ENVIRONMENTAL PRODUCT DECLARATION

as per /ISO 14025/ and /EN 15804/

Owner of the Declaration	Eternit GmbH
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
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NATURA, TEXTURA and MATERIA Fiber-Cement Panels

ETEX

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ECO PLATFORM EPD EN 15804 VERIFIED

EQUITONE
Fibre cement facade materials

1. General Information

Eternit GmbH	NATURA, TEXTURA and MATERIA

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

Owner of the declaration
Eternit GmbH
Im Breitspiel 20
69126 Heidelberg
Deutchland

Declaration number
EPD-ELH-20180136-CAC1-EN

Declared product / declared unit
1m² NATURA, 1m² TEXTURA, 1m² MATERIA, total life cycle

This declaration is based on the product category rules:
Fibre cement / Fibre concrete, 07.2014
(PCR checked and approved by the SVR)

Scope:
The Environmental Product Declaration includes the environmental parameters for the NATURA, TEXTRUA & MATERIA façade panels produced by Eternit GmbH. This document refers to the façade panels manufactured in the Neubeckum plant (Germany). The production data used refers to production year 2016. Based on plausible, transparent and comprehensible basic data, the Life Cycle Assessment fully represents the products in question.

Issue date
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Valid to
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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.

Verification

The standard /EN 15804/ serves as the core PCR
Independent verification of the declaration and data according to /ISO 14025:2010/
☐ internally ☒ externally

Prof. Dr.-Ing. Horst J. Bossenmayer
(President of Institut Bauen und Umwelt e.V.)

Dipl. Ing. Hans Peters
(Head of Board IBU)

Mr Carl-Otto Neven
(Independent verifier appointed by SVR)

2. Product

2.1 Product description / Product definition

The products declared in this EPD concern large-format, smooth panels made of naturally hardened fiber cement, uncoated, with glazed or covering coating. NATURA is a glaze-coated façade panel with a translucent surface structure. TEXTURA is a coated façade panel with a slightly grainy surface. The coated top layer of MATERIA façade panels is sanded. These products involve fiber cement panels with fibers comprising cellulose and plastic for water retention, improved tensile load distribution and increased breaking load and distortion. As the LCA is made for three variants of the product, this LCA is registered in class 1c) declaration of an average product from one plant of one manufacturer, as stated in the /IBU PCR part A/. The weighted average is based on the market share of the products.
For the placing on the market of the product in the EU/EFTA (with exception of Switzerland) Regulation (EU) No. 305/2011 (PCR) applies. The product has a Declaration of Performance taking into consideration /EN12467:2012/, DOP_EQUITONE_180102, dated 02-01-2018 and CE-marking 0432. For the application and use the respective national provisions apply in Germany the General technical approval No. /Z-31.1-34/ of the Deutsches Institut für Bautechnik (DiBt).

2.2 Application

NATURA, TEXTURA & MATERIA serve as cladding materials for back-ventilated curtain façades. The façade panels serve towards assembly on substructures made of wood or metal. As the substructure is depending on user preferences, this structure is assumed out of the scope of this EPD. Since the installation losses are highly depending on the design of the building and user preferences, the installation losses are assumed out of the scope for this LCA. The impact for a default amount of 5% installation losses and calculation rules to include the impact to the required amount are provided in paragraph 2.9.
Once installed correctly according to the manufacturers guidelines CEDRAL needs no further maintenance, repair, replacement or refurbishment during the full life span of the product.

2.3 Technical Data

Constructional data

Name	Value	Unit
Thermal conductivity approx.	0.407	W/(mK)
Water vapour diffusion resistance factor acc. to DIN V 4108-4, EN ISO 12572	140 - 350	-
Swelling (air-dry to water-saturated)	1	mm/m
Gross density >	1650	kg/m³
Flexural strength	17 - 24	N/mm²
Modulus of elasticity	15000 - 17000	N/mm²
Moisture content at 23 °C, 80% humidity	10	M.-%
Coefficient of thermal expansion <	0.01	$10^{-6}K^{-1}$
Permanent temperature resistance	80	°C

Product according to the CPR, based on /DIN EN 12467:2006-12/, Fibre-cement flat sheets – Product specification and test methods; German version EN 12467: 2004 + A1:2005 + A2:2006.
Performance data of the product in accordance with the Declaration of Performance with respect to its Essential Characteristics according to /EN 12467, No. S650_01_107-159_VO01, dated 02-01-2018.

2.4 Delivery status

Dimensions are similar for NATURA, TEXTURA and MATERIA.

Dimensions (mm)	1250x2500 and 1250x3100	
Thickness (mm)	8 and 12	
	1250x2500	1250x3100
Weight (kg) 8mm :	49,9	61,7
12mm :	73,8	91,4
Density (kg/m3)	> 1650	

2.5 Base materials / Ancillary materials

Base materials in % mass (dry mass)

70-90% Portland cement according to /DIN EN 197-1/, (CEM I
32.5 R and 42.5 R) (binding agent)
<10% Trass (as filling material)
<5% Cellulose (as filter fibers)
<5% Synthetic fibers (as reinforcement fibers)
<10% Dye and water for mixing the cement: 0.24 m³/t fiber cement.

Coating
Primer:
Application volume (incl. water): 23g/m²
Application volume (dry): 11g/m²
Top Coat:
Application volume (incl. water): 59g/m²
Application volume (dry): 26g/m²

Aluminium rivets and screws are foreseen for installation of the panels.
Once installed correctly the product needs no further maintenance or refurbishment.
The panels are treated as landfill after the end of life of the product.

2.6 Manufacture

Large format panels made of fiber cement are manufactured largely in accordance with an automated winding process (Hatschek process): the raw materials are mixed with water to prepare a homogenous mixture. Rotating screen cylinders are immersed in this fiber cement pulp which drain internally. The screen surface is covered in a thin film of fiber cement which is transferred onto an infinite conveyor belt from where it is conveyed to a format roller which is gradually covered in an increasingly thicker layer of fiber cement. Once the requisite material thickness is achieved, the still moist and malleable fiber cement layer (fiber cement fleece) is separated and removed from the format roller. The fiber cement fleece is cut to length and leftovers from the wet process are returned to the production process preventing any waste from being incurred. The cut fleece is stacked and compressed at high pressure. The panels are then set aside for binding before stacking on pallets and store for further setting. The setting time lasts approx. 4 weeks. Waste from damaged or broken panels is recycled by an external company as raw material for cement production. The façade panels are given a partially transparent seal on the back. The visible sides are coated for which the high-quality pure acrylic paint is applied twice in the rolling / pouring process or rolling / injection process prior to hot filming. Siliceous hollow spheres (micro glass balls) are also applied to TEXTURA products to achieve the fine-grained surface and a conserving agent is added.

Quality management: The production facilities are TÜV-certified in accordance with /ISO 9001:2015/.

2.7 Environment and health during manufacturing

During the entire manufacturing process, no other health protection measures extending beyond the legally specified industrial protection measures for commercial enterprises are required.

- Air: Any dust arising is collected in filter systems and partially recycled. Emissions are significantly lower than the limit values specified by the “TA Air”.
- Water/Ground: Water incurred during manufacturing and plant cleaning is treated mechanically in waste water treatment systems on the plant site and re-used in the production process.
- Noise: Noise emitted by the production equipment into the environment is below the permissible limit values.

Environment Management: The production facilities are TÜV-certified in accordance with ISO 14001:2015.

2.8 Product processing/Installation

Special low-dust equipment such as slow-running, carbide-tipped splitting saws or cutting burs and hand-operated tools such as guillotine shears etc. are available for processing. Drill holes can be made using standard HSS drills. Additional products necessitated by design for installing the product referred to above include: wood, aluminum or galvanized steel substructures including the requisite anchoring and joining equipment (studs, screws, nails) and joint tape made of EPDM or aluminum. When selecting any requisite constructive products, please ensure that they do not have a negative influence on the

designated function of the building products referred to. As the installation losses are highly depending on the design of the building and user preferences, a default impact for 5% installation losses is presented in the table below. The user can add the impact of installation losses to the impact of the installation phase (A5) declared in the EPD. Additional impact due to the production (A1-A3) and transport to the building site (A4) of these installation losses can be calculated by adding the percentage of the installation losses (eg. 5%) to the impact of A1-A3 and A4.

Impact of waste treatment of 5% installation losses
Global warming potential : 9,11E-03 [kg CO2-Eq.]
Ozone depletion : 1,40E-09 [kg CFC11-Eq.]
Acidification land and water : 4,98E-05 [kg SO2-Eq.]
Eutrophication potential : 1,18E-05 [kg (PO4)3--Eq.]
Photochemical ozone oxidation : 2,82E-06 [kg ethene-Eq.]
Abiotic depletion – non fossil : 1,58E-08 [kg Sb-Eq.]
Abiotic depletion – fossil : 1,25E-01 [MJ]
The set of rules laid out the employers' liability insurance association shall apply.

The typical health and safety measures in line with the manufacturer's instructions must be maintained when processing the products in question. Please note that processing dust can incur alkaline reactions (pH value: approx. 12). The general dust value as per TRGS 900 of ≤6 mg/m³ can be easily adhered to using the processing equipment recommended by Eternit AG (please refer to the brochure entitled "Planning and application, Facade panels made of fiber cement" issued by Eternit in 2011).
According to the current state of knowledge, hazards for water, air and soil cannot arise when processed as designated.

2.9 Packaging
The products are supplied sealed in recyclable poly-ethylene film (LDPE) on special wooden pallets or wooden Euro pallets. VdFZ special pallets are returnable pallets used by member companies of the Verband der Faserzementindustrie (Fiber-Cement Industry Association).

2.10 Condition of use
When the cement and water mixture sets (hydration), cement stone (calcium silicate hydrate) is formed with embedded fibers and fillers as well as micro air voids. Over the service life, free lime in the cement reacts with carbon dioxide in the air to form calcium carbonate (carbonation).
The fiber cement products comprise approx. 10% water (equilibrium moisture) and a proportion by volume of approx. 18% air (contained in the micro-pores).
In the condition of use, the coating substances are bonded as solids via hot-coating. The water evaporates.
Fiber cement products can be used as designated and for practically any application after the cement has set as a bonding agent.

2.11 Environment and health during use
Environmental protection: According to the current state of knowledge, hazards for water, air and soil cannot arise when the products in question are applied as designated (please refer to the section on Requisite evidence).
Health protection: There are no known health risks attributable to the base materials used and their performance in use when the construction products are used as designated (please refer to the section on Requisite evidence). The low algicide additive contained in the TEXTURA coating is integrated in the binding agent (pure acrylic) and cannot be released in any measurable quantities through leaching / washing out with the result that no health risks can be incurred (please refer to the Eluate analysis). Even after many years of use, the weathering rate of the pure acrylic coating is very low (cannot be measured) with the results that no health risks can be incurred.

2.12 Reference service life
The reference service life of fiber cement panels is comparable with the RSL of buildings. In accordance with the BMVBS Guidelines on Sustainable Building dating from 2000, this corresponds with 40 to 60 years. There are no verifiable influences on ageing when the recognized rules of technology are applied.

Description on the influences on the ageing of the product when applied in accordance with the rules of technology.

2.13 Extraordinary effects

Fire

Fire protection

Name	Value
Building material class	A2
Burning droplets	d0
Smoke gas development	S1

Water
No ingredients are washed out which could be hazardous to water (please refer to the section on Evidence: Eluate analyses). The pH value is alkaline (pH≥12).

Mechanical destruction
Not of relevance.

2.14 Re-use phase
Renaturation: Depending on the mounting system, the facade panels can be removed non-destructively by unscrewing or opening the studs.

2.15 Disposal
Fiber-cement product leftovers on the construction site as well as those incurred by demolition can be safely landfilled without pre-treatment in Class I landfills thanks to their largely mineral ingredients. Waste key: 170101 (Concrete) in line with the /European Waste Catalogue/.

2.16 Further information
Additional information and safety data sheets available online at www.eternit.de

3. LCA: Calculation rules

3.1 Declared Unit

This declaration refers to the manufacture, installation and end-of-life treatment of 1m² NATURA, TEXTURA and MATERIA produced in the Eternit A.G. plant in Neubeckum. The values declared in this EPD represent a weighted average based on the market shares of the three products. All products are produced in the same factory in Neubeckum and all put on the German market.
The functional unit mentioned in the IBU PCR part B is 1 ton. As the weight of 1m² installed NATURA, TEXTURA or MATERIA is 15,07kg or 0,015 ton, one ton equals 66,36 m² of installed NATURA, TEXTURA or MATERIA.
The LCA models are depicted on the basis of a 8mm-thick panel (corresponds with 15,07kg).
All other thickness-dependent results can therefore be generated as required by linear scaling of the basic panel to the requisite thickness.

Declared unit

Name	Value	Unit
Declared unit m²	1	t
Gross density >	1650	kg/m³
Conversion factor to 1 kg	15.07	-
Conversion factor for FU 1 ton	66,36	m²

3.2 System boundary

Type of the EPD: cradle to grave.
The modules considered in the Life Cycle Assessment are product stage A1-A3, installation stage A4-A5, use stage B, end-of-life stage C1-C4 and module D.

3.3 Estimates and assumptions

Specific /Ecoinvent/ processes are not available for all preliminary products. As the cellulose used in the production is plant based, the ROW data record for wood chips is used. The modeling of the pigment is based on the compilation declared by the manufacturer.

3.4 Cut-off criteria

All operating data, i.e. all of the starting materials used, thermal energy, internal fuel consumption and electricity consumption, all direct waste as well as all emission measurements available were taken into account in the analyses. Ancillary materials needed in the production process with mass and impact less than 1% are treated as cut-offs. Machinery, plants and infrastructure required in the manufacturing process are neglected.
The biogenic carbon included in the wooden pallets for packaging is not included in the LCA. No uptake nor release of biogenic carbon is modeled.

3.5 Background data

In order to model fiber cement production /SimaPro 8.5/ and Ecoinvent 3.4 was used. The life Cycle Assessment was drawn up for Germany as a reference area. This means that, apart from the production processes under these marginal conditions, the pre-stages also of relevance for Germany, such as provision of electricity or energy carriers were used. The power mix for Germany is applied with 2016 as the year of reference.

3.6 Data quality

Corresponding consistent data records were available for most of the relevant preliminary products and ancillary materials. Other preliminary products such as PVA fibers, for example, could be modeled using data from literature or proxys are assumed as declared in "Estimates and assumptions". The Variability of the data is low since the production process is identical except for the finishing. All materials and processes are declared and integrated in the LCA. As all three products are sold on the German market, there is no relevant geographical variability for the results. The background data used was last revised less than 3 years ago. The production data involves up-to-date industrial data on Eternit GmbH from 2016.

3.7 Period under review

The data applied for this LCA is based on data recorded by Eternit GmbH for the manufacturing of NATURA, TEXTURA and MATERIA façade panels in 2016. The volumes of raw materials energy, ancillary materials are considered as average annual values in the Neubeckum plant.

3.8 Allocation

The products are manufactured in the Neubeckum plant. The production process of the three products is identical except for the coating. Therefore the coating data distinguishing Textura, Natura and Materia facade panels was recorded separately. For the LCA of the average product the inventory data are modeled based on a mass allocation according to the market share of the three products. Part of the energy produced by the cogeneration unit is used in the production of concrete roof tiles and is allocated as co-product. Secondary fuels are used in manufacturing the cement. As they only have a negative or no economic value, they are included in the system without representing any negative impact on the environment. Transport to the plant by truck was taken into consideration. The contributions to the Global Warming Potential as a result of incineration were also considered in the model for renewable and non-renewable primary and secondary fuels. Renewable secondary fuels are used in the manufacturing of the cement. The CO2 included in the cement is not released as the cement is included in the product, which is landfilled at the end of its lifespan.

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.

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4. LCA: Scenarios and additional technical information

The overall **data quality** can be regarded as good for modeling the NATURA, TEXTURA and MATERIA façade panels. Corresponding consistent data records were available for almost all of the preliminary products and auxiliaries used.

The production data involves up-to-date primary data supplied by Eternit GmbH for the Neubeckum plant in 2016.

Transport to the building site (A4)

Name	Value	Unit
Transport distance	440	km

Installation into the building (A5)

Name	Value	Unit
Auxiliary	0.042	kg
Electricity consumption	0.02	kWh
Material loss	-	kg
Output substances following waste treatment on site	0.79	kg

Use or application of the installed product (B1) see section 2.12 "Use"

Name	Value	Unit
No impact during use phase	0	-

Maintenance (B2)

Name	Value	Unit
Requires no maintenance	0	-

Repair (B3)

Name	Value	Unit
Requires no repairs	0	-

Replacement (B4) / Refurbishment (B5)

Name	Value	Unit
Requires no replacement	0	-

Reference service life

The reference service life of fiber cement panels is comparable with the RSL of buildings. In accordance with the BMVBS Guidelines on Sustainable Building dating from 2000, this corresponds with 40 to 60 years. In this LCA a RSL of 50 years is estimated.

Name	Value	Unit
Life Span according to the manufacturer	50	a

End of life (C1-C4)

Name	Value	Unit
Electricity for unscrewing panels Dismantling C1	0.0216	kWh
Transport to EOL with truck type EURO4 Transport to EOL treatment C2	50	km
No impact for sorting, material collected seperately Sorting of materials C3	0	
Landfilling EOL treatment C4	15.07	kg

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

Name	Value	Unit
Production waste recycled as secondary raw materials for cement production	1,4	kg
Transport to cement factory	15	km
Energy use for treatment	1,057	kWh

5. LCA: Results

The environmental impacts of 1m² NATURA, TEXTURA and MATERIA manufactured by Eternit N.V. are outlined below. The modules to DIN EN 15804 marked “x” in the overview are addressed here.
The following tables depict the results of estimated impact, the use of resources as well as the waste and output flows relating the declared unit.

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

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: declared unit and product

Parameter	Unit	A1	A2	A3	A4	A5	B1	B2	B6	B7	C1	C2	C3	C4	D
GWP	[kg CO_2-Eq.]	8.06E+0	5.04E-1	2.76E+0	1.43E+0	2.85E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.40E-2	1.63E-1	0.00E+0	1.82E-1	-1.86E-1
ODP	[kg CFC11-Eq.]	3.15E-7	8.32E-8	2.61E-7	2.52E-7	2.05E-8	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.06E-9	2.87E-8	0.00E+0	2.81E-8	-1.64E-8
AP	[kg SO_2-Eq.]	2.42E-2	5.35E-3	4.89E-3	5.39E-3	1.30E-3	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.12E-4	6.14E-4	0.00E+0	9.96E-4	-4.63E-5
EP	[kg $(PO_4)^{3-}$-Eq.]	2.72E-3	5.68E-4	1.01E-3	9.34E-4	1.25E-4	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.99E-5	1.06E-4	0.00E+0	2.35E-4	2.44E-4
POCP	[kg ethene-Eq.]	1.31E-3	1.86E-4	3.43E-4	2.36E-4	8.49E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	3.87E-6	2.69E-5	0.00E+0	5.64E-5	-3.04E-5
ADPE	[kg Sb-Eq.]	1.12E-5	1.07E-6	5.24E-6	5.09E-6	3.64E-6	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.00E-9	5.80E-7	0.00E+0	3.17E-7	-3.77E-8
ADPF	[MJ]	6.60E+1	7.07E+0	3.95E+1	2.09E+1	3.03E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.58E-1	2.38E+0	0.00E+0	2.50E+0	4.96E+0

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

RESULTS OF THE LCA - RESOURCE USE: declared unit and product

Parameter	Unit	A1	A2	A3	A4	A5	B1	B2	B6	B7	C1	C2	C3	C4	D
PERE	[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
PERM	[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
PERT	[MJ]	8.12E+0	1.43E-1	1.80E+1	2.94E-1	6.27E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.07E-2	3.35E-2	0.00E+0	5.42E-2	-5.83E-1
PENRE	[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
PENRM	[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
PENRT	[MJ]	8.22E+1	7.78E+0	4.91E+1	2.27E+1	3.71E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.92E-1	2.58E+0	0.00E+0	2.74E+0	-3.58E+0
SM	[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	1.15E+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
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
FW	[m³]	7.56E-3	1.67E-4	3.98E-3	5.17E-4	1.92E-4	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.26E-5	5.89E-5	0.00E+0	5.20E-5	-6.71E-4

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 – OUTPUT FLOWS AND WASTE CATEGORIES: declared unit and product

Parameter	Unit	A1	A2	A3	A4	A5	B1	B2	B6	B7	C1	C2	C3	C4	D
HWD	[kg]	4.81E-5	4.80E-6	7.68E-5	1.41E-5	3.36E-6	0.00E+0	0.00E+0	0.00E+0	0.00E+0	9.18E-8	1.60E-6	0.00E+0	2.77E-6	1.84E-6
NHWD	[kg]	6.93E-1	1.74E-1	1.73E+0	8.33E-1	2.45E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.44E-4	9.49E-2	0.00E+0	2.83E+0	1.07E-2
RWD	[kg]	1.83E-4	4.77E-5	8.98E-5	1.42E-4	1.26E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.39E-7	1.61E-5	0.00E+0	1.54E-5	2.28E-5
CRU	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	6.88E-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
MFR	[kg]	0.00E+0	0.00E+0	1.05E+0	0.00E+0	3.88E-2	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
MER	[kg]	0.00E+0	0.00E+0	4.40E-3	0.00E+0	2.36E-2	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
EEE	[MJ]	0.00E+0	0.00E+0	1.91E-1	0.00E+0	8.71E-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
EET	[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

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

6. LCA: Interpretation

In the manufacturing (A1-A3) if 1m² NATURA, TEXTURA and MATERIA, the use of non-renewable primary energy sources accounts for 138 MJ/m². The use of renewable primary energy sources accounts for 26,1 MJ/m².
The use of **non-renewable primary energy sources** during NATURA, TEXTURA and MATERIA

manufacturing is largely determined by the use of energy carriers in the plant, whereby the provision of electricity and thermal energy required from natural gas are important.

The use of **renewable primary energy sources** is determined by the production process.

Secondary raw materials are not used for the manufacturing of NATURA, TEXTURA and MATERIA.

Secondary fuels are used in the upstream process of cement manufacturing.
During the manufacture (A1-A3) of 1m² NATURA, TEXTURA and MATERIA, around 0,01m³ of **water** is used. The water is used as process water and for mixing the cement.

Non-hazardous **waste** depicts the largest amount at the end of life stage, due to the landfill of the product. Radioactive waste is exclusively incurred in generating electricity in nuclear power plants.

Considering the results for the impact categories, the provision of raw materials (A1) and the manufacturing (A3) have a decisive influence on the results.

The **global warming potential** of 1m² NATURA, TEXTURA and MATERIA is primarily dominated by carbon dioxide emissions. This is essentially attributable to the upstream chains associated with cement and paint manufacturing, the use of natural gas for the cogeneration unit and the transport to the building site.

The impact of the upstream processes for cement production and energy production make the primary contribution towards the **Ozone Depletion Potential, Acidification, Eutrophication and Photochemical Ozone oxidation**.

The impact of the upstream processes for the production of the pigment cement make the primary contribution towards the **non-fossil abiotic depletion.** The impact of the upstream processes for the production of the synthetic fibers and cement make the primary contribution towards the **fossil abiotic depletion**.

7. Requisite evidence

7.1 Leaching

Measuring agency / Protocol / Date: Hygiene-Institut des Ruhrgebietes, Gelsenkirchen; No. A 193135-09-To dated 20-10-2009.

Result: the result of the leaching analysis of panels examined in accordance with DIN 38414, Part 4 indicate that the limit and guideline values specified in the Drinking Water Directive and the criteria specified in the TA Municipal Waste for storage in a Class I landfill site are adhered to. No reservation can be asserted against the structural use of the products referred to from a water-hygiene perspective.

Measuring agency / Protocol / Date: Hygiene-Institut des Ruhrgebietes, Gelsenkirchen; No. A 193135-09-To dated 20-10-2009.

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7.2 VOC emissions

Measuring agency: Eurofins Product Testing A/S, Smedeskovvej 38, DK-8464 Galten, Denmark, Report No. G02908BRev dated 09.09.2010; measurement results: test method in accordance with the Health Assessment of Construction Materials (AgBB)

There was no evidence of carcinogenics after 3 and 28 days. At 53 µg/m³, the total VOC ("TVOC") after 3 days was below the limit of 10 mg/m³. At 24 µg/m³, the total VOC ("TVOC") after 28 days was below the limit of 1 mg/m³. At <5 µg/m³, the total SVOC after 28 days was below the limit of 0,1 mg/m³. At more than 5 µg/m³, the VOC individual substances established after 28 days resulted in a rating value R with < 0,02 below the maximum limit of 1. At <5 µg/m³, the total VOC individual substances without an NIK value after 28 days was below the limit of 0,1 mg/m³. At 8,4 µg/m³, the formaldehyde concentration after 28 days was below the limit of 120 µg/m³. All of the measured values are below the respective limits.

The NATURA, TEXTURA and MATERIA products examined are suitable for use in interior areas in accordance with the "Certification principles for health assessment of construction products in interior areas" (DIBt notifications 10/2008) in combination with the NIK values of the AgBB in the version dated May 2010.

VOC emissions

Name	Value	Unit
TVOC 3d	53	µg/m³
Carcinogenic Substances	No evidence after 3&28d	µg/m³
TVOC 28d	24	µg/m³
TSVOC 28d	<5	µg/m³
R (dimensionless)	<1	-
VOC without NIK	<5	µg/m³

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