

KUENZ
SINCE 1931
HEATING & SHEET METAL CO.

Industrial, Institutional, Commercial, Erection and Fabrication

ISO 9001-2000 Certified

August 25, 2017

Paric Corporation
77 Westport Plaza, Suite 250
St. Louis, Missouri 63146

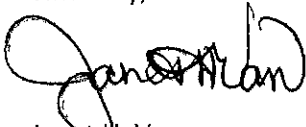
Attention: Devin Gates
Email: ddgates@paric.com

Re: Webster University Interdisciplinary Science Building Warranty
Project: 15051
Subcontract Number: 150510001

Gentlemen;

We hereby warranty the **Fiber Cement/Fibre Concrete** performed on the **Webster University Interdisciplinary Science Building Project**, located at 8274 Big Bend Blvd., Webster Groves, Missouri 63119, for a period of **ONE (1)** year, commencing on **August 7, 2017**. This warrantee is for failures of workmanship in accordance with the requirements of the specifications.

Sincerely,



Janet M. Van,
Vice-President,
Kuenz Heating & Sheet Metal Company
JVKHSMC/jvh

Material & Product Data Form

*NOTE--Please complete a copy of this form for **EACH** product used or installed at the Loop Student Living Initiative Project.*

This is mandatory for LEED Compliance.

Subcontractor/Installer: Kuenz Heating & Sheet Metal Company

Address: 811 Westwood Industrial Park Drive St Charles, Missouri 63304

Contact: Chris Bradley 636.936.1555 Office or 314.960.9136

Manufacturer: Institut Bauen WmWelt e.V.

Manufacturing Location: Rhwinudwe 108 53639 Konigswinter Germany

Material or Product: Fiber Cement/Fibre Concrete

Form Completed By: Janet Van Date: July 24, 2017

Instructions to Subcontractor/Installer: Please complete the following information in all appropriate categories for all materials/products from CSI Master Format 2004 Divisions 3-10, 31, and 32. Use one documentation sheet for **EACH** product or material (ie: tile and grout each require their own form). Note as N/A if not applicable. Attach letter of certification/backup from the manufacturer verifying all applicable credits.

Scope of Work: Furnish and install all fiber cement siding, flashing, trims, fastners

Specification Section: 074646 Fiber- Cement

Exact Model # and Name: Equitone Panel Systems U7000

Material Costs (Including raw materials, shop fabrication or shop assembly labor, and delivery to the jobsite):

\$ 45,000.00

LEED SS Credit 7.1 – Heat Island Effect, Non-Roof

Do paving materials have a Solar Reflectance Index of at least 29? _____

Product Name:	Solar Reflectance Index (SRI):
N/A	

LEED SS Credit 7.2 – Heat Island Effect, Roof

Do roof materials/products have a high Solar Reflectance Index? _____

Product Name:	Roof Slope:	Solar Reflectance Index (SRI):
N/A		

LEED MR Credit 4 – Recycled Content

Does the material/product contain post-consumer and/or pre-consumer content? _____

% of Post-Consumer Content?	
% of Pre-Consumer Content/Post Industrial Content?	

If only part of the assembly contains recycled content, fill in the detail chart below:

Assembly Components:	Weight (lbs):	% Post-Con*:	% Pre-Con*:
Totals by Weight (100% of assembly):*			

*Assembly Recycled Content = [Component Weight (lbs) x Recycled Content (%) / Total Weight (lbs)] x 100%

LEED MR Credit 5 – Regional Materials

Was the material/product manufactured regionally? _____

Location of Manufacturer (City/State):
Distance from Manufacturer to Project Site (Miles):

Does the material/product contain regionally extracted, harvested, or recovered materials? _____

Raw Materials:	City/State:	Miles to Project Site:

If only part of the assembly contains regional material, fill in the chart below:

Assembly Components:	Weight (lbs):	% Regional*:
Totals by Weight (100% of assembly):*		

*Assembly Recycled Material= [Component Weight (lbs) x Regional Material (%) / Total Weight (lbs)] x 100%

LEED MR Credit 6– Rapidly Renewable Materials

Does the product/material contain rapidly renewable materials? _____

If yes, what percentage of the product/material contains rapidly renewable content?

Provide manufacturer information/documentation supporting rapidly renewable materials.

Raw Materials:	% of Material Costs

LEED MR Credit 7 – FSC Certified Wood Materials

Does the product/material contain FSC certified wood?* _____

If yes, what percentage of the material/product contains FSC certified wood?

Provide manufacturer information/documentation supporting FSC certification.

Component:	FSC Pure, Mixed Credit, or Mixed %	Chain of Custody Certificate #	% of Material Costs

*Attach vendor invoices for each new wood-based component.

LEED IEQ Credit 4.1 – Low-Emitting Materials; Adhesives and Sealants

Does the product/material comply with VOC limits of SCAQMD rules or Green Seal standards? _____

Is product applied onsite and inside the building? _____

Product Name:	CRI-ID# if applicable	VOC Content (g/L)
N/A		

LEED IEQ Credit 4.2 – Low-Emitting Materials; Paints and Coatings

Does the product/material comply with VOC limits of SCAQMD rules or Green Seal standards? _____

Is product applied onsite and inside the building? _____

Product Name:	VOC Content (g/L)
N/A	

LEED IEQ Credit 4.3 – Low-Emitting Materials; Flooring Systems

Does the carpet material/product meet the Carpet and Rug Institute's Green Label Plus Program? _____

Carpet Product Name (and backing type):	CRI ID No.
N/A	

Does the carpet pad material/product meet the Carpet and Rug Institute's Green Label Plus Program? _____

Pad Product Name:	CRI ID No.
N/A	

Does the carpet adhesive comply with VOC limits of SCAQMD rules or Green Seal standards? _____

Product Name:	CRI-ID# if applicable	VOC Content (g/L)
N/A		

Is the hard surface flooring compliant with the SCS FloorScore standard? _____

Hard Surface Flooring Product Name:	FS Reg. No.
N/A	

Does the tile setting and grout product/material comply with VOC limits of SCAQMD rules? _____

Tile Setting and Grout Product Name:	VOC Content (g/L)
N/A	

Does the floor coating comply with VOC limits of SCAQMD rules or Green Seal Standards? _____

Product Name:	VOC Content (g/L)
N/A	

LEED IEQ Credit 4.4 – Low-Emitting Materials; Composite Wood and Agrifiber Products

Does the product/material contain added urea-formaldehyde resins? _____

Product Name:	Yes/No	Binder Type:
N/A		

Subcontractor Important Note--Specific manufacturer or fabricator documentation in support of the above information **must** be submitted with **EACH** product or material submission for review by the US Green Building Council for LEED Platinum certification of the project.

Have you provided the necessary support documents to PARIC? YES ~~or~~ NO ~~x~~

Declaration holder
Publisher
Programme holder
Declaration number
Issue date
Validity

Eternit AG
Institut Bauen und Umwelt (IBU)
Institut Bauen und Umwelt (IBU)
EPD-ETE-2013111-E
14.01.2013
13.01.2018

www.bau-umwelt.com



Institut Bauen
und Umwelt e.V.

ETERNIT AG

Programme holder

IBU - Institut Bauen und Umwelt e.V.
Rheinufer 108
D-53639 Königswinter

Declaration number

EPD-ETE-2013111-E

This Declaration is based on the Product Category Rules:

PCR Part B: Fibre cement / Fibre concrete, 07-2011
(PCR tested and approved by the independent Committee of Experts (SVA))

Issue date

14.01.2013

Valid until

13.01.2018



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



Prof. Dr.-Ing. Hans-Wolf Reinhardt
(Chairman of the Expert Committee (SVA))

Equitone Natura / Textura Façade Panels & Eterplan Structural Panels

Holder of the Declaration

Eternit AG
Im Breitspiel 20
D-69126 Heidelberg

Declared product/unit

1 m² Natura, 1 m² Textura, 1 m² Eterplan

Area of applicability:

Within the Environmental Product Declaration, the environmental parameters are indicated separately for three large-format fibre cement panels. This document refers to the manufacture of uncoated Eterplan smooth structural panels as well as the manufacture of Natura and Textura façade panels produced by Eternit AG. The production data referring to 2010 was collated in the Eternit AG plant in Neubeckum. Based on plausible, transparent and comprehensible basic data, the Life Cycle Assessment fully represents the Eternit products in question.

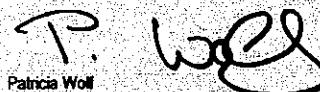
Verification

The CEN DIN EN 15804 standard serves as the core PCR.

Verification of the EPD by an independent third party in accordance with ISO 14025

☐ Internal

☒ external



Patricia Wolf
(Independent auditor appointed by the SVA)

2.1 Product description

The products in question concern large-format, smooth panels made of naturally-hardened fibre cement, uncoated, with glazed or covering coating. Eterplan is an uncoated structural panel. Textura is a coated façade panel with a slightly grainy surface. Natura is a glaze-coated façade panel with a translucent surface structure. These products involve fibre cement panels with fibres comprising cellulose and plastic for water retention, improved tensile load distribution and increased breaking load and distortion.

2.2 Application

Eterplan is an uncoated structural panel for construction and civil engineering. They are used in drywall construction, as manhole covers, foundation beds, container construction, lost formwork etc. Eterplan is also the basic panel for Textura and Natura façade panels.

Textura and Natura serve as cladding materials for back-ventilated curtain façades as well as for decorative interior design applications. The façade panels serve towards assembly on substructures made of wood or metal.

2.3 Technical data

Please refer to the table for technical data.

Standard-related tests for CE marking via type testing in accordance with DIN EN 12467.

Sound insulation: In a 200 mm-thick porous concrete wall with $R_{w,R} = 44$ dB, sound insulation can be improved from 9 to 11 dB (as per DIN 52210) using a back-ventilated curtain façade with 80 mm fibre insulation and cladding with 8 mm fibre cement.

Features	Value
Gross density	$\geq 1,650$ to $1,800$ kg/m ³
Strengths to DIN EN 12467	
Compressive strength	50 N/mm ²
Modulus of elasticity	15,000 N/mm ²
Bending tensile strength II	17 N/mm ²
I	24 N/mm ²
Water vapour diffusion resistance figure μ as per DIN 4108-4	350 / 140
Equilibrium moisture at 23 °C, 80% rel. humidity	approx. 10 M.-%
Linear coefficient of expansion	$\alpha_t = 0.01$ mm/(mk)
Moisture expansion (air-dry to water-saturated)	1 mm/(mk)
Chemical resistance	similar to concrete C 35/45
Ageing resistance	similar to concrete C 35/45
Permanent temperature resistance	to 80 °C
Thermal conductivity λ_R	approx. 0.60 W/(mk)

2.4 Placing on the market / Application rules

DIN EN 12467: 2006-12, Fibre-cement flat sheets – Product specification and test methods; German version EN 12467:2004 + A1:2005 + A2:2006

General technical approval No. Z-31.1-34 of the Deutsches Institut für Bautechnik (DIBt)

2.5 Delivery status

	Max. sizes in mm	Thicknesses in mm	Surface
Eterplan	3100 x 1500	6; 8; 10; 12; 15; 20	smooth
Textura*	3100 x 1500	8; 12	grainy
Natura*	3100 x 1250	8; 12	smooth
Textura (balcony slab)*	3100 x 1500	10	grainy

*) products available in various colours

Packaging is in the form of standard pallets in accordance with the price list with each pallet bearing a weight of 1 to 2 tonnes, seldom exceeding 2 tonnes.

Small orders (< 1 tonne) are packed to customer requirements.

2.6 Base materials / Auxiliaries

Fibre cement: (Base materials in % mass, dry mass)

81.5% Portland cement to DIN EN 197-1, (CEM I 32.5 R and 42.5 R) (as binding agent)

6% Trass (as filling material)

2.5% Cellulose (as filter fibres)

3.5% Polyvinyl alcohol fibres (reinforcement fibres)

6.5% Dye

and water for mixing the cement: 0.24 m³/t fibre cement.

Coatings:

Application	volume	Textura	Natura
Backing sealing			
wet		36 - 44	38 - 42
dry		14 - 18	15 - 17
Coating for the front		Primer	Primer
wet		220 - 240	64 - 88
dry		96 - 104	29 - 40
		Textura TC	Isocolor TC
wet		160 - 192	104 - 134
dry		70 - 84	42 - 53

No substances of REACH relevance are used in production.

2.7 Production

Large-format panels made of fibre cement are manufactured largely in accordance with an automated winding process (Hatschek process): the raw materials are mixed with water to prepare a homogeneous mixture. Rotating screen cylinders are immersed in this fibre-cement pulp which drain internally. The screen surface is covered in a thin film of fibre 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 fibre cement. Once the requisite material thickness is achieved, the still moist and malleable fibre-cement layer (fibre-cement fleece) is separated and removed from the format roller. The fibre-cement fleece is cut to length and leftovers 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 stored temporarily in a special store for further setting. The setting time lasts approx. 4 weeks.

The façade panels are given a partial 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 9001:2008.

2.8 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/Soil: 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 14001:2004.

2.9 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, punch pliers etc. are available for processing. Drill holes can be made using standard HSS drills. Additional products necessitated by design for installing the products referred to above include: wood or aluminium substructures including the requisite anchoring and joining equipment (studs, screws, nails) and joint tape made of EPDM or aluminium. An analysis of these additional products is not a component of this Declaration. 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.

On request, the large-format panels can also be supplied ready for installation merely requiring individual cutting to size on site.

The set of rules laid out by the employers' liability insurance associations 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 $\leq 6 \text{ mg/m}^3$ can be easily adhered to using the processing equipment recommended by Eternit AG (please refer to the brochure entitled "Planning and application, Façade panels made of fibre cement" issued by Eternit in 2011).

According to the current state of knowledge, hazards for water, air and soil can not arise when processed as designated.

2.10 Packaging

The products are supplied sealed in recyclable polyethylene 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 (Fibre-Cement Industry Association).

2.11 Condition of use

When the cement and water mixture sets (hydration), cement stone (calcium silicate hydrate) is formed with embedded fibres 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).

Fibre cement comprises approx. 12% water (equilibrium moisture) and a proportion by volume of approx. 30% air (contained in the micro-pores).

In the condition of use, the coating substances are bonded as solids via hot-coating. The water evaporates.

Fibre-cement products can be used as designated and for practically any application after the cement has set as a bonding agent.

2.12 Environment and health during use

Environmental protection: According to the current state of knowledge, hazards for water, air and soil can not 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 also 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 can not 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 (can not be measured) with the result that no health risks can be incurred as a result.

2.13 Reference Service Life (RSL)

The reference service life of fibre-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 recognised rules of technology are applied.

2.14 Extraordinary effects

Fire

Building materials class A2 as per DIN 4102, Part 1, i.e. "non-flammable"

Building materials classification to DIN EN 13501 A2,s1-d0, i.e. "non-flammable" in accordance with Part A of the Building Rules List

Development of smoke / Smoke density: Smoke development caused by burning the products in question (coating) is very low at less than $30 \text{ m}^2/\text{s}^2$.

Combustion gases: The results in line with testing to DIN 53436 indicate that the gaseous emissions incurred when burning the panels in question are free of sulphur and chlorine compounds. The concentration of hydrogen cyanide HCN released is within the normal range.

Changing the system condition (burning dripping/falling material): When surrounding construction materials are burned, the polyvinyl alcohol fibres bound in the concrete gradually lose their strength; this performance does not lead to an explosion with the result that fibre cement does not represent a risk in the event of a fire. Burning dripping/falling coatings or fibre cement do not occur.

Water

No ingredients are washed out which could be hazardous to water (please also refer to the section on Requisite evidence: Eluate analysis). The pH value is alkaline ($\text{pH} \geq 12$).

Mechanical destruction

Not of relevance

2.15 Re-use phase

Renaturation: Depending on the mounting system, the façade panels can be removed non-destructively by unscrewing or opening the studs.

Re-use: If undamaged, the dismantled products can be re-used in accordance with their original designated use or used as protective panels for basement walls, for example.

Re-use / Further use: When separated by type, the uncoated and coated fibre-cement products referred to can be re-ground and re-used as additives in the manufacture of fibre cement (material recycling). When sorted by type, the uncoated and coated fibre-cement products in question are also suitable for further use as filler and loose material in civil engineering, especially in road construction or for noise barriers (material recycling).

2.16 Disposal

Where the recycling options indicated above are not practical, fibre-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.

2.17 Further information

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

3.1 Declared unit

This Declaration refers to the manufacture of 1m² Eterplan structural panels, 1m² Textura façade panels and 1m² Natura façade panels produced in the Eternit AG plant in Neubeckum.

The LCA models are depicted on the basis of a 10 mm-thick panel (corresponds with 18 kg/m²).

All other thickness-dependent results can therefore be generated as required by linear scaling of the basic panel to the requisite thickness and adding the coating for 1m². The coating is calculated as the difference between the declared products of 10 mm thickness.

3.2 System boundary

Type of EPD: cradle to gate

The following processes were included in product stages A1-A3 of manufacturing the fibre-cement products:

- processes for providing auxiliaries and energy
- transporting the preliminary products (cement, fibres) and auxiliaries to Neubeckum
- manufacturing process in the plant including energy expenses, manufacture of auxiliaries, disposal of residual materials incurred
- manufacturing the pro rata packaging

3.3 Estimates and assumptions

The wooden pallets used involve returnable circulation pallets. They are not considered within the framework of the declared modules.

Specific GaBi (software system for comprehensive analysis) processes are not available for all preliminary products and additives.

Manufacturing of the cellulose fibres is estimated using the RER: Kraftliner data record which is based on data from the European Association of Corrugated Cardboard Manufacturers (FEFCO 2009). Kraftliner production is identical to cellulose production; it merely includes an additional production step: paper manufacture. This process step was not calculated in this LCA model. The estimate for cellulose production therefore represents a conservative approach as it includes an additional process step.

Estimates were also made for some additives and coating components by applying chemically similar data records.

The coating is applied in the manufacturing plant and is therefore a component of the Modules A1-A3 product system. In the LCA model, it is assumed that the percentage of water in the coating evaporates after application to the fibre-cement panels and the organic solvents contained are released in full as NMVOC (worst-case approach).

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 production waste as well as all emission measurements available were taken into consideration in the analysis. Assumptions were made as regards the transport expenses associated with all input and output data taken into consideration. Accordingly, material and energy flows with a share of less than 1 per cent were also considered. It can be assumed that the total of all neglected processes does not exceed 5% in the effective categories. Machinery,

plants and infrastructure required in the manufacturing process are neglected.

3.5 Background data

In order to model fibre-cement production, the GaBi 5 software system for comprehensive analysis developed by PE INTERNATIONAL AG was used. The consistent data items contained in the GaBi data base are outlined in the online GaBi documentation. The basic data in the GaBi data base was applied for energy, transport and consumables. 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 2008 as the year of reference.

Cement is used as a binding agent in the fibre-cement products. The cement data is based on environmental data supplied by the German cement industry's Verein deutscher Zementwerke e.V. (VDZ).

3.6 Data quality

Corresponding consistent data records were available for most of the relevant preliminary products and auxiliaries used. Other preliminary products such as PVA fibres, for example, could be modelled using literary data. Furthermore, detailed coating specifications were supplied by Eternit AG enabling the preliminary products to be included in the LCA model. The background data used was last revised less than 3 years ago. The production data involves up-to-date industrial data on Eternit AG from 2010.

3.7 Period under review

The data in this Life Cycle Assessment is based on data records for manufacturing Natura and Textura façade panels as well as Eterplan structural panels provided by Eternit AG and dating from 2010. The volumes of raw materials, energy, auxiliaries and consumables used are considered as average annual values in the Neubeckum plant.

3.8 Allocation

The products are produced in Neubeckum. Uncoated Eterplan structural panels represent independent products as well as base panels for Textura and Natura façade panels. The coating data distinguishing Textura and Natura façade panels was recorded separately.

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. Ultimately, renewable secondary fuels give rise to neutral CO₂ values as they contain the same volume as they release.

3.9 Comparability

As a general rule, a comparison or evaluation of EPD data is only possible when all of the data to be compared has been drawn up in accordance with EN 15804 and the building context or product-specific characteristics are taken into consideration.



4

Reference service life: 40 to 60 years

The environmental impacts of 1m² Natura façade panels, 1m² Textura façade panels and 1m² Eterplan structural panels manufactured by Etermit AG are outlined below. The modules to DIN EN 15804 marked "x" in the overview are addressed here while the modules marked "MND" (Module not declared) were not taken into consideration.

The following tables depict the results of estimated impact, the use of resources as well as the waste and output flows relating to the declared unit.

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

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	Construction-installation process	Use / Application	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction	Transport	Waste treatment	Disposal	Re-use, recovery and re-cycling 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	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	

LCA RESULTS – ENVIRONMENTAL IMPACT: 1m² Eterplan, 1 m² Natura, 1m² Textura

		Eterplan	Natura	Textura
Parameter	Unit	A1-A3	A1-A3	A1-A3
Global Warming Potential	[kg CO ₂ equiv.]	33.48	33.83	34.32
Depletion Potential of the Stratospheric Ozone Layer	[kg CFC11 equiv.]	5.72E-08	5.81E-08	6.04E-08
Acidification Potential of soil and water	[kg SO ₂ equiv.]	5.87E-02	5.99E-02	6.23E-02
Eutrophication Potential	[kg PO ₄ equiv.]	7.48E-03	7.56E-03	7.68E-03
Formation Potential of Tropospheric Ozone Photochemical Oxidants	[kg ethene equiv.]	2.94E-02	3.25E-02	3.57E-02
Abiotic Depletion Potential non-Fossil Resources	[kg Sb equiv.]	1.85E-05	1.86E-05	1.39E-03
Abiotic Depletion Potential Fossil Fuels	[MJ]	385.49	393.77	401.42

LCA RESULTS – USE OF RESOURCES: 1m² Eterplan, 1 m² Natura, 1m² Textura

		Eterplan	Natura	Textura
Parameter	Unit	A1-A3	A1-A3	A1-A3
Renewable primary energy as energy carrier	[MJ]	26.0	26.3	27.0
Renewable primary energy as material utilisation	[MJ]	7.6	7.6	7.6
Total use of renewable primary energy sources	[MJ]	33.5	33.8	34.6
Non-renewable primary energy as energy carrier	[MJ]	407.0	415.8	424.2
Non-renewable primary energy as material utilisation	[MJ]	14.9	14.9	14.9
Total use of non-renewable primary energy sources	[MJ]	421.9	430.67	439.10
Use of secondary materials	[kg]	0.0	0.0	0.0
Renewable secondary fuels	[MJ]	4.34	4.34	4.34
Non-renewable secondary fuels	[MJ]	45.65	45.65	45.65
Net use of fresh water	[m ³]	0.0956	0.0977	0.1035

LCA RESULTS – OUTPUT FLOWS AND WASTE CATEGORIES: 1m² Eterplan, 1 m² Natura, 1m² Textura

		Eterplan	Natura	Textura
Parameter	Unit	A1-A3	A1-A3	A1-A3
Hazardous waste for disposal*	[kg]	-	-	-
Disposed of, non-hazardous waste	[kg]	81.5	82.2	83.8
Disposed of, radioactive waste	[kg]	0.0147	0.0149	0.01518
Components for re-use	[kg]	-	-	-
Materials for recycling	[kg]	-	-	-
Materials for energy recovery	[kg]	-	-	-
Exported energy (electricity)	[MJ]	-	-	-
Exported energy (thermal energy)	[MJ]	-	-	-

*) In accordance with the transition solution approved by the SVA on 4.10.2012.

The estimated impact results only represent relative statements. They do not make any statements regarding the final impact categories, exceeding threshold values, safety margins or risks.

In the manufacture (Modules A1-A3) of 1m² Eterplan, the use of **non-renewable primary energy sources** corresponds to 422 MJ/m²; 431 MJ/m² for Natura façade panels and 439 MJ/m² for Textura façade panels. The products are only distinguished by coating (Module A1) in terms of their use of primary energy.

When considering the use of non-renewable primary energy during product manufacturing, the manufacture of preliminary products (Module A1) is of significance, whereby PVA fibre manufacturing in particular accounting for 36-37%, cement manufacture with 10-11% and manufacture of paint accounting for 12-13% make a significant contribution. While Eterplan structural panels do not feature any coatings, Natura coatings account for 2% of the use of non-renewable primary energy and Textura coatings account for 4%.

The use of fuels in the plant accounts for around one-third of the use of non-renewable primary energy, whereby the provision of electricity (16-17%) and the thermal energy required from natural gas (15%) play a decisive role.

The **use of renewable primary energy sources** in the manufacture of Eterplan structural panels accounts for 33.5 MJ/m² while Natura façade panels account for 33.8 MJ/m² and Textura façade panels account for 34.6 MJ/m². An essential contribution towards the use of renewable primary energy during product manufacturing is made by cellulose production. This is attributable to the regenerative energy required for growing biomass in the upstream chains of cellulose production. Another percentage results from the regenerative share in the power mix (wind power).

Secondary raw materials are not used when manufacturing the products.

Secondary fuels are used in the upstream chains of cement manufacturing. The cement industry burns a wide variety of secondary fuels in the cement brick baking process.

During manufacture (Modules A1-A3) of 1m² Eterplan, Natura and Textura, around 100 litres of water are required for each, including the upstream chains. **Water** is used in fibre-cement manufacturing as process water and for mixing the cement.

An evaluation of the **waste volume** is depicted separately for the three main areas of disposed of non-hazardous waste (including mining waste, excavation waste, ore treatment residue, municipal solid waste including domestic and commercial waste), hazardous waste for landfilling and disposed of radioactive waste.

Non-hazardous waste depicts the largest percentage during manufacture. Excavation waste is primarily incurred during the extraction of mineral raw materials (lime for cement production) as well as in the extraction of fuels.

Radioactive waste is exclusively incurred in generating electricity in nuclear power plants.

Consideration of the results in the impact categories indicates that the supply of raw materials (Module A1) has a decisive influence.

The **Global Warming Potential** of manufacturing the products under review is primarily dominated by carbon dioxide emissions. This is essentially accounted for by the upstream chains associated with cement production (37-38%) as well as the production of PVA fibres accounting for 22%. The upstream chains associated with the provision of electricity determine 15% of the Global Warming Potential; another 12-13% is caused by direct emissions in the plant as a result of thermal realisation of natural gas. The manufacture of coating components for Natura makes a 1% contribution to the Global Warming Potential and 2.5% for Textura.

R11 and R114 emissions from the upstream chain associated with the provision of electricity make the primary contribution towards the **Ozone Depletion Potential**.

The **Acidification Potential** during product manufacturing (Modules A1-A3) is 54% dominated by sulphur dioxide emissions and 41% by nitric oxides. Contributions to the AP are accounted for by several drivers: the upstream chains associated with cement production, paint manufacturing, the upstream chains associated with PVA fibre production, transport to the plant and the provision of electricity. The manufacture of coating components for Natura makes a 2% contribution to the Acidification Potential and 6% for Textura.

Consideration of the **Eutrophication Potential** indicates a breakdown of primary initiators similar to those for the AP. The EP is 85% determined by nitric oxides in the case of the products under review. The manufacture of coating components for Natura makes a 1% contribution to the Eutrophication Potential and 3% for Textura.

The **Summer Smog Potential** is 87-89% determined by NMVOC emissions in the case of the products under review. In the case of uncoated Eterplan structural panels, around 85% is incurred during preliminary production of paint (recipe component) and 12% by the upstream chains associated with PVA fibre production. In the case of Natura facade panels, 76% originates from the upstream chains associated with fibre production, 11% from the PVA upstream chain and 10% from the manufacturing process in the plant following application of the coating, whereby NMVOC emissions are incurred. The latter percentage of coating application accounts for 19% for Textura façade panels. Another 68% is attributable to paint production and 10% to the PVA upstream chain.

In considering the **fossil abiotic use of resources**, the upstream chains associated with the provision of raw materials (Module A1) dominate at almost 100%. Almost 50% of contributions to Eterplan structural panels and Natura façade panels are attributable to the use of gypsum in cement manufacturing. Cement serves as a direct recipe component. The use of sodium chloride in the upstream chains associated with paint production and PVAL granulate production is also apparent. In the case of Textura façade panels, contributions are primarily attributable to the use of the non-renewable element antimony in the upstream chains of various preliminary products for coatings such as antimony oxide compounds.

Interpretations of the fossil abiotic use of resources comply with those concerning the use of non-renewable primary energy.

Data quality

The data quality can be regarded as good for modelling Eternit Eterplan structural panels as well as Natura and Textura façade panels. Corresponding consistent data records were available for most of the relevant preliminary products and auxiliaries used. Other preliminary products such as PVA fibres, for example, could be modelled using literary data. Life Cycle Assessment results of industrial data on PVA fibre manufacture could be higher or lower than the environmental profile used here for the fibres.

The production data involves up-to-date primary data supplied by Eternit AG for the Neubeckum plant in 2010.

In the LCA model, it is assumed that the percentage of water in the coating evaporates after application to the fibre-cement panels and the organic solvents contained are released in full as NMVOC. This approach as regards NMVOC is reflected in the summer smog potential. Other environmental indicators are not affected by this data gap. A worst-case scenario was pursued here. The reality can however fall short of the assumed value thereby causing lower results in terms of the Summer Smog Potential resulting in restrictions regarding the interpretation of EPD results.

7

7.1 Radioactivity

In Germany, there are currently no statutory limit values specified for assessing the radioactivity of building materials. Assessment can be in accordance with the EU Commission's "Radiation Protection 112" document.

According to BFS 2008, Annex 1, the index for cement is: $I: 0.17 - 0.35$

Accordingly, the index of 0.5 is maintained where an ensuing external exposure < 0.3 mSv/a can be assumed dispensing with the necessity for any further testing as per RP 112. As fibre-cement products comprise $< 100\%$ cement, the index referred to provides a maximum limit value for the products.

All mineral base materials contain low quantities of naturally radioactive substances. The measurements indicate that natural radioactivity from a radiological perspective permits unlimited use of this construction material.

7.2 Leaching

Measuring agency / Protocol / Date: Hygiene-Institut des Ruhrgebietes, Gelsenkirchen;
No. A 1027 S/00/Lo dated 15.03.2000

Result: The results 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 reservations can be asserted against the structural use of the products referred to from a water-hygiene perspective.

7.3 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)

[$\mu\text{g}/\text{m}^3$]	Textura / Natura
TVOC _{3d}	53
Carcinogenics	No evidence after 3 and 28 days
TVOC _{28d}	24
TSVOC _{28d}	< 5
R (dimensionless)	< 1
VOC without NIK _{28d}	< 5

Sample name	ROCKOLON Water a leachate stone dated 24.02.2000 leaching 1-10	Limit values as per Drinking Water Act dated 12.02.1998	Limit values class I landfill TA Municipal waste, Annex B dated 14.06.1993
Parameters			
Colour	Colourless	Colourless	-
Odour	None	None	-
pH value	11.50	6.5 - 9.5	5.5 - 12.0
Electrical conductivity	506	2500	10000
Acid capacity	K_{Acid} mmol/l	2.8	-
Acid capacity	K_{Acid} mmol/l	3.1	-
AC (426 nm)	m ¹	0.3	-
Total dissolved solids	AR mg/l	80	3000
Chloride	Cl ⁻ mg/l	10	250
Sulphate	SO ₄ ²⁻ mg/l	5	240
Phosphate, total	P mg/l	0.2	0.7
Nitrate	NO ₃ ⁻ mg/l	2.0	50
Nitrite	NO ₂ ⁻ mg/l	0.00	0.1
Fluoride	F ⁻ mg/l	0.05	15
Cyanide, total	CN ⁻ mg/l	0.01	0.05
Cyanide, free	CN ⁻ mg/l	0.01	0.1
Sodium	Na ⁺ mg/l	2.2	80
Potassium	K ⁺ mg/l	4.2	12
Calcium	Ca ²⁺ mg/l	44.7	400
Magnesium	Mg ²⁺ mg/l	0.9	50
Ammonium	NH ₄ ⁺ mg/l	0.05	0.5
Iron	Fe ²⁺ mg/l	0.05	0.2
Manganese	Mn ²⁺ mg/l	0.01	0.05
Copper	Cu ²⁺ mg/l	0.01	3
Zinc	Zn ²⁺ mg/l	0.01	5
Nickel	Ni ²⁺ mg/l	0.01	0.02
Chromate, total	Cr ⁶⁺ mg/l	0.01	0.05
Chromate	Cr ⁶⁺ mg/l	0.01	0.05
Cadmium	Cd ²⁺ mg/l	0.005	0.005
Mercury	Hg ²⁺ mg/l	0.0002	0.001
Lead	Pb ²⁺ mg/l	0.01	0.04
Antimony	Sb ³⁺ mg/l	0.001	0.01
Selenium	Se ²⁻ mg/l	0.001	0.01
Thallium	Tl ³⁺ mg/l	0.001	-
Antimony	Sb ³⁺ mg/l	0.001	0.01
Tin	Sn ²⁺ mg/l	0.005	-
Barium	Ba ²⁺ mg/l	0.01	-
Beryllium	Be ²⁺ mg/l	0.002	-
Boron	B ³⁺ mg/l	0.05	1
Cobalt	Co ²⁺ mg/l	0.01	-
Silver	Ag ⁺ mg/l	0.01	-
Vanadium	V ⁵⁺ mg/l	0.05	-
Aluminium	Al ³⁺ mg/l	0.56	0.2
YH ₂ O ₂ consumption	mg/l	3.5	5
Chem. oxygen demand (COD)	O ₂ mg/l	15	-
Total Organic Carbon (TOC)	C mg/l	3.8	20
Phenol index	mg/l	n.a.	0.2
Absorb. org. bound halogens (AOH)	Cl ⁻ mg/l	0.026	0.3
Σ PCB	mg/l	n.a.	-
Σ PCB as per the Drinking Water	mg/l	n.a.	-
Orthocresol	mg/l	n.a.	-
Benzo(a)pyrene	mg/l	n.a.	-
Σ CVOC	mg/l	n.a.	-

n.a. = unavailable (below the detection limit)

- There was no evidence of carcinogenics after 3 and 28 days.
- At 53 $\mu\text{g}/\text{m}^3$, the total VOC ("TVOC") after 3 days was below the limit of 10 mg/m^3 .
- At 24 $\mu\text{g}/\text{m}^3$, the total VOC ("TVOC") after 28 days was below the limit of 1 mg/m^3 .
- At < 5 $\mu\text{g}/\text{m}^3$, the total SVOC after 28 days was below the limit of 0.1 mg/m^3 .
- At more than 5 $\mu\text{g}/\text{m}^3$, the VOC individual substances established after 28 days resulted in a rating value R with < 0.02 below the maximum limit of 1.



- At $< 5 \mu\text{g}/\text{m}^3$, the total VOC individual substances without an NIK value after 28 days was below the limit of $0.1 \text{ mg}/\text{m}^3$
- At $8.4 \mu\text{g}/\text{m}^3$, the formaldehyde concentration after 28 days was below the limit of $120 \mu\text{g}/\text{m}^3$.

All of the measured values are below the respective limits.

8

Institut Bauen und Umwelt e.V., Königswinter (pub.)

General principles

General principles for the EPD range of Institut Bauen und Umwelt e.V. (IBU), 2011-06

PCR Part A

PCR Part A: Calculation rules for the LCA and requirements on the background report 2011-07

PCR Part B

PCR Part B: Requirements on the EPD for fibre cement / fibre concrete, 2011-06

www.bau-umwelt.de

DIN EN ISO 14025

DIN EN ISO 14025: 2011-10, Environmental labels and declarations – Type III environmental declarations – Principles and procedures (ISO 14025:2006); German and English versions EN ISO 14025:2011

DIN EN 15804

DIN EN 15804:2012-04, Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products; German version EN 15804:2012

DIN EN ISO 9001

DIN EN ISO 9001:2008, Quality management systems – Requirements (ISO 9001:2008); trilingual version EN ISO 9001:2008

DIN EN ISO 14001

DIN EN ISO 14001:2004, Environmental management systems – Requirements with guidance for use

DIN EN 12467

DIN EN 12467:2006-12: Fibre-cement flat sheets – Product specification and test methods; German version EN 12467:2004 + A1:2005 + A2:2006

Eternit 2011

Eternit planning and application – Eternit façades with fibre cement, 2011

http://www.eternit.de/fileadmin/downloads/P_A/Fassaden_2011.pdf

Z-31.1-34

General technical approval no. Z-31.1-34 of the Deutsches Institut für Bautechnik (DIBt) for Eternit façade boards, 2001

The Textura/Natura product examined is 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.

DIN 4102

DIN 4102:1994-03: Fire behaviour of building materials and building components; A1: synopsis and application of classified construction materials, components and special components

DIN EN 13501

DIN EN 13501-1:2010-01: Fire classification of construction products and building elements – Part 1: Classification using data from reaction to fire tests; German version EN 13501-1:2007 + A1:2009

DIN EN 197-1

DIN EN 197-1:2011-11: Cement – Part 1: Composition, specifications and conformity criteria of common cement; German version EN 197-1:2011

DIN 38414-4

DIN 38414-4:1984-10: German standard methods for the examination of water, waste water and sludge; sludge and sediments (group S)

DIN 53436

DIN 53436-1:1981-04: Producing thermal decomposition products from materials in an air stream and their toxicological testing, decomposition apparatus and determination of test temperature

BfS 2008

K. Gehrke, B. Hoffmann, U. Schkade, V. Schmidt, K. Wichterey: Natürliche Radioaktivität in Baumaterialien und die daraus resultierende Strahlenexposition (Natural radioactivity in construction materials and the ensuing radiation exposure) – Interim report, Federal Office for Radiation Protection, Berlin 2008

FEFCO 2009

FEFCO – Fédération Européenne des Fabricants de Carton Ondulé (European Database for Corrugated Board Life Cycle Studies), Cepi ContainerBoard, 2009

GaBi software

GaBi 5: Software and data base for comprehensive analysis. LBP, University of Stuttgart and PE International, 2011

GaBi documentation

GaBi 5: Documentation of GaBi 5 data from the data base for comprehensive analysis LBP, University of Stuttgart and PE International, 2011 <http://documentation.gabi-software.com/>



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ROXUL ROCKBOARD® 80

PLEASE PROVIDE ROXUL CAVITYBOARD 80

Commercial Multi-Purpose Board

Product Description & Application

ROXUL ROCKBOARD® 80 is a rigid, multi-purpose mineral wool insulation board.

	Performance	Test Standard
Compliance	Mineral Fiber Block and Board Thermal Insulation - Type IVB Compliant	ASTM C612
Reaction to Fire	Flame spread index = 0 ; Smoke developed index = 0 Flame spread index = 0 ; Smoke developed index = 0 Determination of Non Combustibility of Building Materials - Non Combustible Hot Surface Performance - 1200°F	ASTM E84 (UL 723) CAN/ULC S102 CAN/ULC S114 ASTM C411
Density	Actual Density - 8 lbs/ft³ (128 kgs/m³)	ASTM C303
Dimensional Stability	Linear Shrinkage - <1% @ 1200°F	ASTM C356
Corrosion Resistance	Stress Corrosion Cracking Tendency of Austenitic Stainless Steel - Passed Corrosion of Steel - Passed	ASTM C795 ASTM C665
Thermal Resistance	R-Value / inch @ 75°F 4.0 hr.ft².F/Btu RSI value / 25.4mm @ 24°C 0.70 m²K/W	ASTM C518 (C177)
Reaction to Moisture	Moisture Sorption - 0.05% Determination of Fungi Resistance - Passed	ASTM C1104 ASTM C1338
Compressive Strength	439psf (21kPa) @ 10% compression 1065psf (50kPa) @ 25% compression	ASTC C165
Thickness Dimensions	Product is available in 2" through 4" offerings (50.8mm - 101.6mm) 24"x48" (610mm x 1219mm)	
Acoustical Performance	Thickness	125 Hz 250 Hz 500 Hz 1000 Hz 2000Hz 4000 Hz NRC ASTM C423
	2"	0.43 0.78 0.9 0.97 0.97 1 0.9
	3"	0.75 0.82 0.89 0.94 1 1 0.9

Issued 04-01-16
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Subcontractor/Supplier LEED Documentation Requirements

Date: 3/01/16

RE: Webster Interdisciplinary Science Building LEED requirements

LEED Certification Process

Dear Subcontractor/Supplier:

As you know, Webster ISB in Webster Groves is pursuing LEED-New Construction v2009 Silver Certification.

As a subcontractor/supplier on this project, your company is responsible for supporting compliance under the LEED rating system and for taking specific measures to meet the specific standards required to earn certain credits.

As a supplier/subcontractor on this project, you are obligated to provide cost and construction material backup documents and information to be included with the project LEED-NC application.

Please review the following list of requested items from your subcontract scope of work for this project. You may need to consult with material suppliers and manufacturers for additional information.

Backup cut sheets similar to those providing with shop drawings will be necessary.

MSDS sheets may be necessary.

Please call or email with questions or comments.

Thank you.

Devin Gates
Paric Corporation
Senior Project Engineer

ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025 and EN 15804

Designation of product	Eternit AG
Publisher	Institut Bauen und Umwelt (IBU)
Designation of product	Institut Bauen und Umwelt (IBU)
Designation of product	Eternit AG
Issue date	14.07.2013
Validity	13.04.2014

**Eternit Equitone Natura Façade Panels,
Eternit Equitone Textura Façade Panels,
Eterplan Structural Panels**

ETERNIT AG

www.bau-und-umwelt.com



Institut Bauen
und Umwelt e.V.

2.4 Placing on the market / Application rules

DIN EN 12467: 2006-12, Fibre-cement flat sheets – Product specification and test methods; German version EN 12467:2004 + A1:2005 + A2:2006

General technical approval No. Z-31.1-34 of the Deutsches Institut für Bautechnik (DIBt)

2.5 Delivery status

	Max. sizes in mm	Thickness- es in mm	Surface
Eterplan	3100 x 1500	6; 8; 10; 12; 15; 20	smooth
Textura*	3100 x 1500	8; 12	grainy
Natura*	3100 x 1250	8; 12	smooth
Textura (balcony slab)*	3100 x 1500	10	grainy

*) products available in various colours

Packaging is in the form of standard pallets in accordance with the price list with each pallet bearing a weight of 1 to 2 tonnes, seldom exceeding 2 tonnes.

Small orders (< 1 tonne) are packed to customer requirements.

2.6 Base materials / Auxiliaries

Fibre cement: (Base materials in % mass, dry mass)

81.5% Portland cement to DIN EN 197-1, (CEM I 32.5 R and 42.5 R) (as binding agent)

6% Trass (as filling material)

2.5% Cellulose (as filter fibres)

3.5% Polyvinyl alcohol fibres (reinforcement fibres)

6.5% Dye

and water for mixing the cement: 0.24 m³/t fibre cement.

Coatings:

Application [g/m²]	volume	Textura	Natura
Backing sealing			
wet		36 - 44	38 - 42
dry		14 - 18	15 - 17
Coating for the front		Primer	Primer
wet		220 - 240	64 - 88
dry		96 - 104	29 - 40
		Textura TC	Isocolor TC
wet		160 - 192	104 - 134
dry		70 - 84	42 - 53

No substances of REACH relevance are used in production.

2.7 Production

Large-format panels made of fibre cement are manufactured largely in accordance with an automated winding process (Hatschek process): the raw materials are mixed with water to prepare a homogeneous mixture. Rotating screen cylinders are immersed in this fibre-cement pulp which drain internally. The screen surface is covered in a thin film of fibre 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 fibre cement. Once the requisite material thickness is achieved, the still moist and malleable fibre-cement layer (fibre-cement fleece) is separated and removed from the format roller. The fibre-cement fleece is cut to length and leftovers 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 stored temporarily in a special store for further setting. The setting time lasts approx. 4 weeks.

The façade panels are given a partial 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 9001:2008.

2.8 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/Soil: 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 14001:2004.

2.9 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, punch pliers etc. are available for processing. Drill holes can be made using standard HSS drills. Additional products necessitated by design for installing the products referred to above include: wood or aluminium substructures including the requisite anchoring and joining equipment (studs, screws, nails) and joint tape made of EPDM or aluminium. An analysis of these additional products is not a component of this Declaration. 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.

On request, the large-format panels can also be supplied ready for installation merely requiring individual cutting to size on site.

The set of rules laid out by the employers' liability insurance associations shall apply.

LCA: Calculation rules

3.1 Declared unit

This Declaration refers to the manufacture of 1m² Eterplan structural panels, 1m² Textura façade panels and 1m² Natura façade panels produced in the Eternit AG plant in Neubeckum.

The LCA models are depicted on the basis of a 10 mm-thick panel (corresponds with 18 kg/m²).

All other thickness-dependent results can therefore be generated as required by linear scaling of the basic panel to the requisite thickness and adding the coating for 1m². The coating is calculated as the difference between the declared products of 10 mm thickness.

3.2 System boundary

Type of EPD: cradle to gate

The following processes were included in product stages A1-A3 of manufacturing the fibre-cement products:

- processes for providing auxiliaries and energy
- transporting the preliminary products (cement, fibres) and auxiliaries to Neubeckum
- manufacturing process in the plant including energy expenses, manufacture of auxiliaries, disposal of residual materials incurred
- manufacturing the pro rata packaging

3.3 Estimates and assumptions

The wooden pallets used involve returnable circulation pallets. They are not considered within the framework of the declared modules.

Specific GaBi (software system for comprehensive analysis) processes are not available for all preliminary products and additives.

Manufacturing of the cellulose fibres is estimated using the RER: Kraftliner data record which is based on data from the European Association of Corrugated Card-board Manufacturers (FEFCO 2009). Kraftliner production is identical to cellulose production; it merely includes an additional production step: paper manufacture. This process step was not calculated in this LCA model. The estimate for cellulose production therefore represents a conservative approach as it includes an additional process step.

Estimates were also made for some additives and coating components by applying chemically similar data records.

The coating is applied in the manufacturing plant and is therefore a component of the Modules A1-A3 product system. In the LCA model, it is assumed that the percentage of water in the coating evaporates after application to the fibre-cement panels and the organic solvents contained are released in full as NMVOC (worst-case approach).

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 production waste as well as all emission measurements available were taken into consideration in the analysis. Assumptions were made as regards the transport expenses associated with all input and output data taken into consideration. Accordingly, material and energy flows with a share of less than 1 per cent were also considered. It can be assumed that the total of all neglected processes does not exceed 5% in the effective categories. Machinery,

plants and infrastructure required in the manufacturing process are neglected.

3.5 Background data

In order to model fibre-cement production, the GaBi 5 software system for comprehensive analysis developed by PE INTERNATIONAL AG was used. The consistent data items contained in the GaBi data base are outlined in the online GaBi documentation. The basic data in the GaBi data base was applied for energy, transport and consumables. 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 2008 as the year of reference.

Cement is used as a binding agent in the fibre-cement products. The cement data is based on environmental data supplied by the German cement industry's Verein deutscher Zementwerke e.V. (VDZ).

3.6 Data quality

Corresponding consistent data records were available for most of the relevant preliminary products and auxiliaries used. Other preliminary products such as PVA fibres, for example, could be modelled using literary data. Furthermore, detailed coating specifications were supplied by Eternit AG enabling the preliminary products to be included in the LCA model. The background data used was last revised less than 3 years ago. The production data involves up-to-date industrial data on Eternit AG from 2010.

3.7 Period under review

The data in this Life Cycle Assessment is based on data records for manufacturing Natura and Textura façade panels as well as Eterplan structural panels provided by Eternit AG and dating from 2010. The volumes of raw materials, energy, auxiliaries and consumables used are considered as average annual values in the Neubeckum plant.

3.8 Allocation

The products are produced in Neubeckum. Uncoated Eterplan structural panels represent independent products as well as base panels for Textura and Natura façade panels. The coating data distinguishing Textura and Natura façade panels was recorded separately.

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. Ultimately, renewable secondary fuels give rise to neutral CO₂ values as they contain the same volume as they release.

3.9 Comparability

As a general rule, a comparison or evaluation of EPD data is only possible when all of the data to be compared has been drawn up in accordance with EN 15804 and the building context or product-specific characteristics are taken into consideration.

LCA: Results

The environmental impacts of 1m² Natura façade panels, 1m² Textura façade panels and 1m² Eterplan structural panels manufactured by Eternit AG are outlined below. The modules to DIN EN 15804 marked "x" in the overview are addressed here while the modules marked "MND" (Module not declared) were not taken into consideration.

The following tables depict the results of estimated impact, the use of resources as well as the waste and output flows relating to the declared unit.

LCA RESULTS - ENVIRONMENTAL IMPACTS - IMPACT CATEGORIES AND IMPACT FACTORS																
Product stage			Construction process stage		Use stage							End-of-life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport	Construction-installation process	Use / Application	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction	Transport	Waste treatment	Disposal	Re-use, recovery and re-cycling 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	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND
LCA RESULTS - ENVIRONMENTAL IMPACTS - IMPACT CATEGORIES AND IMPACT FACTORS																
							Unit		Eterplan		Natura		Textura			
Parameter							Unit		A1-A3		A1-A3		A1-A3		A1-A3	
Global Warming Potential							[kg CO ₂ equiv.]		33.48		33.83		34.32			
Depletion Potential of the Stratospheric Ozone Layer							[kg CFC11 equiv.]		5.72E-08		5.81E-08		6.04E-08			
Acidification Potential of soil and water							[kg SO ₂ equiv.]		5.87E-02		5.99E-02		6.23E-02			
Eutrophication Potential							[kg PO ₄ ³⁻ equiv.]		7.48E-03		7.56E-03		7.68E-03			
Formation Potential of Tropospheric Ozone Photochemical Oxidants							[kg ethene equiv.]		2.94E-02		3.25E-02		3.57E-02			
Abiotic Depletion Potential non-Fossil Resources							[kg Sb equiv.]		1.85E-05		1.86E-05		1.39E-03			
Abiotic Depletion Potential Fossil Fuels							[MJ]		385.49		393.77		401.42			
LCA RESULTS - USE OF RESOURCES AND EMISSIONS OF POLLUTANTS																
							Unit		Eterplan		Natura		Textura			
Parameter							Unit		A1-A3		A1-A3		A1-A3		A1-A3	
Renewable primary energy as energy carrier							[MJ]		26.0		26.3		27.0			
Renewable primary energy as material utilisation							[MJ]		7.6		7.6		7.6			
Total use of renewable primary energy sources							[MJ]		33.5		33.8		34.6			
Non-renewable primary energy as energy carrier							[MJ]		407.0		415.8		424.2			
Non-renewable primary energy as material utilisation							[MJ]		14.9		14.9		14.9			
Total use of non-renewable primary energy sources							[MJ]		421.9		430.67		439.10			
Use of secondary materials							[kg]		0.0		0.0		0.0			
Renewable secondary fuels							[MJ]		4.34		4.34		4.34			
Non-renewable secondary fuels							[MJ]		45.65		45.65		45.65			
Net use of fresh water							[m³]		0.0956		0.0977		0.1035			
LCA RESULTS - WASTE AND WASTE MANAGEMENT																
							Unit		Eterplan		Natura		Textura			
Parameter							Unit		A1-A3		A1-A3		A1-A3		A1-A3	
Hazardous waste for disposal*							[kg]		-		-		-			
Disposed of, non-hazardous waste							[kg]		81.5		82.2		83.8			
Disposed of, radioactive waste							[kg]		0.0147		0.0149		0.01518			
Components for re-use							[kg]		-		-		-			
Materials for recycling							[kg]		-		-		-			
Materials for energy recovery							[kg]		-		-		-			
Exported energy (electricity)							[MJ]		-		-		-			
Exported energy (thermal energy)							[MJ]		-		-		-			

* In accordance with the transition solution approved by the SVA on 4.10.2012.

The estimated impact results only represent relative statements. They do not make any statements regarding the final impact categories, exceeding threshold values, safety margins or risks.

Interpretations of the **fossil abiotic use of resources** comply with those concerning the use of non-renewable primary energy.

Data quality

The data quality can be regarded as good for modelling Eternit Eterplan structural panels as well as Natura and Textura façade panels. Corresponding consistent data records were available for most of the relevant preliminary products and auxiliaries used. Other preliminary products such as PVA fibres, for example, could be modelled using literary data. Life Cycle Assessment results of industrial data on PVA fibre manufacture could be higher or lower than the environmental profile used here for the fibres.

The production data involves up-to-date primary data supplied by Eternit AG for the Neubeckum plant in 2010.

In the LCA model, it is assumed that the percentage of water in the coating evaporates after application to the fibre-cement panels and the organic solvents contained are released in full as NMVOC. This approach as regards NMVOC is reflected in the summer smog potential. Other environmental indicators are not affected by this data gap. A worst-case scenario was pursued here. The reality can however fall short of the assumed value thereby causing lower results in terms of the Summer Smog Potential resulting in restrictions regarding the interpretation of EPD results.

Requisite evidence

7.1 Radioactivity

In Germany, there are currently no statutory limit values specified for assessing the radioactivity of building materials. Assessment can be in accordance with the EU Commission's "Radiation Protection 112" document.

According to BfS 2008, Annex 1, the index for cement is: 0.17 – 0.35

Accordingly, the index of 0.5 is maintained where an ensuing external exposure < 0.3 mSv/a can be assumed dispensing with the necessity for any further testing as per RP 112. As fibre-cement products comprise < 100% cement, the index referred to provides a maximum limit value for the products.

All mineral base materials contain low quantiles of naturally radioactive substances. The measurements indicate that natural radioactivity from a radiological perspective permits unlimited use of this construction material.

7.2 Leaching

Measuring agency / Protocol / Date: Hygiene-Institut des Ruhrgebietes, Gelsenkirchen;
No. A 1027 S/00/Lo dated 15.03.2000

Result: The results 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 reservations can be asserted against the structural use of the products referred to from a water-hygiene perspective.

7.3 VOC emissions

Measuring agency: Euroflns 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)

[µg/m³]	Textura / Natura
TVOC _{3d}	53
Carcinogenics	No evidence after 3 and 28 days
TVOC _{28d}	24
TSVOC _{28d}	< 5
R (dimensionless)	< 1
VOC without NiK _{28d}	< 5

Parameter	Sample name	ISO-COLOR Natura stone dated 24.02.2000 including 1-10	Limit values as per Drinking Water Act dated 12.12.1990	Limit values class I landfill TA Municipal waste, Annex B dated 14.05.1992
Colour		Colourless	Colourless	-
Odour		None	None	-
pH value		10.0	6.5 – 8.5	6.5 – 12.0
Electrical conductivity		556	2500	10000
Acid capacity	K _{10.0}	mmol/l	2.6	-
Alkal capacity	K _{10.0}	mmol/l	3.1	-
AC (425 mm)		m²	0.9	-
Total dissolved solids	AR	mg/l	150	3000
Chloride	Cl⁻	mg/l	< 30	260
Sulphate	SO₄²⁻	mg/l	< 6	240
Phosphate, total	P	mg/l	< 0.2	6.7
Nitrate	NO₃⁻	mg/l	< 2.0	50
Nitrite	NO₂⁻	mg/l	0.100	0.1
Fluoride	F⁻	mg/l	0.09	15
Cyanide, total	CN⁻	mg/l	< 0.01	0.05
Cyanide, free	CN⁻	mg/l	< 0.01	0.1
Sodium	Na	mg/l	2.2	150
Potassium	K	mg/l	4.2	12
Calcium	Ca	mg/l	19.7	400
Magnesium	Mg	mg/l	9.8	80
Ammonium	NH₄⁺	mg/l	< 0.05	0.5
Iron	Fe	mg/l	< 0.05	0.2
Manganese	Mn	mg/l	< 0.01	0.05
Copper	Cu	mg/l	< 0.01	0.1
Zinc	Zn	mg/l	< 0.01	0.2
Nickel	Ni	mg/l	< 0.01	0.02
Chromium, total	Cr	mg/l	< 0.01	0.05
Chromate	Cr ^{VI}	mg/l	< 0.01	0.05
Cadmium	Cd	mg/l	< 0.005	0.005
Mercury	Hg	mg/l	< 0.0002	0.001
Lead	Pb	mg/l	< 0.04	0.04
Arsenic	As	mg/l	< 0.001	0.01
Selenium	Se	mg/l	< 0.001	0.01
Thallium	Tl	mg/l	< 0.001	0.01
Antimony	Sb	mg/l	< 0.001	0.01
Tin	Sn	mg/l	< 0.005	0.01
Barium	Ba	mg/l	< 0.01	1
Beryllium	Be	mg/l	< 0.002	1
Boron	B	mg/l	< 0.05	1
Cobalt	Co	mg/l	< 0.01	0.01
Silver	Ag	mg/l	< 0.01	0.01
Vanadium	V	mg/l	< 0.05	0.2
Aluminium	Al	mg/l	0.58	0.2
RMVOC consumption		mg/l	3.5	5
Chem. oxygen demand (COD)	C ₂	mg/l	< 5	20
Total Organic Carbon (TOC)	C	mg/l	3.8	0.2
Phenol index		mg/l	n.n.	0.02
Absorb. org. bound halogens (AO-CR)		mg/l	0.026	0.2
E _{POB}		mg/l	n.n.	-
E _{POB} 10 per 100 Drinking Water		mg/l	n.n.	-
Orthocresol		mg/l	n.n.	-
Benzocyclopentadiene		mg/l	n.n.	-
E _{OVOC}		mg/l	n.n.	-

n.n. = unverifiable (below the detection limit)

- 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.



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