ENVIRONMENTAL PRODUCT DECLARATION

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

Owner of the Declaration	**Etex Building Performance International**
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-ETE-20200285-IBC1-EN
Issue date	01/04/2021
Valid to	31/03/2026

Duripanel B1

Etex Germany Exteriors GmbH

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1. General Information

Etex Germany Exteriors GmbH	Duripanel B1
Programme holder IBU – Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin Germany	**Owner of the declaration** Etex Building Performance International 500 rue Marcel Demonque 84915 Avignon Cedex 9 FRANCE
Declaration number EPD-ETE-20200285-IBC1-EN	**Declared product / declared unit** 1m² Duripanel B1 with thickness 18mm.
This declaration is based on the product category rules: Wood cement - Mineral-bonded wooden composites, 01.2019 (PCR checked and approved by the SVR)	**Scope:** The life cycle assessment is based on production data of Duripanel B1 of the year 2018 at the production site of Etex Germany Exteriors GmbH in Beckum, Germany. The results of the life cycle assessment provided in this EPD are based on a thickness of 18mm and are globally valid. The LCA results for additional thicknesses are declared in an annexe to this EPD.
Issue date 01/04/2021	
Valid to 31/03/2026	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 14025:2010* ☐ internally ☒ externally
Dipl. Ing. Hans Peters (chairman of Institut Bauen und Umwelt e.V.)	
Dr. Alexander Röder (Managing Director Institut Bauen und Umwelt e.V.))	Mr Carl-Otto Neven (Independent verifier)

2. Product

2.1 Information about the enterprise

Etex is an international building materials specialist with headquarters in Belgium since 1905. The Etex group operates 101 production sites in 42 countries and employs over 13 200 people worldwide. Duripanel is produced at the production site of Etex Germany Exteriors GmbH.

2.2 Product description/Product definition

Duripanel B1 is a three-layer cement-bonded particleboard according to *EN 634-1 and -2* for internal and external construction applications. It mainly consists of the natural raw material wood particles and cement.
It is being produced in different thicknesses between 8 and 40 mm. It is available in an unsanded smooth or sanded surface, with smooth trimmed edges or with tongue and groove. The surface colour is mainly being characterized by the fine wood particles in the outside layers.

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 construction product is covered by the harmonized declaration of performance No. Si-DOP/Duripanel_B1/v01.10.2020 taking into consideration *EN 13986*: 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.

2.3 Application

The Duripanel B1 base panel with straight edges can be used in timber frame construction, high-quality interior finishing and container construction as a load-bearing and stiffening wood-based panel.

The Duripanel B1 installation panels with tongue and groove can be used for supporting formwork and dry subfloors with high compressive strength.

2.4 Technical Data

The constructional data shown in the table are valid for all thicknesses and surfaces (sanded/unsanded), unless where indicated otherwise.

Constructional data

Name	Value	Unit
Raw density acc. to EN 634-2:2007; EN 13986:2004+A1:2015	≥ 1000	kg/m³
Grammage (18 mm)	22.7	kg/m²
Bending strength (longitudinal)	≥ 9	N/mm²
Bending strength (transverse)	≥ 9	N/mm²
E-module (longitudinal)	≥ 4500	N/mm²
E-module (transverse)	≥ 4500	N/mm²
Tensile strength rectangular (internal bond)	≥ 0.5	N/mm²
Thermal conductivity λ acc. to DIN EN 13986:2015	0.23	W/(mK)
Water vapour diffusion resistance factor μ acc. to DIN EN ISO 12572:2001	40 (moist); 67 (dry)	-
Moisture content at 23 °C, 80% acc. to DIN EN ISO 12571:2000	9	Vol. %
Coefficient of thermal expansion αt	11	$10^{-6}K^{-1}$
Swelling in thickness 24h acc. to EN 634-2: 2007	≤ 1,5	%
Sound absorption coefficient (only with reference to the corresponding component design) acc. to EN 13986:2004+A1:2015	10 at 250-500Hz / 30 at 1000-2000Hz	%

For more detailed info on product characteristics please refer to the latest DOP.

The performance data of the product is in accordance with the declaration of performance with respect to its essential characteristics according to the standards mentioned in the headline in the table for constructional data.

2.5 Delivery status

Duripanel B1 basic panels are available in two sizes 1250 x 2600 mm or 1250 x 3100 mm.
The panels are delivered sanded and unsanded in various thicknesses:
8, 10, 12, 14, 16, 18, 20, 22, 24, 28, 32, 36, 40 mm.

Duripanel B1 installation panels are available in sizes 1250 x 625 mm. The panels are delivered sanded on both sides in thicknesses 18 and 25 mm.

2.6 Base materials/Ancillary materials

The main raw materials used are (in weight percentages; dry) :

- 55-75% Portland cement
- 15-25% spruce wood (Atro)
- 5-15% recycled production residues

By using cement as a binder, no binder related isocyanates, synthetic resin or formaldehyde are being added. No wood protection agents are being used.

This article contains substances listed in the *candidate list* (date: 19.01.2021) exceeding 0.1 percentage by mass: no.
This 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.

2.7 Manufacture

The production of large-format panels from wood cement takes place according to a largely automated, semi-dry spreading process in which no excess water is produced. In a mechanical mixer, the litter mixture of wood chips, cement, recycled material from trimming waste, auxiliary materials and water is processed. The material is evenly distributed on carrier plates via a mechanical throw sifting system. Excess material at the edges is returned directly to the spreader. The scattered material is pressed, stored in a climatic chamber for setting (heat exchanger, steam generation via natural gas), the hardened sheets restacked, trimmed and temporarily stored for 28 days. The panels are then dried in a circulating air oven to the moisture content required for delivery.

The quality management system of the company and the production facility are certified according to *ISO 9001:2015*.

2.8 Environment and health during manufacturing

During the entire manufacturing process, no health and safety measures are required beyond the legally stipulated occupational health and safety measures for commercial enterprises.

Air: Any dust produced is collected in filter systems and partially recycled. The emissions are well below the limit values of *TA Luft*.

Water/Soil: The water resulting from production and plant cleaning is mechanically clarified in wastewater treatment plants on the factory premises and reused in the production process.

Noise: Noise emissions from production plants to the environment are below the permissible limits.

The environmental management system of the company and the production facility are certified *ISO 14001:2015*.

2.9 Product processing/Installation

The processing of Duripanel can include the following processes, for example: sawing, drilling, grinding. Under certain conditions Duripanel can be milled.

Fixing the boards will require appropriate means, which will depend upon the application and bearing structure. Boards can be installed using screws or glues. Under certain conditions, the boards can be fixed using clamps.
When selecting structurally necessary additional products, care must be taken that these do not adversely affect the described properties of the

environmental compatibility of the construction products mentioned.

The local regulations for the workers' health and safety and the environment apply (e.g. trade associations or ordinance on hazardous substances). Also, when processing the above-mentioned products, the usual occupational health and safety measures must be observed in accordance with the manufacturer's instructions. It should be noted that dust produced during processing can react alkaline (pH value: approx. 12). The machining tools and equipment used at the workplace should be such that the relevant dust limits are observed.
For example, in Germany the general dust limit value is given in the directive *TRGS 900*. According to current knowledge, water, air and soil cannot be endangered if wood cement is processed as intended.

2.10 Packaging
PE shrink films, paper, wooden pallets and steel strapping are used as packaging materials. The wooden pallets used are one-way pallets.

2.11 Condition of use
Duripanel building boards are resistant to the effects of moisture and are not physically affected when used in humid or wet conditions. Some performance characteristics are affected by moisture content. The panels do not promote mould growth and are resistant to attacks by insects or vermin.

Setting (hydration) of the cement-water mixture produces hardened cement paste (calcium silicate hydrates) with embedded wood chips, ground production waste and auxiliary materials, with the proportions indicated in the item 2.5 "Base materials". Over the period of use, free lime from the cement reacts with carbon dioxide from the air to form calcium carbonate (carbonation).

Wood cement contains approx. 9-11 % water (equilibrium moisture) which can vary with the environmental conditions.

2.12 Environment and health during use
Duripanel B1 is chemically inert. When the product is used as designed, the current state of knowledge indicates that hazards to water, air and soil cannot arise.

The ingredients of the construction product are firmly bound in the state of use. Dust emissions will not occur unless the boards are machined with abrasive tools. In case of contact (skin, eye, mouth contact), it should be noted that hardened cement paste reacts slightly alkaline in combination with moisture.

2.13 Reference service life
The service life according to the "Bundesinstitut für Bau-, Stadt- und Raumforschung" (*BBSR*) table "Service lives of components for life cycle assessment according to Bewertungssystem Nachhaltiges Bauen (BNB)" is indicated to be >50 years.
Over the service life, free lime in the cement reacts with carbon dioxide in the air to form calcium carbonate (carbonation). There will be no verifiable influences on ageing when the products are applied in accordance with the generally accepted rules of technology.

2.14 Extraordinary effects

Fire
The Duripanel B1 boards have a fire classification according to *EN 13501-1* as given in the table below.

Fire protection

Name	Value
Building material class - base panel	B
Smoke gas development - base panel	s1
Burning droplets - base panel	d0
Building material class - installation panel	Bfl
Smoke gas development - installation panel	s1
Burning droplets - installlation panel	-

Water
No ingredients that could be hazardous to water are washed out (see also item Evidence: Eluate analysis). The pH value is basic (pH ≥ 12).

Mechanical destruction
Extraordinary effects related to a mechanical destruction (e.g. emissions) are not known.

2.15 Re-use phase
Several possibilities exist for the boards after the end-of-life of the application in which they were used.

In undamaged form, the dismantled products can be used again in accordance with their original purpose or, for example, be reused as foundation wall protection.
If not contaminated with other building construction material, the boards can be ground up again and reused as an additive in the production of wood cement (material recycling).

Furthermore, the products referred to could be used as filler and bulk material in civil engineering, road construction or e.g. for noise barriers (material recycling).

In addition, material and energetic recycling in the cement plant is possible.

2.16 Disposal
For the consideration of possible disposal channels, the following disposal stages are proposed:

A) Production waste (before use)
B) Waste generated before use
  a) at a finishing company that cuts panels to size
  b) during installation on the building site
C) Waste after use, when a building is demolished or when structural changes are made during the use phase of the building.

Disposal channels at stage A)
If the wood cement products are separated by type in the factory, they can be ground again and reused as an additive in the production of wood cement (material recycling). This shall be preferred.
Thermal treatment in residual waste treatment plants and cement works can be considered.
The lowest priority route may be landfill.

Disposal channels at stage B) and C)

a) At collection: keeping cement-bonded particleboard separate from wood waste as well as from other mineral wastes
b) Thermal treatment and/or energy recovery
c) Landfill

As for disposal facilities, depending on the composition and quantity of waste, thermal residual waste treatment plants and cement works can be considered. As the landfill classes are being defined differently in the member states, the landfill class of the respective country applies.

The following waste codes are suggested:
Disposal channel A) 10 13 11 (wastes from cement-based composite materials other than those mentioned in 10 13 09 and 10 13 10).
Disposal channels B) and C) 17 09 04 (mixed construction and demolition wastes other than those mentioned in 17 09 01, 17 09 02 and 17 09 03).

2.17 Further information
Further information can be found on the homepage https://www.siniat.com/.

3. LCA: Calculation rules

3.1 Declared Unit
The functional unit declared in this EPD is 1m² of Duripanel B1 with a thickness of 18mm (abbreviated as 1m²18mm).
In an annexe to this EPD, the LCA results for the other existing thicknesses are declared.

Declared unit

Name	Value	Unit
Declared unit	1	m²
Gross density used in calculations based on 2018 average data	1263	kg/m³
Grammage	22.7	kg/m²
Conversion factor to 1 kg	22.7	-

3.2 System boundary
Type of the EPD: cradle to grave.
The following life cycle stages and modules are included:

Production stage (A1-A3):
- manufacturing of pre products and transportation to the manufacturing site
- energy consumption during production
- recycling and disposal of production wastes
- production of packaging

Construction stage (A4-A5):
- transportation of product to the construction site
- energy consumption during the installation of products
- production of fixing material
- disposal of installation wastes including emissions of biogenic CO2 from the wood content
- incineration/recycling of packaging materials (potential benefits from energy substitution within the incineration process are declared in module D) including emissions of biogenic CO2 from renewable packaging materials

Use stage (B1-B7):
- efforts for the use of the product, maintenance and operational efforts
- modules B3, B4, B5 are declared as MNR (module not relevant) according to the IBU requirement. These modules are defined on building level in general.

End-of-life stage (C1-C4):
Two end-of-life scenarios were considered:

1) Scenario 1: 100% recycling in cement plant.
Due to the wood content of Duripanel B1, the shredded product can reduce the use of energy in the cement plant during cement clinker production.
Simultaneously, the other raw material components in the wood cement boards help to reduce the use of virgin raw materials in the cement plant. Energy and material credits were assigned using the substitution approach. The resulting credits from energy recovery and material recycling are assigned to module D.

2) Scenario 2: 100% landfilling.

For both scenarios, the following processes were included:
- energy consumption for deconstruction and demolition
- transportation to disposal
- waste processing and recycling or landfilling of product

Loads and benefits beyond system boundary (D):
- loads and benefits from recycling/landfilling of production waste, packaging, installation losses and product waste.

3.3 Estimates and assumptions
Most of the input and output influences of the Life Cycle Inventory Analyses could be depicted using corresponding data from the *GaBi* database.
There were no data records available for the wooden pallets, they were approximated using the solid construction timber dataset. For well water, a worst case scenario dataset “tap water from groundwater” was used. For the Duripanel product waste sent to landfill, a combination of an inert waste dataset and a municipal solid waste dataset was used in a ratio to match the calorific value of the Duripanel B1 waste. Bluewater consumption is taken into consideration in the background data system. Water which is embedded in the product, as well as water which is evaporated from the product during production, is included in the calculations.

3.4 Cut-off criteria

All available data from production processes were considered, i.e., all pre-products used, thermal energy and electric power consumption as well as waste management processes using the best available life cycle inventory (LCI) datasets. This includes input flows with a contribution of less than 1% of mass or energy.
Production of capital equipment, facilities and infrastructure required for manufacture are outside the scope of this assessment.

3.5 Background data

The *GaBi ts software* was used to model the product life cycle. The background data were sourced from the *GaBi database*.

3.6 Data quality

This study is mainly based on primary data collected directly from the manufacturing site and therefore data quality can be assumed to be very good.
Background data are from the *GaBi database*, last update was in 2020.

3.7 Period under review

Data for the entire production period of 2018 were collected and used for this EPD.

3.8 Allocation

Allocation in background data
Specific information on allocation within the background data is given in the *GaBi documentation.*

Allocation of upstream data
The product receives recycled water provided by another production line.
Allocation in foreground data
The production process does not deliver any co-products. In module A1-A3, specific raw material, water and transport data were available.
Thermal energy used at plant level in a cogeneration unit could not be directly allocated to the product and was allocated via recalculation based on consumed amounts of electricity and steam.
Allocation for waste materials
The environmental burden of waste treatment of the installation loss and the incineration of packaging is assigned to the system in A5. The resulting credits for thermal and electrical energy are declared in module D.
The environmental burdens of the product at end-of-life scenarios are assigned to C3 and C4, the resulting credits for thermal and electrical energy are declared in module D.

3.9 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.

GaBi database version 2020.1, SP40 serves as background database for the calculation of the life cycle assessment. .

4. LCA: Scenarios and additional technical information

Characteristic product properties
Information on biogenic Carbon

Information on describing the biogenic Carbon Content at factory gate

Name	Value	Unit
Biogenic Carbon Content in product	2.22	kg C
Biogenic Carbon Content in accompanying packaging	0.19	kg C

Transport to the building site (A4)

Name	Value	Unit
Transport distance	300	km
Capacity utilisation (including empty runs)	61	%
Gross density of products transported	1263	kg/m³

Installation into the building (A5)

Name	Value	Unit
Auxiliary galvanized steel screws	0.12	kg
Electricity consumption	0.075	kWh
Material loss	2.27	kg
Dust in the air	0	kg
VOC in the air	0	kg

Use or application of the installed product (B1) see section 2.12 "Use"
No efforts and releases of substances occur during the normal (i.e. anticipated) use phase

Name	Value	Unit

Maintenance (B2)
No efforts occur during maintenance.

Name	Value	Unit
Water consumption	0	m³
Auxiliary	0	kg
Other resources	0	kg
Electricity consumption	0	kWh
Other energy carriers	0	MJ
Material loss	0	kg

Reference service life

Name	Value	Unit
Reference service life (according to ISO 15686-1, -2, -7 and -8)	-	a
Life Span (according to BBSR)	>=50	a
Life Span according to the manufacturer	-	a
Declared product properties (at the gate) and finishes	-	-
Design application parameters (if instructed by the manufacturer), including the references to the appropriate practices and application codes	-	-
An assumed quality of work, when installed in accordance with the manufacturer's instructions	-	-
Outdoor environment, (for outdoor applications), e.g. weathering, pollutants, UV and wind exposure, building orientation, shading, temperature	-	-
Indoor environment (for indoor applications), e.g. temperature, moisture, chemical exposure	-	-
Usage conditions, e.g. frequency of use, mechanical exposure	-	-
Maintenance e.g. required frequency, type and quality and replacement of components	-	-

Operational energy use (B6) and Operational water use (B7)

No efforts occur in modules B6 and B7.

Name	Value	Unit
Water consumption	0	m^3
Electricity consumption	0	kWh
Other energy carriers	0	MJ
Equipment output	0	kW

End-of-life (C1-C4)

Two end-of-life scenarios are considered :
- scenario 1: 100% recycling in cement plant
- scenario 2: 100% landfill

Name	Value	Unit
Collected as mixed construction waste	22.82	kg
Recycling (scenario 1)	22.82	kg
Recycling (scenario 2)	0.12	kg
Landfilling (scenario 1)	0	kg
Landfilling (scenario 2)	22.7	kg

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

Possible benefits from the recycling of production waste and installation losses were considered. Also, benefits from the incineration of packaging were considered. Additionally, benefits from the recycling of the product at the end-of-life was taken into account according to the selected scenario.

Name	Value	Unit
Recycled production waste	1.25	kg
Recycled installation losses	0.796	kg
PE packaging	11	g
Wood packaging	472	g
Paper packaging	0.75	g
Steel strip packaging	5	g
EoL Recycling (scenario 1)	22.8	kg
EoL Recycling (scenario 2)	0.12	kg

5. LCA: Results

Disclaimer – for the indicator EF-freshwater, this indicator (the kg PO4 eq.) has been calculated as “kg P eq.” as required in the characterization model EC-JRC : EF 3.0; http://eplca.jrc.ec.europa.eu/LCDN/developerEF.xhtml. The characterization factors are available both in ILCD structure and as Excel file and they are identified by the name EN_15804.

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	X	X	X	X	MNR	MNR	MNR	X	X	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 m²18mm Duripanel B1

Core Indicator	Unit	A1-A3	A4	A5	B1	B2	B6	B7	C1	C2	C3/1	C3/2	C4/1	C4/2	D/1	D/2
GWP-total	[kg CO_2-Eq.]	8.97E+0	5.33E-1	3.04E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.03E-2	8.71E-2	1.28E+0	0.00E+0	0.00E+0	8.90E+0	-6.41E+0	-1.07E+0
GWP-fossil	[kg CO_2-Eq.]	1.83E+1	5.30E-1	2.35E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.02E-2	8.66E-2	1.27E+0	0.00E+0	0.00E+0	1.15E+0	-6.40E+0	-1.06E+0
GWP-biogenic	[kg CO_2-Eq.]	-9.34E+0	-8.89E-4	6.88E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.01E-4	-1.45E-4	4.24E-3	0.00E+0	0.00E+0	7.74E+0	-6.75E-3	-1.98E-3
GWP-luluc	[kg CO_2-Eq.]	6.33E-3	4.29E-3	1.06E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.38E-5	7.01E-4	1.84E-3	0.00E+0	0.00E+0	1.05E-3	-8.46E-4	-6.68E-4
ODP	[kg CFC11-Eq.]	4.96E-14	9.72E-17	8.26E-15	0.00E+0	0.00E+0	0.00E+0	0.00E+0	6.64E-16	1.59E-17	2.80E-14	0.00E+0	0.00E+0	1.83E-15	-4.36E-15	-8.91E-15
AP	[mol H^+-Eq.]	2.14E-2	6.12E-4	3.58E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	6.66E-5	1.00E-4	2.81E-3	0.00E+0	0.00E+0	3.86E-3	-5.48E-3	-1.76E-3
EP-freshwater	[kg PO_4-Eq.]	3.25E-5	1.61E-6	2.08E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	8.06E-8	2.64E-7	3.40E-6	0.00E+0	0.00E+0	1.67E-4	-1.41E-6	-1.25E-6
EP-marine	[kg N-Eq.]	7.24E-3	1.88E-4	1.20E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.48E-5	3.07E-5	6.23E-4	0.00E+0	0.00E+0	2.31E-3	-1.95E-3	-4.38E-4
EP-terrestrial	[mol N-Eq.]	7.81E-2	2.23E-3	1.19E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.56E-4	3.65E-4	6.55E-3	0.00E+0	0.00E+0	1.26E-2	-2.15E-2	-4.71E-3
POCP	[kg NMVOC-Eq.]	2.21E-2	5.07E-4	3.56E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.06E-5	8.29E-5	1.71E-3	0.00E+0	0.00E+0	5.81E-3	-5.95E-3	-1.29E-3
ADPE	[kg Sb-Eq.]	8.33E-7	4.28E-8	2.19E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	8.74E-9	7.00E-9	3.68E-7	0.00E+0	0.00E+0	5.02E-8	-3.76E-7	-1.49E-7
ADPF	[MJ]	1.11E+2	7.06E+0	1.59E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.31E-1	1.15E+0	2.23E+1	0.00E+0	0.00E+0	9.31E+0	-1.03E+2	-1.64E+1
WDP	[m^3 world-Eq deprived]	2.72E-1	5.16E-3	1.37E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	6.58E-3	8.44E-4	2.77E-1	0.00E+0	0.00E+0	5.25E-2	-4.10E-2	-9.23E-2

Caption	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 m²18mm Duripanel B1

Indicator	Unit	A1-A3	A4	A5	B1	B2	B6	B7	C1	C2	C3/1	C3/2	C4/1	C4/2	D/1	D/2
PERE	[MJ]	3.36E+1	4.08E-1	2.04E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.35E-1	6.68E-2	9.01E+1	0.00E+0	0.00E+0	8.11E+1	-1.71E+0	-3.29E+0
PERM	[MJ]	8.75E+1	0.00E+0	-7.30E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-8.02E+1	0.00E+0	0.00E+0	-8.02E+1	0.00E+0	0.00E+0
PERT	[MJ]	1.21E+2	4.08E-1	1.31E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.35E-1	6.68E-2	9.90E+0	0.00E+0	0.00E+0	8.32E-1	-1.71E+0	-3.29E+0
PENRE	[MJ]	1.10E+2	7.09E+0	1.63E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.31E-1	1.16E+0	2.23E+1	0.00E+0	0.00E+0	9.31E+0	-1.03E+2	-1.64E+1
PENRM	[MJ]	4.40E-1	0.00E+0	-4.40E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PENRT	[MJ]	1.11E+2	7.09E+0	1.59E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.31E-1	1.16E+0	2.23E+1	0.00E+0	0.00E+0	9.31E+0	-1.03E+2	-1.64E+1
SM	[kg]	1.49E+0	0.00E+0	1.49E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
RSF	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
NRSF	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
FW	[m^3]	1.35E-2	4.76E-4	4.69E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.72E-4	7.78E-5	1.15E-2	0.00E+0	0.00E+0	1.61E-3	-2.15E-3	-4.07E-3

Caption	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 m²18mm Duripanel B1

Indicator	Unit	A1-A3	A4	A5	B1	B2	B6	B7	C1	C2	C3/1	C3/2	C4/1	C4/2	D/1	D/2
HWD	[kg]	3.24E-7	3.28E-7	4.24E-8	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.20E-10	5.36E-8	9.25E-9	0.00E+0	0.00E+0	7.16E-8	-6.07E-8	-8.29E-9
NHWD	[kg]	3.29E+0	1.12E-3	2.46E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.77E-4	1.84E-4	1.59E-2	0.00E+0	0.00E+0	2.12E+1	-2.71E-2	-9.58E-3
RWD	[kg]	1.58E-3	1.31E-5	3.67E-4	0.00E+0	0.00E+0	0.00E+0	0.00E+0	8.06E-5	2.14E-6	3.39E-3	0.00E+0	0.00E+0	1.09E-4	-4.99E-4	-1.14E-3
CRU	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
MFR	[kg]	8.81E-1	0.00E+0	9.31E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.62E+1	9.98E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0
MER	[kg]	3.65E-1	0.00E+0	3.65E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	6.66E+0	0.00E+0	0.00E+0	2.36E+0	0.00E+0	0.00E+0
EEE	[MJ]	2.20E-3	0.00E+0	1.54E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
EET	[MJ]	5.07E-3	0.00E+0	2.37E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0

Caption	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; EEE = Exported thermal energy

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1 m²18mm Duripanel B1

Indicator	Unit	A1-A3	A4	A5	B1	B2	B6	B7	C1	C2	C3/1	C3/2	C4/1	C4/2	D/1	D/2
PM	[Disease Incidence]	4.52E-7	4.06E-9	6.05E-8	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.59E-10	6.63E-10	2.35E-8	0.00E+0	0.00E+0	4.25E-8	-1.85E-7	-2.36E-8
IR	[kBq U235-Eq.]	1.55E-1	1.93E-3	4.17E-2	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.32E-2	3.15E-4	5.56E-1	0.00E+0	0.00E+0	1.42E-2	-7.99E-2	-1.89E-1
ETP-fw	[CTUe]	3.61E+1	5.29E+0	6.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.27E-1	8.64E-1	9.56E+0	0.00E+0	0.00E+0	1.09E+1	-3.31E+0	-3.63E+0
HTP-c	[CTUh]	1.61E-9	1.09E-10	5.94E-10	0.00E+0	0.00E+0	0.00E+0	0.00E+0	6.27E-12	1.79E-11	2.64E-10	0.00E+0	0.00E+0	5.80E-10	-1.01E-9	-4.09E-10
HTP-nc	[CTUh]	1.34E-7	5.57E-9	2.41E-8	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.31E-10	9.11E-10	9.73E-9	0.00E+0	0.00E+0	5.94E-8	-3.05E-8	-6.65E-9
SQP	[-]	8.50E+2	2.48E+0	8.60E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.69E-1	4.05E-1	7.12E+0	0.00E+0	0.00E+0	1.10E+0	-1.73E+0	-2.39E+0

Caption	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 IRP : 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 nor due to 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 ADPE, ADPF, WDP, ETP-fw, HTP-c, HTP-nc, SQP : the results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

6. LCA: Interpretation

Looking at the overall life cycle for the scenario 1 (recycling), for most of the impact categories (except for GWP-luluc, ADP-minerals&metals and WDP), the manufacturing of Duripanel B1 contributes to the largest share (>50%) to the environmental performance.

The C3 phase has only minor impacts, except in the category ODP and WDP relevant influences can be seen, linked to the electricity use for shredding the waste material.

Looking at the overall life cycle for the scenario 2 (landfill) in most of the impact categories (except for GWP-total, biogenic and luluc, EP freshwater, ADP-minerals&metals and WDP), the manufacturing of Duripanel B1 contributes to the largest share (>50%) to the environmental performance.
For the GWP-total and the GWP-biogenic, next to the production phase, the main impacts occur in module C4 linked to the EOL landfilling of the waste and re-emission of organic carbon dioxide linked to it.
For the EP-freshwater, the production waste sent to landfill in C4 is the main contributor.
The C4 phase has very important impacts (>25%) in the categories GWP total and GWP biogenic and the most important contribution (>50%) in EP freshwater.

Within A1-A3, the pre-chains of the raw material have the most important impact in all impact categories except for GWP total/ ADP-fossil and EP-freshwater, followed by the energy consumption for the production. Transport to site (A2) has a negligible influence (<2.5%) on the overall LCA results (except for GWP-luluc where it has little influence (<10%)).

The LCA for Duripanel B1 is in module A1 almost fully determined by the pre-chains of the cement in all impact categories except in the GWP-total and biogenic where the wood has high impact and in WDP where the water consumed in the Duripanel process has a very important contribution.

7. Requisite evidence

7.1 Testing pretreatment of substances used

Measurements according to the *Waste Wood Ordinance* are not relevant as no waste wood is used in the manufacture of Duripanel B1 wood cement products.

7.2 Leaching

Measurement in accordance with *EN 71-3,* University of Osnabrück, Institute of Chemistry, Osnabrück; 03.02.2000

Results : the analysis results of the leaching of the examined boards showed that the limit values laid down in *EN 71* were complied with.

Measurement in accordance with *EN 12457-4*, UCL *Umwelt Control Labor GmbH*, Lünen; 23.07.2019 :

Name	Value	Unit
Sb Antimony	<0.001	mg/l
As Arsenic	<0.001	mg/l
Ba Barium	0.667	mg/l
Pb Lead	0.0487	mg/l
Cd Cadmium	<0.0003	mg/l
Cr Chromium	<0.0077	mg/l
Cu Cupper	0.016	mg/l
Mo Molybdenum	<0.005	mg/l
Ni Nickel	0.0465	mg/l
Hg Mercury	<0.2	mg/l
Se Selenium	<0.002	mg/l
Zn Zinc	<0.0176	mg/l

7.3 VOC emissions

Measurements in line with the *AgBB* diagram; *Eurofins Product Testing A/S*, Galten, Denmark 29.05.2008.

AgBB overview of results (28 days [µg/m³])

Name	Value	Unit
TVOC (C6 - C16)	160	µg/m³
Sum SVOC (C16 - C22)	0 - 0.5	µg/m³
R (dimensionless)	0.07	-
VOC without NIK	16	µg/m³
Carcinogenic Substances	0 - 0.1	µg/m³

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

Name	Value	Unit
TVOC (C6 - C16)	540	µg/m³
Sum SVOC (C16 - C22)	0 - 0.5	µg/m³
VOC without NIK	23	µg/m³
Carcinogenic Substances	0 - 0.1	µg/m³

8. References

Standards

DIN EN 1995-1-1/NA
DIN EN 1995-1-1/NA:2013-08, National Annex – Nationally determined parameters – Eurocode 5: Design of timber structures – Part 1-1: General – Common rules and rules for buildings.

DIN 4102-1
DIN 4102-1:1998, Fire behaviour of building materials and elements - Classification of building materials - Requirements and testing.

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

EN 12457-4
EN 12457-4:2002, Characterisation of waste. Leaching. Compliance test for leaching of granular waste materials and sludges. One stage batch test at a liquid to solid ratio of 10 l/kg for materials with particle size below 10 mm (without or with size reduction).

EN 13501-1
EN 13501-1:2018, Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests.

EN 13986
DIN EN 13986:2015-06, Wood-based panels for use in construction - Characteristics, evaluation of conformity and marking.

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

EN 1995-1-1
EN 1995-1-1:2004/A2:2014, Eurocode 5: Design of timber structures – Part 1-1: General – Common rules and rules for buildings.

EN 634-1
EN 634-1:1995, Cement-bonded particleboards - Specifications - Part 1: General requirements.

EN 634-2
EN 634-2:2007, Cement-bonded particleboards - Specifications - Part 2: Requirements for OPC bonded particleboards for use in dry, humid and external conditions.

EN 71-3
EN 71-3:2019, Safety of toys - Part 3: Migration of certain elements.

ISO 12571
DIN EN ISO 1271:2000, Hygrothermal performance of building materials and products — Determination of hygroscopic sorption properties.

ISO 12572
DIN EN ISO 12572:2001, 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 9001
UNI EN ISO 9001:2015 September 2015, Quality management systems - Requirements

ISO 14001
UNI EN ISO 14001:2015, Environmental management systems - Requirements with guidance for use.

OHSAS 18001
OHSAS 18001:2007, Occupational Health and Safety Management Certification.

Further References

AgBB
Ausschuss zur gesundheitlichen Bewertung von Bauprodukten, AgBB (eng. German Committee for health-related evaluation of building products.

BBSR
BBSR table "Service lives of components for life cycle assessment according to Bewertungssystem Nachhaltiges Bauen (BNB)" Sustainable Building Information Portal by the Federal Ministry of Transport, Building and Urban Affairs (Bundesinstitut für Bau-,Stadt-und Raumforschung, BBSR). (https://www.nachhaltigesbauen.de/baustoff-undgebaeudedaten/ nutzungsdauern-von-bauteilen.html)

Candidate list
Candidate List of substances of very high concern for Authorisation, published on ECHA website, latest version 19.01.2021. (https://echa.europa.eu/candidate-list-table)

CPR
Construction Products Regulation, Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 laying
down harmonized conditions for the marketing of construction products and repealing Council Directive 89/106/ EEC Text with EEA relevance.

Eurofins Product Testing A/S
Eurofins Product Testing A/S, Smedeskovvej 38, 8464 Galten, Denmark.

GaBi ts software/ GaBi database
GaBi Software System and Database for Life Cycle Engineering, 1992-2020, Sphera Solutions GmbH, Leinfelden-Echterdingen, with acknowledgement of LBP University of Stuttgart, program version 9.5.2.49. Database version 2020.1, SP40.

GaBi documentation
GaBi dataset documentation for the software system and databases, LBP, University of Stuttgart and Sphera Solutions GmbH, Leinfelden-Echterdingen, 2020.
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IBU 2016
Institut Bauen und Umwelt e.V.: General Programme Instructions for the Preparation of EPDs at the Institut Bauen und Umwelt e.V. Version 1.1, Berlin: Institut Bauen und Umwelt e.V., 2016. (http://www.ibu-epd)

Ordinance on Biocide Products
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PCR Part A
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REACH Regulation
Regulation (EU) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission
Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC.

TA Luft
Technische Anleitung zur Reinhaltung der Luft, version 16.12.2020.

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BArBl. issue 1/2006 p. 41-55
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https://www.baua.de/DE/Angebote/Rechtstexte-und-Technische-Regeln/Regelwerk/TRGS/TRGS-900.html

Waste Wood Ordinance
Ordinance on requirements for the exploitation and disposal of waste wood of 15.08.2002.

Umwelt Control Labor GmbH
Umwelt Control Labor GmbH, Postfach 2063, 44510 Lünen, Deutschland.

Publisher
Institut Bauen und Umwelt e.V.
Panoramastr. 1
10178 Berlin
Germany

Tel +49 (0)30 3087748- 0
Fax +49 (0)30 3087748- 29
Mail info@ibu-epd.com
Web **www.ibu-epd.com**

Programme holder
Institut Bauen und Umwelt e.V.
Panoramastr 1
10178 Berlin
Germany

Tel +49 (0)30 - 3087748- 0
Fax +49 (0)30 – 3087748 - 29
Mail info@ibu-epd.com
Web **www.ibu-epd.com**

Author of the Life Cycle Assessment
Peggy Van De Velde
Bormstraat 24
2830 Tisselt
Belgium

Tel +32 (0)15 71 82 83
Fax +32 (0)15 71 82 29
Mail peggy.vandevelde@etexgroup.com
Web **www.etexgroup.com**

Owner of the Declaration
Etex Building Performance International
Marcel Demonque 500 r
84915 Avignon Cedex 9
France

Tel +32 2 778 12 11
Fax +32 2 778 12 12
Mail info@etexgroup.com
Web **http://www.etexgroup.com**