ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025 und EN 15804

Declaration holder	**Cembrit Holding A/S**
Publisher	Institut Bauen und Umwelt (IBU)
Programme holder	Institut Bauen und Umwelt (IBU)
Declaration number	EPD-CEM-2013411-EN
Issue date	14.01.2013
Validity	13.01.2018 | 13.01.2019 (in renewal process)

Large-format fibre-cement panels
Cembrit True, Cembrit Metro, Cembrit Zenit

Cembrit Holding A/S

www.bau-umwelt.com

Institut Bauen und Umwelt e.V.

1 General information

Cembrit Holding A/S	Cembrit True, Cembrit Metro, Cembrit Zenit
Programme holder IBU - Institut Bauen und Umwelt e.V. Panoramastr. 1 D-10178 Berlin GERMANY	**Holder of the Declaration** Cembrit Holding A/S Sohngaardsholmsvej 2 / P O Box 750 DK-9100 Aalborg DENMARK
Declaration number EPD-FCH-2013311-EN	**Declared product/unit** Large-format fibre-cement panels / tonne t
This Declaration is based on the Product Category Rules: Requirements on the EPD for fibre cement / fibre concrete, 09-2011 (PCR approved by the independent Committee of Experts (SVA))	**Area of applicability:** This EPD refers to three types of large-format fibre-cement panels manufactured on behalf of Cembrit A/S in Vöcklabruck, Austria. The LCA represents an average of the supplier´s average production, weighted by production volumes, in three production plants. Besides the Austrian plant two plants in Switzerland (Niederurnen and Payerne) have been considered.
Issue date 14.01.2013	
Valid until 13.01.2019	
Prof. Dr.-Ing. Horst J. Bossenmayer (President of Institut Bauen und Umwelt e.V.)	**Verification** The CEN EN 15804 standard serves as the core PCR. Verification of the declaration and data by an independent third party in accordance with ISO 14025 ☐ internal ☒ external
Prof. Dr.-Ing. Hans-Wolf Reinhardt (Chairman of the Expert Committee (SVA))	Patricia Wolf (Independent auditor appointed by the SVA)

2 Product

2.1 Product description

Large-format, smooth panels made from naturally-hardened fibre cement based on grey or white cement. The panels are manufactured as

- grey panels with a glazed or opaque coating
- pigmented panels (dyed throughout) with a glazed or opaque coating
- panels made from white cement with a glazed or opaque coating.

2.2 Application

Smooth panels for mounting on façades or roofs on wooden or metal substructures

On facades in accordance with the principle of back-ventilated curtain facades

2.3 Technical data

Thermal conductivity [W/mK]: 0.56 WmK

Bulk density [kg/m³]: 1550 - 1900 kg/m³

Bending tensile strength [N/mm²]: vertically (in direction of fibres) 15.5 to 26 N/mm², horizontally 21.5 to 34.5 N/mm²

Elastic modulus [N/mm²]: 12,000 to 15,000 N/mm²

Linear coefficient of expansion [mm/mK]: 0.01 mm/mK

Ageing resistance: resistant as per EN 12467

2.4 Placing on the market / Application rules

In accordance with EN 12467:2012-12, Fibre-cement flat panels – Product specification and test methods

2.5 Delivery status

The large-format panels made of fibre cement are supplied in various lengths and widths at thicknesses ranging from 6 to 12 mm.

The maximum untrimmed format is 3070 x 1250 mm. The maximum usable format is 3040 x 1220 mm.

The panels are cut to individual dimensions and drilled.

Delivery is on special pallets with a max. weight of 1900 kg.

2.6 Base materials / Auxiliaries

The large-format panels made of fibre cement comprise the following base materials (base materials as mass percentages of the hardened product):

Cement	57 to 78%
Cellulose	1.2 to 5%
Polyethylene fibrides	1.5 to 3.4%
Polyvinyl alcohol fibres	1.5 to 1.7%

Microsilica/ Limestone powder	0 to 18.2%
Pigments	0 to 5.3%
Acrylate for the coating	< 1.1%

and water for processing

Water (chemically-bound and free water)	14.2 to 16.2%

The unbound share of water on delivery is approx. 5-8 %.

2.7 Production

Large-format panels made of fibre cement are manufactured in accordance with an automated winding process:

The raw materials are mixed with water to prepare a homogeneous mixture. The mixture is pumped into material boxes in which screen cylinders rotate and drain internally. The screen surface is covered in a thin film of fibre cement which is transferred onto an infinite conveyor belt (transport felt) 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 (fleece) is separated and rolled off the format roller.

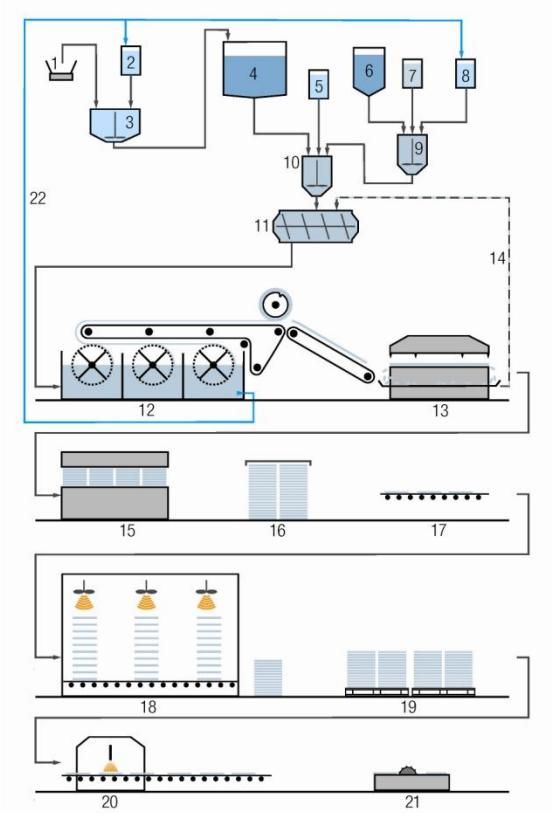
The fibre-cement layer (fleece) is subsequently cut to length and leftovers are returned to the production process preventing any waste from being incurred. The cut and malleable panel which has not yet set is stacked between interim layers and pressed.

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 visible side is usually coated for which the high-quality pure acrylic paint is applied twice in a pouring or spraying process prior to hot filming.

The reverse is attributed a single or double coating which is usually rolled on.

A Quality Management system in accordance with EN ISO 9001:2008 is introduced and certified in the manufacturing plants.



1 Scales for process fibres (cellulose)	12 Board machine
2 Water	13 Punch press
3 Pulper	14 Punched sections
4 Vat of process fibres in water	15 Press
5 Reinforcement fibres (synthetic fibres)	16 Setting
6 Portland cement	17 Cooling line
7 Additives	18 Dryer
8 Water	19 Semi-finished products store
9 Intensive mixer 1	20 Coating
10 Intensive mixer 2	21 Blanks
11 Horizontal mixer	22 Water circuit

2.8 Environment and health during manufacturing

All of the manufacturing plants adhere to the national environmental and health regulations. The requisite processes, monitoring and measurements are in place and implemented. Past measurements indicated that the limit values are significantly fallen short of in each case..

Directive 2003/53/EC of the European Parliament and Council dated 18 June 2003 on the 26th amendment of Council Directive 76/769/EEC governing restrictions on the marketing and use of certain hazardous substances and preparations (nonylphenol, nonylphenol ethoxylate and cement) is taken into consideration and implemented in the manufacturing plants.

The substances are prepared and processes exclusively in closed rooms in order to keep noise emissions as low as possible. Raw materials are largely transported by rail in order to keep emissions as low as possible there, too.

The process water is retained in a closed circuit. Excess volumes are treated and redirected into public waters under the supervision of the regional waste water providers. This minimises environmental pollution by waste water.

2.9 Product processing / Installation

The panels are generally cut and drilled to the customer's requests in the plant or by suppliers availing of the appropriate equipment. Individual cutting to size is possible on the building site. Suitable hand-held circular or circular table saws with blades suitable for fibre cement must be used for processing.

The panels are mounted on the façade in accordance with the principle of back-ventilated curtain façades on wooden or metal substructures using the appropriate anchoring and securing equipment.

Separate systems are available for mounting on roofs where the panels are screwed or suspended.

In the case of mechanical blanks, the cutting dust should be removed using a suitable dust extraction system. Respiratory masks are recommended and must be used in accordance with the specifications outlined in national regulations.

During transport, storage and assembly, all measures must be taken to prevent the risk of injury, material damage and consequential damage.

Slates bundled on pallets may only be moved when secured properly using fastening elements.

The relevant accident prevention measures for avoiding injuries and material damage in accordance with the country-specific regulations must be adhered to.

No other special measures are necessary.

2.10 Packaging

The panels are bound on reusable pallets for regional shipping or shipping within Europe directly to the building site or to the distributor. These pallets are generally used several times.

Composition of packaging per 1000 kg panels:

Wood (reusable pallet)	1.5 kg
Cardboard as edge protection	0.5 kg
PE foil	0.4 kg

Specific pallets are used for overseas transport which are disposed of locally or re-used.

Composition of packaging per 1000 kg:

Wood (Euro pallet)	106 kg
PE foil	0.8 kg

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 RSL, the surface of the cement stone reacts to the effects of CO_2 (carbon dioxide) from the air and moisture to form calcium carbonate (carbonation).

Owing to this material composition, there are no particular characteristics which need to be observed during the use phase.

2.12 Environment and health during use

When the products are used as designated, the current state of knowledge indicates that there are no risks involved for the environment or health.

2.13 Reference Service Life (RSL)

The utilisation phase is not evaluated in this Environmental Product Declaration.

2.14 Extraordinary effects

Fire

The large-format fibre-cement panels display the following fire performance in accordance with DIN EN 13501-1:

A2 – s1, d0

Fire class A2	non-combustible, with shares of combustible building materials
Smoke class s1	no/little smoke development
d0	no dripping/falling

Water

The ingredients are firmly bound in the cement/fibre matrix after setting. Thanks to this form bond, no ingredients which could be hazardous to water are washed out in the event of extraordinary effects by water.

Mechanical destruction

The product displays brittle breakage behaviour under mechanical loads. Splinters and sharp edges can arise.

Resistance to mechanical influences in accordance with EN 12467 complies with classes A3 – A5.

2.15 Re-use phase

The large-format panels can be removed non-destructively by releasing the screws. In undamaged form, the de-constructed products can be used in accordance with their original designated purpose.

2.16 Disposal

When separated by type, the uncoated and coated fibre-cement products referred to are suitable for further use when crushed and as additives in the manufacture of cement (material recycling).

Furthermore, the uncoated and coated fibre-cement products referred to are suitable for further use as filler and bulk material in civil engineering, especially in road construction or for noise barriers (material recycling).

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:

in accordance with the European Waste Catalogue (EWD) and the disposal guide for waste types for VeVA codes in class 17 01 01.

In Austria in accordance with the Austrian Landfill Ordinance 2008 (Federal Law Gazette No. BGBl. II no. 39/2008 Part II) under code number 31409.

2.17 Further information

Further information is available on the following Web sites:

www.cembrit.com

3 LCA: Calculation rules

3.1 Declared unit

The declared unit is 1 tonne (1000 kg).

The declared indicators for the Life Cycle Inventory Analysis and estimated impact were calculated as averages, weighted by production volumes, from the Life Cycle Assessment results of manufacturing in the plants in Switzerland and Austria.

3.2 System boundary

Type of EPD: cradle to plant gate

In accordance with EN 15804, the Life Cycle Assessment refers to the product stage (information modules A1 to A3). Other life cycle phases such as processing, use and disposal were not assessed. Accordingly, it comprises the raw material supply and raw material processing as well as the finishing processes concerning secondary materials serving as input (A1), transport to the manufacturer (A2) and manufacturing (A3). All of the processes supplying material and energy input in Modules A1 to A3 as well as the treatment of all waste and emissions into the air incurred by these processes are part of the system. A large percentage of waste is incurred by cutting the panels to size. Emissions of volatile organic compounds are caused during coating. Waste water is treated by in-company sewage systems.

3.3 Estimates and assumptions

Most of the input and output influences of the Life Cycle Inventory Analysis could be depicted using corresponding data from the "ecoinvent v2.2" data base. There were no data records on "ecoinvent" for certain inputs such as polyethylene fibride, polyvinyl alcohol fibres or polyethylene wax (coating component). In some cases, they were modelled using data which is as similar as possible (proxy data). For PVA, data was used which was drawn up by ESU-services within the framework of a project by the Swiss Federal Office of Energy (BFE, Switzerland)[1]. Where possible, specific regional data was used when selecting background data.

3.4 Cut-off criteria

No data was available on the infrastructure of the manufacturing plants (buildings and machinery) when recording data on fibre-cement production.

The following details can be provided, however:

The production and storage halls as well as the administration buildings are several decades old. Thanks to unchanging production processes, most of the production equipment and machinery have also been in use for several years.

On the basis of an estimate, it can be assumed that the impact by the infrastructure per kilogramme of product as per the Product Category Rules is less than 5% of the total use of primary energy and accounts for less than 5% of the total mass of the product stage.

3.5 Background data

Data from "ecoinvent, version 2.2[2]" was used for drawing up the Life Cycle Assessments.

3.6 Data quality

The data records were comprehensive and carried out directly at the various production locations using a standardised questionnaire. All data was examined for plausibility in collaboration with the manufacturers. Very good data quality can therefore be assumed. The background data used from "ecoinvent" relates to data stocks from 2010.

3.7 Period under review

Data for the entire production in 2010 was recorded at the production facilities.

3.8 Allocation

Within Modules A1, A2 and A3, the inputs and outputs of data records which could not be directly allocated to a product were allocated via the production volume of individual products.

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. The building context or product-specific characteristics also need to be taken into consideration.

4 LCA: Scenarios and other technical information

No further details.

[1] N. Jungbluth et al., Life Cycle Inventories of Photovoltaics, ESU-services, 2012, http://www.esu-services.ch/data/public-lci-reports/

[2] ecoinvent Centre, Swiss Centre for Life Cycle Inventories, ecoinvent v2.2, 2010, www.ecoinvent.org

5 LCA: Results

The following tables depict the results of the indicators for the Life Cycle Assessment, use of resources and waste with reference to one tonne:

- grey panels, coated
- pigmented panels, coated
- white cement panels, coated.

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

Product stage			Construction process stage		Use stage							End-of-life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacture	Transport	Construction-installation process	Use / Application	Maintenance	Repairs	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction	Transport	Waste treatment	Landfilling	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: 1 tonne large-format fibre-cement panels

		Grey panels, coated	Pigmented panels, coated	white cement panels, coated.
Parameter	**Unit**	**A1 - A3**	**A1 - A3**	**A1 – A3**
Global Warming Potential (GWP)	[kg CO_2 equiv.]	1.06E+03	1.15E+03	1.12E+03
Depletion Potential of the Stratospheric Ozone Layer (ODP)	[kg CFC11 equiv.]	6.54E-05	1.31E-04	7.68E-05
Acidification Potential of soil and water (AP)	[kg SO_2 equiv.]	2.23E+00	2.53E+00	2.43E+00
Eutrification Potential (EP)	[kg PO_4^3 equiv.]	7.63E-01	7.95E-01	8.13E-01
Formation Potential of Tropospheric Ozone Photochemical Oxidants (POCP)	[kg ethene equiv.]	1.60E-01	1.70E-01	1.73E-01
Abiotic Depletion Potential non-Fossil Resources (ADPE)	[kg Sb equiv.]	1.19E-03	1.51E-03	1.37E-03
Abiotic Depletion Potential Fossil Resources (ADPF)	[MJ]	9.59E+03	1.36E+04	1.12E+04

LCA RESULTS – USE OF RESOURCES: 1 tonne large-format fibre-cement panels

		Grey panels, coated	Pigmented panels, coated	white cement panels, coated.
Parameter	**Unit**	**A1 – A3**	**A1 – A3**	**A1 – A3**
Renewable primary energy as energy carrier (PERE)[3]	[MJ]	–	–	–
Renewable primary energy as material utilisation (PERM)	[MJ]	–	–	–
Total use of renewable primary energy sources (PERT)	[MJ]	2.16E+03	2.17E+03	1.71E+03
Non-renewable primary energy as energy carrier (PERE)	[MJ]	–	–	–
Non-renewable primary energy as material utilisation (PENRM)	[MJ]	–	–	–
Total use of non-renewable primary energy sources (PENRT)	[MJ]	1.24E+04	1.64E+04	1.42E+04
Use of secondary materials (SM)	[kg]	–	–	–
Renewable secondary fuels (RSF)	[MJ]	–	–	–
Non-renewable secondary fuels (NRSF)	[MJ]	–	–	–
Net use of fresh water (FW)	[m^3]	1.16E+01	1.19E+01	1.11E+01

LCA RESULTS – OUTPUT FLOWS AND WASTE CATEGORIES: 1 tonne large-format fibre-cement panels

		Grey panels, coated	Pigmented panels, coated	White cement panels, coated.
Parameter	**Unit**	**A1 – A3**	**A1 – A3**	**A1 – A3**
Hazardous waste for disposal (HWD)	[kg]	–	–	–
Disposed of, non-hazardous waste (NHWD)	[kg]	8.63E+01	8.63E+01	8.63E+01
Disposed of, radioactive waste (RWD)	[kg]	–	–	–
Components for re-use (CRU)	[kg]	–	–	–
Materials for recycling (MFR)	[kg]	–	–	–
Materials for energy recovery (MER)	[kg]	–	–	–
Exported energy (EE)	[MJ]	–	–	–

[3] The primary energy used as energy carriers and for material utilisation can not be differentiated using ecoinvent.

6 LCA: Interpretation

The following graphics depict a dominance analysis for the most important indicators of the Life Cycle Inventory Analysis or estimated impact.

Independent of the respective indicator, the results for grey coated panels are largely determined by the percentages of cement and synthetic fibres in the basic mixture as well as electricity and natural gas consumption during manufacturing while packaging, water consumption and waste only have a minor influence on the overall results (only a few per cent) (Fig. 1).

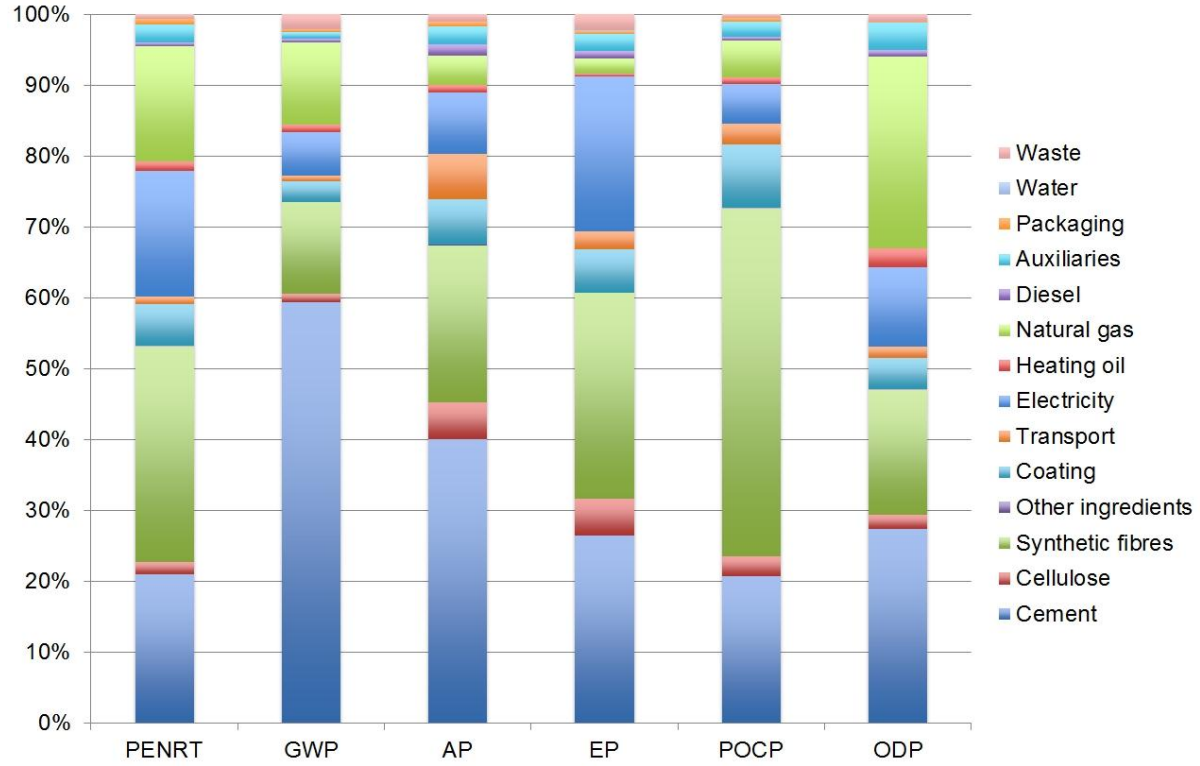


Fig. 1: Dominance analysis of grey panels with coating

The additional pigments (other ingredients) in the basic mixture have a decisive influence on the results in the case of pigmented panels which are dyed throughout. The share of pigments in the overall result is primarily dominant in the total use of non-renewable primary energy sources (PENRT) and the formation potential of tropospheric ozone photochemical oxidants (ODP) dominant (Fig. 2).

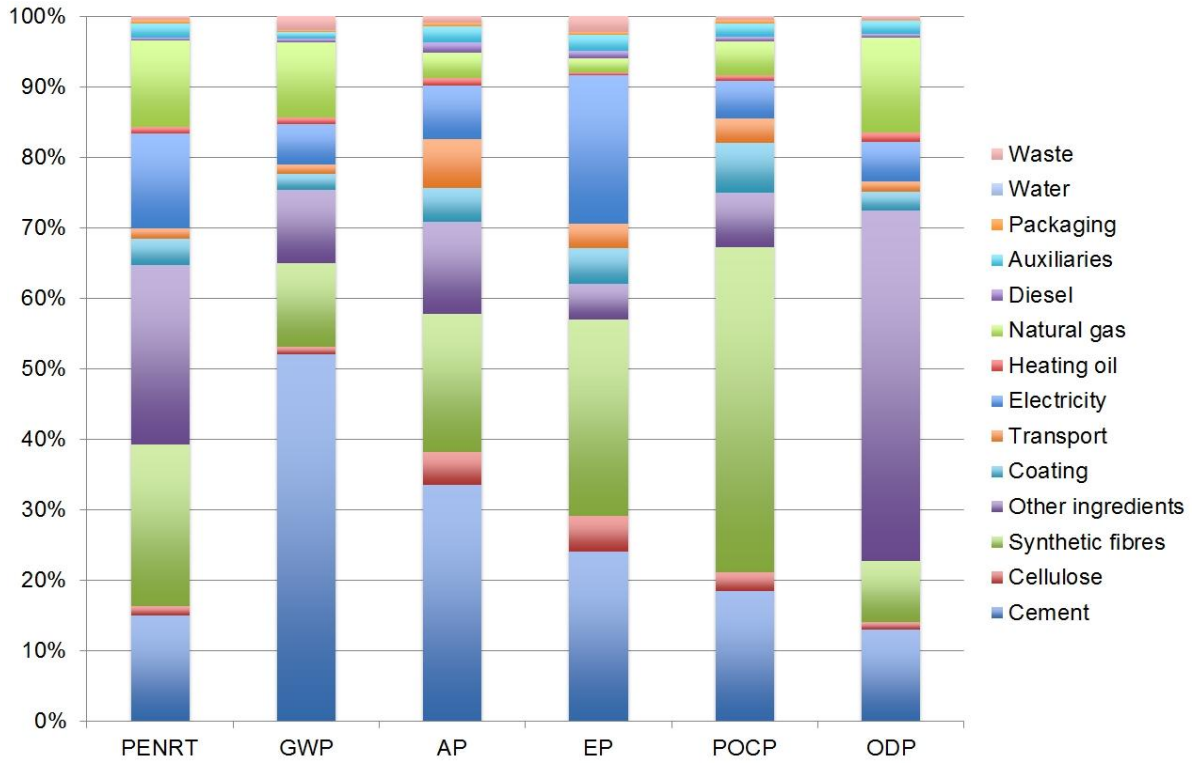


Fig. 2: Dominance analysis of pigmented panels with coating

The dominance analysis panels made from white cement is comparable with that of panels comprising grey basic materials, the difference being that the provision of white cement is associated with longer transport distances (see also Fig. 3, "Transport").

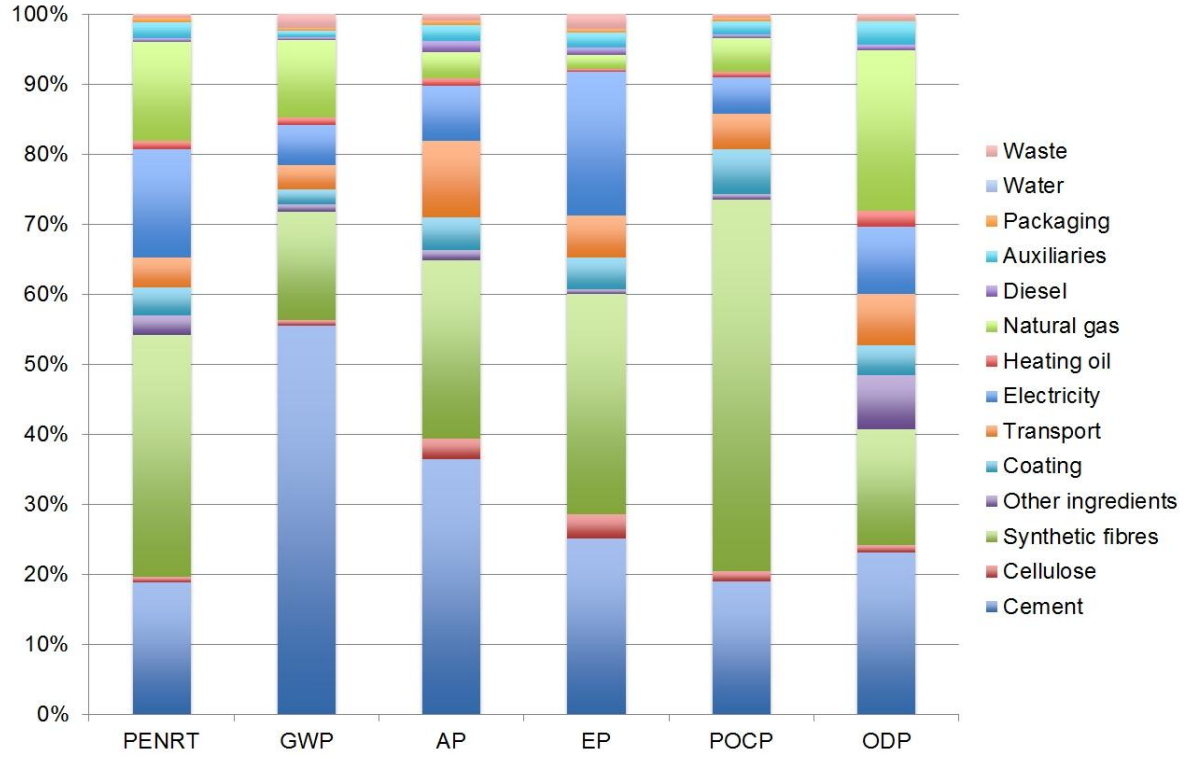


Fig. 3: Dominance analysis of white cement panels with coating

7 Requisite evidence

7.1 Radioactivity

In accordance with ÖNORM S 5200:2009 (test "A"), the material can be classified as harmless as the limit assessment factor (ÖNORM S5200 / level "A") of 1 was significantly fallen short of by the assessment factors 0.09 to 0.016 +/- 0.02.

Measurements were carried out on materials from each of the individual manufacturing plants.

Measuring agency / Report / Date:

Seibersdorf Laboratories, 2444 Seibersdorf, Austria / LA278-1/12, LA278-2/12, LA278-3/12, LA278-4/12 / 18.06.2012

7.2 Leaching

No reservations can be asserted against the structural use of the products referred to from a water-hygiene perspective.

An eluate measurement was carried out to determine the disposal class.
The material falls short of all limit values for Class I landfill sites and complies with disposal code 10 13 11.

Measuring agency / Registration no. / Report / Date:
Pulp and Paper Institut, Bogisiceva ul.8, 1000 Ljubljana, Slovenia / Registration code 1253344 / Report no. 23.650 / 23.01.2012

7.3 VOC emissions

The product is not used in residential applications.

8 References

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

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

Product Category Rules for Building Products, Part A: Calculation rules for the LCA and requirements on the background report 2011-07

Product Category Rules for Building Products, Part B: Requirements on the EPD for fibre cement / fibre concrete

www.bau-umwelt.de

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

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

EN 12467:2012-12 Fibre-cement flat panels – Product specification and test methods

DIN EN ISO 9001:2008-12, Quality management systems – Requirements (ISO 9001:2008)

EN 13501-1:2007+A1:2009, Fire classification of construction products and building elements – Part 1: Classification using data from reaction to fire tests

European Waste Catalogue (EWC)

Regulation dated 22 June 2005 on handling waste (VeVA)

Austrian Landfill Ordinance 2008 (Federal Law Gazette No. BGBl. II No. 39/2008 Part II)

Data:

ecoinvent Centre, Swiss Centre for Life Cycle Inventories, ecoinvent version 2.2, 2010, www.ecoinvent.org

N. Jungbluth et al., Life Cycle Inventories of Photovoltaics, ESU-services, 2012, http://www.esu-services.ch/data/public-lci-reports/

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

Tel. +49 (0) 2223 296679-0
Fax +49 (0) 2223 296679-0
E-mail info@bau-umwelt.com
Web **www.bau-umwelt.com**

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

Tel. +49 (0) 2223 296679-0
Fax +49 (0) 2223 296679-0
E-mail info@bau-umwelt.com
Web **www.bau-umwelt.com**

Holder of the Declaration
Cembrit Holding A/S
Sohngaardsholmsvej 2 / P O Box 750
DK-9100 Aalborg
DENMARK

Tel. +45 (0) 99 37 22 22
Fax +45 (0) 99 37 23 22
E-mail info@cembrit.com
Web **www.cembrit.com**

Author of the Life Cycle Assessment
büro für umweltchemie
Schaffhauserstrasse 21
8006 Zurich
SWITZERLAND

Tel. +41 (0) 43 300 5040
Fax +41 (0) 43 255 1535
E-mail m.klingler@umweltchemie.ch
Web **www.umweltchemie.ch**