jobsite and post-consumer chipboard waste (e.g. from demolition projects) should be reused/recycled where possible, in line with the cascade principle. Should this not be possible, the waste must be utilized for energy recovery as opposed to being landfilled (in accordance with *EWC* waste codes 170201/030105).
Waste from packaging materials, which protect the product from damage during transport, can be reused and recycled if sorted correctly.

2.16 Further information

Please contact Unilin's sales team or reach out to info.panels@unilin.com for additional information.

3. LCA: Calculation rules

3.1 Declared Unit

The declared information and values in this Environmental Product Declaration refer to 1 m³ of Unilin Chipboard with a sales-weighted average composition and density of 676 kg/m³.

Declared unit and mass reference

Name	Value	Unit
Declared unit	1	m^3
Gross density	676	kg/m^3

Other declared units are allowed if the conversion is shown transparently.

The composition of the Unilin Chipboard, for which values are declared in this EPD, was obtained by averaging Unilin's entire chipboard portfolio based on the annual sales volumes. The product is produced at the SPANO and BOSPAN plants, which are both in the scope of this declaration.

3.2 System boundary

This is a cradle-to-gate EPD with options, including the following life cycle phases A1 - A3, C1 - C4 and D. The following processes have been considered for each of the modules:

A1 - A3: Product Stage
The production stage encompasses the extraction of raw materials (i.e. wood, glue, additives), their transportation to the production plants, and the subsequent manufacturing of the product. The required energy for production, ancillary materials, and production emissions are included. Energy and material input/output data were obtained from Unilin's chipboard factories (SPANO and BOSPAN) as well as Unilin's glue factory.

A large share of the supplied production energy is derived from renewable sources. These consist of post-consumer woody waste streams, which are not recyclable. The adjacent biomass plants A&S and A&U generate renewable energy and heat from these waste streams, which are directly supplied to Unilin's chipboard plants. Any remaining energy needs are met through the local grid in Belgium.

C1: Deconstruction/Demolition stage
It is assumed that the end-of-life chipboard is manually dismantled from the building/furniture. The efforts involved in this process are considered negligible, leading to the absence of a declared environmental impact arising from the dismantling of the product.

C2: Transport to Waste Processing
This life cycle stage describes the impact of the end-of-life chipboard's transport from the demolition site to the waste processing facility. A representative distance of 50 km is assumed.

C3: Waste Processing
Processing of the post-consumer chipboard waste involves (preliminary) sorting and shredding of the material. As an end-of-life chipboard is either recycled or energetically recovered, the material leaves the system as a secondary material or fuel in module C3. The impact of both end-of-life scenarios is declared in section 5. Material inherent properties (e.g. biogenic carbon and primary energy content) are thus exported from the system in C3.

C4: Waste Disposal
This module describes the loads and emissions attributed to the disposal of the product after waste processing. As the end-of-life product leaves the system in C3 as secondary material or fuel, no environmental impact is declared in C4.

D: Loads and Benefits beyond the System Boundaries
Module D describes the loads and benefits related to the use of the end-of-life chipboard either as a secondary material or as a secondary fuel. The latter involves the energy recovery of post-

consumer chipboard waste. Here it is assumed that the end-of-life product replaces an European-averaged mix of electricity and heat. When used as a secondary material, the impact of substituting fresh wood chips is considered.

The system boundary between subsequent systems is defined in accordance with *EN 15804+A2*, i.e. when the material reaches its end-of-waste state. During A1 - A3, the recycled wood input is considered as end-of-waste after (preliminary) sorting and shredding in the previous system. Similarly, end-of-life chipboard reaches its end-of-waste state after sorting and shredding the waste, as inventoried in C3. The end-of-life chipboard leaves the current system at module C3 and enters a subsequent system as a secondary material or fuel.

3.3 Estimates and assumptions

Specific, primary data have been used to the highest extent possible. In case of absence, estimates and assumptions were made to model reality as closely as possible. These assumptions are based on publicly available data and literature. Generic dataset from the *EcoInvent 3.8*. database have been used to model the impact of some raw materials and process-related parameters for which specific data was lacking.

End-of-life chipboard can leave the product system in C3 as a secondary fuel, for which the benefits and loads are inventoried in module D. Here it is assumed that the secondary fuel substitutes electricity and heat in accordance with an average mix available on the European grid.

3.4 Cut-off criteria

All in- and outputs to the system under study have been included in the LCA. Primary data was used to the highest extent possible. If primary data was lacking, secondary data from EcoInvent was resorted to. Conservative assumptions were made using average or generic data in case of data gaps. These assumptions are based on publicly available (literature reported) data. As such, all processes, materials, or emissions expected to have a significant contribution to the environmental impact of the system under study were considered in the LCA. The total sum of omitted flows can therefore be deemed as significantly below the 5 % threshold of the system's energy and mass input, as stated in the *EN 15804+A2*.

3.5 Background data

The relevant background data was either taken from the *EcoInvent 3.8.* database or peer-reviewed literature sources. Measures were taken to ensure that the used secondary data was no more than 10 years old. These data types allowed to map the background system in the LCA of the product under study.

3.6 Data quality

Data collection and necessary calculations were done in line with *ISO 14044*. Primary data was directly gathered from the designated person at Unilin's chipboard and glue plants. It was ensured that the collected data accurately represented reality, so it can be assumed that the used primary data is of high quality.

The technological, geographical, and time-related representativeness of background data (e.g. from EcoInvent) was verified, as stated in *EN 15804+A2*.

3.7 Period under review

Primary data, needed to calculate the LCA of the system under study, was collected for the year 2020 from the BOSPAN, SPANO and Unilin's glue production facility.

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: Belgium

3.9 Allocation

In line with the *EN 15804+A2 and EN 16485*, the biogenic carbon and primary energy content of the recycled and fresh wood have been balanced over the product's entire life cycle (A1 - C4) based on their inherent material characteristics and underlying physical flows. Fresh wood inventories were taken from *EcoIvent 3.8*. Here, it was made sure that the biogenic carbon and energy content reflect the physical relationships of the different wood-based materials.

The output of Unilin's chipboard plants consists of two products, i.e. the chipboard and post-consumer metal-based products (i.e. by-product). The latter is extracted from the post-consumer wood waste of which the Unilin Chipboard is largely composed. These metal-based materials are abstracted from the woody waste streams in module A3. Since the difference in revenue between the 2 outputs is relatively significant, the allocation of the relevant production-related process and emissions was carried out based on their respective economic values (as described in *EN 15804*).

The system boundary (and subsequent allocation) relating to the flow of post-consumer wood and end-of-life product are as described in section 3.2.

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. Background data was used from the *EcoInvent 3.8.* database.

4. LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon

The values declared below describe the amount of biogenic carbon and stored biogenic CO_2 in the building product under study when it leaves the factory gate. The values relate to 1 m³ of Unilin chipboard, with a sales-weighted average composition.

Biogenic carbon content at factory gate

The carbon uptake of the packaging materials is not included below as their end-of-life impact is not declared in module A5.

Name	Value	Unit
Biogenic carbon content in product	286.8	kg C/m³
Stored carbon dioxide in the product	1051.7	kg CO2/m³

Note: 1 kg biogenic carbon is equivalent to 44/12 kg CO_2.

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).

Installation into the building (A5)

The end-of-life impact of the used packaging materials is not declared. However, its impact can be modelled based on the data given below.

Name	Value	Unit
Wood-based packaging	23.15	kg/m³
Cardboard	0.23	kg/m³
PET straps	0.18	kg/m³
Stretch foil	0.05	kg/m³

Information on the reference lifetime can be found in section 2.12. Please contact Unilin's sales team or info.panels@unilin.com for more information.

End-of-life (C1-C4)

The following table provides the parameters required to model the end-of-life of the product under study. Since the product is not intended for extended outdoor use, it is assumed that its moisture content remains consistent with its state at the factory gate. The end-of-life product reaches its end-of-waste state after (preliminary) sorting and shredding. The losses during the sorting and shredding are assumed to have a negligible impact and are thus discarded. The material leaves the system either as secondary material (recycling) or as secondary fuel (energy recovery).

Name	Value	Unit
Collected separately waste type waste type	676	kg
Secondary material (output at C3)	676	kg/m³
Secondary fuel (output at C3)	676	kg/m³

Reuse, recovery and/or recycling potentials (D)

In module D, the loads and benefits of exporting secondary material or fuel from the system under study are inventoried. The moisture content of this material/fuel is assumed to remain at a total of 6 %. This value may vary significantly based on the storage conditions prior to its intended use.

Recycling (secondary material)

To correctly model the recycling potential, the net flow of secondary material in the system was mapped during the product's entire lifecycle. It is assumed that post-consumer wood chips replace fresh wood chips. The avoided impact of this fresh wood chips production was thus modeled using secondary data from EcoInvent.

Energy Recovery (secondary fuel)

Similarly, the recovery potential is modeled based on the net output flow of secondary fuel. It is assumed that a biomass power plant located in the EU recovers the secondary fuel's energy, with 55 % of the energy being recovered as heat and the remaining 30 % as electricity. The generated energy carriers are assumed to substitute heat and electricity in accordance with the average mix available on the European grid.

Name	Value	Unit
Net output flow of secondary material	145	kg/m³
Net output flow of secondary fuel	520	kg/m³
Energy Efficiency Biomass plant	85	%

5. LCA: Results

The declared values refer to 1 m³ of Unilin Chipboard with a sales-weighted average composition and density of 659 kg/m³.

As previously stated, two end-of-life scenarios are evaluated: energy recovery (secondary fuel) and recycling (secondary material). These scenarios only affect modules C3 and D, thus two sets of impacts for each module are given below. Columns C3/1 and D/1 represent the scenario in which the end-of-life product exits the system as a secondary fuel, while the impacts of the recycling scenario are described in columns C3/2 and D/2.

Table "Description of the system boundary" summarizes the scope of the system under study from a life cycle point of view. Declared modules are indicated with an "X", non-declared modules are indicated with "MND". "MNR" refers to modules which are deemed as not relevant.

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	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 Unilin Chipboard

Parameter	Unit	A1-A3	C1	C2	C3/1	C3/2	C4	D/1	D/2
GWP-total	kg CO_2 eq	-9.1E+02	0	2.92E+00	1.06E+03	1.06E+03	0	-5.1E+02	-8.9E+00
GWP-fossil	kg CO_2 eq	1.41E+02	0	2.92E+00	1.14E+01	1.14E+01	0	-5.09E+02	-8.8E+00
GWP-biogenic	kg CO_2 eq	-1.05E+03	0	9.46E-04	1.05E+03	1.05E+03	0	-8.76E-01	-4.17E-02
GWP-luluc	kg CO_2 eq	2.14E-01	0	1.13E-03	1.55E-02	1.55E-02	0	-7.03E-01	-5.68E-02
ODP	kg CFC11 eq	2.75E-05	0	7.33E-07	1.64E-06	1.64E-06	0	-6.61E-05	-1.27E-06
AP	mol H^+ eq	1.07E+00	0	9.37E-03	6.43E-02	6.43E-02	0	-5.92E-01	-6.85E-02
EP-freshwater	kg P eq	3.75E-03	0	2.1E-05	6.27E-04	6.27E-04	0	-3.08E-02	-7.43E-04
EP-marine	kg N eq	2.64E-01	0	2.06E-03	1.64E-02	1.64E-02	0	3.4E-01	-2.14E-02
EP-terrestrial	mol N eq	3.41E+00	0	2.29E-02	1.83E-01	1.83E-01	0	3.72E+00	-2.42E-01
POCP	kg NMVOC eq	8.06E-01	0	9.02E-03	5.19E-02	5.19E-02	0	6.91E-01	-7.5E-02
ADPE	kg Sb eq	1.32E-03	0	7.26E-06	3.8E-05	3.8E-05	0	-1.56E-04	-5.81E-05
ADPF	MJ	3.09E+03	0	4.78E+01	2.07E+02	2.07E+02	0	-1.21E+04	-1.64E+02
WDP	m^3 world eq deprived	1.41E+02	0	1.62E-01	5.74E-01	5.74E-01	0	-6.69E+01	-6.73E+00

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: 1 m³ Unilin Chipboard

Parameter	Unit	A1-A3	C1	C2	C3/1	C3/2	C4	D/1	D/2
PERE	MJ	1.95E+03	0	6.09E-01	1.05E+04	1.05E+04	0	-9.93E+02	-9.01E+02
PERM	MJ	1.05E+04	0	0	-1.05E+04	-1.05E+04	0	0	2.25E+03
PERT	MJ	1.25E+04	0	6.09E-01	2.19E+01	2.19E+01	0	-9.93E+02	1.35E+03
PENRE	MJ	1.86E+03	0	4.78E+01	1.43E+03	1.43E+03	0	-1.21E+04	-1.64E+02
PENRM	MJ	1.26E+03	0	0	-1.22E+03	-1.22E+03	0	0	2.61E+02
PENRT	MJ	3.12E+03	0	4.78E+01	2.07E+02	2.07E+02	0	-1.21E+04	9.7E+01
SM	kg	5.58E+02	0	0	0	0	0	0	1.45E+02
RSF	MJ	1.2E+03	0	0	0	0	0	6.88E+03	0
NRSF	MJ	0	0	0	0	0	0	7.96E+02	0
FW	m^3	4.09E+00	0	5.69E-03	1.15E-01	1.15E-01	0	-4.9E+00	-2.07E-01

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: 1 m³ Unilin Chipboard

Parameter	Unit	A1-A3	C1	C2	C3/1	C3/2	C4	D/1	D/2

HWD	kg	1.3E+01	0	3.31E-02	3.08E-01	3.08E-01	0	-2.28E+00	-2.64E-01
NHWD	kg	6.38E+01	0	4.72E+00	8.46E+00	8.46E+00	0	-7.37E+01	-5.11E+00
RWD	kg	6.26E-03	0	3.24E-04	1.44E-03	1.44E-03	0	-4.81E-02	-8.75E-04
CRU	kg	0	0	0	0	0	0	0	0
MFR	kg	0	0	0	0	6.76E+02	0	0	0
MER	kg	0	0	0	6.76E+02	0	0	0	0
EEE	MJ	0	0	0	0	0	0	0	0
EET	MJ	0	0	0	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:
1 m³ Unilin Chipboard

Parameter	Unit	A1-A3	C1	C2	C3/1	C3/2	C4	D/1	D/2
PM	Disease incidence	1.19E-05	0	3.41E-07	7.57E-07	7.57E-07	0	7.54E-06	-2.5E-06
IR	kBq U235 eq	5.56E+00	0	2.07E-01	1.41E+00	1.41E+00	0	-5.53E+01	-8.48E-01
ETP-fw	CTUe	4.73E-05	0	5.86E-08	2.88E-07	2.88E-07	0	-1.39E-06	-1.87E-04
HTP-c	CTUh	4.26E-07	0	4.76E-10	3.2E-09	3.2E-09	0	2.6E-08	-3.28E-08
HTP-nc	CTUh	7.79E-08	0	1.33E-09	1.05E-08	1.05E-08	0	-5.6E-08	-7.4E-09
SQP	SQP	1.3E+04	0	5.47E+01	1.01E+02	1.01E+02	0	-9.47E+02	-4.92E+03

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

This section aims to analyze and interpret the results of the LCA analysis carried for 1 m³ of the Unilin Chipboard. The results shown below, for both end-of-life scenario's, refer to the product with a sales-weighted average composition. Although the values for specific commercial references can vary from the declared and discussed ones, the observed trends will be the same throughout the entire product category.

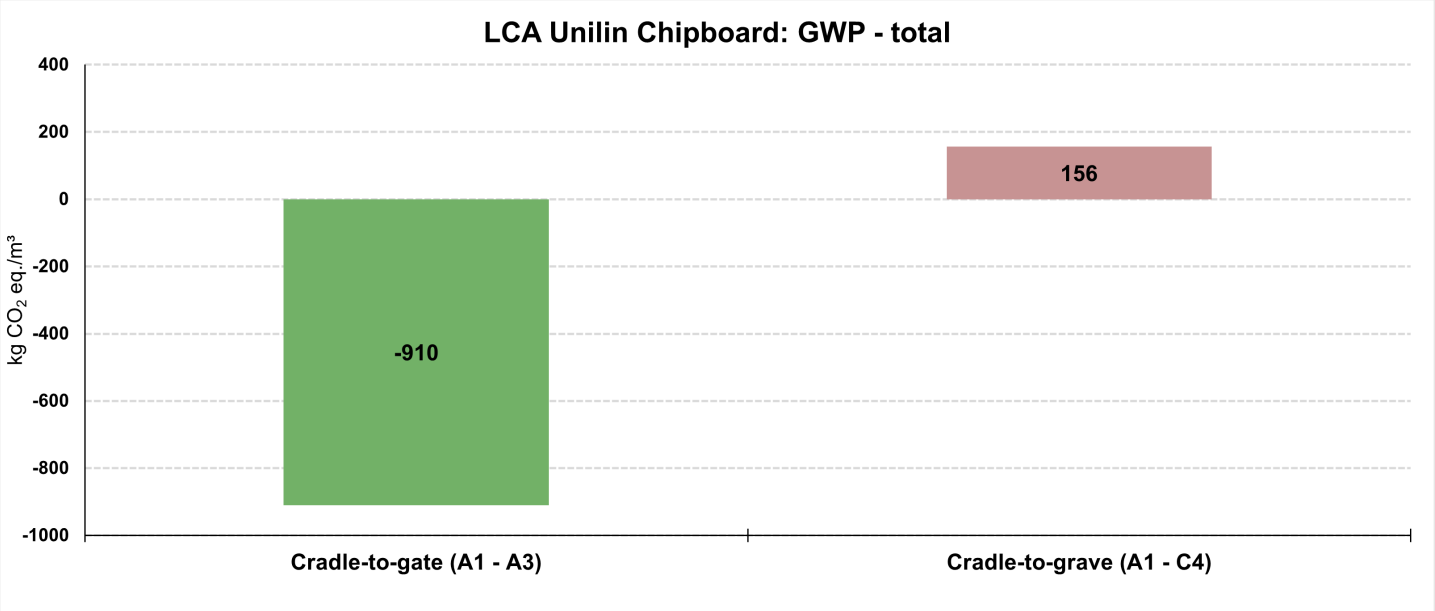
Summary

This part intends to summarize the trends observed in the cradle-to-gate environmental impact of the Unilin Chipboard. An in-depth analysis is available in the following subsections.

Unilin Chipboard is composed of 85 % wood, of which 92 % is pre- and post-consumer recycled wood. This is highlighted in the 'use of secondary material' indicator, which has a value of 558 kg SM/m³ chipboard for modules A1 - A3.

During its growth, wood absorbs CO_2 through photosynthesis and stores it as biogenic carbon in its biomass. The chipboard's high wood content results in a GWP-total of - 910 kg/m³. The product thus stores carbon and does not contribute to global warming when it leaves Unilin's factory gate. The stored carbon will only be released if the chipboard can no longer fulfill its intended purpose (end of life).

A deep dive in the drivers of the cradle-to-gate environmental impact shows the significant contribution of the raw materials (module A1). 53 % of the fossil CO_2 emissions can primarily be allocated to the (M)UF-glue production, as well as 98 % of the water used in A1 - A3. The generation of heat and electricity, required for the chipboard's production, is an important driver of the production-related impact. This is observable in the AP, EP, POCP indicators.



Energy Recovery (Secondary Fuel)

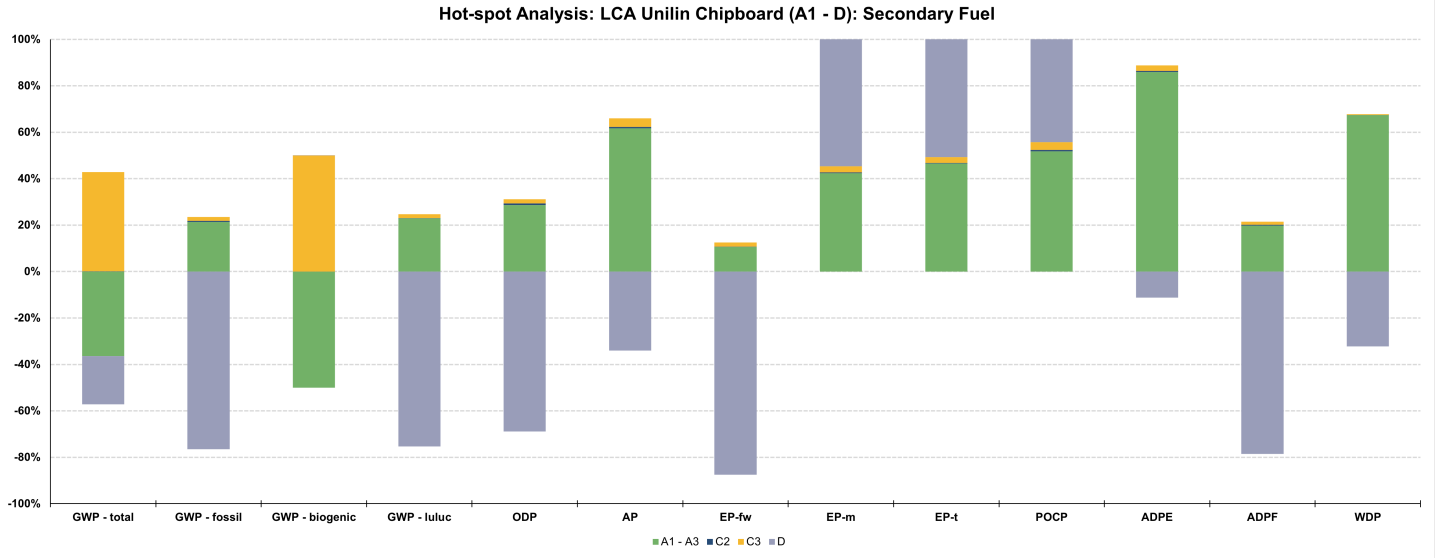
The hot-spot analysis highlights the negative GWP-value of modules A1 - A3, as depicted in the GWP-focused one. To improve the clarity of the graph, the values of the GWP-luluc indicator have been omitted.

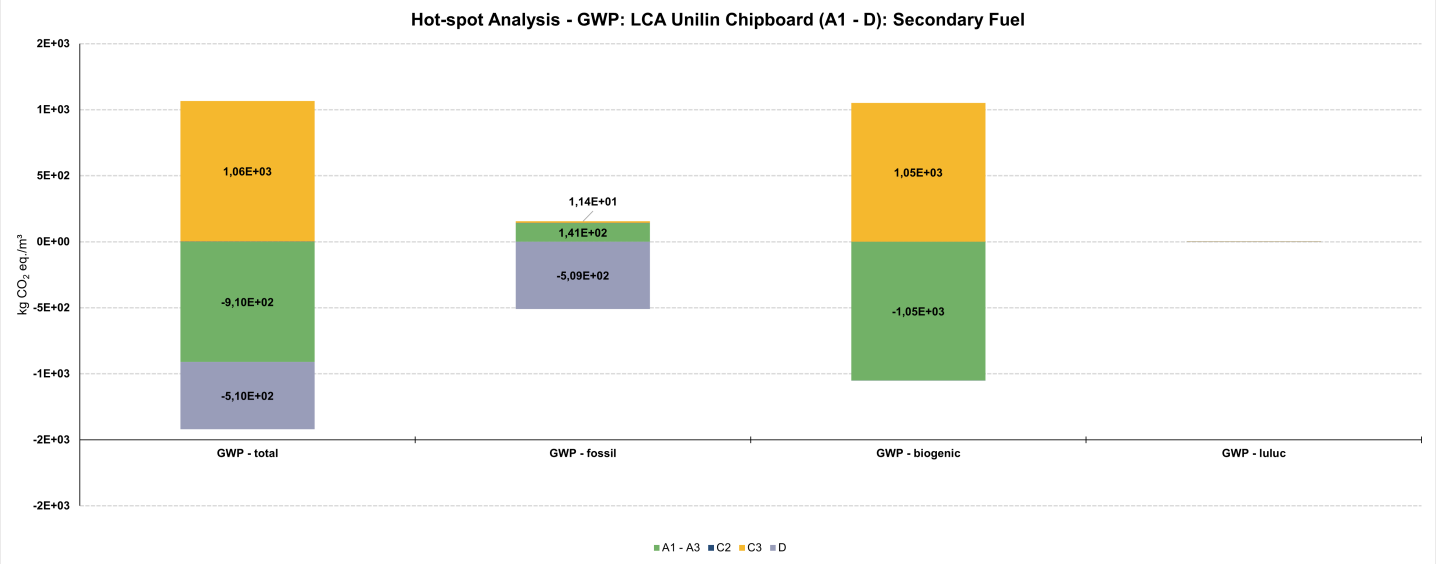
Wood stores CO_2 as biogenic carbon during its growth (GWP-biogenic = -1051 kg CO_2 eq./m³). This negative GWP-value is partially counterbalanced by the positive GWP-impact of the fossil materials and energy resources used during A1 - A3 (GWP-fossil). This results in a GWP-total of - 910 kg CO_2 eq./m³ when the Unilin Chipboard leaves the factory gate. The product under study thus stores carbon and does not contribute to the global warming potential.

The stored carbon will only be released when the end-of-life product leaves the system as a secondary fuel. The figure below clearly demonstrates a neutral biogenic carbon balance in accordance with *EN16485*.

The GWP-focused analysis also illustrates the "avoided" impact (described in module D) related to the export of end-of-life chipboard as a secondary fuel. The energy recovery of the secondary fuel generates heat and electricity, which substitutes a European averaged mix of heat and electricity from the grid. Since the largest share of the heat and electricity on the European grid is fossil-based, a negative GWP-fossil is obtained (i.e. avoided fossil CO_2 emissions from combustion). It indicates that the combustion of these fossil fuels has a higher impact on global warming than the energy recovery from the secondary fuel.

The hot-spot analysis shows that, for non-GWP-related parameters, modules A1 - A3 are the main contributors to the system under study. Values for module D are generally negative, except for the EP and POCP indicators. This is attributed to the emissions from the energy recovery process of the end-of-life chipboard.

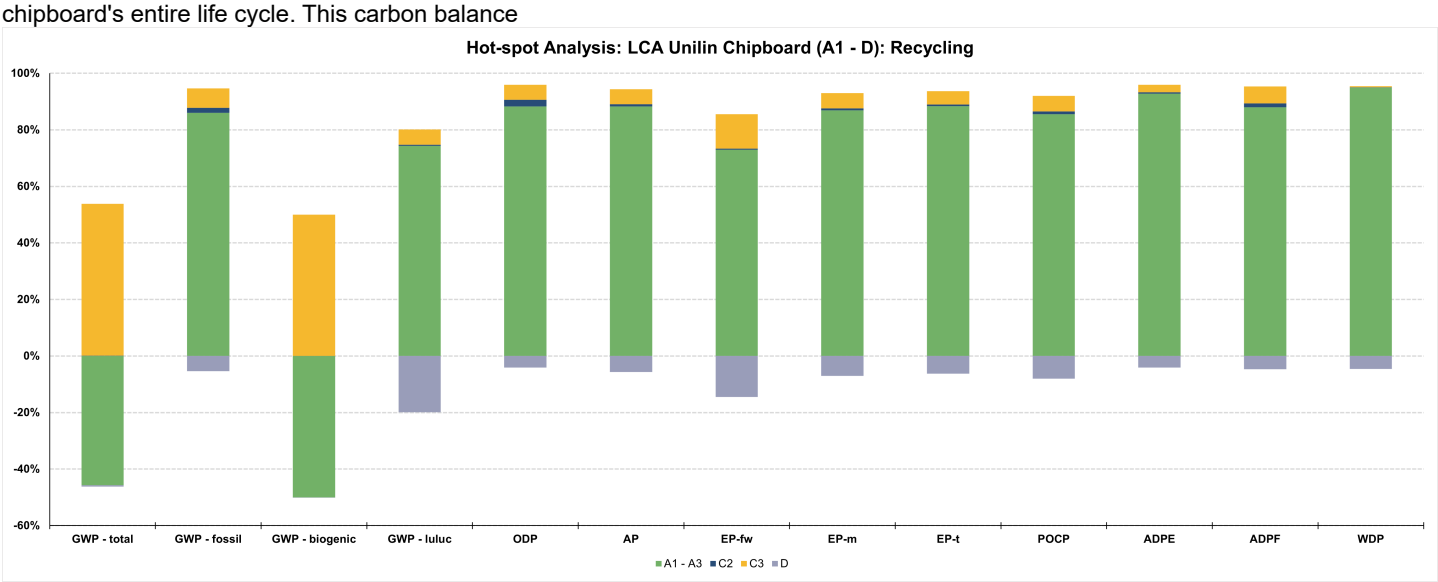


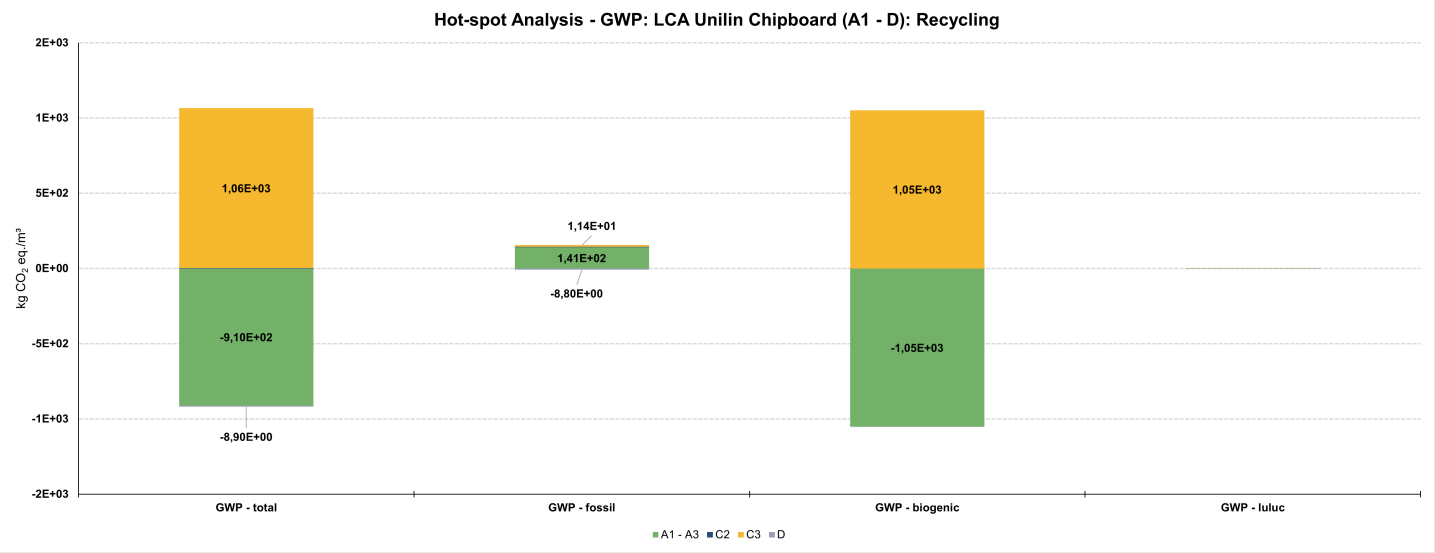


Recycling (Secondary Material)

If the end-of-life chipboard leaves the system as a secondary material, the cradle-to-gate environmental impact remains the same as for the energy recovery scenario. The end-of-waste state is achieved (for both secondary material and fuel) after sorting and shredding the end-of life chipboard. The environmental impact during module C3 also remains the same. The GWP-focused hot-spot analysis, shown below, also demonstrates a neutral biogenic carbon balance over the chipboard's entire life cycle. This carbon balance accommodates the transfer of the wood's biogenic carbon content from the system under study to a subsequent system. It is assumed that the exported secondary material replaces fresh wood chips.

The non-GWP-related parameters show a lower contribution of module D to the core environmental indicators in comparison to the energy recovery EOL scenario. This is attributed to the fact that the production of wood chips from fresh wood is less environmentally encumbered than the combustion processes needed to generate (fossil-based) energy carriers.

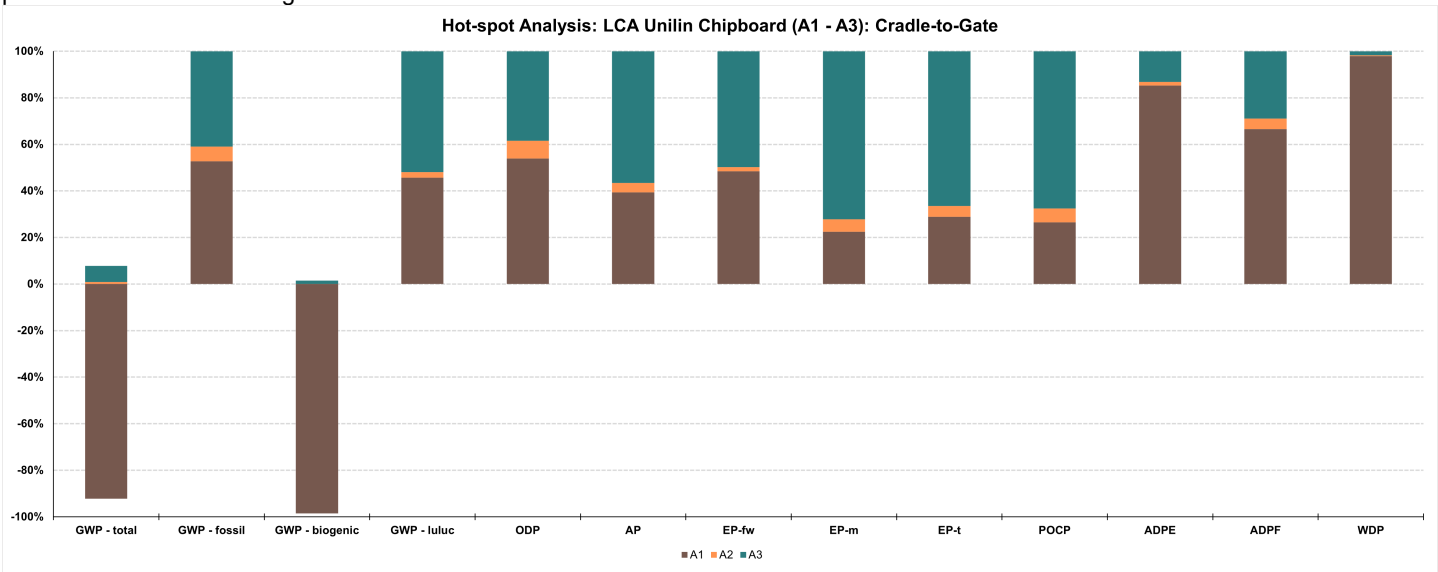




Product Stage (A1 - A3) - Main Drivers

The graph below allows to identify the primary sources of the cradle-to-gate environmental impact. The results show that raw material production (module A1) has a significant impact. 53 % of the fossil CO_2 emissions are primarily attributed to the production of (M)-UF glue. The contribution of the raw material production is even more significant for the indicators ADPE and WDP. 98 % of all water used in modules A1 - A3 is allocated to the production of the raw materials (mainly related to the production of (M)UF-glue).

Energy-related processes are typically the main drivers of the environmental impact of module A3. This is observed in the contribution of A3 to AP, EP and POCP, which is traced back to the generation of electricity and heat at the adjacent biomass plants A&S and A&U.



7. Requisite evidence

Formaldehyde emissions

E1 - *EN 13986:2004+A1:2015*

- Test report : QA-2023-0135
- Method : *EN ISO 12460-5*
- Product : Belspan LF+
- Laboratory : WKI Fraunhofer
- Result : 2.3 mg/100g DS [Limit value < 8 mg/100g DS)

E0.5 - ChemVerbotsV

- Test report : QA-2023-0134
- Method : *EN 717-1*
- Product : Belspan LF+
- Laboratory : WKI Fraunhofer
- Result : 0.03 ppm [Limit value < 0.05 ppm)

CARB2/TSCA Title VI

- Test report : 230061-REQ1
- Method : *ASTM D6007-14*
- Product : Belspan LF
- Laboratory : Wood.be
- Result : 0.05 ppm [Limit value < 0.09 ppm]

PCP + Heavy metals + Wood preservative analysis

- Test Report : 0001131684/20 AZ 593092
- Method : see report details
- Product : Belspan LF+
- Laboratory : TUV Reinland
- Result : PCP < 0.1 mg/kg; Lindane < 0.1 mg/kg; Lead 67 mg/kg; Arsenic < 5 mg/kg; Chromium < 10 mg/kg; Copper 11 mg/kg

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VOC Emissions

Unspecified while raw chipboards are always coated with a finish in their end application. The type of finish (melamine, paper foil, veneer, HPL,...) will determine the indoor air quality.

8. References

Standards

ASTM D6007

ASTM D6007:2020, Standard Test Method for Determining Formaldehyde Concentrations in Air from Wood Products Using a Small-Scale Chamber.

ASTM E1333

ASTM E1333:2020, Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Using a Large Chamber.

EN 310

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

EN 312

EN 312:2010-12, Particleboards – Specifications

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

EN 323

EN 323:2005, Wood-based panels - Determination of density.

EN 717-1

EN 717-1:2004, Wood-based panels - Determination of formaldehyde release Formaldehyde emission by the chamber method.

EN 12460-5

EN 12460-5:2015, Wood-based panels. Determination of formaldehyde release Extraction method (called the perforator method).

EN 13501-1

EN 13501-1:2007-05+A1:2009, Fire classification of construction products and building elements - Part 1: classification with the results of tests on the reaction to fire of building products.

EN 13986

EN 13986:2004+A1:2015, Wood-based panels for use in construction— Characteristics, valuation of conformity and marking.

EN 15804

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

EN 16368

EN 16368:2014, Lightweight Particleboards –Specifications.

EN 16449

EN 16449:2014, Wood and wood-based produts - Calculation of the biogenic carbon content of wood and conversion to carbon dioxide.

EN 16485

EN 16485:2014, Round and sawn timber. Environmental Product Declarations. Product category rules for wood and wood-based products for use in construction.

EN 16516

EN 16516:2020, Construction products: Assessment of release of dangerous substances - Determination of emissions into indoor air.

ISO 9001

EN ISO 9001:2008-11, Quality Management Systems – Requirements.

ISO 14025

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

ISO 14040

EN ISO 14040:2006-10, Environmental management — Life cycle assessment — Principles and framework.

ISO 14044

ISO 14044:2006-10, Environmental management — Life cycle assessment — Principles and framework.

JIS A 1460

JIS A 1460:2021, Building boards Determination of formaldehyde emission -- Desiccator method.

JIS A 5908

JIS A 5908:2022, Particleboards

Additional References

BBSR Table

BBSR 2017, Useful lives of building components for life cycle analyses according to the Sustainable Building Assessment System, 2017, BBSR Germany 2017.

CPR

CPR EU Ordinance No. 305/2011 of the European Parliament and Council of 9th March 2011 to define harmonized conditions for marketing building products.

EcoInvent 3.8.

Ecoinvent 3.8, Database for Life Cycle Inventory and Assessment. Swiss Centre for Life Cycle Inventories, 2021. Available at: https://ecoinvent.org/the-ecoinvent-database/data-releases/ecoinvent-3-8/.

EU Biocidal Products Ordinance No. 528/2012

Regulation (EU) No 528/2012 of the European Parliament and Council of 22 May 2012 concerning the making available on the market and use of biocidal products.

EWC

European Waste Catalogue, Ordinance on the European Waste Catalogue (Waste Catalogue Ordinance - AVV), reference Federal Official Journal I 2001, 3379.

IBU 2022

Institut Bauen und Umwelt e.V.: General Instructions for the EPD programme of Institut Bauen und Umwelt e.V., Version 2.1, Berlin: Institut Bauen und Umwelt e.V., 2022 www.ibu-epd.com

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. (eds.), 2021.

PCR Part B

Product Category Rules for Building-Related Products and Services. Part B: Requirements on the EPD for Wood based panels. Version 2. Berlin: Institut Bauen und Umwelt e.V. (eds.), 2023.

SVHC List

List of Substances of Very High Concern (SVHC) Candidate for Authorisation (ECHA Candidate List), dated 04.07.2023, published in accordance with Article 59(10) of the REACH Regulation. Helsinki: European Chemicals Agency.

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

Unilin B.V. Division Panels
Ooigemstraat 3
8710 Wielsbeke
Belgium

+32 56 67 52 11
info.panels@unilin.com
https://www.unilinpanels.com/en-gb

Owner of the Declaration

Unilin B.V. Division Panels
Ooigemstraat 3
8710 Wielsbeke
Belgium

+32 56 66 70 21
info.panels@unilin.com
https://www.unilinpanels.com/en-gb