Environmental product declaration

in accordance with ISO 14025

PAVATEX
Woodfibre insulation board

PAVATEX SA

Declaration number
EPD-PTX-2010121-D

Institut Bauen und Umwelt e.V.
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Summary

Environmental Product Declaration

Institut Bauen und Umwelt e.V. **www.bau-umwelt.com**	**Programme owner**
PAVATEX SA Rte de la Pisciculture 37 CH-1701 Fribourg	**Declaration holder**
EPD-PTX-2010121-D	**Declaration number**
PAVATEX DIFFUTHERM ISOROOF-NATUR-KNbzw. ISOLAIR L, PAVATHERM-PLUS+, PAVATHERM. The present environmental product declaration is made in accordance with ISO 14025 and provides information on the environmental performance of the products shown. Its goal is to promote an environmentally-friendly manner of building and one that is not injurious to health. The present approved declaration contains all relevant environmental data and is based on the PCR document 'Wood Materials', period 2009-11.	**Building products subject to the declaration**
The present approved declaration allows usage of the InstitutBauen und Umwelt mark. It applies solely to the products shown for a period of one year from the date of issue. The declaration holder is responsible for the data and supporting documentation forming the basis of it.	**Validity**
The present declaration is complete and contains full information on the following: - the product definition and constructional data - raw material and material origin data - product manufacturing descriptions - guidance on using the products - information on the products as used, extraordinary effects and disposal - life cycle assessment results - testing and supporting documentation	**Declaration contents**
1st December 2012	**Date of issue**
Prof. Dr.-Ing. Horst J. Bossenmayer (President oftheInstitutBauen und Umwelte.V.)	**Signatures**
The present declaration and the regulations on which it is based have been checked by the independent Committee of Experts (SVA) in accordance with ISO 14025.	**Verificationofthe declaration**
Prof. Dr. –Ing Hans-Wolf Reinhardt (SVAChairman) Dr. Wolfram Trinius (SVA appointedverifier)	**Signatures**

Product group	Wood materials	Created
Declaration holder:	PAVATEX SA	01-12-2010
Declaration number:	EPD-PTX-2010121-D	

Summary

Environmental Product Declaration

Product description

PAVATEX woodfibre insulation materials are vapour-permeable thermal insulation materials in the form of boards for use in buildings in accordance with EN 13171 and in part with EN 622-4 and EN 14964. The boards are produced by the so-called wet method in which the binding forces (principally lignin) contained in the wood itself are utilised for the cohesion of the finished board. This is achieved by using a thermo-mechanical process to break down the wood into fibres and the resulting pulp binding by the application of thermal. This process requires no additional chemical binders.

PVAc glue (casein glue) is applied to the dry boards (maximum thickness 30 mm) to achieve finished thicknesses of between 20 and 160 mm. The nominal density is between 135 and 260 kg/m3.

Area of application

PAVATEX DIFFUTHERM, ISOROOF-NATUR-KN and ISOLAIR L, PAVATHERM-PLUS+ and PAVATHERM are pressure-resistant woodfibre insulation boards.PAVATEX DIFFUTHERM is a render-ready insulation element for thermal insulation integrated systems for external walls of masonry or wood construction.ISOLAIR L and ISOROOF-NATUR-KN (CH) are sarking boards and under-roof systems for roofs and walls that can withstand weathering for 3 months. PAVATHEM –PLUS+ elements can be used as roof insulation with integrated sarking and for the insulation of external walls in buildings with masonry walls as well as those of a timber construction with curtain walls. PAVATHERM woodfibre insulation board can be used in the roof space as well as for wall or floor areas.

Life cycle assessment parameters

The life cycle assessment was carried out as specified by DIN ISO 14040 ff. in accordance with the requirements of the IBU guidelines in respect of Type III declarations. The database used comprised specific data from products tested as well as data from the “Ecoinvent” database. The life cycle assessment comprises the production of raw materials and energy, transportation of raw materials, the manufacturing phase itself including packaging and its recycling to produce energy, as well as end of life in a biomass power plant and energy recovery. The standard declared unit is one cubic metre of Pavatex soft woodfibre insulation material.

Life cycle assessment results

		PAVATHERM			PAVATHERM PLUS+		
Per m3		Manufacture	Disposal	Total	Manufacture	Disposal	Total
Primary energy, non-renewable	MJ	1341	-3214	-1872	1647	-3933	-2286
Primary energy, renewable	MJ	3601	-90	3512	4553	-110	4443
Global WarmingPotential (GWP)	Kg CO2 eq.	-181	71	-110	-220	88	-132
Ozone Depletion Potential (ODP)	Kg CFC-11 eq.	5.96E-06	-2.04E-05	-1.45E-05	6.93E-06	-2.52E-05	-1.83E-05
Acidification Potential (AP)	Kg SO2 eq.	0.192	-0.147	0.044	0.274	-0.182	0.093
Over-fertilisation Potential (NP)	Kg PO43- eq.	0.072	-0.013	0.059	0.094	-0.015	0.079
Photochemical Ozone Creation Potential (POCP)	Kg C2H4 eq.	1.29E-02	-1.25E-02	3.16E-04	1.73E-02	-1.55E-02	1.85E-03

		ISOROOF NATUR/ISOLAIR			DIFFUTHERM		
Per m3		Manufacture	Disposal	Total	Manufacture	Disposal	Total
Primary energy, non-renewable	MJ	2764	-5592	-2828	1718	-4132	-2414
Primary energy, renewable	MJ	6184	-156	6028	4644	-115	4528
Global Warming Potential (GWP)	Kg CO2 eq.	-285	125	-160	-233	91	-142
Ozone Depletion Potential (ODP)	Kg CFC-11 eq.	1.15E-05	-3.55E-05	-2.41E-05	7.63E-06	-2.63E-05	-1.86E-05
Acidification Potential (AP)	Kg SO2 eq.	0.503	-0.257	0.246	0.247	-0.189	0.057
Over-fertilisation Potential (NP)	Kg PO43- eq.	0.131	-0.02	0.111	0.093	-0.016	0.076
Photochemical Ozone Creation Potential (POCP)	Kg C2H4 eq.	2.78E-02	-2.78E-02	5.91E-03	1.66E-02	-1.61E-02	4.41E-04

NB: Life cycle assessment results that are based on several databases cannot be unreservedly compared with each other.

Produced by Werner Umwelt und Entwicklung GmbH, Zurich
In collaboration with Pavatex SA, Fribourg.

Dr. Frank Werner
Umwelt & Entwicklung

Product group	Wood materials	Created
Declaration holder:	PAVATEX SA	01-12-2010
Declaration number:	EPD-PTX-2010121-D	

In addition, the results of the following tests are shown in the environmental product declaration: • Formaldehyde in accordance with DIN EN 717-1 • MDI in accordance with DIN EN ISO 16000-6 • Eluate (heavy metals) in accordance with DIN EN ISO 17294-2 • VOC in accordance with DIN EN ISO 16000-6 • Adsorbable and extractable in accordance with DIN EN 1485 • Pesticides as per Melliland test reports 1-2/1995; 39-42 and DFG method S-19 • Natureplus as per Natureplus award guidelines	**Testing procedures and supporting documentation**

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Scope of application

The present document contains information on the DIFFUTHERM, ISO-ROOF-NATUR-KN and ISOLAIR L, PAVATHERM-PLUS+ and PAVATHERM (wet method) woodfibre insulation boards manufactured in both of the following PAVATEX SA factories:

Fribourg: PAVATEX SA , Route de la Pisciculture 37, CH-1701 Fribourg

Cham: PAVATEX SA, Knonauerstrasse, CH-6330 Cham

1 Product definition

Product definition

PAVATEX woodfibre insulation materials are vapour-permeable thermal insulation materials in the form of boards for use in buildings in accordance with EN 13171 - Thermal insulation materials for buildings - Factory-manufactured woodfibre [WF] products, and in part with EN 622-4 - Fibre boards – Requirements- Part 4 Requirements of porous boards, as well as in accordance with EN 14964 – Sarking boards - Definition and Characteristics. The boards are manufactured by the so-called wet method in which the binding forces within the wood itself (principally lignin) are utilised for the cohesion of the finished board. This is achieved by breaking down the wood into fibres by a thermo-mechanical process and the resulting pulp binding together by the application of heat. This process requires no additional chemical binders. In order to improve the quality of the product further, individual materials, e.g. binders containing latex (approx. 2-5% by weight) are added. Individually manufactured layers of woodfibre insulation board are between approximately 8 and 30 mm thick.

In order to produce a thicker product individual boards are glued together using PVAc glue. They are then cut to size and, depending on the final product, a double-end profiler gives them a tongue and groove finish. At this stage the nominal density is between 135 and 240 kg/m^3.

Application

PAVATEX DIFFUTHERM is a render-ready insulation element for thermal insulation in integrated systems for external walls of a masonry or timber construction.

ISOLAIR L and ISOROOF-NATUR-KN (CH) are sarking boards and under-roof systems for roofs and walls that can survive weathering for 3 months.

PAVATHERM-PLUS+ insulation elements can be used as roof insulation with integrated sarking as well as for the insulation of the external walls of a masonry or timber construction with curtain walls.

PAVATHERM woodfibre insulation board can be used for roof, wall or floor areas.

Product standards/Approvals

Pavatex insulation materials are approved for building use in accordance with technical approval Z-23. 15-1429 of the German Institute for Building Technology. For the purposes of the certificates of conformity issued in accordance with this, the areas of application are set out in the following standards:

- EN 13171 - Thermal insulating products for buildings. Factory madewoodfibre (WF) products
- DIN 4108-10 - Thermal insulation and energy economy in buildings - Part 10: Application-related requirements for thermal insulation materials - Factory made products
- EN 622-4 – Fibre boards – Requirements – Part 4: Requirements of porous boards
- EN 14964 – Sarking boards for roof coverings – Definitions and Characteristics

Quality assurance

- CE marking in accordance with EN 13986 - Notified Body: Materials Testing Institute(MPA) - Stuttgart, Germany
- CE marking in accordance with EN 13171 - Notified Body: Materials Testing Institute (MPA) - Stuttgart, Germany
- FSC, Chain of Custody SQS-COC-021707
- EN ISO 9001:2008 - SQS, EN ISO 14001: 2004, Zollikofen, Switzerland (CH)

Product group	Wood materials	Created
Declaration holder:	PAVATEX SA	01-12-2010
Declaration number:	EPD-PTX-2010121-D	

Supply characteristics

Table 1: Sizes supplied Germany/Switzerland

Product	Length x Width [cm]	Thickness [mm]
DIFFUTHERM	79 x 130	60 / 80 / 100
DIFFUTHERM kf	60 x 102	60 / 80 / 100
DIFFUTHERM gf (CH)	79 x 250	60
ISOROOF NATUR/ISOLAIR	77 x 250	18 / 22 / 35 / 52 / 60
PAVATHERM-PLUS^{+}	80 x 160	60 / 80 / 100 / 120
PAVATHERM	60 x 102	20 / 30 / 40 / 60 / 80 / 90 / 100 / 120
PAVATHERM	120 x 205	40 / 60

Table 2: DIFFUTHERM - Technical characteristics (EN 13717 and DIN 4108-10)

Characteristic	Unit	Value
Thermal conductivity: Rating Germany	W/(mK)	0,045
Thermal conductivity: Nominal value CH	W/(mK)	0,043
Nominal density	kg/m³	180
Specific heat capacity	J/(kgK)	2100
Diffusion resistance		5
Compression stress at 10% deformation	kPa	100
Tensile strength diagonally	kPA	10
Building materials class DIN 4102-1		B2
Fire rating	BKZ	4.3
Euroclass DIN EN 13501-1		E

Table 3: ISOROOF-NATUR-KN and ISOLAIR L - Technical characteristics (EN 13717 andDIN 4108-10)

Characteristic	Unit	Value
Thermal conductivity: Rating Germany	W/(mK)	0,050
Thermal conductivity: Nominal value CH	W/(mK)	0,047
Nominal density	kg/m³	240
Specific heat capacity	J/(kgK)	2100
Diffusion resistance		5
Compression stress at 10% deformation	kPa	L22 200; L35, L52, L60 175
Tensile strength diagonally	kPA	10
Building materials class DIN 4102-1		B2
Fire rating	BKZ	4.3
Euroclass DIN EN 13501-1		E

Table 4 : PAVATHERM PLUS+ - Technical characteristics (EN 13717 and DIN 4108-10)

Characteristic	Unit	Value
Thermal conductivity: Rating Germany	W/(mK)	0,045
Thermal conductivity: Nominal value CH	W/(mK)	0,043
Nominal density	kg/m³	180
Specific heat capacity	J/(kgK)	2100
Diffusion resistance		5
Compression stress at 10% deformation	kPa	100
Tensile strength diagonally	kPa	2.5
Building materials class DIN 4102-1		B2
Fire rating	BKZ	4.3
Euroclass DIN EN 13501-1		E

Product group	Wood materials	Created
Declaration holder:	PAVATEX SA	01-12-2010
Declaration number:	EPD-PTX-2010121-D	

Table 5 : PAVATHERM - Technical characteristics (EN 13717 and DIN 4108-10)

Characteristic	Unit	Value
Thermal conductivity: Rating Germany	W/(mK)	0,040
Thermal conductivity: Nominal value CH	W/(mK)	0,038
Nominal density	kg/m³	140
Specific heat capacity	J/(kgK)	2100
Diffusion resistance		5
Compression stress at 10% deformation	kPa	20
Tensile strength diagonally	kPA	2.5
Building materials class DIN 4102-1		B2
Fire rating		4.3
Euroclass DIN EN 13501-1		E

2 Raw materials

Raw materials Intermediate products

Woodfibre insulation board can be manufactured in starting thicknesses of about 8 to 30 mm. The manufactured boards are glued together using PVAc glue to form multi-layer boards. The nominal density is between 135 and 240 kg/m^3.

Ancillary materials/ Additives

DIFFUTHERM (in % by weight)

- Swiss softwood 95.8%
- max. 0.7% paraffin
- max. 3.5% casein glue (PVAC for gluing the layers together)
- max. 1% aluminium sulphate

ISOROOF-NATUR-KN and ISOLAIR L

- Swiss softwood 91.8%
- max 5.0% latex
- max. 0.7% paraffin
- max. 0.5% casein glue (PVAC for gluing the layers together)
- max. 1% aluminium sulphate

PAVATHERM-PLUS$^+$

- Swiss softwood 95%
- max 2.0% latex
- max. 1.0% paraffin
- max. 2.0% casein glue (PVAC for gluing the layers together)
- max. 1% aluminium sulphate

PAVATHERM

- Swiss softwood 97.5%
- max. 1.2% paraffin
- max. 2.0% casein glue (PVAC for gluing the layers together)
- max. 1% aluminium sulphate

PAVATHERM-Plus+ and Diffutherm are PAVATEX soft fibre boards of a sandwich construction and of different types and thicknesses.

Product group	Wood materials	Created
Declaration holder:	PAVATEX SA	01-12-2010
Declaration number:	EPD-PTX-2010121-D	

Constituents

Wood: Soft woods are used in the manufacture of PAVATEX fibre boards: spruce and fir being the preferred types. The types of raw materials used principally comprise recently sawn offcuts from sawmills in the form of slabs, sticks and chippings. Slabs and sticks are processed into chippings at the factory.

Latex emulsion: Latex is used to increase the physical properties of ISOROOF-Natur KN and ISOLAIR L boards as manufactured.

Paraffin wax emulsion: This is added to improve the moisture-resistance properties.

Casein glue: Polyvinyl acetate (PVAc) is used in the form of an aqueous solution to glue together the manufactured boards.

Aluminium sulphate: An additive that is also permitted in the EU as a food additive (E520).

Raw material acquisition and origin

Only wood from indigenous forests and those near to the Swiss border are used: principally sawmill offcuts. Preference is given to wood from sustainable and socially-acceptable sources. All the wood used is from amaximum area of 160 kilometres and, by being purchased within the region, makes a significant contribution to a sustainable, ecological forestry industry. The average distance for transport is about 50 kilometres. Additives such as latex, paraffin and casein glue are bought in from distances of 100 to 1000 kilometres.

Regional and general availability of raw materials

The wood is sourced solely from sustainably-managed forests specialising in a limited number of tree species and is available as a renewable raw material in sufficient quantities. The additives used, latex, paraffin and the PVAc binders are petroleum products, the availability of which is limited. Aluminium hydroxide and sulphuric acid, the raw materials for the manufacture of aluminium sulphate, are not inexhaustible but there is no shortage of supply.

3 Manufacture

Manufacture

The wet method for the manufacture of PAVATEX soft woodfibre boards is identical at both locations. The process sequence is as follows:

1. Further processing of the blocks and sticks into chippings
2. Cooking the shavings and chippings under pressure
3. Producing the fibres by a process of defibration
4. Grinding on a Raffinator machine (depending on the product)
5. Suspension of the fibres in water to make a pulp
6. Feeding into a forming machine
7. Formation of fibre cakes
8. Extraction of the water by mechanical pressure
9. Lengthways cutting of the fibre cake
10. Drying at temperatures of between 160 and 220°C
11. Gluing the raw boards and cutting according to product
12. Stacking
13. Finishing and packing

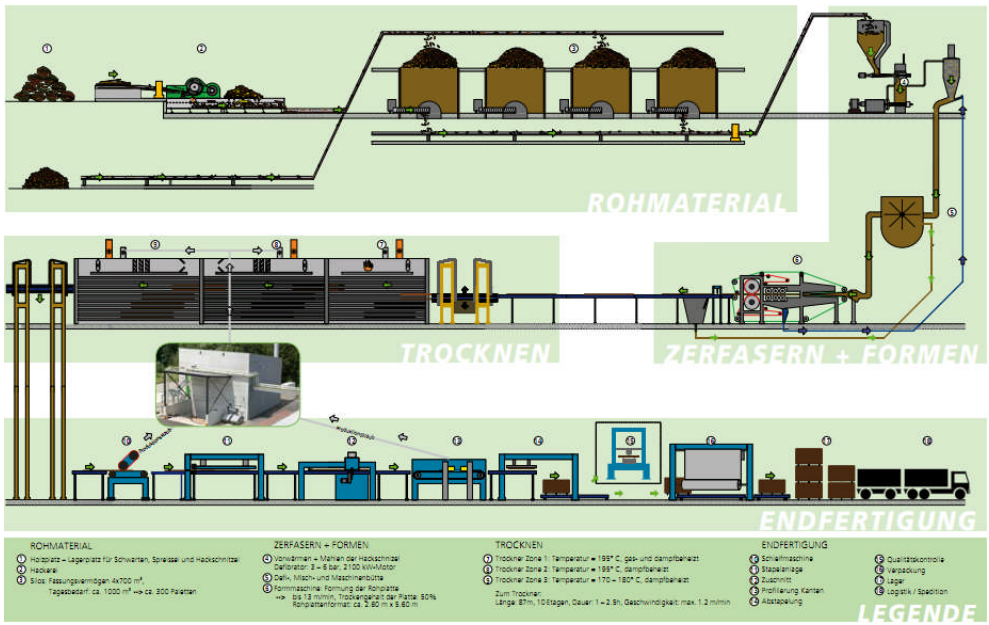

Figure 1: **Manufacture of soft woodfibre boards by the wet method (Source: Pavatex SA)**

Any waste occurring during production (from trimming or milling) is always used to produce energy at the plant.

Health and safe-tyduring manufac-ture

Measures to obviate health risks/problems during the manufacturing during manufacture process:

Due to the way in which the goods are produced, no health protection measures are required beyond those stipulated by statute or other regulations. At every point in the factory the Threshold Limit Values (MAK) are below those laid down in Switzerland.

Environmental protection during manufacture

- **Air:** Any waste air resulting from the production process is cleaned in accordance with the relevant statutory provisions. Emissions are below the Clean Air Ordinance levels set.
- **Water/Soil:** There is no direct pollution of either. Any waste water resulting from the production process is processed at the plant and re-used or undergoes treatment at a sewage treatment plant.

4 Using the product

Recommendations

PAVATEX woodfibre boards can be worked with standard building tools or machines, such as insulation cutters, jig, circular or band saws. Circular saws with a high number of teeth and a high cutting speed are recommended for up to 80 mm thickness, above this a sable saw is recommended. When using hand-operated tools without automatic dust extraction, appropriate respiratory protection must be worn.

Full information and recommended methods of working are to be found in the technical brochures at www.pavatex.com.

Health and safety Environmental protection

Health and safety procedures: When working with/installing PAVATEX woodfibre boards, the usual safety procedures are to be followed (protective goggles and a respirator, if dust is produced). If working with the material takes place as part of a trade or profession, the provisions laid down by the relevant trade association are to be followed.

Environmental protection measures: No environmental pollution is released by working with/installing PAVATEX insulation materials. No special measures are re-

quired for environmental protection purposes.

Waste

Waste: Any offcuts from work carried out on the building site are to be separated as required. Local disposal regulations are to be followed, due attention being paid to the guidelines given in section 7, "Disposal".

Packaging

PAVATEX woodfibre board packaging

Inserts, cardboard, polyethylene film and wood are used for packing PAVATEX insulation materials.

Packaging used during transport, inserts and cardboard (both waste code 15 01 01), polyethylene film (waste code 15 01 02), wood (waste code 17 02 01) and plastic (waste code 15 01 02) as well as metal ties (waste code 15 01 04) can be sorted and sent for recycling or used for the production of energy).

In individual cases third-party disposal may be arranged with the manufacturer.

5 The product

Constituents

Constituents of the product in its usable form: The constituent proportions of the materials used in the manufacture of PAVATEX boards correspond to those of the raw materials shown in section 2 “Raw materials".

Effects on health and the environment

Environmental protection: According to the information available at present, when the products shown are used as directed risks cannot arise for water, the air or soil (please refer to section 9 “Test results”).

Health: No damage to or effect on health is expected if PAVATEX boards are used for their intended purpose. The natural constituents of the wood itself can be released in small quantities.

The release of harmful substances that could have an effect on health has not been detected (cf. Test Results 9.1: Formaldehyde, 9.2: MDI, 9.4: Eluate, 9.6: AOX/EOX, 9.7: Pesticides).

Working life

The qualities ofPAVATEX boards during use are defined by their class of use in accordance with EN 13171 and EN 622-4 (please refer to Section 1 "Product definition", as well as Tables 2 and 3). The average working life is in the region of that of the building.

6 Extraordinary effects

Fire

Fire performance of PAVATEX woodfibre boards

- Euroclass E in accordance with DIN EN 13501-1
- Fire rating 4.3 as per the Association of Regional Fire Insurance Companies (VKF)
- Smoke class s2 - normal amount of smoke produced (like solid wood)
- Toxicity of fire gases: Due to the process of conversion during incineration, toxic gases can be released if this should take place under anaerobic conditions. Therefore, product waste may only be burned at duly authorised locations.
- Conversion of the physical state (burning whilst dripping/falling to the ground): d0 (no burning droplets/deposition of particles) since PAVATEX woodfibre boards do not become liquid when heated.

Effect of water

No constituents are released that could pose a risk to water (please refer to Test Results 9.4: Eluate and 9.6: AOX/EOX).Woodfibre boards are not resistant to long-term water ingress. Damaged sections can be replaced..

Mechanical destruction

PAVATEX woodfibre boards can be affected by mechanical forces (compression and tensile stress). If damage should occur, a slight break will result leading to the regular tearing of the fibres.

7 Disposal

Re-use/Further use

As a part of building conversion work or when the useful life of the building has ended, and provided that they are untreated and undamaged, PAVATEX woodfibre insulation materials may be re-used for the same purpose.

Recycling

Provided they have not been soiled or damaged, PAVATEX insulation materials may be recycled, e.g. for making compost.

Being a renewable source of energy, enjoying a high calorific value of 17.9 to 18.2 MJ/kg (at u= 20%), PAVATEX woodfibre board may be used at the end of cascade utilisation for the production of process energy and electricity in wood-burning installations or waste incineration plants/waste water sludge incineration plants.

European Waste Code: 17 02 01.

8 Life cycle assessment

8.1 Manufacture of PAVATEX soft woodfibre boards

Declared unit

The present declaration is made in respect of the manufacture of 1 m^3 of soft woodfibre board.

System limits

The limits comprise manufacture of the boards including the acquisition of raw materials, energy generation, manufacture, transport, packaging and the use of it to produce energy etc. (cradle to grave), as well as recycling to produce energy as the end of life process (gate to grave).

The individual manufacturing stages examined are:

- Wood cultivation processes for the provision and transport of the wood,
- Production of all raw materials and additives, intermediate and ancillary products, including the relevant transport,
- Provision of the energy sources used,
- The PAVATEX SA production process,
- Packaging including its recycling to produce energy.

All products examined are manufactured in either or both of the factories at Fribourg and Cham.

The usage period of PAVATEX soft woodfibre boards was not included in the present life cycle assessment.

The end of life scenario was taken to be a biomass power plant with energy generation (substitution credits) (gate to grave). The assessment period commences at the gate of the recycling plant and it is assumed that any ashes produced are taken to landfill.

Cut-off criteria

All data used in the assessment were obtained from internal sources, i.e. all raw materials specified for manufacture, the heat used, the internal use of fuel and the consumption of electricity, all direct production waste as well as all available measurements of emissions. Assumptions regarding the usage of transport were made for all input and output data assessed. When doing this, material and energy sources making up a proportion of less than 1% were included.

It can be assumed that the sum of the processes that were not included does not exceed 5% of the impact categories. Any PAVATEX SA machinery or installations required for manufacture were not included.

Transport

All transport for the raw materials and ancillary materials used was included

Period of observation

The data used are in respect of PAVATEX SA production for 2008: the life cycle assessment being carried out in respect of Switzerland.

The consequence of this is that, in addition to the production processes, any preliminary stages of relevance for Switzerland, such as the provision of sources of electricity and power, were also considered.

Background data

The ecoinvent v. 2.2 (2009) database was used to model the manufacture and disposal life-cycle.

Assumptions

The most important assumptions made as a basis for the life cycle assessment were:

The amounts of energy consumed, as well as those of the emissions into the air or water, are related to the individual products and in accordance with the quantity used in the case of fibres or the manufacturing guidelines in the case of ancillary materials.

The products were assessed as having the average quantity of glue for the specific product and manufacturing location and were weighted for the life cycle assessment to take account of the quantity produced at each location.

Transportation used for all raw materials and ancillary materials was calculated in accordance with the means of transport used and using data from ecoinvent v. 2.2.

Any waste from the production or finishing areas (trimmings, offcuts, milling residue) is used in the company biomass power plant to produce power and is set off in the energy assessment statement.

Packaging is recycled in a waste incineration plant/waste water sludge incineration plant to produce power.

At the end of their useful life the insulation boards are recycled in a biomass power plant to produce energy, the emissions being modelled to reflect their composition (see below).

Data quality

Data were collected at both PAVATEX SA factories and checked for accuracy prior to production of the life cycle assessment. Therefore, the representative nature of the data in respect of the stated products is very high (100%).

The major portion of the background data in respect of the upstream stages is from industrial sources and was collected under consistent time and method framework conditions as laid down by ecoinvent and was updated periodically. Emphasis was placed on the completeness of the data collected regarding material and energy flows relevant to the environment.

The process data and the background data used are consistent. The data quality can therefore be considered as very good.

Allocation

Allocation is understood to be the assignment of the input and output streams in a life cycle assessment model to the product system being examined.

For the purpose of modelling the manufacture of woodfibre insulation board, as well as the relevant energy supply, no allocations are necessary in respect of the information given under "Assumptions".

The processes in the wood chain are allocated in ecoinvent on an economic basis (Werner et al. 2009) with the result that sawmill offcuts when compared to whole trees are associated with smaller environmental effects.

According to the PCR, recycling to produce energy as the end of life scenario for packaging and woodfibre board is offset using the substitution method by which credits are awarded for the heat and power produced (for details please see below).

Usage period

The condition of the product as used as well as possible extraordinary events were not examined in the life cycle assessment: direct environmental effects during the usage period are of no relevance for it. When comparing systems, aspects of the working life are to be considered as a function of stresses and loading.

8.2 Recycling to produce power

Choice of disposal method

For the purposes of a basis to the present life cycle assessment, recycling to produce power in a biomass power plant with combined heat and power output was assumed for all products, and models were produced based on the particular board composition. The fuel utilisation factor is 93%.

Credits

The substitution method is used in respect of energy production. Credits are awarded for the heat and power produced: credits that would be due for any savings made in respect of fossil fuels and the relevant emissions in the case of conventional energy production. The ecoinvent processes "Medium-high power from the grid/CH", as well as "Useful heat, natural gas, from industrial furnaces, Low NOx>100KW" are replaced.

8.3 Presentation of the results and the analysis

Life cycle inventory analysis

In the following section an evaluation of the life cycle inventory analysis with reference to the consumption of primary energy and water, theCO2 survey and the production of waste is presented, followed by an assessment of the effects.

Primary energy

Table 7 shows primary energy usage, renewable and non-renewable, divided up under the headings of manufacture, disposal and total for one cubic metre of soft fibre insulation board in each case. The net heating value (Hu) was offset for flammable primary energy sources.

In practice about the same quantity of renewable as of non-renewable primary energy is used in the manufacture of soft fibre boards. By far the greatest portion of renewable primary energy is contained within the wood and remains in the soft fibre boards to be recycled as energy at the end of its life.

Table 7: Non-renewable and renewable primary energy consumption (based on the net heating value Hu) per cubic metre

		PAVATHERM			PAVATHERM PLUS+		
Per m3		Manufacture	Disposal	Total	Manufacture	Disposal	Total
Primary energy, non-renewable	MJ/m3	1341	-3214	-1872	1647	-3933	-2286
Primary energy, renewable	MJ/m3	3601	-90	3512	4553	-110	4443
Of which energy content of the wood	MJ/m3	2447			3134		

		ISOROOF NATUR/ISOLAIR			DIFFUTHERM		
Per m3		Manufacture	Disposal	Total	Manufacture	Disposal	Total
Primary energy, non-renewable	MJ/m3	2764	-5592	-2828	1718	-4132	-2414
Primary energy, renewable	MJ/m3	6184	-156	6028	4644	-115	4528
Of which energy content of the wood	MJ/m3	4081			3146		

When fibre board is recycled to produce power the energy content of the wood is used in a biomass power station and, as a result, the generation of electricity and heat using fossil-fuel sources is avoided. This leads to credits in the case of non-renewable primary energy that are significantly higher than the non-renewable primary energy used for manufacturing.

In view of the relatively low current efficiency when recycling is used to produce energy and due to the relatively high proportion of non-renewable electricity in the Swiss power-mix (consumption mix), credits from recycling to produce power in the case of renewable primary energy are of less significance.

Table 8 shows a compilation of the non-renewable primary energy sources used.

Table 8: Compilation of the non-renewable primary energy consumption used in manufacturing (based on the net heating value Hu) per cubic metre.

	PAVATHERM		PAVATHERM PLUS+		ISOROOF NATUR/ISOLAIR		DIFFUTHERM	
	MJ-equiv.	%	MJ-equiv.	%	MJ-equiv.	%	MJ-equiv.	%
Lignite	38.5	2.90%	46.8	2.80%	67.6	2.40%	49.5	2.90%
Coal	52.5	3.90%	67.2	4.10%	100	3.60%	67.5	3.90%
Natural gas	442.7	33.00%	471.5	28.60%	782.3	28.30%	563.9	32.80%
Crude oil	263.1	19.60%	428.3	26.00%	849.2	30.70%	339.7	19.80%
Uranium	543.7	40.50%	631.6	38.40%	962.4	34.80%	696.1	40.50%
Other sources	1	0.10%	1.3	0.10%	2	0.10%	1.3	0.10%
TOTAL	1341.5	100%	1646.7	100%	2764.1	100%	1717.9	100%

Just about two thirds of the natural gas used can be traced back to the provision of heat for the production of soft fibre boards. The remaining use of non-renewable primary energy sources is mainly for the generation of electricity; the manufacture of additives such as paraffin, latex or PVAc glue consumes about 10% of non-renewable primary energy. On the same scale are the net credits from the manufacture of packaging and the recycling of it to produce energy.

Table 9 shows a compilation of the proportions made up by the renewable primary energy sources:

Table 9: Compilation of the renewable primary energy consumption used in manufacture (based on the net heating value Hu) per cubic metre

	PAVATHERM		PAVATHERM PLUS+		ISOROOF NATUR/ISOLAIR		DIFFUTHERM	
	MJ-equiv.	%	MJ-equiv.	%	MJ-equiv.	%	MJ-equiv.	%
Wind	1.78	0.05%	2.14	0.05%	3.06	0.05%	2.28	0.05%
Solar power	0.09	0.00%	0.11	0.00%	0.16	0.00%	0.12	0.00%
Wave power	98	2.71%	113	2.48%	173	2.79%	125	2.69%
Biomass	900	25.00%	1078	23.70%	1367	22.10%	1172	25.20%
Energy in wood	2447	67.90%	3134	68.80%	4081	66.00%	3146	67.70%
Organic waste	154	4.30%	226	5.00%	560	9.10%	198	4.30%
TOTAL	3601	100%	4553	100%	6184	100%	4644	100%

The consumption of renewable primary energy in the manufacture of soft fibre boards is determined by the wood used, more than two thirds of the wood used being energy within it that is retained until the wood is recycled to produce energy at the end of its life. Other less important sources of renewable power are other organic waste that is used to produce heat for manufacturing purposes, as well as wave power for the generation of electricity.

CO_2 audit

A fundamental characteristic of wood is the capture and storage of CO2 over its lifetime. At the end of their useful lives wood products can be recycled to produce energy without any net increase in CO2 and can, therefore, amongst other things, replace fossil-fuel energy sources.

Table 10 shows the CO_2 audit for the products declared.

Product group	Wood materials	Created
Declaration holder:	PAVATEX SA	01-12-2010
Declaration number:	EPD-PTX-2010121-D	

Table 10: CO_2 audit for the products declared

	PAVATHERM	PAVATHERM PLUS+	ISOROOF NATUR/ISOLAIR	DIFFUTHERM
	Kg CO_2/m^3	Kg CO_2/m^3	Kg CO_2/m^3	Kg CO_2/m^3
	Manufacture (without packaging)			
Carbon intake	-283.7	-364.7	-481.4	-347.6
Biogenic emissions	51.4	66.1	94	64.2
Fossil emissions	51.1	65.8	92.7	63.8
Carbon storage	-232.3	-298.7	-387.4	-283.4
Manufacturing balance	**-181.2**	**-232.9**	**-299.5**	**-220.5**
	Thermal recycling			
Biogenic emissions	232.3	298.7	387.4	283.4
Fossil emissions	9.8	12.6	35.9	15.6
	Substitution effect			
Substituted emissions: biogenic	-0.7	-0.9	-1.2	-0.8
Substituted emissions: fossil	-162	-208.3	-282	-199.8
Thermal recycling balance	**79.5**	**102.2**	**131.4**	**96.7**
	Life cycle balance			
Life cycle balance	**-101.7**	**-130.7**	**-168.1**	**-123.8**

Figure 2 shows the CO_2 audit for PAVATHERM:

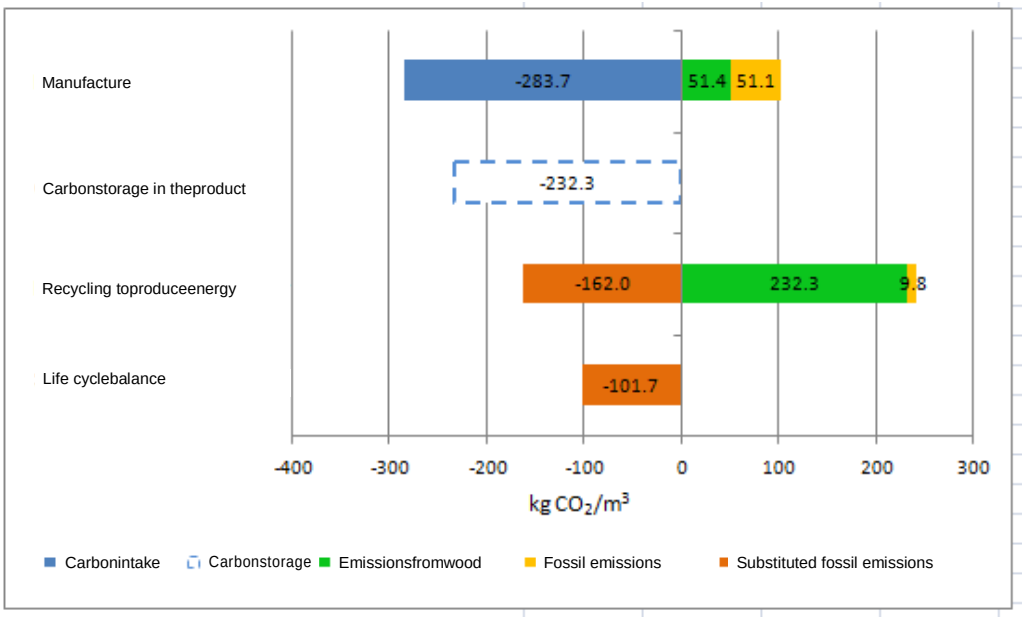

Figure 2: CO_2 audit for PAVATHERM

Due to the process of photosynthesis, while the tree grows about 280 kg of $CO_2/m^3$are locked in the wood in the form of carbon: during production this is used as a raw material or fuel. During production of the soft fibre board about 20% of this is released on a carbon-neutral basis by being used as fuel. On the same scale are emissions from non-renewable sources that are released due to the use of fossil fuels.

About 80% of the carbon stored in the wood, i.e. about 230 kg CO_2/m^3 remains in the soft fibre board and acts as a carbon storage medium during its working life.

If the product is recycled to produce energy the stored carbon is released CO_2 neutral; if it is used as fuel a small quantity of CO_2 from fossil sources, e.g. from the additives, is also released. By means of recycling to produce energy and the substitution of fossil-based energy sources about 160 kg of CO2/m^3 can be saved.

Over the life cycle of PAVATEX soft fibre board, assuming recycling to produce energy, it is observed that far fewer fossil-based energy sources are used than can be substituted by means of its use as energy at the end of its life cycle. Over the life cycle of the soft fibre board this leads to a total saving in emissions of 100 kg of CO2/m3. This does not include the emissions saved due to the insulating effects of the soft fibre board over its working life.

Waste

The analysis of the amount of waste produced during manufacture of one cubic metre of soft fibre board is shown (Table 11) separately for the three segments: mining/pile waste (including mineral processing waste), commercial waste similar to domestic waste and special waste, including radioactive waste. The figures include only quantities of waste disposed of.

Table 11: Amount of waste produced during manufacture and disposal of 1 m2 of soft fibre board.

		PAVATHERM			PAVATHERM PLUS+		
		Production	Disposal	Total	Production	Disposal	Total
Mining/Pile waste	kg/m3	60.72	-62.15	-1.43	73.58	-74.92	-1.34
Commercial waste similar to domestic waste	kg/m3	0.429	0.031	0.459	0.585	0.486	1.071
Special waste	kg/m3	0.734	0.77	1.504	0.908	1.908	2.816
Radioactive waste	kg/m3	9.75E-03	-8.25E-03	1.51E-03	1.12E-02	-1.01E-02	1.10E-03

		ISOROOF NATUR/ISOLAIR			DIFFUTHERM		
		Production	Disposal	Total	Production	Disposal	Total
Mining/Pile waste	kg/m3	104.96	-107.6	-2.64	77.95	-79.9	-1.95
Commercial waste similar to domestic waste	kg/m3	0.746	0.188	0.934	0.554	0.039	0.593
Special waste	kg/m3	0.942	1.315	2.258	0.948	0.99	1.938
Radioactive waste	kg/m3	1.71E-02	-1.43E-02	2.77E-03	1.25E-02	-1.06E-02	1.88E-03

Pile waste makes up by far the most significant portion of the waste followed by special waste and municipal solid waste.

In the case of manufacturing, mining waste from the upstream stages - principally due to the extraction of lignite and coal - forms the most significant portion of the pile waste. Of similar relevance is building site waste from infrastructure works (energy generation, roads, etc.). Just as great is the potential for substitution by means of recycling to produce energy, due to which the extraction of lignite and coal is avoided.

Commercial waste similar to domestic waste is the result of various preliminary processes in the manufacture of soft fibre board. Recycling to produce energy at the end of its useful life produces a small increase in the total quantity of such waste.

In Switzerland, **special waste**, principally the ashes from the use of wood as energy, is sent mainly to landfill. This type of waste also increases due to recycling to produce energy at the end of the working life of the soft fibre board.

Radioactive waste is almost entirely the result of uranium extraction for the production of electricity, as well as being a result of the disposal of spent fuel rods. However, radioactive waste can be avoided by energy recuperation at the end of their life cycle due to the substitution effect.

Water

Table 12 shows the water consumption for the manufacture of soft fibre board. Consumption includes electricity generation, cooling as well as process water.

		PAVATHERM			PAVATHERM PLUS+		
Per m3		Manufacture	Disposal	Total	Manufacture	Disposal	Total
Water	m3/m3	604	-502	102	695	-615	80

		ISOROOF NATUR/ISOLAIR			DIFFUTHERM		
Per m3		Manufacture	Disposal	Total	Manufacture	Disposal	Total
Water	m3/m3	1062	-873	189	773	-645	127

Table 12: Water consumption during the production and recycling of 1 m3 of soft fibre board for energy production

About 95% of the water requirement is used directly for the generation of the electricity used during production. Of less significance is the consumption of water used for the manufacture of additives. The direct consumption of water used during the manufacturing process of soft fibre board is negligible.

Assessment of effects

Table 13 shows the contributions made by the manufacturing of 1 m^3 of soft fibre board and its recycling to produce energy to the impact categories of: Global Warming Potential (GWP 100), Ozone Depletion Potential (ODP), Acidification Potential (AP), Over-

fertilisation Potential (NP) and Photochemical Ozone Creation Potential (summer smog potential, POCP).

Table 13: Impact assessment for the Pavatex products declared, per m^3

		PAVATHERM			PAVATHERM PLUS+		
Per m3		Manufacture	Disposal	Total	Manufacture	Disposal	Total
Global Warming Potential (GWP)	kg CO2 eq.	-181	71	110	-220	88	-132
Ozone Depletion Potential (ODP)	Kg CFC-11 eq.	5.96E-06	-2.04E-05	-1.45E-05	6.93E-06	-2.52E-05	-1.83E-05
Acidification Potential (AP)	Kg SO2 eq.	0.192	-0.147	0.044	0.27	0.18	0.09
Over-fertilisation Potential (NP)	Kg PO43- eq.	7.20E-02	-1.30E-02	5.90E-02	9.00E-02	-2.00E-02	8.00E-02
Photochemical Ozone Creation Potential (POCP)	Kg C2H4 eq.	1.29E-02	-1.25E-02	3.16E-04	1.73E-02	-1.55E-02	1.85E-03

		ISOROOF NATUR/ISOLAIR			DIFFUTHERM		
Per m3		Manufacture	Disposal	Total	Manufacture	Disposal	Total
Global Warming Potential (GWP)	kg CO2 eq.	-285	125	-160	-233	91	-142
Ozone Depletion Potential (ODP)	Kg CFC-11 eq.	1.15E-05	-3.55E-05	-2.41E-05	7.63E-06	-2.63E-05	-1.86E-05
Acidification Potential (AP)	Kg SO2 eq.	0.503	-0.257	0.246	0.25	-0.19	0.06
Over-fertilisation Potential (NP)	Kg PO43- eq.	1.31E-01	-2.00E-02	1.11E-01	9.00E-02	-2.00E-02	8.00E-02
Photochemical Ozone Creation Potential (POCP)	Kg C2H4 eq.	2.78E-02	-2.18E-02	5.91E-03	1.66E-02	-1.61E-02	4.41E-04

Using PAVATHERM as an example, Figure 3 shows a breakdown of the environmental effects of soft fibre boards. All contributions made by the manufacturing process are shown without packaging (= 100%):

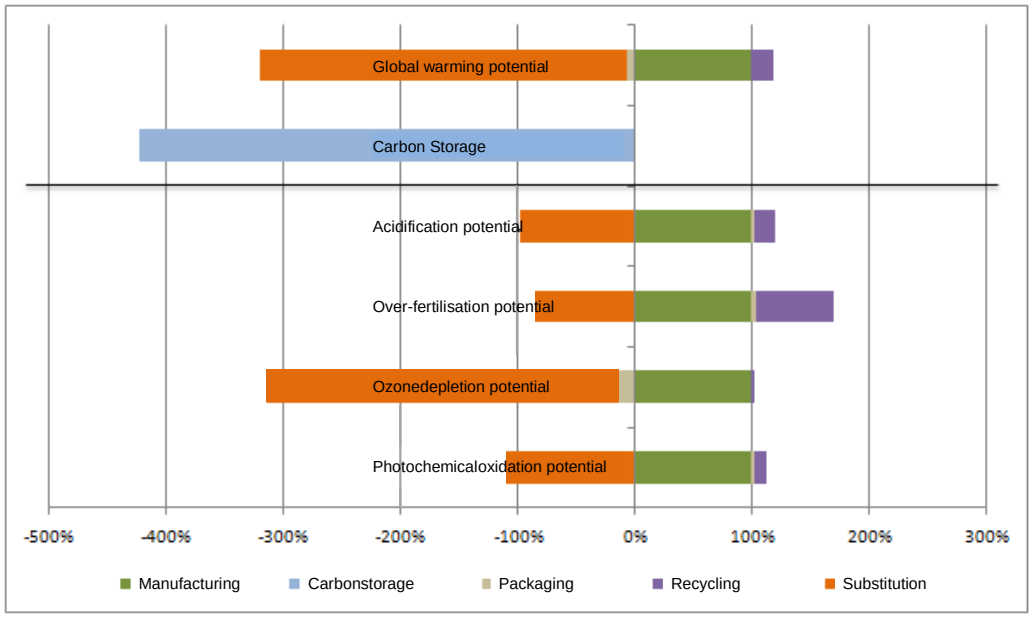

Figure 3: Breakdown of the environmental effects of the manufacture of PAVATHERM (without packaging) (= 100%)

It can be seen that the avoidance of environmental effects due to the use of soft fibre board for the production of energy and the substitution of fossil energy sources is of a similar extent over several impact categories, such as those related to manufacturing. In the case of the ozone depletion potential, and in particular in respect of the global warming effect, the substitution effect exceeds by far the contribution made by manufacturing.

With regard to the greenhouse gas potential, it can be ascertained that the amount of carbon stored in the soft fibre board - that is to say the temporary extraction from the atmosphere of the CO2 stored in the wood - is significantly greater than the substitution effect resulting from usage to produce power.

The contributions made by thermal recycling and packaging are of lesser importance, except for the contribution made by thermal recycling to the over-fertilisation potential which surpasses the contribution made by manufacturing.

In the case of manufacturing, the **global warming potential** is marked by the carbon

dioxide result. Greenhouse gas emissions from non-renewable sources emanating from the manufacturing process are primarily the result of the direct use of fossil-fuel energy sources (natural gas approx. 40%, heavy oil approx. 10%), as well as from the generation of electricity (approx. 10%) and the manufacture of additives.

However, the greenhouse gas potential is dominated by the CO2 locked inside the wood in the form of carbon: greenhouse gas emissions from non-renewable sources making up about one quarter of this quantity.

When soft fibre board is recycled to produce energy at the end of its working life, the CO2 fixed inside the wood in the form of carbon is released on a CO2-neutral basis, as well as other greenhouse gases from non-renewable sources, e.g. from additives. However, the use of the energy content of the wood to produce energy and the accompanying substitution effects mean that over its life-cycle a far greater amount of greenhouse gas emissions can be saved than are released during the manufacture and disposal of soft fibre board. This does not include all the savings made in greenhouse gas emissions that arise due to its insulating effect during its working life.

The different processes used for the acquisition of fossil-fuel energy sources make a fundamental contribution to the **potential for ozone depletion**.

By the process of the substitution of fossil fuel energy sources, the recycling of soft fibre board to produce energy leads to a situation where more emissions that contribute to the potential for ozone depletion are saved than are released during manufacture of the products.

The **potential for acidification** is caused mainly by the process of combustion for the acquisition of energy during manufacture, principally due to the use of heavy oil (approx. 25%), but also due to the burning of wood (approx. 15%) and gas (approx. 10%). Other significant contributions originate during the upstream stages of electricity generation that is directly used in the manufacture of soft fibre board and also for the manufacture of the additives.

The recycling of soft fibre board to produce energy and the accompanying substitution effect leads to a significant reduction in the overall potential for acidification.

The **potential for over-fertilisation** is caused to a significant degree by the burning of wood (20%) and organic waste (approx. 10%) for the manufacture of soft fibre board, and also due to the waste water that is treated in waste-treatment plants (approx. 15%). Other contributions of less than 10% are the result of combustion processes, e.g. for the generation of electricity or for the manufacture of additives.

In contrast to the potential for acidification, the recycling of soft fibre board for the production of energy leads to an increase in the potential for over-fertilisation. This means that the emissions from recycling for the production of energy contributing to this potential effect are greater than the emissions saved by the process of substitution.

About one third of the ground-level **ozone depletion potential** is produced during the initial stages of the manufacture of casein glue. In addition, the combustion processes for the production of energy are also relevant in this impact category, i.e. the burning of heavy oil (approx. 15%), organic waste (approx. 15%) and gas (approx. 10%). Emissions from the burning of wood or resulting from the generation of electricity are each under 10%.

In this category the effect produced by emissions resulting from substitution is of the same order of magnitude as that produced by emissions due to the manufacturing process.

It can further be asserted that packaging and the recycling of it for the production of energy play a lesser role (+/- approx. 5%) in all impact categories with the exception of the potential for over-fertilisation and that the direct means of transport to both factories for the products and raw materials used are not of significance.

The approximate percentage assessment used here can also be transferred to the

other products that have been declared since the percentage composition does not vary significantly between them for the purpose of interpreting the life cycle assessment.

Environmental indicators as per KBOB information sheet 2009-1

As an addition to the indicators required by IBU in respect of the life-cycleinventory analysis and the estimation of effects, Table 14 sets out the greyenergy indicators (as per SIA information sheet 2032), environmental impact points (UBP 2006, as per Öbu 2008) and global warming potential (IPCC2007), as per the calculation bases set out in the KBOB recommendation 2009/1, as they are used in Switzerland in many assessment and planning tools supported by official bodies and the SIA. As recommended by the KBOB, the information refers to 1 kg of soft fibre board; End of life certificates are not granted.

Table 14: Grey energy, environmental impact points (UBP) and greenhouse gas potential for the Pavatex products declared in accordance with KBOB recommendation 2009/1, per kg

		PAVATHERM			PAVATHERM PLUS+		
		Production	Disposal	Total	Production	Disposal	Total
Grey energy (SIA 2032)	MJ/kg	10.87	0.11	10.98	10.66	0.107	10.77
UPB 2006	UPB/kg	543	411	954	528	398	925
GWP IPCC 2007 100a	Kg CO2 eq./kg	0.393	0.037	0.431	0.381	0.045	0.427

		ISOROOF NATUR/ISOLAIR			DIFFUTHERM		
		Production	Disposal	Total	Production	Disposal	Total
Grey energy (SIA 2032)	MJ/kg	12	0.116	12.1	10.9	0.11	11
UPB 2006	UPB/kg	580	430	1010	543	411	954
GWP IPCC 2007 100a	Kg CO2 eq./kg	0.416	0.077	0.493	0.393	0.037	0.431

The calculation method used for the indicators shown in Table 14 differs from the IBU guidelines in several respects as a result of which the figures cannot be compared with each other.

9 Test results

9.1 Formaldehyde

During the manufacture of PAVATEX products no glue containing formaldehyde is used. Therefore, the following test is representative of all the declared products.

Test location: eco-Institut GmbH, Accredited Institute for Product Testing, Certification and Quality Assurance, Cologne, Germany

Test report, **Date**: 21050/1 of 28.08.2009, Isoroof-Natur

Results: Testing of the formaldehyde content was carried out in accordance with DIN EN 717-1:

- Isoroof-Natur 6µg/m^3 / 0.006 ppm

9.2 Monomeriso-cyanate

During the manufacture of PAVATEX products no glue containing isocyanate is used. Therefore, the following test is representative of all the declared products.

Test location: eco-Institut GmbH, Accredited Institute for Product Testing, Certification and Quality Assurance, Cologne, Germany

Test report, Date: 21050/1 of 28.08.2009, IsoroofNatur

Results: Testing the MDI content was carried out in accordance with DIN EN ISO 16000-6:

- IsoroofNatur< detection threshold

9.3 Checking for the pre-treatment of materials used

No mature treated wood is used in the manufacture of PAVATEX products.

9.4 Eluate analysis

No additives containing heavy metals are used during the manufacture of PAVATEX products.Therefore, the following test is representative of all the declared products.

Test location: INDIKATOR Environmental Analysis Company mbH

Accredited testing laboratory:INDIKATOR Environmental Analysis Company mbH, Kaiserstrasse 86 A, Wuppertal

Test report, Date: 2009/1761 of 09.06.2009 : Isoroof-Natur

Results: Detection of leachable heavy metals was carried out in accordance with DIN EN ISO 17294-2 "Detection of 62 elements by means of ICP-MS".

The following values were ascertained [mg/kg]: antimony, arsenic, barium, cadmium, cobalt, chrome, lead, copper, nickel, mercury, selenium:

- All values below the detection level

9.5 VOC

Test location: eco-Institut GmbH, Accredited Institute for Product Testing, Certification and Quality Assurance, Cologne, Germany

Test report, Date: 21050/1 of 28.08.2009, Isoroof-Natur

Results: Testing of the overall VOC content was carried out in accordance with DIN EN ISO 16000-6:

- $TVOC_{28d}$: 338 µg/m^3
- KMR-VOC: no carcinogenic, mutagenic or reproduction toxic volatile organic compounds were detected
- $VVOC_{28d}$: no VVOC compounds were detected
- $SVOC_{28d}$: no SVOC compounds were detected

9.6 AOX/EOX (adsorbable and extractable halogen-compounds)

During the manufacture of PAVATEX products no additives containing halogen are used. Therefore, the following test is representative of all the declared products.

Test location: INDIKATOR Environmental Analysis Company mbH

Accredited testing laboratory: INDIKATOR Environmental Analysis Company mbH, Kaiserstrasse 86 A, Wuppertal

Test report, Date: 2009/1762 of 09.06.2009:IsoroofNatur

Results: Testing for absorbable and extractable organic halogen compounds was carried out in accordance with DIN EN 1485:

- AOX , 0.5 mg/kg
- EOX < 2 mg/kg

9.7 Pesticide

During the manufacture of PAVATEX products no additives containing pesticides are used. Therefore, the following test is representative of all the declared products.

Test location: eco-Institut GmbH, accredited Institute for Product Testing, Certification and quality Assurance, Cologne, Germany

Test report, Date: 21050/1 of 28.08.2009, Isoroof-Natur

Analysis:

Organ chlorine pesticides: Melliand test report 1-2/1995; 39-42

Pyrethroids: extraction, cleaning with silica gel as per the German research Council (DFG) S-19 method, analysis by GC/ECD

Results:

- Organ chlorine pesticides and pyrethroids under the detection level of 0.1 mg/kg.
- Exception: PCP 0.2 mg/kg

9.8 Nature plus

Test location: IBO Austrian Institute for Building Biology and Ecology GmbH, Alserbachstr. 5/8, 1090 Vienna.

Test report, Date:

- np-WP-2009-135-1 of 24.08.2009: Pavatherm and Pavatherm-Plus+,
- np-WP-2009-135-2 of 24.08.2009: Isolair L/Isoroof-Natur,

Results: The declared products fulfil the natureplus requirements as laid down in the RL0000, RL0100, RL0104 and the RL0000, RL0200, RL0201 award guidelines.

This result also applies to Diffutherm as a combination of Pavatherm and Isolair (please see Natureplus certificate no. 0104-0307-04-1)

10 PCR document and testing

The present declaration is based on the PCR document “Wood Materials” 11/2009

PCR document review by the Committee of Experts. Chairman of the committee: Prof. Dr.-Ing. Hans-Wolf Reinhardt (University of Stuttgart, IWB)
Independent examination of the declaration in accordance with ISO 14025: ☐ internally ☒ externally
Declaration validation: Dr Wolfram Trinius

11 References

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SIA 2010 — SIA 2010: Grey energy from buildings: SIA information sheet 2032, Swiss Association of Engineers and Architects.

Werner et al. 2009 — Werner F., T. Künniger, H.-J. Althaus and K. Richter (2003: Life cycle inventories of wood as fuel and construction material, Dübendorf, data v 2.2, Centre for life cycle inventories in the ETH domain, Dübendorf.

Standards and Legislation

DIN EN 622-4 — DIN EN 622-4 Fibreboards - Specifications - Part 4: Requirementsforsoftboards; German version EN 622-4: 2009

DIN EN 13171 — DIN EN 13171:2009-02, Thermal insulating products for buildings. Factory- made woodfibre (WF) products. Specification; German version EN 13171:2008

DIN EN 13986:2005 — DIN EN 13986: 2005-03, Wood-based panels for use in construction - Characteristics, evaluation of conformity and marking; German and English version EN 13986:2005

DIN 4108-10 — DIN 4108-10:2008-06, Thermal insulation and energy economy in buildings - Part 10: Application-related requirements for thermal insulation materials – Factory-made products

DIN 68800-2 — DIN 68800-2: 1996-05, Wood preservation in building construction. Part 2: Preventive structural measures

ISO 14025 — ISO 14025: 2007–10, Environmental labels and declarations. Type III environmental declarations. Principles and procedures (ISO 14025:2006);
German and English version

DIN EN 717-1	EN 717-1: 2005-01, Wood-based panels - Determination of formaldehyde release - Part 1: Formaldehyde emission by the chamber method; German version EN 717-1:2004
DIN EN 1485	DIN EN 1485: 1996-11 Column method, Equipment for the preparation of samples by the shaking method, Equipment for the preparation of samples from salty and organically-polluted waters, Active charcoal; German version EN 1485: 1996
ISO 14040	DIN EN ISO 14040: 2006-10, Environmental management. Life cycle assessment. Principles and framework (ISO 14040:2006); German and English versionEN ISO 14040:2006
ISO 14044	DIN EN ISO 14044:2006-10, Environmental management. Life cycle assessment. Requirements and guidelines (ISO 14044:2006); German and English version EN ISO 14044:2006
DIN ISO 16000-6	DIN ISO 16000-6: 2004-12 Indoor air - Part 6: Determination of volatile organic compounds in indoor and test chamber air by active sampling on Tenax TA®, energetic desorption and gas chromatography with MS/FID (ISO 16000-6: 2004)
DIN EN 17294-2	DIN EN 17294-2; 2005-02, Water quality - Application of inductively coupled plasma mass spectrometry (ICP-MS) - Part 2: Determination of 62 elements (ISO 17294-2:2003); German version EN ISO 17294-2:2004

For further literature please refer to the PCR document

Institut Bauen
und Umwelt e.V.

Publisher:

Institut Bauen und Umwelt e.V.
Rheinufer 108
53639 Königswinter
Germany

Tel.: +49 (0) 2223 296679 0

Fax: +49 (0)2223 296679 1

E-Mail: info@bau-umwelt.com

Internet: www.bau-umwelt.com

Layout:

PE INTERNATIONAL GmbH

Bildnachweis:

Pavatex SA