ENVIRONMENTAL PRODUCT DECLARATION

According to /ISO 14025/ and /EN 15804/

Declaration owner	Rieder Sales GmbH
Issuer	*Institut Bauen und Umwelt e.V.* (IBU)
Programme holder	*Institut Bauen und Umwelt e.V.* (IBU)
Declaration number	EPD-RSE-20180069-IAD1-DE
Date of issue	29.10.2018
Valid until	28.10.2023

concrete skin' and 'öko skin' –
Glass-fibre-reinforced concrete

Rieder Sales GmbH

Institut Bauen und Umwelt e.V.

www.ibu-epd.com / https://epd-online.com

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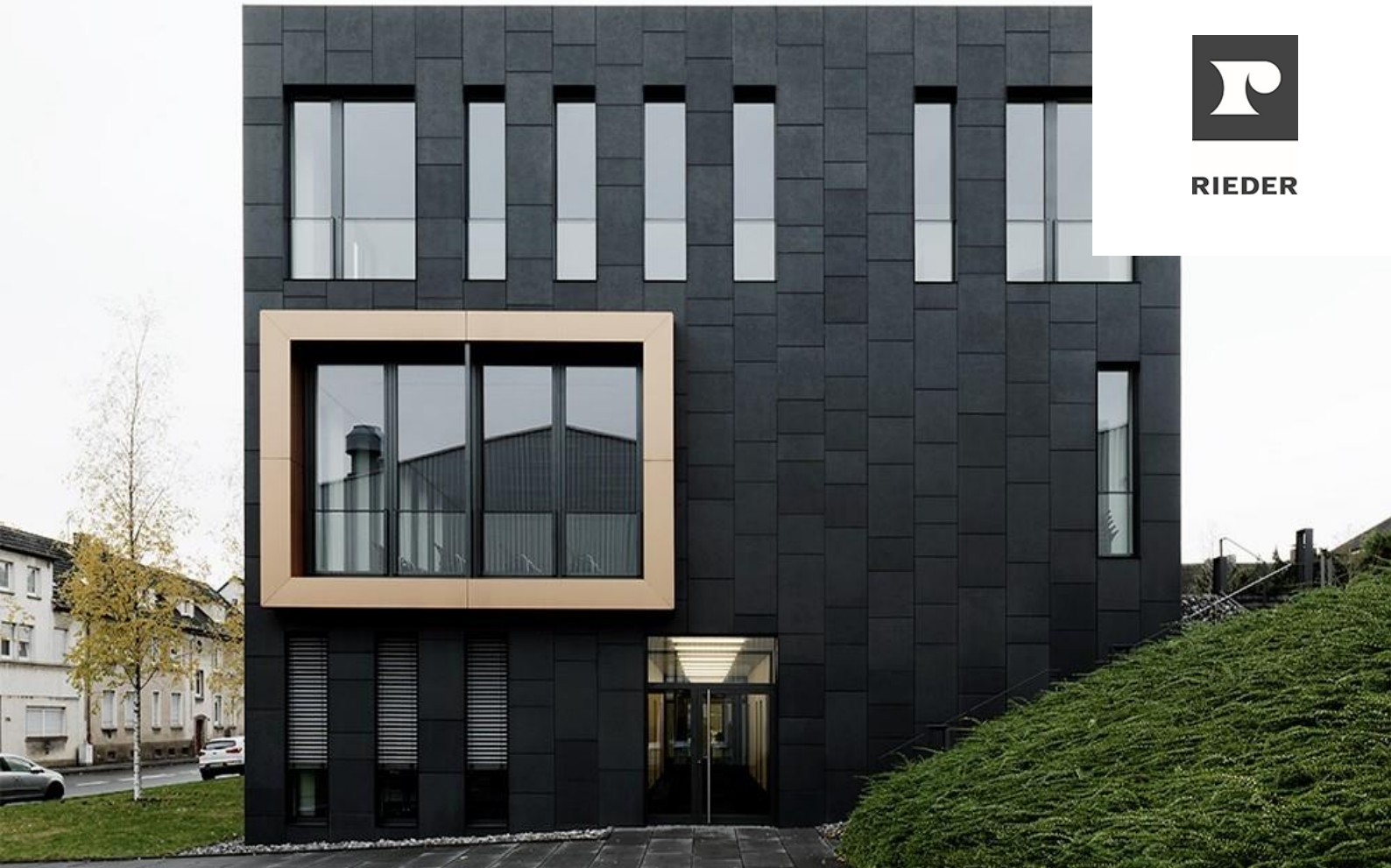

1. General Information

Rieder Sales GmbH

Holder of programme
IBU - Institut Bauen und Umwelt e.V.
Panoramastr. 1
10178 Berlin
Germany

Declaration number
EPD-RSE-20180069-IAD1-DE

This declaration is based upon the following product-category rules:
Fibre cement / fibre concrete, 07.2014
(PCR-checked and endorsed by the independent council of experts (the 'SVR'))

Date of issue
29.10.2018

Valid until
28.10.2023

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

Hans Peters, Diploma Engineer
(Chief Executive Officer, IBU)

concrete skin and öko skin – glass-fibre-reinforced concrete

Owner of declaration
Rieder Sales GmbH
Mühlenweg 22
5751 Maishofen
Austria

Declared product/declared unit
The declaration relates to 1 t of glass-fibre-reinforced facade sheet - 'concrete skin' and 'öko skin'

Area of validity:
The life-cycle assessment (LCA) is based upon Rieder Sales GmbH data from the production-year 2016. The study's subject matter is the glass-fibre-reinforced sheets manufactured at *Rieder Faserbeton-Elemente GmbH* in Kolbermoor, Germany; these products are declared to be an average product; the average refers to the span of production quantities that emerged throughout the year referred-to.

The declaration's owner shall hold liability for the information and items of proof that form the basis for it; it is ruled out for there to be any liability on the part of IBU, in relation to manufacturer information, LCA data, or items of proof.

Verification

The CEN norm /EN 15804/ serves as core PCR
Verification of the EPD by an independent third party, according to /ISO 14025/
☐ internal ☒ external

Dr.-Ing. Andreas Ciroth,
Independent verifier, appointed by the SVR

2. Product

2.1 Product description/product definition

'concrete skin' and 'öko skin' are facade sheets made from the material named 'fibreC' glass-fibre-reinforced concrete. The reinforcement consists of textile and fibre made of alkali-resistant glass (AR glass). The sheet is dyed throughout. The standard thickness comprises 13 mm. The declaration is valid for the '*ferro,' 'ferro light*,' and '*matt*' surfaces respectively, and also for all 12 colours.

2.2 Application

The sheets, made of fibreC glass-fibre-reinforced concrete, serve as cladding material for back-ventilated pre-hung facades, as an indoor and outdoor cladding, and also as a floor covering.

2.3 Technical data

Data on construction technology

Designation	Value	Unit
Thermal conductivity	2	W/(mK)
Bulk density	2000 - 2400	kg/m^3
Bending tensile strength	> 18	N/mm^2
Modulus of elasticity	10000	N/mm^2
Temperature – reciprocal value of modulus of elasticity	10	$10^{-6}K^{-1}$

2.4 State at time of delivery

Regulated according to the product norm */DIN EN ISO 12467:2016/* 'Fibre-Cement Flat Sheets – Product Specification and Test Methods'
Additional proof of use, for application in Germany, is provided through the approval by the construction supervisory body. Approval No. Z-31.4-166, from the *DIBt* institute (*Deutsches Institut für Bautechnik).*

Safeguarding of quality:
Quality management acc. to /DIN EN ISO 9001:2015/
Environmental management /DIN EN ISO 14001:2015/

2.5 Constituent materials/auxiliary materials

Standard dimensions:
3600/1200/13

3100/1200/13
2500/1200/13
or individually cut

Material thickness: 13 mm as standard
Weight: 26-31.5 kg/m²

The sheets are available in 12 standard colours, each version offers 3 surface-types respectively.
Colours: *polar white, off-white, ivory, silvergrey, chrome, anthracite, liquid black, sahara, sandstone, terra, terracotta, green.*
Surfaces: *ferro, ferro light, matt*

2.6 Manufacture
The glass-fibre-reinforced exposed-concrete sheets are manufactured in a special extrusion procedure. After being hardened accordingly, the sheets are passed on for further processing (surface, cuts, drilling of holes, etc.)

2.7 Environment and health during manufacture
QM system /DIN EN ISO 9001:2015/
Environmental management system
/DIN EN ISO 14001:2015/

Throughout the manufacturing process, there is no necessity to use health-protection measures that go beyond those established in law for organisations running a business.

2.8 Product processing/Installation
Usually the sheets are delivered to the building site already cut to size and drilled. In principle it is possible to process the product *in situ* on the building site.

The sheets are mounted onto a sub-structure made of metal or wood. There are the following options for fastening:

- Rivets (visible)
- Screws (visible)
- Undercut anchor (not visible)
- Rieder Power Anchor (not visible)
- Adhesion (not visible)

2.9 Packaging
The sheets made of fibreC glass-fibre-reinforced concrete are packed at the manufacturer's facility. Wooden pallets and transport boxes are reuseable.

2.10 State of use
Non-water-permeable according to /DIN EN 12467:2016/
Resistant to interchangeable exposure to heat and rain respectively, according to /DIN EN 12467:2016/
Frost-resistance according to /DIN EN 12467:2016/
Resistance of the colouring pigments to UV, according to /DIN EN 12878:2014/
Resistant to interchangeable exposure to wet and dry conditions, according to /DIN EN 12467:2016/
Resistant in the event of storage in warm water, according to /DIN EN 12467:2016/

2.11 Environment & health during use
It is not known for there to be interactions whereby the product, the environment and health exert an effect upon one another.

2.12 Reference duration of use
The technical characteristics of fibreC glass-fibre-reinforced concrete remain effective for a calculated duration of over 50 years. The normal manifestations of wear-and-tear and the gradual nature of optical effects, due to environmental influences, do not restrict either the panels' safety or those mechanical characteristics for which assurances are given.

2.13 Extraordinary influencing factors

Fire
Fire protection: Building-Materials Class A1 – non-flammable according to /DIN EN 13501-1:2010/
Building-materials Classification A2-s1, d0 – non-flammable according to /DIN EN 13501-1:2010/

Water
No environmental consequences are to be expected in this context. fibreC glass-fibre-reinforced concrete sheets constitute facade sheets that hold approval from the supervisory authority for building-activities (German general supervisroy approval for building-activities: Z-31.4-166, from the *Deutsches Institut für Bautechnik* /DIBt/, Berlin)

Mechanical destruction
This aspect is not of relevance.

2.14 Post-product-use phase
fibreC glass-fibre reinforced concrete consists of mineral raw materials sourced from minerals; it can be used in shredded form as a filling material for construction work, used in dam-construction and road-building.

2.15 Disposal
FibreC glass-fibre reinforced concrete is approved for storage on landfills for construction waste-materials and mass waste material, according to the Landfill Ordinance (*Deponieverordnung /BGBI* 164/1996/), provided that this material is made available in disposal or refurbishment activities.
/Waste-code according to European Waste Catalogue/:
17 01 01 Concrete

2.16 Further information
You can obtain further information at www.rieder.cc

3. LCA: Rules of calculation

3.1 Declared unit
The declaration pertains to the declared unit of 1 t, according to the IBU-PCR Instructions Text, Part B, for the product group 'fibre cement / fibre concrete.'
What is taken into consideration is an average product for the Kolbermoor facility in Germany. fibreC glass-fibre-reinforced concrete has a thickness of 13 mm; ist average surface-area weight comprises 28.73 kg/m²

Declared unit

Designation	Value	Unit
Declared unit	1	t
Conversion factor // 1 kg	0.001	-

3.2 System limit

This LCA addresses that life-cycle stage of product manufacture called 'Cradle to factory gate'
This production stage comprises these modules: A1 (Provision of raw materials), A2 (Transport), A3 (Manufacture) according to /DIN EN 15804:2012/

3.3 Estimates and assumptions

Because the product declared is manufactured in Germany, background data for Germany (as the reference area) was used for the LCA (e.g. provision of electrical energy). If no data-sets specific to Germany were available, global or European data-sets were used.
Primary data were not present in /GaBi ts/ for dyes and other basic materials. Estimates were used, based on the security data sheets.
For the combustion process, the generic background data-set "Thermic Energy from Natural Gas" was used. The order of magnitude of the emissions supplied was comparable with the available GaBi data-set.

3.4 Cut-off rules

In producing the LCA results, all data was taken into account that came from the registration of company operating data, i.e. all relevant starting materials deployed according to the product formula, the thermic energy applied, and also the electricity required and all direct waste generated in production. This took into account all raw-material flows and energy flows that had a proportion exceeding 0.1 %. It can be taken as the basis that the sum of the processes not taken into account does not exceed 5 % of the categories that do indeed exert an effect. Machines, facilities and infrastructure required in manufacture were ignored. All transport processes were taken into account.

3.5 Background data

The background were obtained from the GaBi databanks of /GaBi ts/. The documentation can be viewed online.

3.6 Data quality

In order to model the product stage of the 'fibreC' glass-fibre-reinforced panels, Rieder's primary data was used. All other relevant background-datasets no more than five years old were obtained from the database of the /GaBi ts/ software.

3.7 Period under consideration

The period under consideration is the year 2016.

3.8 Allocation

The data was obtained exclusively for the product declared. Therefore, no co-product allocation was necessary.

In this study, factors included in 'Allocation in the Case of Multi-Input Processes' include the following: the disposal of residual waste in the waste-incineration facility, and the disposal of the loam rubble in the landfill (landfill for inert material at the facility in Kolbermoor).
Credits that emerge as a consequence of the electrical and thermal energy substitution are directly allocated to the relevant product stage. This is possible because the quantity credited is not larger than the energy demand generated on the input side, for supply of energy in production and in pre-product manufacture. The energy under consideration is of consistently high quality.

3.9 Comparability

As a matter of principle, it is possible to juxtapose EPD data, or to assess it, solely if all data-sets to be compared were produced according to /EN 15804/ and if one takes into account the building's context, and/or respectively the product-specific performance characteristics.
The background-database used is /GaBi ts/.

4. LCA: Scenarios and further technical information

In accordance with /DIN EN 15804:2012/ no scenarios are indicated for the fibreC glass-fibre-reinforced panels referred to; this is because only the obligatory modules - A1, A2 and A3 (Production stage) - were taken into account.

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5. LCA: Results

The following tables follow contain the results of the LCA for 1 tonne of glass-fibre-reinforced concrete sheet from the company Rieder Sales GmbH, sourced from the Kolbermoor facility in Germany, relating to the declared stages in the product's life.

SYSTEM-LIMIT INFORMATION (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)

Production stage			Stage in erection of the given structure		Stage of use							Disposal stage				Credits and burdens outside the system limit
Raw-materials supply	Transport	Manufacture	Transport from manufacture to place of use	Assembly	Use / Application	Maintenance	Repair	Replacement	Renewal	Energy-use to operate the building	Water-use to operate the building	Deconstruction / Demolition	Transport	Waste treatment	Removal	Potential for reuse, recovery or recycling
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	MND	MND	MND	MND	MNR	MNR	MNR	MND	MND	MND	MND	MND	MND	MND

RESULTS OF THE LCA / ENVIRONMENTAL IMPACT: 1 tonne, fibreC and Öko Skin

Parameter	Unit	A1-A3
Global warming potential	[kg CO_2-equ.]	723.90
Potential for depletion of stratospheric ozone layer	[kg CFC11 equ.]	1.02E-8
Potential for acidification of soil and water	[kg SO_2 equ.]	1.89E+0
Eutrophication potential	[kg $(PO_4)^{3-}$ equ.]	1.90E-1
Potential for formation of tropospheric ozone	[kg Ethen equ.]	8.69E-2
Potential for abiotic decomposition of non-fossil resources	[kg Sb-equ.]	3.24E-3
Potential for abioitic decomposition of fossil fuels	[MJ]	8,192.00

RESULTS OF THE LCA / DEPLOYMENT OF RESOURCES: 1 tonne, fibreC and Öko Skin

Parameter	Unit	A1-A3
Renewable primary energy as an energy source	[MJ]	1,599.00
Renewable primary energy for use as materials	[MJ]	0,00
Total / renewable primary energy	[MJ]	1,599.00
Non-renewable primary energy as an energy source	[MJ]	8,777.00
Non-renewable primary energy for use as materials	[MJ]	24.00
Total non-renewable primary energy	[MJ]	8,801.00
Use of secondary materials	[kg]	0.00
Renewable secondary fuels	[MJ]	0.00
Non-renewable secondary fuels	[MJ]	0.00
Use of freshwater resources	[m^3]	2.88

RESULTS OF THE LCA / OUTPUT-FLOWS AND WASTE-CATEGORIES: 1 tonne, fibreC and Öko Skin

Parameter	Unit	A1-A3
Hazardous waste for the landfill	[kg]	3.05E-5
Non-hazardous, disposed-of waste	[kg]	180.20
Radioactive, disposed-of waste	[kg]	0.24
Components for re-use	[kg]	0.00
Materials for recycling	[kg]	0.00
Materials for recouping of energy	[kg]	0.00
Exported electrical energy	[MJ]	0..00
Exported thermal energy	[MJ]	0.00

Information on the calorific value of the product, including the packaging:
In accordance with the product formula, the products taken into account in this study contain no flammable resources. Nonetheless the packaging materials used (polypropylene, polyethylene and polystyrene) contain raw materials made from fossil resources (calorific value / PP, PE 44 MJ/kg; calorific value / polystyrene: 40 MJ/kg). The calculation for the PENRM indicator (non-renewable primary energy for use as materials) contains solely the packaging materials named, because the products themselves are non-flammable.
The PERM indicator (renewable primary energy for use as materials) is indicated as being zero, because the wooden pallets used (pallets in circulation) are considered to not constitute a burden (for the environment).

Remark about secondary fuels:
The secondary fuels indicated relate solely to the foreground system. Accordingly, no secondary fuels are deployed in the manufacture of fibreC and Öko Skin. (By contrast, the preliminary activity chains in cement manufacture do indeed use secondary fuels.)

6. LCA: Interpretation

Generally speaking, it is the manufacture of the pre-products that exerts the greatest influence throughout all categories of impact; i.e. the manufacture of the cement, the glass fibres, the concrete-chuting foil, and the other pre-products. The use of electricity, thermal energy, packaging materials and transport are of little

significance.

The **non-renewable primary-energy demand** is influenced, to a value of 72 %, through the provision of the pre-products (cement, glass fibres, concrete-chuting foil for post-treatment, etc.). When considering **renewable primary-energy consumption,** what is evident - apart from the share accounted for by manufacture of the other pre-products (primarily the preliminary activity chains in microsilica manufacture) - is likewise renewable energy's share in the electricity mix, indicated as being almost one-third.

Greenhouse potential
The global-warming potential is influenced, to a value of approx. 66 %, by manufacture of the pre-products. The largest contributor among the pre-products is cement manufacture. Moreover, both the electricity demand and the waste treatment contribute approx. 12 % each respectively. The main reason for this is carbon-dioxide emissions made in providing the energy to produce the raw materials and electricity, in addition to carbon-dioxide emissions in the burning of waste.

Ozone depletion potential (ODP)
To a value of approx. 96 %, the ODP is dominated by manufacture of the pre-products. In this context the largest contribution comes from the manufacture of the glass fibres. Here organic emissions into the air, containing halogen, are responsible for the ozone-depletion potential.

Acidification potential
To a value of 73 %, the AP results from manufacture of the pre-products, primarily from supply of the other pre-products, such as microsilica. The factors responsible for the acidification potential are mainly emissions of sulphur-dioxide and nitrogen-oxide respectively. These come from the preliminary activity chains in the supply of energy.

Eutrophication potential
As regards EP, which is primarily determined by NOx emissions, what is evident is the influence of the transport processes, at 24 %, and the manufacture of the pre-products, at 53%.

Photo-chemical oxidant creation potential
What dominates in the POCP is the provision of pre-products, generated by emissions of NMVOC, nitrogen oxide and sulphur dioxide respectively, from their manufacturing-activity chains. Regarding POCP, a negative value is indicated for the transport activity. This results from the NO emissions of transport activities. NO counteracts the POCP.

Abiotic resource-use on elementary level
The ADPE is almost entirely caused by provision of the pre-products. Here the main contribution made by the fibres (74 %) is primarily attributable to the use of colemanite ore in glass-fibre manufacture.

Abiotic resource-use, fossil-based
The sub-systems' contributions to the ADPF are similar to those made to total non-renewable primary-energy consumption.

7. Proof

Radioactivity

Place of issue: Seibersdorf Laboratories

Test report, date: Test report no. LR-RS127-1/11. Date of test: 9.4.2011. Test according to ÖNORM S 5200:2009 (Test A)

Results:
Radioactivity of construction materials - cement
Nuclide (detection limit)
k-40: 6 Bq/kg
U-238 sec: 2 Bq/kg
Th-232 sec: 2 Bq/kg

Resource exhaustion
Place of issue: Leopold Franzens-Universität Innsbruck, Faculty of Construction Engineering Sciences, 6020 Innsbruck, Austria.

Test report, date: B13/12 Saa. 14.08.2012.
Resource-exhaustion behaviour is determined for the fibreC concrete fibre sheets, taking as its orientation-point the LAGA Directive EW 98 T. The outcome of assessment of the solid-material content, and also of the eluate content, is allocation to quality-class A; this is in accordance with the Federal Waste Management Plan 2011 for residual mass from construction activity, or respectively for construction materials for recycling.

Results:

The values determined in the examination report B13/12 Saa, dated 14.08.2012, are lower than the maximum permissible emission level; as a result, for all components the requirements are more than fulfilled.

VOC emissions

Place of issue:
eco-Institut GmbH Sachsenring 69 50677 Cologne

Test report, date: No. 35964-001. Receipt of samples: 15.05.2012. Date of production of report: 19.6.2012
Analyses of emissions according to the principles applied to assessment of indoor construction products, from the health perspective, published by the *Deutsches Institut für Bautechnik* /DIBt/; status: October 2010

- Volatile organic compounds (VOC) after 3 days and 28 days respectively (according to /DIN ISO 16000-6/)
- Aldehydes and ketones, after 3 days and 28 days (according to /DIN ISO 16000-3/)

Results: (28 days)

a. TVOC (C6-C16) 251 ug/m3
b. ∑SVOC (C16-C22) 0 ug/m3
c. R (dimensionless) 0.904 ug/m3
d. VOC or NIK 0 ug/m3
e. Carcinogens: 0,000 ug/m3

All results comply with /AgBB/ requirements.

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8. Literature

Institut Bauen und Umwelt e.V., Berlin (publishers): Production of Environmental Product Declarations (EPDs);

General guidance on the programme
For production of the EPD, at the *Institut Bauen und Umwelt e.V.* (IBU), 10/2015
www.ibu-epd.com

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

/EN 15804/
/EN 15804:2012-04+A1 2013/, Sustainability of construction works — Environmental product declarations — Core rules for the product category of construction products.

Waste Catalogue Ordinance, dated 10 December 2001 (Federal Law Gazette I, p. 3379), last amended by means of Article 2 of the Ordinance, dated 17 July 2017 (Federal Law Gazette I, p. 2644)

AgBB
Committee on Health Assessment of Construction Products

Landfill Ordinance 1996 – Federal Law Gazette No. 164/1996 in the following version: Federal Law Gazette II, No. 49/2004

/DIN ISO 16000-6:2012-11/
Air impurities in indoor areas – Part 6: Determination of VOC values in indoor air and in test chambers, sampling on Tenax TA®, thermic desorption and gas chromatography using MS or MS-FID

/DIN ISO 16000-3/
Air impurities in in indoor areas – Part 3: Measurement of formaldehyde and other carbonyl compounds in indoor air and in test chambers – sampling by use of a pump

/DIN EN 12467:2016-12/
Fibre-cement flat sheets – Production specification and test methods

/DIN EN 12878:2014-07/
Pigments for the colouring of cement-bonded or lime-bonded building materials. Specifications for the test procedure; German-language version. EN 12878:2005 + AC:2006

/DIN EN 13501-1:2010-01/
Fire Classification of Construction Products and Construction Types
Part 1: Classification using data on reaction to fire tests

/DIN EN 14001:2015/
Environmental management systems – Requirements with guidance for use

/DIN EN ISO 9001:2015/
Quality Management Systems – Requirements (ISO 9001:2015); bilingual version: EN ISO 9001:2015

/OHSAS 18001:2017/
Management Systems on Protection at Workplace – Series of Requirements on Assessment of Protection at the Workplace and Health Protection

/GaBi ts/
GaBi Software System and Database for Life Cycle Engineering Copyright© 1992-2018 thinkstep AG, Version 8.2, SP33. Documentation: www.gabisoftware.com/deutsch/databases/gabi-dabases/

/96/603/EG:2006-06/, Commission Decision dated 06.06.2003 on amendment of Decision 96/603/EC specifying a catalogue of products to be classified in Category A 'No contribution to fire‘, in accordance with Decision 94/611/EC on implementing Article 20 of Council Directive 89/106/EEC on construction products.

PCR – Part A: Rules of calculation for the LCA and requirements for the background report; *Institut Bauen und Umwelt e.V.,* www.bau-umwelt.com, v.1.5, 2016

PCR – Part B: Requirements concerning the EPD for fibre cement / fibre concrete, *Institut Bauen und Umwelt e.V.*, www.bau-umwelt.com, v.1.6., November 2017

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