ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804

Owner of the Declaration	**Pavatex SA**
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-PAV-20150043-IBA2-EN
Issue date	26.03.2014
Valid to	25.03.2019

PAVAFLEX flexible woodfibre insulation material

Pavatex SA

Institut Bauen und Umwelt e.V.

www.bau-umwelt.com / https://epd-online.com

1. General Information

Pavatex SA

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

Declaration number
EPD-PAV-20150043-IBA2-EN

This Declaration is based on the Product Category Rules:
Wood based panels, 07.2014
(PCR tested and approved by the independent expert committee)

Issue date
26.03.2014

Valid to
25.03.2019

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

Dr. Burkhart Lehmann
(Managing Director IBU)

PAVAFLEX flexible woodfibre insulation material

Owner of the Declaration
Pavatex SA
Rte de la Pisciculture 37
CH-1701 Fribourg
Switzerland

Declared product / Declared unit
1 cubic metre of PAVAFLEX wood fibre insulation material

Scope:
This document refers to Pavatex Pavaflex flexible woodfibre insulation material, which is manufactured in the Kronoply GmbH plant in Heiligengrabe, Germany.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 CEN Norm /EN 15804/ serves as the core PCR
Independent verification of the declaration according to /ISO 14025/
☐ internally ☒ externally

Matthias Klingler
(Independent verifier appointed by SVR)

2. Product

2.1 Product description
PAVAFLEX is a wood fibre insulation material in accordance with EN 13171 and is manufactured in a dry process. This insulating material is manufactured as boards in thicknesses of 40 – 240 mm. The gross density of the boards is 55 kg/m³.

2.2 Application
PAVAFLEX has construction inspection approval to Z-23.15-1429. The areas of application are regulated in accordance with DIN 4108-10 and largely as flexible compartment filling in ceilings, walls and roofs.

2.3 Technical Data

Construction data

Name	Value	Unit
Gross density acc. to /EN 1602/	55	kg/m³
Thermal conductivity acc. to /EN13171/	0.038	W/(mK)
Water vapour diffusion resistance factor acc. to /EN12667/	5	-

2.4 Placing on the market / Application rules
Placing on the market in the EU/EFTA is governed by Directive (EU) No. 305/2011 dated 9 March 2011. The products require a Declaration of Performance taking consideration of the harmonised European standard

EN 13171 Thermal insulation products for buildings – Factory-made wood fibre (WF) products – Specification; German version EN 13171:2012

and CE marking.

The respective national guidelines apply for use; in Germany: the general construction inspection approval no. Z-23.15-1429 issued by the Deutsches Institut für Bautechnik (DIBt, Berlin).

The areas of application are regulated in accordance with DIN 4108-10 Thermal insulation and energy economy in buildings.

2.5 Delivery status
Format 1350 x 575 mm
Thicknesses: 40 to 240 mm
Special formats available on request

2.6 Base materials / Ancillary materials

• Wood content, of which min. 80 % pine, some hardwood, of which min. 70 % with PEFC certificate (*Programme for the Endorsement of Forest Certification Schemes)*
• Binding fibres (BiKo) 3 - 8 %
• Water in the form of wood moisture 4 - 8 %
• Ammonia phosphate 6 - 8 %

2.7 Manufacture

1) Wood is available in the form of wood chips, processed internally from raw wood
2) Pulping the wood chips
3) Addition of ammonia phosphate as a flame retardant
4) Drying the fibres
5) Adding the binding fibres
6) Application of a preliminary fleece (regardless of thickness)
7) Application of the main fleece
8) Melting the binding fibres in hot air in the through-air drying furnace
9) Cooling the binding fibres in cold air in the through-air drying furnace
10) Trimming the boards
11) Formatting
12) Stacking and packing

Production avails of a Quality Management system to ISO 9001.

2.8 Environment and health during manufacturing

Owing to the manufacturing conditions, no particular statutory or regulatory health protection measures are required.

2.9 Product processing/Installation

PAVAFLEX can be processed using the PAVATEX knife for insulating material, electric jack saw or band saws. Detailed processing information is available directly from PAVATEX SA or at www.pavatex.com.

2.10 Packaging

OSB (oriented strand board), polyethylene (PE) foils and wood are used for packing PAVAFLEX.

2.11 Condition of use

The material composition for the period of use complies with the base material composition in accordance with section 2.6.

2.12 Environment and health during use

No damage to health can be anticipated if PAVAFLEX is used as designated. There are no risks for water, air and soil if the products are used as designated.

2.13 Reference service life

Due to the many different usage possibilities of PAVAFLEX, a reference service life is not declared. Durability in the usage condition for PAVAFLEX is definied via the application classes pursuant to EN 13171. The average service life lies in the order of magnitude of the building.

2.14 Extraordinary effects

Fire

Fire protection

Name	Value
Building material class according to EN 13501-1	E

Water

No heavy metals could be established in the quantitative analysis of inorganic trace substances in the material. No environmental consequences are to be anticipated.

Mechanical destruction

No environmental consequences are to be anticipated in the event of mechanical destruction.

2.15 Re-use phase

Provided they are untreated and undamaged, PAVAFLEX can be easily segregated and re-used for the same application when converting or completing the usage phase of a building. *Energetic utilisation* (in approved systems): Owing to the high heat value, energetic utilisation for generating process energy and electricity (CHP plants) from PAVAFLEX leftovers and PAVAFLEX arising from breakage measures on the building site is recommendable.

2.16 Disposal

PAVAFLEX leftovers on the building site as well as those incurred by breakage measures may not be landfilled where material recycling is not possible but rather require energy recovery (see above) or combustion in a waste incineration plant owing to their purely organic components (wood, BiKo) and their high heat values. Waste key: EWC code 03 01 05 in accordance with the European Waste Catalogue. *Packaging:* Following segregated collection, transport packaging (OSB, wood, PE foil) can be directed to the recycling process or also utilised energetically. In individual cases, external disposal can be arranged with the manufacturer.

2.17 Further information

Further information is available at www.pavatex.com.

3. LCA: Calculation rules

3.1 Declared Unit

The declared unit is one cubic metre of PAVAFLEX with a density of 55 kg/m³. The analysis is based on data supplied by the Kronoply production facility in Heiligengrabe.

Declared Unit

Name	Value	Unit
Declared unit	1	m^3
Mass reference	-	kg/m^3
Density	55	kg/m^3

3.2 System boundary

Type of EPD: cradle to plant gate – with options
The systems comprise the following stages in accordance with EN 15804:
Product stage (Modules A1-A3):

A1 Provision of raw materials and processing of secondary materials serving as input
A2 Transport to manufacturer

A3 Production

The product stages A4-A5, B1-B7, C1, C2 and C4 were not considered in this study.
Once the product has reached *End-of-Waste* status, it is assumed that the product is directed to bio-mass incineration which produces thermal energy and electricity. Any ensuing impacts and credits are declared in Module D. The substances for energy recovery are declared in Module C3.

3.3 Estimates and assumptions

The End-of-Life (EOL) system limit between waste disposal and Module D is applied where outputs such as secondary materials or fuels reach their *End-of-Waste* status (EN 15804, section 6.4.3). It is assumed that the wood fibre insulation boards reach *End-of-Waste* status after sorting and processing.

3.4 Cut-off criteria

All operating data was taken into consideration in the analysis. Accordingly, material flows with a share of less than 1% were also balanced. It can be assumed that the total of all neglected processes does not therefore exceed 5% in the impact categories. Accordingly, the cut-off criteria in line with EN 15804 are complied with.

3.5 Background data

All of the relevant background data sets were taken from the GaBi 6 software data base (GABI 6 2013a). The data used was recorded under consistent conditions in terms of time and methods.

3.6 Data quality

Data on the products under review was recorded directly at the production facility for fiscal 2012 on the basis of a questionnaire drawn up by the consulting agency PE INTERNATIONAL. The input and output data was supplied by Kronoply and has been examined for plausibility with the result that good data representativity can be assumed.
The transport distances applied in the model are based on records maintained by Kronoply.

3.7 Period under review

The data refers to the manufacturing processes between 01.01.2012 and 31.12.2012.

3.8 Allocation

The data used was collated in the Heiligengrabe production facility. Energy consumption was calculated on the basis of volumes used per cubic metre of product and extrapolated for the production year. Residual materials incurred during production (trimmings, wood leftovers etc.) are recycled energetically. Incineration of these residual materials is balanced using the corresponding GaBi 6 data sets and taking consideration of the credits in the German energy mix. Energy credits for electricity produced in the bio-mass power plant and thermal energy produced at the End-of-Life are allocated according to the calorific value of the inputs, whereby plant efficiency is also considered. The credit for thermal energy is calculated on the basis of the “EU-27: Thermal energy from natural gas PE" data set; the credit for electricity is calculated from the "EU-27: Power mix PE" data set. The emissions dependent on input (e.g. CO_2, HCl, SO_2 or heavy metals) at the End-of-Life were calculated in line with the content composition of the ranges used. Emissions dependent on technology (e.g. CO) are added in terms of waste gas volume.

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.

4. LCA: Scenarios and additional technical information

A product re-use rate of 100% is assumed for the *End-of-Life* (EoL) (optional scenario for EoL), whereas 261.3 kg CO2 eq stored in the wood fiberboard are leaving the product system in module C3 (according to EN 16485). Once the product has reached End-of-Waste status, it is assumed that the product is directed to bio-mass incineration which produces thermal energy and electricity. Any ensuing impacts and credits are declared in Module D. The analysis assumes that the product displays 4.5% moisture when incinerated. With the result that the overall volume of product generated is directed to bio-mass incineration where electricity credits incurred are modelled as the EU-27 power mix as there is no specification as to the country in which the product is incinerated at the EoL. It is assumed that the product has not been treated or serviced with chemicals during use; for this reason, bio-mass incineration is assumed suitable. It is assumed that the product can be recycled energetically after use with a calorific value of 17.8 MJ/kg.

5. LCA: Results

The following tables depict the results of the environmental impact analysis differentiated by the CML environmental categories, use of resources, output flows and waste categories scaled to the functional unit of 1 m³ PAVAFLEX.

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[1)]	Refurbishment[1)]	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	MND	MND	MND	MND	MND	MND	MND	X	MND	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 m³ PAVAFLEX

Parameter	Unit	A1-A3	C3	D
Global warming potential	[kg CO_2-Eq.]	1.63E+0	2.61E+2	-2.08E+2
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	3.73E-9	-	-1.11E-8
Acidification potential of land and water	[kg SO_2-Eq.]	2.60E-1	-	-4.11E-2
Eutrophication potential	[kg $(PO_4)^{3-}$- Eq.]	2.36E-2	-	6.38E-3
Formation potential of tropospheric ozone photochemical oxidants	[kg Ethen Eq.]	2.20E-2	-	-4.50E-3
Abiotic depletion potential for non fossil resources	[kg Sb Eq.]	2.80E-5	-	-1.67E-6
Abiotic depletion potential for fossil resources	[MJ]	1.53E+3	-	-5.13E+2

RESULTS OF THE LCA - RESOURCE USE: 1 m³ PAVAFLEX

Parameter	Unit	A1-A3	C3	D
Renewable primary energy as energy carrier	[MJ]	1.78E+2	-	-5.07E+1
Renewable primary energy resources as material utilization	[MJ]	7.59E+2	-	0.00E+0
Total use of renewable primary energy resources	[MJ]	9.37E+2	-	-5.07E+1
Non renewable primary energy as energy carrier	[MJ]	1.43E+3	-	-6.14E+2
Non renewable primary energy as material utilization	[MJ]	2.20E+2	-	0.00E+0
Total use of non renewable primary energy resources	[MJ]	1.65E+3	-	-6.14E+2
Use of secondary material	[kg]	0.00E+0	-	0.00E+0
Use of renewable secondary fuels	[MJ]	3.12E-2	-	-8.18E-3
Use of non renewable secondary fuels	[MJ]	2.47E-1	-	-9.03E-2
Use of net fresh water	[m³]	1.61E-1	-	1.08E-1

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 m³ PAVAFLEX

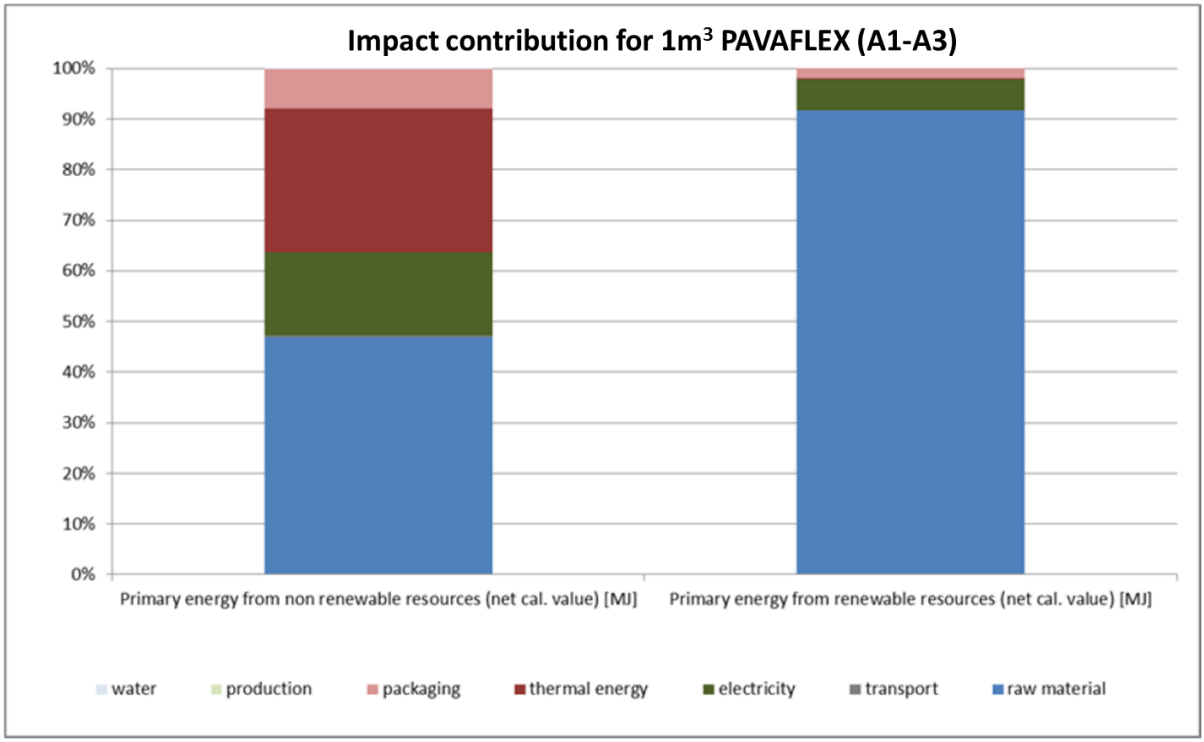
Parameter	Unit	A1-A3	C3	D
Hazardous waste disposed	[kg]	1.49E-1	-	-3.67E-2
Non hazardous waste disposed	[kg]	2.93E+1	-	1.55E+0
Radioactive waste disposed	[kg]	4.77E-2	-	-4.05E-2
Components for re-use	[kg]	0.00E+0	-	0.00E+0
Materials for recycling	[kg]	0.00E+0	-	0.00E+0
Materials for energy recovery	[kg]	1.07E+0	5.50E+1	0.00E+0
Exported electrical energy	[MJ]	0.00E+0	-	0.00E+0
Exported thermal energy	[MJ]	0.00E+0	-	0.00E+0

6. LCA: Interpretation

Within the framework of a dominance analysis of the LCA results pertaining to PAVAFLEX and in terms of the declared unit of 1 m³, the relevant influences on the individual impact categories are calculated as well as on the use of primary energy.
The interpretation was carried out taking consideration of the assumptions and restrictions of the EPD as well as in relation to methods and data.

Water consumption
Consumption of net fresh water resources ("*Blue Water Consumption*") for 1 m³ PAVAFLEX amounts to 1.61E-01 m³ water during the product stage (A1-A3). More than 1.08E-01 m³ is required during stage D. The main share of water consumption results from the use of net fresh water during electricity production (more than 48% and 56% of entire consumption during production).

Renewable and non-renewable primary energy
Non-renewable primary energy requirements are almost exclusively influenced by the provision of raw materials and consumption of thermal energy, whereby the provision of raw materials accounts for approx. 47% and thermal energy is responsible for approx. 29% of energy requirements (see graphic below). The largest share of non-renewable energy requirements is displayed by BiKo fibres and ammonia phosphate, for example.



Waste
The highest percentage of waste produced is represented by disposed of, non-hazardous waste. Disposed of, radioactive waste is primarily incurred by energy utilised in the upstream stages of preliminary products (generation of electricity).

Global Warming Potential
The Global Warming Potential is dominated by carbon dioxide in manufacturing. By using wood, CO_2 is bound in the sustainable raw materials required for production.
Outside the system under review, the emissions of GWP relevance are incurred by incineration. Credits attributable to the bound carbon dioxide (wood chips) enable substitution of a percentage of the global warming emissions incurred.

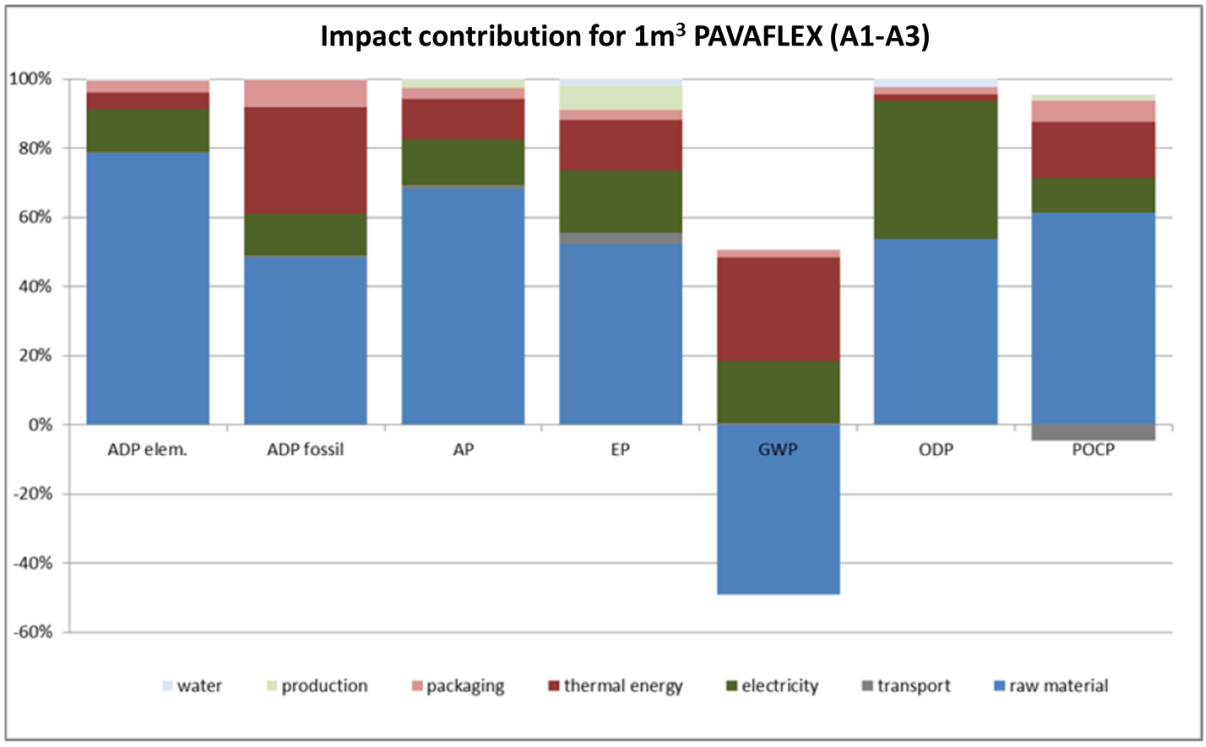
Ozone Depletion Potential
The Ozone Depletion Potential is primarily dominated by the provision of raw materials as well as the use of electricity. Substituting energy utilisation with PAVAFLEX at the *End-of-Life* reduces the overall Ozone Depletion Potential as organic emissions containing halogens are responsible for the Ozone Depletion Potential. The Ozone Depletion Potential is primarily attributable to the provision of raw materials accounting for 54% in PAVAFLEX.

Acidification Potential
The Acidification Potential is primarily attributable to emissions during the provision of raw materials and within the system under review, accounting for approx. 68% of the overall impact in A1-A3. Ammonia phosphate processing generates a large share accounting for 52% of the overall impact in A1-A3 where sulphur dioxide, ammonia and nitrogen oxides are the main contributors to the Acidification Potential.

Eutrification Potential
During production, the provision of raw materials accounts for 52%, electricity consumption accounts for 18%, thermal energy accounts for15% and emissions (NOx) contribute 7% to the Eutrification Potential.

Photochemical Ozone Creation Potential
The Photochemical Ozone Creation Potential is largely incurred by the provision of raw materials, whereby 61% of the overall impact arises during the production phase (A1-A3) where non-methane volatile organic compounds (NMVOCs) and carbon monoxide emissions represent the greatest share of the Photochemical Ozone Creation Potential.

The POCP records a negative value for transport. This is the result of NO emissions during transport. NO is offset against the POCP (see graphic below).



Abiotic Depletion of Resources (fossil)
The abiotic depletion of fossil resources is primarily caused by utilisation of raw materials (58%) and thermal energy (31%).

Abiotic Depletion of Resources (elementary)
The abiotic depletion of elementary resources is primarily caused by non-renewable material elements such as phosphorus.

These consumption values are primarily incurred by the production of ammonia phosphate (69%) (of the entire impact in A1-A3).

7. Requisite evidence

7.1 Formaldehyde
The adhesive system for PAVAFLEX does not contain any formaldehyde. It is therefore not of relevance.

7.2 MDI
The adhesive system for PAVAFLEX does not contain any MDI. It is therefore not of relevance.

7.3 Testing for preliminary treatment of materials used
No waste wood is used for manufacturing PAVAFLEX. It is therefore not of relevance.

7.4 Toxicity of fire gases
Measuring agency: Elektro-Physik Aachen GmbH
Test report: 12/2009 dated 14.5.2009

Result: "KRONOPLY flex" was tested. The results in accordance with EN 53 436 indicate that no chlorine or sulphur compounds could be verified unlike CO, CO_2, hydrogen cyanide and COHb. The gaseous emissions released under the selected test conditions do not comply with the emissions released by wood under the same conditions.

7.5 VOC emissions
Measuring agency: Bremer Umweltinstitut GmbH, Bremen
Test report: H 7147 FG dated 29.01.2013

AgBB overview of results (28 days)

Name	Value	Unit
TVOC (C6 - C16)	77	µg/m³
Sum SVOC (C16 - C22)	0	µg/m³
R (dimensionless)	0.06	-
VOC without NIK	24	µg/m³
Carcinogenic Substances	0	µg/m³

7.6 Lindane/PCP
Measuring agency: WKI Fraunhofer Wilhelm-Klauditz-Institut, Prüf-, Überwachungs- und Zertifizierungsstelle, Braunschweig, Germany

Test report: B 3196 / 2008, 25.8. – 28.8.2008 [as per PA-C-12:2006-02 "Determining penta-chlorphenol (PCP) and γ-hexachlorocyclohexane (lindane) in wood and wood materials"]

Result: After extraction of the substances contained, the solutions were derivatised, reprocessed and subjected to a gas chromatography analysis. The PCP and lindane values are below the limit of detection of 0.1 mg/kg.

8. References

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Institute of Environmental Sciences, Leiden University, The Netherlands: Handbook on impact categories "CML 2001", http://www.leidenuniv.nl/cml/ssp/projects/lca2/index.html

CEN/TR 15941
CEN/TR 15941:2010-03: Sustainability of construction works – Environmental Product Declarations – Methods for selecting and using generic data; German version (CEN/TR 15941:2010)

DIN EN 13171 Thermal insulation products for buildings – Factory-made wood fibre (WF) products – Specification; German version EN 13171:2012

DIN EN 12667 Thermal performance of building materials and products – Determination of thermal resistance by means of guarded hot plate and heat flow meter methods – Products of high and medium thermal resistance; German version EN 12667:2001

DIN 4108-10 Thermal insulation and energy economy in buildings – Part 10: Application-related requirements for thermal insulation materials – Factory-made products

DIN EN 53 436-1 Producing thermal decomposition products from materials in an air stream and their toxicological testing; decomposition apparatus and determination of test temperature

DIN EN 1602 Thermal insulating products for building applications – Determination of the apparent density; German version EN 1602:2013

EN 16485
DIN EN 16485:2014-07, Round and sawn timber - Environmental Product Declarations - Product category rules for wood and wood-based products for use in construction; German version EN 16485:2014

ISO 9001
Quality management systems – Requirements (ISO 9001:2008); trilingual version EN ISO 9001:2008, Corrigenda to DIN EN ISO 9001:2008-12; trilingual version EN ISO 9001:2008/AC:2009

GaBi 6 2013a
Software system and data bases for life cycle engineering; Copyright, TM Stuttgart, Echterdingen 1992-2013

GaBi 6 2013B
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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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