ENVIRONMENTAL PRODUCT DECLARATION

as per /ISO 14025/ and /EN 15804/

Owner of the Declaration	**Cembrit Holding A/S**
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-CEM-20180031-IAD1-EN
Issue date	5/3/2018
Valid to	5/2/2023

Large-size fibre cement boards, pigmented, coated Cembrit Transparent

Cembrit Holding A/S

Institut Bauen und Umwelt e.V.

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

1. General Information

Cembrit Holding A/S

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

Declaration number
EPD-CEM-20180031-IAD1-EN

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

Issue date
5/3/2018

Valid to
5/2/2023

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

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

Cembrit Transparent

Owner of the declaration
Cembrit Holding A/S
Sohngaardsholmsvej 2
9100 Aalborg
Denmark

Declared product / declared unit
Large-size fibre cement boards, pigmented, coated / t

Scope:
The EPD refers to large-size, coated grey boards made of fibre cement that are produced on behalf of Cembrit Holding A/S in Vöcklabruck, Austria. The EPD represents an average of the supplier´s average production, weighted by production volumes, in two production plants. Besides the Austrian one, a plant in Switzerland has been considered.

The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

Verification

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

Prof. Dr. Birgit Grahl
(Independent verifier appointed by SVR)

2. Product

2.1 Product description / Product definition

Large-size, even boards made of natural-hardened fibre cement based on grey cement. The boards are made as pigmented boards (dyed) with a translucent or opaque Coating.
The placing on the market of the product in the EU/EFTA (except for Switzerland) is governed by Regulation (EU) No. 305/2011 (/CPR/). The product requires a declaration of performance considering the /EN12467:2012+A1:2016/ and the CE labelling.
For use, the respective national regulations apply.

2.2 Application

Even boards for installation on the facade or on the roof on substructures made of wood or metal. On the façade according to the principle of the curtain, ventilated facade.

2.3 Technical Data

The following technical data are to be mentioned:

Structural data

Name	Value	Unit
Thermal conductivity	0.56	W/(mK)
Calculation value for thermal conductivity	0.56	W/(mK)
Water vapour diffusion resistance factor	0.00328	-
Swelling (air-dry to water-saturated)	0.5	mm/m
Gross density	1750 - 1950	kg/m^3
Compressive strength	40	N/mm^2
Tensile strength transverse/longitudinal Mean	6.0/9.3	N/mm^2
Flexural strength Class 4	21	N/mm^2
Modulus of elasticity	13000 - 15000	N/mm^2
Moisture content at 23 °C, 80% humidity	7	M.-%
Coefficient of thermal expansion	10	$10^{-6}K^{-1}$
Chemical resistance	constant	-
Ageing resistance	according to /EN 12467/	-
Permanent temperature resistance	-40 bis + 80	°C
Frost resistance Category A	fulfilled	
Impermeability to water	fulfilled	

Performance values of the product according to the declaration of performance with regard to its essential characteristics according to /EN12467:2012+A1:2016/.

2.4 Delivery status

The large-size fibre cement boards are delivered in different length/width ratios in thicknesses from 6 to 12 mm. The maximum formats are 3070 x 1250; the max. usable formats are 3040 x 1220.

They are delivered on pallets with a maximum weight of up to 1900 kilograms. For use, the boards can be cut to individual size and drilled.

2.5 Base materials / Ancillary materials

The large-size boards made of fibre cement consist of the following Elements:

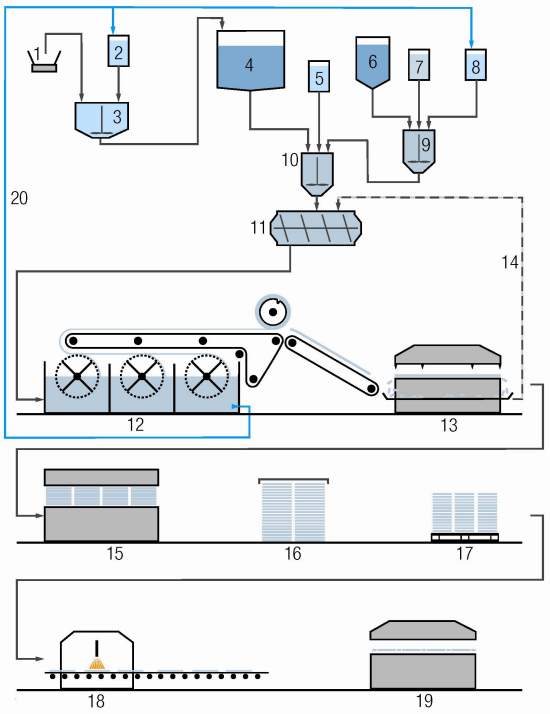
Name	Value	Unit
Cement	57 to 78	%
Pulp	1,2 to 5	%
Polyethylene fibrids	1,5 to 4	%
Polyvinyl alcohol fibres	1,5 to 3	%
Silica fume/Limestone meal	5 to 15	%
Pigments	0,5 to 5	%
Acrylate for the coating	0,5 to 3	%
Water (chemically bound and free water)	11 to 17	%

The unbound water content at delivery is about 5-8%.

The elements are in % by mass in the cured product.

2.6 Manufacture

The production of large-size boards made of fibre cement is carried out by an automated filament winding (see figure):



1 Scales for process fibres (pulp)
2 Water
3 Pulper
4 Vat process fibres in water
5 Reinforcing fibres (synthetic fibres)
6 Portland cement
7 Admixed substances
8 Water
9 Intensive mixer 1
10 Intensive mixer 2
11 Horizontal mixer
12 Platen machine
13 Punching machine
14 Punching sections
15 Press
16 Setting
17 Half-finished products' warehouse
18 Coating
19 Punching
20 Water cycle

The raw materials are treated with water to a homogeneous mixture. The mixture is pumped into head boxes, in which sieve cylinders rotate, that are dewatered inside. Thereby the sieve surface is covered with a thin fleece of fibre cement, which is transferred to the endless circulating conveyor belt (transport felt). From there, the fleece of fibre cement reaches a format roller, which is gradually covered with a thickening layer of fibre cement. Once the desired material thickness is achieved, the still moist and formable layer of fibre cement (fleece) is separated and unrolled from the format roller.

In the next step, the layer of fibre cement (fleece) is punched, residual material is returned to the production process, so that no waste is left. The cut, not yet hardened, mouldable board is stacked with intermediate layers and pressed.
Subsequently, the boards are stored for hardening, later stacked on pallets and stored for further hardening in a maturation store. The setting time is about four weeks.
The visible side is usually coated for which high-grade pure acrylate paint is twice applied and hot-filmed in the casting process and spray treatment.
The back side gets a single or double coating which is usually rolled on.
A quality management system according to the /EN ISO 9001:2015/ has been introduced and certified in the manufacturing plants.

2.7 Environment and health during manufacturing

All manufacturing plants adhere to the national environment and health regulations. The necessary processes, monitoring and measurements are installed and implemented. Measurements in the past have shown that, in any case, the limit values are well below. A safety system according to the /EKAS directive 6508/ has been introduced at the manufacturing plant in Switzerland.

Directive /2003/53/EC/ of the European Parliament and of the Council of 18 June 2003 for the 26th amendment of Directive /76/769 /EEC/ on restrictions regarding the placing on the market and use of certain dangerous substances and preparations (nonylphenol, nonylphenolethoxylat and cement) is considered and implemented in the manufacturing plants.

The preparation and processing of the substances takes place exclusively in closed rooms in order to keep the noise emissions as low as possible. The transport of raw materials is largely done by rail to keep emissions as low as possible there as well.
The process water is kept in a closed circuit. Excess quantities are reprocessed and returned to public waters under the supervision of regional waste-water treatment sites. This minimises the environmental impact of waste-water.

2.8 Product processing/Installation

Usually, the boards are factory-cut or drilled according to customer requirements by appropriately equipped suppliers. On the construction site, single fitting cuts are possible. Suitable portable circular saws or table saws with a saw blade suitable for fibre cement must be used for processing.

The installation on the facade is carried out according to the principle of the curtain, ventilated facade on substructures of wood or metal with the corresponding anchoring and fastening devices.
For mounting on the roof own systems in which the boards are screwed and/or mounted, are available.
In the case of machine cuts, the cutting dust must be removed by a suitable dust suction plant. Respirators are recommended and must be used in accordance with national regulations.
The basis is the technical documentation of the individual companies of Cembrit Holding A/S.
During transport, storage and assembly work, all measures must be taken which can prevent the risk of injury, property damage and consequential damage.
The moving of the pallet-bundled boards is allowed only if the boards are properly secured with security elements.
The relevant accident prevention measures to avoid injuries and material damage in accordance with the country-specific regulations must be followed.
Further extraordinary measures are not to be taken.

2.9 Packaging

For regional or intra-European shipment to dealers or directly to the construction site, the boards are bundled and tied to reusable pallets according to the format. These pallets are usually used multiple times.

Depending on the format, specific container pallets are used for overseas transport, which can be disposed of on site or sent for further use.

In addition, recyclable cardboard is used as edge protection and recyclable polyethylene film for weather protection.

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2.10 Condition of use

The hardening (hydration) of the cement water mixture forms cement paste (calcium silicate hydrates) with embedded fibres and fillers as well as smallest air voids.

During the period of use, the cement paste reacts on the surface under the influence of CO2 (carbon dioxide) from the air and from moisture to calcium carbonate (carbonation).

Due to the material composition, there are no specific features to be considered during the use phase.

2.11 Environment and health during use

According to the current state of knowledge, no risks for the environment or health are given for the intended use of the products.

2.12 Reference service life

The use phase is not evaluated in this environmental product declaration.

Influences on aging when applied according to the rules of technology.

2.13 Extraordinary effects

Fire

The large-size fibre cement boards have the following fire behaviour according to DIN /EN 13501-1/:

Fire protection

Name	Value
Class of inflammability ; non-combustible, with fractions of combustible building materials	A2
Smoke gas development no little/ smoke development	s1
Burning droplets no dripping/falling off	d0

Water

The ingredients are firmly embedded in the cement / fibre matrix after hardening. Due to the firm binding no ingredients that could be water-contaminating are flushed out in the event of extraordinary impacts by water.

Mechanical destruction

The product shows a brittle fracture behaviour under mechanical stress. It can cause chipping and rough edges.

The resistance to mechanical effects, according to /EN 12467/, corresponds to the classe A4.

2.14 Re-use phase

The large-size boards can be removed non-destructively by unscrewing. In undamaged form, the disassembled products can be used according to their original Purpose.

2.15 Disposal

When fully separated, the said uncoated as well as coated fibre cement products can be comminuted and recycled as an additive in the production of cement (material recycling).
Furthermore, the said uncoated as well as coated fibre cement products are suitable for further use as filling and bulk material in civil engineering, in particular in road construction or for noise protection walls (material recycling).

Residues of the fibre cement products mentioned above as well as those from demolition can, if the above-mentioned recycling possibilities are not practicable, be easily deposited on disposal sites of Class Type B due to their predominantly mineral contents without pretreatment:

In the European countries and Switzerland according to the European Waste Catalogue Ordinance (/AVV/) according to waste classification 170107/170101 and the Regulation on Handling Waste (/VeVA/), in Austria according to the Austrian Landfill Ordinance 2008 (Federal Law Gazette No. II No. 39/2008 Part II) under the key number 31409.

2.16 Further information

Further information can be found on the following Websites:
www.cembrit.com

3. LCA: Calculation rules

3.1 Declared Unit

The life-cycle assessment refers to 1 ton of fibre cement boards.
The declared indicators for the inventory and impact assessment indicators were calculated as an average, weighted by the production volumes, from the results of the life-cycle assessments of the production in the plants in Switzerland and Austria.

Declared Unit

Name	Value	Unit
Declared unit	1	t
Gross density	1850	kg/m^3
Conversion factor to 1 kg	0.001	-

3.2 System boundary

Type of the EPD: Cradle to factory gate
The LCA refers to the stage of product development in accordance with /EN 15804/ (information modules A1 to A3). Other life-cycle phases such as processing, use and disposal have not been accounted for. The system boundary includes the provision and processing of raw materials. These include in particular cement, plastic fibres, pulp and packaging materials (A1). The transports to the manufacturer (A2) were specifically collected for all starting materials. The production (A3) includes also all in-plant energy consumption, the consumption of auxiliary materials, VOC emissions of the coating process as well as the treatment of the quantities of waste and waste-water. All material and energy input processes of modules A1 to A3 and the treatment of all waste are part of the system. A large part of the waste arises when cutting the boards. Some of the waste-water is treated in in-plant sewage treatment plants.

3.3 Estimates and assumptions

The VOC emissions of the coating process were estimated on the basis of formulations of the coatings. It was assumed that all organic solvents in the coating products are emitted into the environment.

3.4 Cut-off criteria

All collected data were taken into account in the LCA. No data was collected on the infrastructure. The production halls and warehouses as well as the administration buildings are already several decades old. Similarly, little has changed in the production process over the years, so that the machines are often older and are only partially replaced. According to the product category rules, the impact of the infrastructure per tonne of the product is expected to be less than 1% of the total use of primary energy (renewable and non-renewable) and less than 1% of the total mass of the stage of product development.

3.5 Background data

Data from /ecoinvent v3.1/ (data status 2014) was used to compile the LCA.

3.6 Data quality

The data collection was extensive and was carried out on the basis of a standardised questionnaire for 2016 directly at the various production sites. All data was checked for plausibility together with the manufacturers. Therefore, with regard to the foreground data, a very good data quality can be assumed.
Most input and output flows of the inventory could be displayed with corresponding data from the ecoinvent v3.1 database. Data developed by ESU-services as part of a project of the Swiss Federal Office of Energy (SFOE, Switzerland), was used for polyvinyl alcohol (PVA). The data was collected according to ecoinvent guidelines and recalculated with ecoinvent v3.1. Where possible, regionally specific data was used in the selection of background data.

3.7 Period under review

Data on total production for 2016 was collected at the production sites. In addition to large-size boards, the various plants of the Swisspearl Group also produce medium- and small-size boards, corrugated sheets and roof boards.

3.8 Allocation

Within the modules A1, A2 and A3, those inputs and outputs of the data collection that could not be directly assigned to a product were assigned via the production quantity to the individual products. For the production of fibre cement products, silica fume is used. 3.5 – 7% by mass. Silica fume is a by-product of the production of silicon and ferrosilicon alloys. All environmental impacts have been assigned to the production of the alloys.
As a result, no environmental burdens have been recorded for the production of silica fume.

3.9 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to /EN 15804/ and the building context, respectively the product-specific characteristics of performance, are taken into account.

. Background data from ecoinvent v3.1 (data status 2014) was used.

4. LCA: Scenarios and additional technical information

No further information.

5. LCA: Results

The following tables show the results of life-cycle assessment indicators, resource use and waste related to 1 ton large-size fibre cement boards, pigmented, coated.

The data is representative of the products of Cembrit Holding A/S.

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

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MNR	MNR	MNR	MND	MND	MND	MND	MND	MND	MND

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 ton large-size fibre cement boards, pigmented, coated

Parameter	Unit	A1-A3
Global warming potential	[kg CO_2-Eq.]	1.28E+3
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	1.56E-4
Acidification potential of land and water	[kg SO_2-Eq.]	3.60E+0
Eutrophication potential	[kg $(PO_4)^{3-}$-Eq.]	4.90E-1
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	2.45E-1
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	1.83E-2
Abiotic depletion potential for fossil resources	[MJ]	1.57E+4

RESULTS OF THE LCA - RESOURCE USE: 1 ton large-size fibre cement boards, pigmented, coated

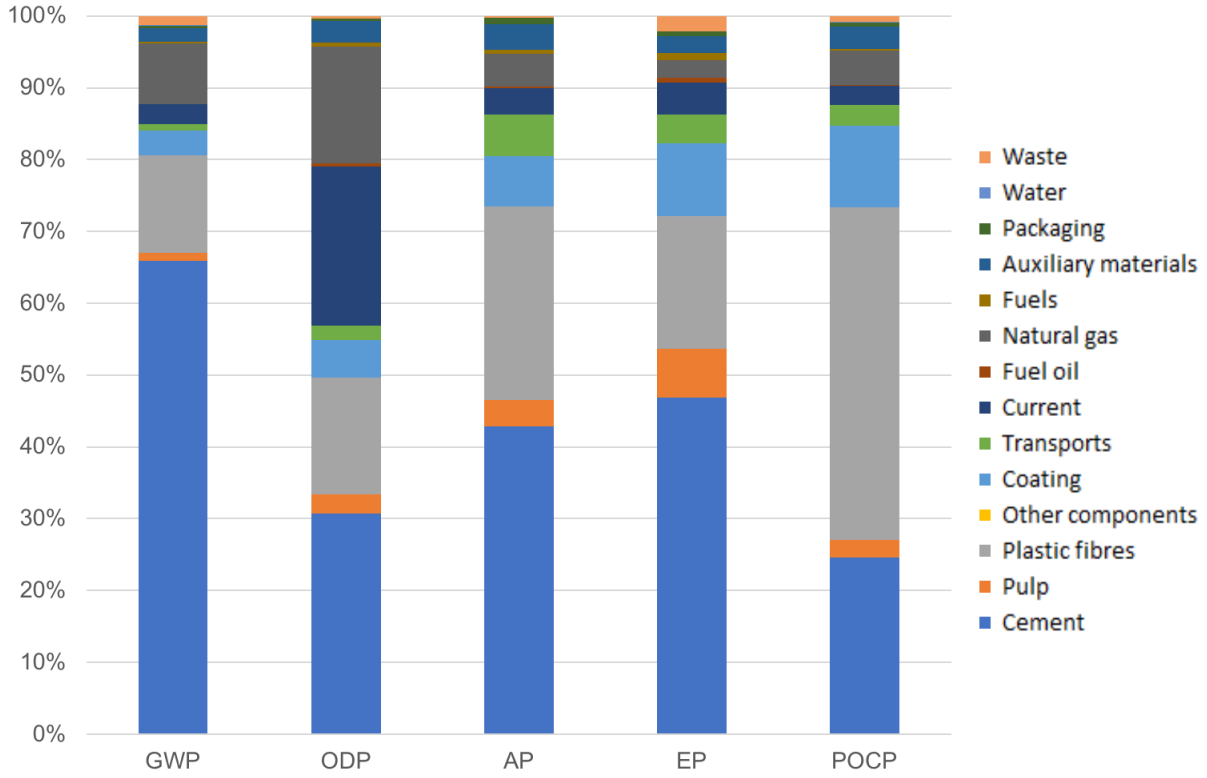
Parameter	Unit	A1-A3
Renewable primary energy as energy carrier	[MJ]	2.74E+3
Renewable primary energy resources as material utilization	[MJ]	8.31E+2
Total use of renewable primary energy resources	[MJ]	3.57E+3
Non-renewable primary energy as energy carrier	[MJ]	1.61E+4
Non-renewable primary energy as material utilization	[MJ]	9.79E+2
Total use of non-renewable primary energy resources	[MJ]	1.71E+4
Use of secondary material	[kg]	0.00E+0
Use of renewable secondary fuels	[MJ]	0.00E+0
Use of non-renewable secondary fuels	[MJ]	0.00E+0
Use of net fresh water	[m^3]	1.10E+1

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 ton large-size fibre cement boards, pigmented, coated

Parameter	Unit	A1-A3
Hazardous waste disposed	[kg]	3.03E-2
Non-hazardous waste disposed	[kg]	2.01E+2
Radioactive waste disposed	[kg]	7.85E-2
Components for re-use	[kg]	0.00E+0
Materials for recycling	[kg]	0.00E+0
Materials for energy recovery	[kg]	0.00E+0
Exported electrical energy	[MJ]	0.00E+0
Exported thermal energy	[MJ]	0.00E+0

6. LCA: Interpretation

The following figure shows a dominance analysis for the most important impact assessment indicators. Regardless of the indicator, the results of small and medium-size boards are largely determined by the proportions of cement and plastic fibres in the base mix, as well as electricity and natural gas consumption during manufacture. On the other hand, packaging, water consumption and waste only affect the overall results in the range of a few percent.



The proportion of pigments in the overall result is mainly dominant at the degradation potential of the stratospheric ozone layer (**ODP**). The environmental impact of the pulp in the base mix is relevant only in the eutrophication potential (**EP**). The share of the total load for this indicator is 12%. The influence of the coating is greatest at the formation potential for tropospheric ozone (**POCP**) and amounts to 10%. The share of transport in the environmental impact is less than 5% for all indicators. Depending on the indicator, the auxiliary materials contribute 1 to 2% to the environmental impact.

The declared average product differs from specific products in terms of pigmentation and colour scheme of the coating. As a result, LCA results for specific products should differ by a few percent from the values declared here.
With regard to the production site, regarding the large-size, pigmented boards, the deviation of the plant-specific result for **PENRT** (totally non-renewable primary energy) compared to the average value of the EPD is in the range of -6% to +0%, thus, the declared value corresponds to the maximum.

7. Requisite evidence

7.1 Radioactivity

According to /ÖNORM S 5200:2009/ (test 'A'), the material is to be classified as non-hazardous since the limit assessment factor (ÖNORM S5200 / level 'A') of 1 was clearly undercut with the evaluation factors of 0.09 to 0.016 +l- 0.02.

The measurements were carried out on material of each single manufacturing plant.
Measurement Institute/Report/Date:
Seibersdorf Laboratories, Austria - 2444 Seibersdorf / LA278-1/12, LA278-2/12, LA278-3/12, LA278-4/12/18.06.2012

7.2 Leaching

The examinations are within the scope of the accreditation according to ISO /IEC 17025 conforms to DIN 12457-4.
Analysis report 09.02.2018 (A18-00230) of the Arcadis (Schweiz) AG
Eluate solid matter M1802-00721 according to VVEA 'no limit exceeded'

7.3 VOC-emissions

The product is not used in indoor spaces.

8. References

Creation of environmental product declarations (EPDs);
General principles for the EPD program of the Institut Bauen und Umwelt e.V. (IBU),2016-03.

Product Category Rules for Construction Products Part A: Calculation rules for the LCA and requirements for the background report. Version 1.5, 11.08.2016

Product Category Rules for Construction Products Part B: Requirements for the EPD for fibre cement/fibre concrete. Version 1.3, O4.O7.2014
Gonstruction Products Regulation CPR EU 305/2011

EN ISO 9001:2015 Quality management system

EN 12467: 2012+A1;2016 Fibre-cement panels - product specification and test methods
EN 13501-1:2007+A1/2009, Classification of construction products and types of fire behaviour - Part 1: Classification with the results of the fire behaviour tests of construction products

ÖNORM S 5200:2009 / Level A /

European Waste Catalogue (EWC)
(Swiss) Ordinance of 22 June 2005 for handling waste (VeVA)
Austrian Landfill Ordinance 2008 (Federal Law Gazette No. BGBI. II No. 39/2008 Part II)
Data:
ecoinvent Centre, Swiss Centre for Life Cycle Inventories, ecoinvent v3.1, vnitru. ecoinvent.orq

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

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/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

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