ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804

Declaration holder	Fermacell GmbH
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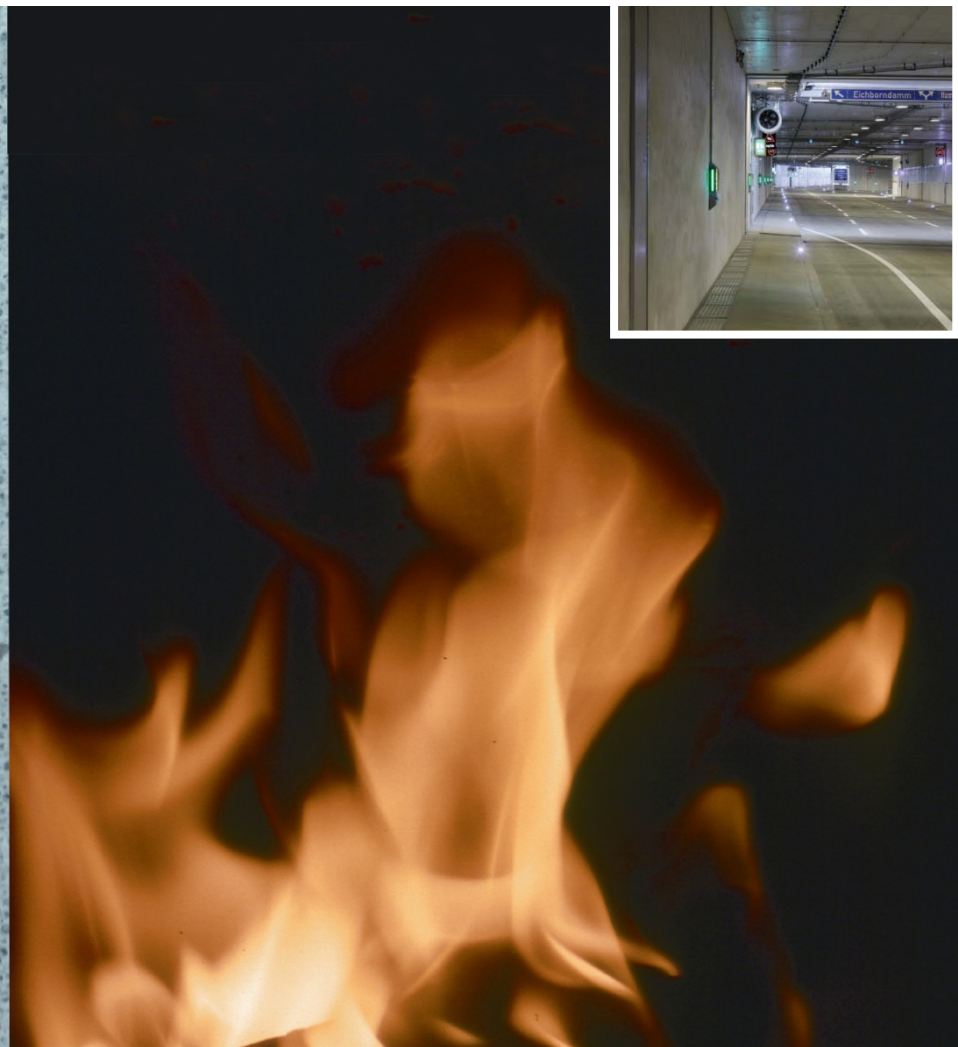
AESTUVER and AESTUVER T Fire-resistant board

Fermacell GmbH

www.bau-umwelt.com

Institut Bauen und Umwelt e.V.



1 General information

Fermacell GmbH

Programme holder
IBU - Institut Bauen und Umwelt e.V.
Rheinufer 108
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Declaration number
EPD-FMC-2012111-E

This Declaration is based on the Product Category Rules:
PCR Part B: Fibre cement / Fibre concrete, 06-2011
(PCR examined and approved by the independent Expert Committee (SVA))

Issue date
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Valid to:
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Prof. Dr.-Ing. Horst J. Bossenmayer
(President of Institut Bauen und Umwelt e.V.)

Prof. Dr.-Ing. Hans-Wolf Reinhardt
(Chairman of the Expert Committee (SVA))

AESTUVER and AESTUVER T Fire-resistant board

Declaration holder
Fermacell GmbH
Düsseldorfer Landstraße 395
D-47259 Duisburg

Declared product/unit
1 m² AESTUVER and 1m² AESTUVER T

Area of application:
This document refers to the manufacture of AESTUVER and AESTUVER T fire-resistant boards by Fermacell GmbH. These products are produced in the manufacturing plant in Calbe in which the production data for 2010 was recorded. The Life Cycle Assessment therefore fully represents the fire-resistant boards produced in Calbe by Fermacell GmbH. The Declaration holder is liable for the details and documentation upon which the evaluation is based.

Verification

The CEN DIN EN 15804 standard serves as the core PCR.
Verification of the EPD by an independent third party in accordance with ISO 14025
☐ internal ☒ external

Dr. Wolfram Trinius
(Independent auditor appointed by the SVA)

2 Product

2.1 Product description

AESTUVER and AESTUVER T fire-resistant boards are cement-bound, fibreglass-reinforced lightweight concrete boards manufactured in thicknesses of 10 to 60 mm.
Boards with thicknesses <12 mm are formed monolithically, i.e. they exclusively comprise surface layer material.
Boards with thicknesses >12 mm have a sandwich structure, i.e. they comprise surface layer and core material components whose mass ratio varies with thickness. Encompassing the top and bottom of the board core, both surface layers are around 3 mm thick. The surface and core layer material is manufactured from the same raw materials.

2.2 Application

AESTUVER fire-resistant boards are used as construction and fire-resistant boards for partition walls, as fireproof lining of components and elements as well as lining of components in interior and exterior applications, as plaster base boards for façades as well as for ceilings and as fire-resistant products for technical building services as well as components of fire-resistant construction parts.

AESTUVER T fire-resistant boards for tunnelling are used in preventive construction fire protection as concreted or subsequently secured lining protecting the structural concrete in tunnels.

2.3 Technical Data

AESTUVER fire-resistant board (exemplary for a board of 20 mm thickness):

- Thermal conductivity [W/mK]: approx. 0.2 (DIN EN 12667)
- Calculation value for thermal conductivity [W/mK]: n.a.
- Water vapour diffusion resistance factor as per DIN V 4108-4, EN ISO 12572: 54
- Swelling (60% change in humidity) [mm/m]: approx. 1.5
- Degree of sound absorption: n.a.
- Gross density [kg/m³]: between 640 kg/m³ (60 mm) and 980 kg/m³ (10 mm) (DIN EN 12467) depending on thickness
- Compressive strength [N/mm²]: > 9 (DIN EN 789)
- Tensile strength [N/mm²]: approx. 0.8 (DIN EN 319)
- Bending tensile strength [N/mm²]: > 3 (DIN EN 12467)
- Modulus of elasticity [N/mm²]: approx. 3000 (DIN EN 12467)
- Moisture content at 20 °C, 65% humidity [M-%]: approx. 7 M-%
- Linear coefficient of expansion [Mm/mK]: 0.01
- Chemical resistance: n.a.

- Ageing resistance: permanent in usage categories A-D (DIN EN 12467) – usage category as per ETAG 018-1: X, Y, Z_1, Z_2

- Permanent temperature resistance [°C]: 105 °C

2.4 Placing on the market / Application rules

AESTUVER fire-resistant board:

European Technical Approval no. ETA 11/ 0458 of the Deutsches Institut für Bautechnik (DIBt), member of the EOTA

AESTUVER T tunnel fire-resistant board:

Non-combustible building material A1 to DIN EN 13501-1 in accordance with the 96/603/EG decision and 2000/605/EC of the European Commission

2.5 Delivery status

The boards are manufactured in a range of thicknesses from 10 mm to 60 mm. The boards can be up to 3000 mm in length and up to 1250 mm wide.

2.6 Base materials / Auxiliaries

Base materials	Weight as a percentage
Portland cement	40-75
Hard coal fly ash	0-25
Foam glass granulate / Perlite	20-35
Alkali-resistant glass fibres	0.5-5

Auxiliaries / Additives

Plasticisers, stabilising agents, air-entraining agents

2.7 Manufacture

AESTUVER fire-resistant boards are manufactured layer-by-layer and "fresh in fresh" in an entirely automated manufacturing process on a production line in steel forms.

An initial step involves injecting the bottom surface layer into the form along with glass fibre segments cut from an endless strand. This is immediately followed by applying the central layer from a distribution station to the fresh bottom surface layer already in the form. The last step involves injecting the top surface layer onto a carrier foil which is applied to the middle layer and rolled.

The finished rough strand is then cut according to the form size; the filled forms are stacked separately before spending several hours in a binding channel.

The hardened boards are taken out of the forms in the formwork removal station, deposited on stacking grids and dried in the drier until equilibrium moisture. The drying period is followed by trimming the edges of the boards, calibrating their thickness, palleting and packing. The boards remain in the store until a maturation period has elapsed.

The manufacturing plant has been certified to the DIN EN ISO 9001:2008 Quality Management System by TÜV Nord since 2010 and operates a system of internal production control which is oriented towards the approval and product safety requirements. Apart from inspection of raw materials on receipt and permanent production monitoring, this also includes final inspection of the finished products.

2.8 Environment and health during manufacture

During production of AESTUVER fire-resistant boards, exclusively low-chromate (< 2ppm) cement is used in accordance with RL 2003/53/EG and the REACH Directive (EC), Annex XVII, No. 1907/2006.

Excess process water or cleaning water is mechanically filtered in the process water circuit in order to separate cleaning residue. The cleaned water is added to the manufacturing process as service water.

Noise: Sound protection analyses have established that all values communicated inside and outside the production facility are far below the requisite technical standards thanks to the sound protection measures taken.

Waste: All types of waste such as scrap metal, waste oil, foils and plastic chips (packaging), wood (pallets) and paper are separated, stored and directed back into the recycling system.

2.9 Product processing / Installation

AESTUVER fire-resistant board cuttings are achieved using conventional rail-guided hand-held circular saws with suction, preferably as plunge-cut sawing. The use of carbide-tipped saw blades with alternate toothing is recommended for exact and sharp-edged cuts. Dust is reduced by using saw blades with a low number of teeth and at low speeds. Coarse thread screws or standard clamps are used for securing.

2.10 Packaging

AESTUVER fire-resistant boards are packed horizontally on wooden pallets and supplied covered with cardboard edge protection and foil. These packaging materials are segregated and redirected to the recycling circuit. The wooden pallets can be returned to the respective dealers.

2.11 Condition of use

Thanks to stable crystalline calcium-silicate-hydrate phase binding and the strong structure achieved after hardening, emissions are extremely low for normal use in line with the designated purpose of the respective product and are regarded as harmless to health.

No risks are associated with water, air and soil if the products are used as designated

Natural ionising radiation by AESTUVER fire-resistant boards is extremely low and negligible in terms of health hazards

2.12 Environment and health during use

The Institut für Baubiologie in Rosenheim has tested AESTUVER fire-resistant boards and their manufacturing process with regard to healthy living and environmental protection. Thanks to the outstanding test results, the "Tested and recommended by IBR" test seal was awarded. The "Low-emission product" certificate awarded by the eco-Institut in Cologne confirms that AESTUVER fire-resistant boards comply with stringent health and ecological requirements.

2.13 Reference service life (RSL)

A service life of at least 25 years has been confirmed by test scenarios for AESTUVER fire-resistant boards. The practical service life can however be much longer. In the case of tunnel projects, a service life of 100 years can be assumed.

Details on the service life can not however be regarded as a guarantee on the part of the

manufacturer but are only to be regarded as an aid in selecting the right products in view of the appropriate anticipated economical service life of the respective structure.

One prerequisite for a long service life is that the requisite conditions for packaging, transport, storage, installation, use, maintenance and repairs are complied with (please refer to www.aestuver.de/de/content/technische_unterlagen_deutsch.php).

2.14 Extraordinary effects

Fire: In accordance with the 96/603/EC and 2000/605/EC rulings by the European Commission, uncoated AESTUVER fire-resistant boards are classified as Class A1, non-combustible building materials as per DIN EN 13501-1. What's more, they are also Class A1 non-combustible building materials as per DIN 4102.

Water: AESTUVER fire-resistant boards display neutral reaction when exposed to water (e.g. flooding). No substances are washed out which could be hazardous to water.

Mechanical destruction: Not relevant

2.15 Re-use phase

Cement-bound lightweight concrete boards can be easily deconstructed. They do not need to be treated as special waste when demolished / deconstructed. With regard to an efficient recycling process, care should be exercised in ensuring dismantling whereby waste is sorted into as many different categories as possible.

Reuse and further use

Cement-bound lightweight concrete boards usually outlast the service life of the buildings in which they are used. After deconstructing such buildings, the materials can therefore be prepared, classified, assessed (environmental compatibility, building material characteristic values, consistency) and re-used.

The waste incurred by these boards and any components manufactured from them can be recovered in building material recycling plants before being used as an aggregate for various applications. Unmixed residual materials can be taken by the manufacturers and re-used or recycled. This material can be used as aggregates in production.

Building rubble and production rejects should be prepared mixed to ensure the consistent features of lightweight concrete products made from recycled material.

The recycled material should comply with the natural requirements of the material standards for the raw material to be replaced. Furthermore, recycled material made from lightweight concrete can also be used for building roads and paths in construction class V.

2.16 Disposal

If in exceptional cases, materials can not be directed to a building material recycling plant, the AESTUVER fire-resistant boards can be disposed of at any building rubble landfill in accordance with the waste key number 170101 (concrete).

2.17 Further information

Further information on the products is available in the Download area on www.fermacell.de.

Safety data sheets can be requested by calling 0800 5235665.

3 LCA: Calculation rules

3.1 Declared unit

This Declaration refers to the manufacture of one square metre of AESTUVER and AESTUVER T fire-resistant boards by Fermacell GmbH. The boards are manufactured in varying thicknesses. The average grammage of both fire-resistant boards produced is 17.3 kg/m² for one square metre of AESTUVER (complies with a board of approx. 23 mm thickness) and 15.8 kg/m² for one square metre of AESTUVER T (complies with a board of approx. 22 mm thickness).

3.2 System limit

Type of EPD: Cradle to gate - with options

The following processes were included in the **A1-A3** production stage of board manufacture:

- Manufacture of preliminary products (cement, foam glass, glass fibres)
- Transporting the raw materials and preliminary products to the plant
- Manufacturing process in the plant including energy, manufacture of auxiliaries, disposal of residual materials incurred and consideration of any emissions incurred
- Manufacture of packaging

Emissions and pollution attributable to the disposal of packaging are allocated to **Module A5**. Installation of the products is not taken into consideration within the system limits.

Credits attributable to the disposal of packaging are allocated to **Module D**.

3.3 Estimates and assumptions

Specific GaBi processes are not available for all additives. Assumptions were made for the plasticiser and air-entraining agent used. The mass percentage is < 0.2% in each case. The data records used are based on European marginal conditions and reflect a typical plasticiser as well as a typical air-entraining agent.

Contrary to the manufacturer's details concerning packaging material recycling, the model is formed under the assumption of an incineration model with the associated energy credits.

3.4 Cut-off criteria

All operating data, i.e. all of the starting materials used, thermal energy, internal fuel consumption and electricity consumption, all direct production waste as well as all emission measurements available were taken into consideration in the analysis. Assumptions were made as regards the transport expenses associated with all input and output data taken into consideration. Accordingly, material and energy flows with a share of less

than 1 per cent were also considered. It can be assumed that the total of all neglected processes does not exceed 5% in the effective categories. Machinery, plants and infrastructure required in the manufacturing process are not taken into consideration.

3.5 Background data

The "GaBi 4" software system for comprehensive analysis developed by PE INTERNATIONAL AG was used for modelling the Life Cycle Assessment. The consistent data items contained in the GaBi data base are documented in the online GaBi documentation. The basic data in the GaBi data base was applied for energy, transport and consumables. The Life Cycle Assessment was drawn up for Germany as a reference area. This means that apart from the production processes under these marginal conditions, the pre-stages also of relevance for Germany such as provision of electricity or energy carriers were used. The 2008 Power Mix for Germany is used.

Cement is used as a binding agent in AESTUVER and AESTUVER T fire-resistant boards. The cement data is based on environmental data provided by the German cement industry: Verein deutscher Zementwerke e.V. (VDZ).

3.6 Data quality

All of the background data records of relevance for manufacturing were taken from the GaBi software data base or supplied by Fermacell GmbH. The background data used was last revised less than 10 years ago. The production data involves up-to-date industrial data provided by Fermacell GmbH and dated 2010.

3.7 Period under review

The data on which this Life Cycle Assessment is based concerns data collated in 2010. The volumes of raw materials, energy, auxiliaries and consumables are considered as average annual values in the Calbe manufacturing plant.

3.8 Allocation

Both products are produced in Calbe. Data has been recorded separately for each of these two products. No allocations are required.

Cement is used as a binding agent in the fire-resistant boards and for the manufacture of which secondary fuels are used. As the secondary fuels used do not have any or only a negative economical value, they are integrated in the system without representing any burden on the environment. Transport by truck to the plant has been taken into consideration.
Contributions to the global warming potential as a result of incineration were also taken into consideration in the model for regenerative and non-regenerative primary and secondary fuels. Regenerative secondary fuels give rise to CO_2 neutrality as the levels incorporated equal those released.
Packaging material is incinerated in a waste incineration plant. This is modelled in an input-specific manner in the model, whereby any emissions incurred are considered in the model (Module A5). In line with their elementary composition and the ensuing heating values, credits are taken into consideration for thermal utilisation in Module D.

3.9 Comparability

As a general rule, it is only possible to compare or evaluate EPD data if all of the data records to be compared have been drawn up in accordance with DIN EN 15804 and the building context and/or product-specific characteristics are taken into consideration.

4 LCA: Scenarios and other technical information

The following technical information forms the basis for the declared modules or can be used for developing specific scenarios within the context of a building evaluation.

Module A5

The following packaging material is incurred on the building site:

AESTUVER

Polyethylene foil: 0.95 g/m²

Wooden pallets: 0.85 kg/m²

AESTUVER T

Polyethylene foil: 0.51 g/m²

Wooden pallets: 0.48 kg/m²

Reuse, recovery and recycling potential (D)

Module D contains credits for electricity and thermal energy as a result of thermal utilisation of packaging materials.

5 LCA: Results

The following tables depict the results of the indicators of the estimated impact, use of resources as well as waste and other output flows based on 1 m² AESTUVER and AESTUVER T fire-resistant boards, manufactured by Fermacell GmbH. The estimated impact results only represent relative statements. They do not enable any deductions to be made as regards the end points of the impact categories, exceeding threshold values, safety levels or risks.

SYSTEM LIMITS (X = INCLUDED IN LIFE CYCLE ASSESSMENT; MND = MODULE NOT DECLARED)

Production stage			Building construction stage		Use stage							Disposal stage				Credits and loads outside the system limit
Provision of raw materials	Transport	Manufacture	Transport to site	Installation in building	Use / Application	Maintenance	Repairs	Replacement	Renewal	Energy used for operating the building	Water used for operating the building	Deconstruction / Demolition	Transport	Waste treatment	Landfilling	Reuse, recovery or recycling potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	MND	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	X

ENVIRONMENTAL EFFECTS OF THE LIFE CYCLE ASSESSMENT: 1 m² AESTUVER

		Production	Installation	Credit
Parameter	**Unit**	**A1-A3**	**A5**	**D**
GWP	[kg CO_2 equiv.]	10.0	1.59	-0.69
ODP	[kg CFC11 equiv.]	5.46E-07	3.95E-10	-2.40E-08
AP	[kg SO_2 equiv.]	2.49E-02	3.38E-04	-6.35E-04
EP	[kg PO_4^{3-} equiv.]	3.91E-03	9.06E-05	-8.22E-05
POCP	[kg ethene equiv.]	2.04E-03	2.84E-05	-7.14E-05
ADPE	[kg Sb equiv.]	3.17E-05	1.44E-08	-4.35E-08
ADPF	[MJ]	99.5	0.68	-10.69

GWP = Global Warming Potential; ODP = Ozone Depletion Potential of the stratospheric ozone layer; AP = Acidification Potential of soil and water; EP = Eutrification Potential; POCP Photochemical Ozone Creation Potential; ADPE = Abiotic Depletion Potential of non-fossil resources; ADPF = Abiotic Depletion Potential of fossil fuels

ENVIRONMENTAL EFFECTS OF THE LIFE CYCLE ASSESSMENT: 1 m² AESTUVER T

		Production	Installation	Credit
Parameter	**Unit**	**A1-A3**	**A5**	**D**
GWP	[kg CO_2 equiv.]	9.4	0.91	-0.39
ODP	[kg CFC11 equiv.]	4.83E-07	2.25E-10	-1.37E-08
AP	[kg SO_2 equiv.]	2.19E-02	1.93E-04	-3.62E-04
EP	[kg PO_4^{3-} equiv.]	3.11E-03	5.17E-05	-4.69E-05
POCP	[kg ethene equiv.]	1.87E-03	1.62E-05	-4.07E-05
ADPE	[kg Sb equiv.]	1.32E-05	8.18E-09	-2.48E-08
ADPF	[MJ]	91.6	0.39	-6.09

GWP = Global Warming Potential; ODP = Ozone Depletion Potential of the stratospheric ozone layer; AP = Acidification Potential of soil and water; EP = Eutrification Potential; POCP Photochemical Ozone Creation Potential; ADPE = Abiotic Depletion Potential of non-fossil resources; ADPF = Abiotic Depletion Potential of fossil fuels

LIFE CYCLE ASSESSMENT RESULTS - USE OF RESOURCES: 1 m² AESTUVER

		Production	Installation	Credit
Parameter	**Unit**	**A1-A3**	**A5**	**D**
PERE	[MJ]	20.9	-	-
PERM	[MJ]	0.00E+00	-	-
PERT	[MJ]	20.9	2.07E-03	-3.04E-01
PENRE	[MJ]	118.95	-	-
PENRM	[MJ]	0.00E+00	-	-
PENRT	[MJ]	118.95	6.94E-01	-11.54
SM	[kg]	4.99	-	-
RSF	[MJ]	1.92	0	0
NRSF	[MJ]	6.46	0	0
FW	[m³]	0.06	1.46E-03	-1.57E-03

PERE = Regenerative primary energy as an energy carrier; PERM = Regenerative primary energy for material usage; PERT = Total regenerative primary energy; PENRE = Non-regenerative primary energy as an energy carrier; PENRM = Non-regenerative primary energy for material usage; PENRT = Total non-regenerative primary energy; SM = Use of secondary materials; RSF = Regenerative secondary Fuels; NRSF = Non-regenerative secondary fuels; FW = Use of fresh water resources

LIFE CYCLE ASSESSMENT RESULTS - USE OF RESOURCES: 1 m² AESTUVER T

		Production	Installation	Credit
Parameter	**Unit**	**A1-A3**	**A5**	**D**
PERE	[MJ]	10.3	-	-
PERM	[MJ]	0.00E+00	-	-
PERT	[MJ]	10.3	1.18E-03	-1.73E-01
PENRE	[MJ]	108.76	-	-
PENRM	[MJ]	0.00E+00	-	-
PENRT	[MJ]	108.76	3.96E-01	-6.58
SM	[kg]	0.00E+00	-	-
RSF	[MJ]	1.92	0	0
NRSF	[MJ]	6.46	0	0
FW	[m³]	0.05	8.30E-04	-8.93E-04

PERE = Regenerative primary energy as an energy carrier; PERM = Regenerative primary energy for material usage; PERT = Total regenerative primary energy; PENRE = Non-regenerative primary energy as an energy carrier; PENRM = Non-regenerative primary energy for material usage; PENRT = Total non-regenerative primary energy; SM = Use of secondary materials; RSF = Regenerative secondary Fuels; NRSF = Non-regenerative secondary fuels; FW = Use of fresh water resources

LIFE CYCLE ASSESSMENT RESULTS - OUTPUT FLOWS AND WASTE CATEGORIES: 1 m² AESTUVER				
		Production	Installation	Credit
Parameter	**Unit**	**A1-A3**	**A5**	**D**
HWD*	[kg]	-	-	-
NHWD	[kg]	25.89	0.01	-0.85
RWD	[kg]	6.82E-03	4.80E-06	-3.01E-04
CRU	[kg]	-	-	0
MFR	[kg]	-	-	0
MER	[kg]	-	-	0
EE electricity	[MJ]	-	0.84	-
EE heat	[MJ]	-	8.70	-
HWD = Hazardous waste for landfilling; NHWD = Non-hazardous disposed of waste; RWD = Radioactive disposed of waste; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EE = Exported energy per type				

LIFE CYCLE ASSESSMENT RESULTS - OUTPUT FLOWS AND WASTE CATEGORIES: 1 m² AESTUVER T				
		Production	Installation	Credit
Parameter	**Unit**	**A1-A3**	**A5**	**D**
HWD*	[kg]	-	-	-
NHWD	[kg]	23.49	0.01	-0.48
RWD	[kg]	6.02E-03	2.74E-06	-1.71E-04
CRU	[kg]	-	-	0
MFR	[kg]	-	-	0
MER	[kg]	-	-	0
EE electricity	[MJ]	-	0.48	-
EE heat	[MJ]	-	4.96	-
HWD = Hazardous waste for landfilling; NHWD = Non-hazardous disposed of waste; RWD = Radioactive disposed of waste; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EE = Exported energy per type				

*In accordance with DIN EN 15804, hazardous waste for landfilling is modelled to the end of the respective waste feature.

6 LCA: Interpretation

In the manufacture (Modules A1-A3) of 1 m² AESTUVER, the use of non-regenerative primary energy (PENRT) is 119 MJ/m² and 103 MJ/m² for AESTUVER T. Additionally, another 21 MJ/m² of regenerative primary energy is used for AESTUVER in Modules A1-A3 and an additional 10 MJ/m² for AESTUVER T. In the manufacture of fire-resistant boards, the use of energy carriers in the plant in the form of electricity and thermal energy dominates the PENRT with about 32-35%. Preliminary production of the glass fibres and the cement contained therein continue to play a determining role accounting for 20 to 22% of the PENRT. A further 14 to 21% is attributable to the manufacture of foam granulate.

The use of regenerative primary energy is primarily determined by the wooden pallets used and in turn attributable to the requisite solar energy for biomass growth.

In addition to the primary energy referred to, secondary fuels – both regenerative and non-regenerative – are also used in the manufacture of fire-resistant boards. They can be almost entirely attributed to the upstream chain of cement manufacturing.

Between 0.05 and 0.06 m³ water are required (Modules A1-A3) for the manufacture of 1m² AESTUVER and AESTUVER T, including the upstream chains. Approx. 25% is required in the upstream chains for cement production and 30% is attributable to the provision of plant electricity. Between 25 and 40% can be attributed to the direct water requirements in the plant for binding the cement.

An evaluation of the waste volume incurred indicates that non-hazardous waste represents the largest percentage during the manufacture of fire-resistant boards. Excavated waste is primarily incurred in the upstream chain associated with cement production (42-46%) and the generation of electricity (30-33%), especially in recovering energy carriers. Radioactive waste is exclusively incurred in generating electricity in nuclear power plants.

When considering the environmental impacts of AESTUVER fire-resistant boards, the primary apparent influence concerns cement production, followed by preliminary production of glass fibres and foam glass. More than 56% of the greenhouse gases emitted within Modules A1-A3 are incurred during the production of cement. Cement production also makes a primary contribution towards EP, AP and POCP with values ranging from 33% to 38%. During the production of cement clinker, carbon dioxide, carbon monoxide and nitrogen oxide arise which have a significant influence on the environmental effects. The share by glass fibre manufacture as regards EP, AP and POCP in Modules A1-A3 ranges between 24 and 30% while foam glass accounts for 12 to 21%. When considering the ADPE, manufacture of foam glass incurs a value of approx. 58%. This is particularly attributable to the requirements of sodium chloride in the upstream chains.

When considering the environmental impacts of AESTUVER T fire-resistant boards, the primary apparent influence concerns cement production as well as preliminary production of glass fibres. 56% of the greenhouse gases emitted within Modules A1-A3 are incurred during the production of cement. Cement production also makes a primary contribution towards EP, AP and POCP with values ranging from 38% to 45%. The share by glass fibre manufacture as regards EP, AP and POCP in Modules A1-A3 ranges between 26 and 34%. When considering the ADP (elementary), manufacture of foam glass incurs a value of approx. 76%. This is particularly attributable to the requirements of plaster in cement clinker production.

7 Requisite evidence

7.1 Leaching

Measuring agency: IBR Institut für Baubiologie Rosenheim GmbH, Rosenheim; measurement report: Report no. 4012-101 & -102 Eluate analysis to DIN 38414, Part 4

Measurement results: Apart from the copper value, the /IBR 2012/ measured values fall below the permissible limit values. The copper value measures leads to classification in Z 1: limited open installation in accordance with LAGA. All eluate values measured are below the permissible limit values. No burdens by the substances tested can be anticipated.

[mg/kg] TS	AESTUVER	AESTUVER T
Arsenic (As)	7	3
Cadmium (Cd)	< 0.2	< 0.2
Cobalt (Co)	6	5
Chrome (Cr)	40	52
Copper (Cu)	92	100
Iron (Fe)	12200	15000
Mercury (Hg)	< 0.1	< 0.1
Manganese (Mn)	210	275
Nickel (Ni)	26	26
Lead (Pb)	25	15
Antimony (Sb)	< 1	< 1
Tin (Sn)	10	15
Zink (Zn)	140	105

7.2 VOC emissions

Measuring agency: MPA für das Bauwesen, 38106 Braunschweig, tested for the eco-Institut Label, eco Institut GmbH, Cologne; test report no. 32071-006 dated 10 August 2011; measurement results: Test process in accordance with the AgBB scheme

[µg/m³]	AESTUVER	AESTUVER T
$TVOC_{3d}$	8	8
KMR-VOC_{3d} (incl. VVOC and SVOC)	< 1	< 1
$TVOC_{28d}$	n.n.	n.n.
$TSVOC_{28d}$	n.n.	n.n.
R (dimensionless)	0	0
VOC excl. NIK	n.n.	n.n.

7.3 Radioactivity

Measuring agency: IBR Institut für Baubiologie Rosenheim GmbH, D-83022 Rosenheim;

Measurement report: Report nos. 4012-101 & 4012-102

Measurement results:

[Bq/kg]	^{212}Pb	^{214}Pb	^{40}K	^{131}I	^{134}Cs	^{137}Cs
A	31.2	64	307.7	< 0.6	< 0.7	< 0.7
A T	17.5	42	259	< 0.5	< 0.6	< 0.7

A. – AESTUVER A T. – AESTUVER T

An ACI value of 0.47 was established for AESTUVER and 0.31 for AESTUVER T. Artificial radioactivity by Chernobyl or overground atom bomb tests during the 1960s could not be established in the sample examined. The product examined complies with the official guideline value of A < 1 as well as test conditions A < 0.75 of the IBR and the stringent standard of the Munich Environment Institute of ACI < 0.5.

8 References

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IBR 2012

Institut für Baubiologie Rosenheim GmbH, report nos. 4012-101 and 4012-102 based on the "Tested and recommended by IBR" test stamp, including radioactivity and eluate analysis, Rosenheim, 2012

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