ENVIRONMENTAL PRODUCT DECLARATION

as per ISO 14025 and EN 15804

Owner of the Declaration	**Pittsburgh Corning Europe NV**
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-PCE-20150041-IBA1-EN
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Valid to	18.08.2020

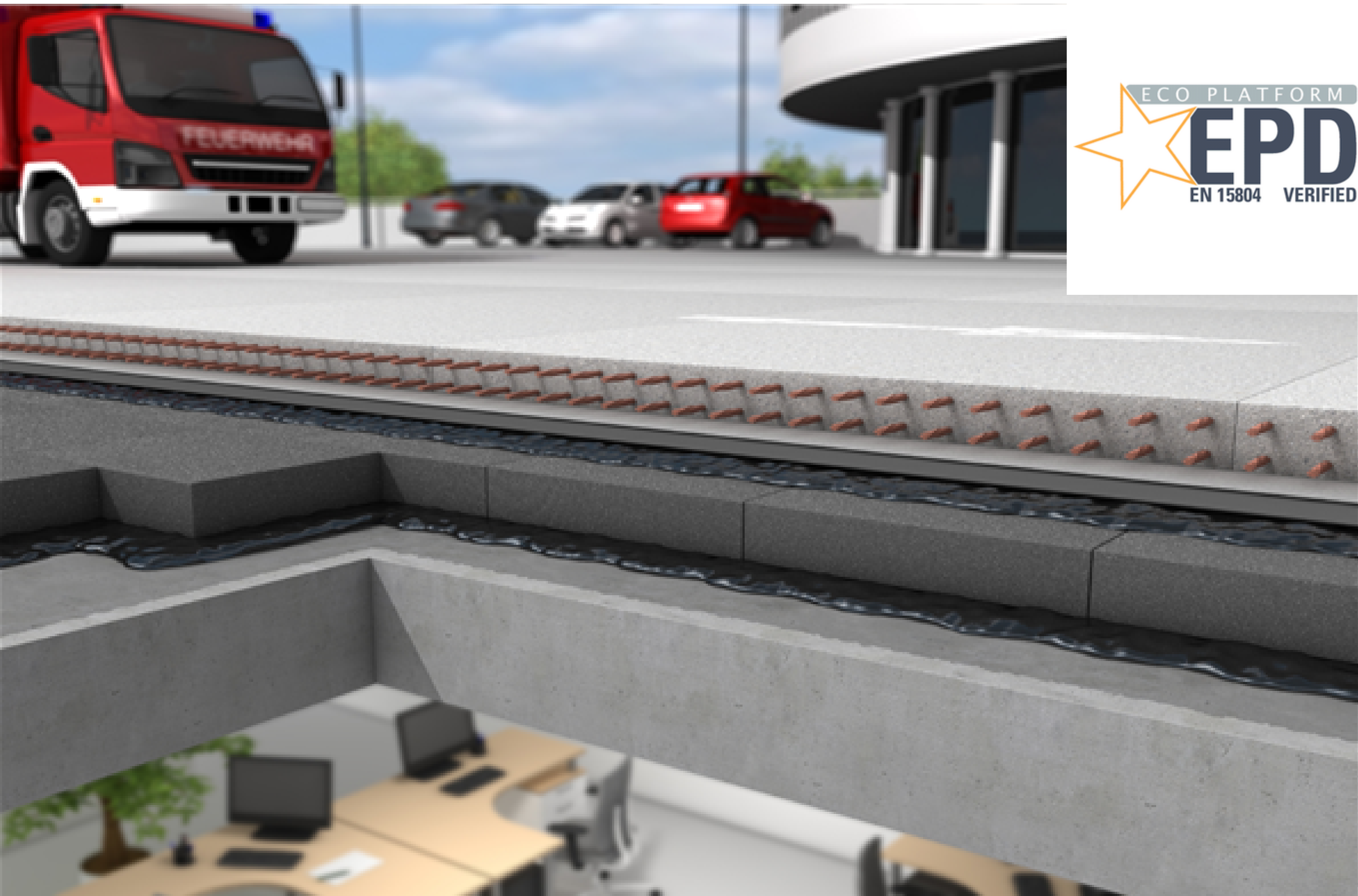
FOAMGLAS® F

Pittsburgh Corning Europe NV

Institut Bauen und Umwelt e.V.

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

ECO PLATFORM EPD EN 15804 VERIFIED



1. General Information

Pittsburgh Corning Europe NV	FOAMGLAS® F
Programme holder IBU - Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin Germany	**Owner of the Declaration** Pittsburgh Corning Europe NV Albertkade 1 B-3980 Tessenderlo Belgien
Declaration number EPD-PCE-20150041-IBA1-EN	**Declared product / Declared unit** 1 kg unclad, uncoated **FOAMGLAS® F cellular glass insulation material**
This Declaration is based on the Product Category Rules: Mineral insulating materials, 07.2014 (PCR tested and approved by the SVR)	**Scope:** This document refers to the production of 1 kg uncoated "**FOAMGLAS® F**" cellular glass manufactured in Belgium at the Tessenderlo production facility of Pittsburgh Corning Europe NV. The environmental impacts of the coated product "**FOAMGLAS® F**" are to be assessed with the help of a markup factor in the amount of 13%. This document is translated from the German Environmental Product Declaration into English. It is based on the German original version EPD-PCE-20150041-IBA1-DE. The verifier has no influence on the quality of the translation. 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.
Issue date 19.08.2015	
Valid to 18.08.2020	
Prof. Dr.-Ing. Horst J. Bossenmayer (President of Institut Bauen und Umwelt e.V.)	**Verification** The CEN Norm /EN 15804/ serves as the core PCR Independent verification of the declaration according to /ISO 14025/ ☐ internally ☒ externally
Dr. Burkhart Lehmann (Managing Director IBU)	Matthias Schulz (Independent verifier appointed by SVR)

2. Product

2.1 Product description

FOAMGLAS® is an insulating material made of foamed glass for building construction and industrial installations. It is used to manufacture dimensionally-accurate slabs, boards, pipe shells, segments and other special elements.

FOAMGLAS® slabs and elements are largely manufactured from high-quality recycled glass (e.g. windscreens) and mineral base materials such as sand and without the use of binding agents. They display a closed-cell structure. The product **FOAMGLAS® F** is declared with a gross density of 165 kg/m³ (± 15 %).

The products are supplied in thicknesses of 40 mm to 160 mm, e.g. as slabs with high compressive strength. The use of coated or uncoated **FOAMGLAS®** is application-dependent. The uncoated slab is frequently used for interior insulation, and then coated with various types of plaster.

For roofs, **FOAMGLAS®** is either coated with hot bitumen before the waterproofing membranes are applied, or special boards are used, for example **FOAMGLAS®** READY BOARD. This ex-works coating is a thin bitumen coating combined with foil or non-woven fabric.

The products by **Pittsburgh Corning Europe NV** are produced in the Tessenderlo plant (Belgium).

2.2 Application

FOAMGLAS® insulation material is used for the entire building envelope.

• All types of application comply with DIN4108 or other local application guidelines for roofs, walls, ceilings, perimeters and other special applications.
• Building equipment (air ducts, cold water systems, conduits)
• Technical insulation (insulation of pipes, containers, tanks and equipment)
• Fire protection (fire protection upgrades for walls, connections and pipe ducts)

2.3 Technical Data

Structural data

Name	Value	Unit
Thermal conductivity (DIN EN	0.05	W/(mK)

13167)		
Calculation value for thermal conductivity Only valid for Germany (acc. to general building inspection approval)	0.052	W/(mK)
Water vapour diffusion resistance factor (DIN EN ISO 10456)	infinite	-
Water vapor diffusion equivalent air layer thickness	40000	m
Sound absorption coefficient	-	%
Gross density (DIN EN 13501-1)	165	kg/m³
Compressive strength (DIN EN 826)	1600	N/mm²
Reaction to fire (DIN EN 13501-1)	non-combustible A1	
Melting point (DIN 4102-17)	> 1.000	°C

The specification of the sound absorption coefficient is irrelevant for the product FOAMGLAS®.

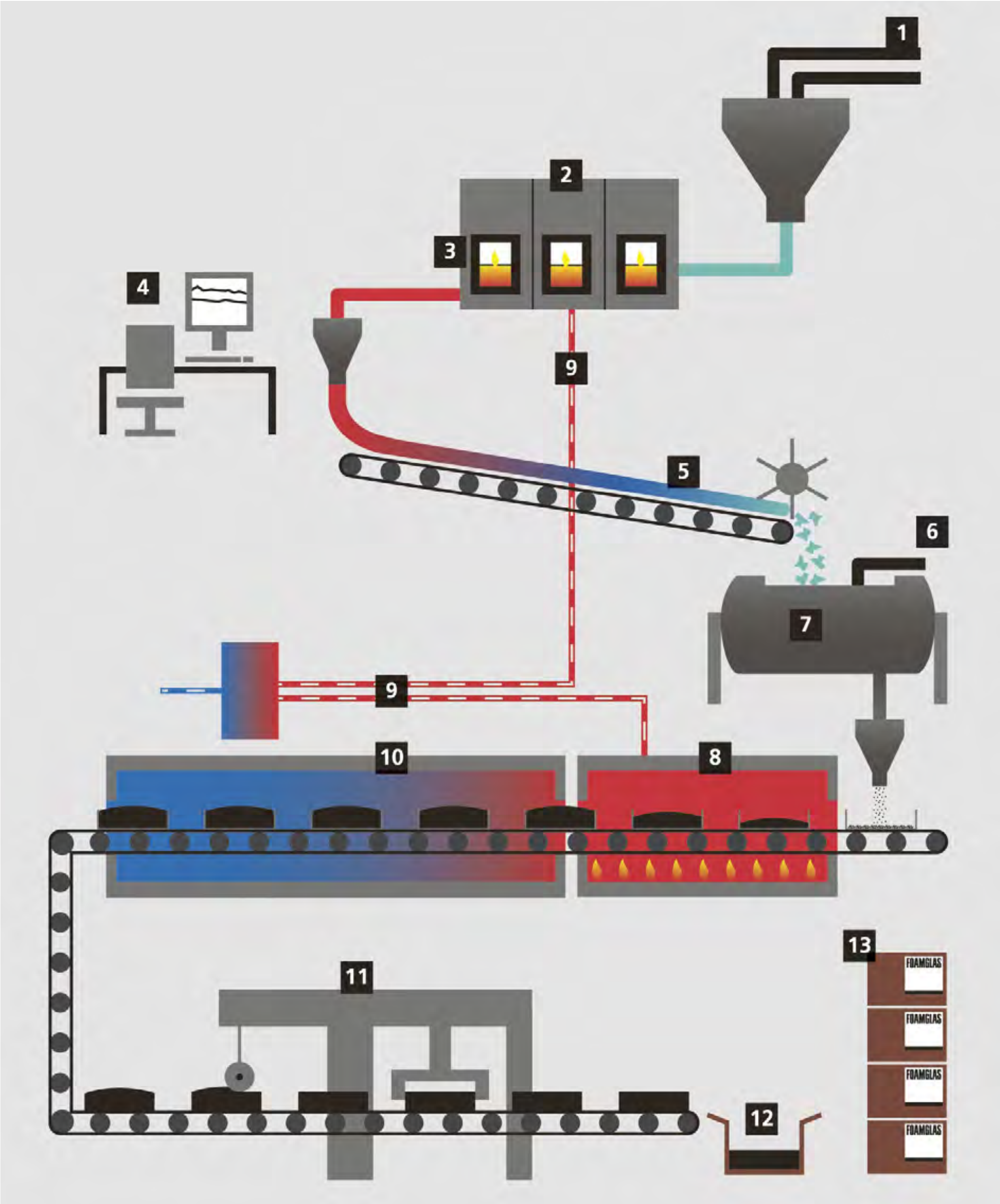
2.4 Placing on the market / Application rules
Directive (EU) No. 305/2011 of 9 March 2011 applies for placing the product on the market in the EU/EFTA. The products require a Declaration of Performance taking account of the harmonised European Standard DIN EN 13167:2013-03 and CE marking.
For use, the respective national regulations apply, in Germany the general building inspection approval of the DIBt for **FOAMGLAS®** insulation materials by **Deutsche FOAMGLAS® GmbH** No. Z-23.15-1403.

2.5 Delivery status
FOAMGLAS® F slabs are available in the following dimensions: 600 x 450 mm, 300 x 450 mm . Board thickness: 40 – 160 mm. Gross density: 165 kg/m³
Other dimensions available on request

2.6 Base materials / Ancillary materials
Average composition of
FOAMGLAS® F

Description Value Unit
Recycled glass ≥ 60 % by weight
Feldspar ≤ 20 % by weight
Sand ≤ 15 % by weight
Soda (disodium carbonate) ≤ 10 % by weight
Ferric oxide ≤ 5 % by weight
Sodium nitrate ≤ 1 % by weight
Sodium sulphate ≤ 1 % by weight
Carbon ≤ 1 % by weight
FOAMGLAS® consists of naturally occurring mineral base materials. An auxiliary material is used for the process, e.g. aluminium hydroxide (≤1%).

2.7 Manufacture
A first step involves weighing, crushing and mixing the raw materials followed by melting at 1250 °C in the electrode furnace. Using electrical energy for melting guarantees a homogeneous melt.
Once the melt has cooled, the glass is finely ground in ball mills with the aid of corundum cylinders. Some of the recycled glass used can be ground and foamed directly without necessarily being melted first. It is combined with the pretreated powder mixture and poured into foaming moulds made of stainless steel. The mixture then runs through a foaming process at 850 °C followed by a controlled cooling process. Stressless cooling is followed by cutting and packing.
Production process:



1 Mixing and batching of the raw materials: Recycled glass, feldspar, sodium carbonate, iron oxide, manganese oxide, sodium sulphate, sodium nitrate.
2 The melting furnace has a constant temperature of 1250°C.
3 Molten glass is drawn out of the furnace.
4 Control room for monitoring the production.
5 The glass is drawn off and falls onto the conveyor band where it cools down before entering the ball mill.
6 Addition of "carbon black".
7 Ball mill grinds all ingredients into a fine powder before putting them into stainless steel moulds.
8 The filled moulds pass through a cellulating oven (foaming furnace) with a temperature of 850°C. This is where the material gains its unique cell structure.
9 Energy recovery of heat.
10 The FOAMGLAS® blocks pass through an annealing oven to allow carefully controlled cooling without thermal stress.
11 The blocks are cut to size and sorted by batch. Production waste is recycled.
12 FOAMGLAS® slabs are then packaged, labelled and palletized.
13 Finished FOAMGLAS® products are stored and prepared for transport.

Quality assurance:
Quality is assured through internal and external monitoring. The product complies with the Declaration of Performance. It also bears the CEN Keymark certificate in accordance with DIN EN 13167 and DIN EN 13172.

Electricity requirements are fully guaranteed by purchasing a certified electricity mix from hydropower plants.

2.8 Environment and health during manufacturing

During the entire manufacturing process, no other health protection measures extending beyond the legally specified industrial protection measures for commercial enterprises.
Health and safety management in accordance with BS OHSAS 18001:2007

Environmental protection during manufacturing:
Water/Soil:
Water incurred during manufacturing and plant cleaning is treated mechanically in a waste water treatment system on the plant site and re-used in the production process. Waste water corresponds with the local specifications and the low Al2O3 suspended particles contained in the waste water support waste water cleaning.
Noise:
The noise emissions into the environment by production equipment fall short of the permissible limit values.
The requirements concerning quality management, environmental management and
energy management are complied with:

(DIN EN ISO 9001:2008-12, DIN EN ISO 14001:2009-11, DIN EN ISO 50001:2011-12)

2.9 Product processing/Installation

Recommendations on product processing depend on the respective product and system and are outlined in the respective documentation and data sheets (available at www.foamglas.com).
The product does not contain any concentrations of substances known to be hazardous to health. Dust incurred during sawing is inert and non-crystalline.

Depending on requirements, **FOAMGLAS®** elements are applied dry or using mineral or bituminous adhesives.

The insulating slabs are staggered and butt-joined with or without glue. The professional liability associations' rules apply. When applying the products under review, conventional industrial protection measures must be observed in accordance with information supplied by the manufacturer.

According to the present state of knowledge, hazards for water, air and soil cannot arise if **FOAMGLAS®** is applied as designated.

2.10 Packaging

Re-usable wooden pallets, PE shrink foil and cardboard elements serve as packaging material. Packaging material (PE foil and cardboard) is disposed of on the building site. Thermal utilisation takes place.

2.11 Condition of use

Material composition does not alter during use. **FOAMGLAS®** products can be used practically indefinitely when used as designated. They are impervious to moisture, pests, acids and chemicals.

2.12 Environment and health during use

Ingredients: No particular features regarding the material composition for the period of use. In accordance with official emission measurements for indoor air,
FOAMGLAS® is an insulating material which does not display VOC (volatile organic compounds) or carcinogenic emissions after 3 and 28 days (see section 7.2) according to the German Committee for the Health-Related Evaluation of Building Products (AgBB scheme). (emissions test as per DIN EN ISO 16000-6/9).

2.13 Reference service life

When used as designated, the service life of **FOAMGLAS®** products is unlimited in accordance with current scientific findings and is solely limited by the service life of the components and/or building as a whole.
The closed-cell structure of **FOAMGLAS®** prevents the insulation material from absorbing any water.
Insulation performance remains without restriction throughout the entire service life. The insulation products are impervious to moisture, pests, acids and chemicals.
Influences on ageing when the recognised rules of technology are applied.

Influences on ageing when applied in accordance with the rules of technology

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2.14 Extraordinary effects

Fire
FOAMGLAS® is classified as Euro class A1 in accordance with
DIN EN 13501-1:2010-01 and building material class A1 as per DIN 4102-1:1998-05.
Class A1 building products do not display any hazard potential regarding smoke development, flammability or burning drips.
The melting temperature of **FOAMGLAS®** insulating slabs is above 1000 °C (DIN 4102-17) and the maximum application limit temperature is approx. 430 °C.

Fire protection

Name	Value
Building material class / Euro class	A1
Burning droplets	No
Smoke gas development	No

Water
Thanks to its closed-cell structure, exposure to moisture cannot impair the insulating properties of **FOAMGLAS®**. Even when exposed to water over long periods of time (e.g. floods), the insulating material remains intact. In accordance with the general building inspectorate approval (Z-23.5-103), **FOAMGLAS®** remains functional over the long term even when exposed to pressing water at an immersion depth of up

to 12 metres. **FOAMGLAS®** does not represent an environmental hazard, even when exposed to water for longer periods of time (please refer to section 7.1 Eluate test).

Mechanical destruction
FOAMGLAS® is extremely resilient in all respects, and there is no risk of mechanical destruction if used as designated. It does not represent any environmental hazards thanks to its mineral composition. See Material Safety Data Sheets (MSDS) for **FOAMGLAS®** and natureplus certificate.

2.15 Re-use phase

When sorted, the declared products can be re-ground and re-used as additives in the manufacture of **FOAMGLAS®** (material recycling). Otherwise sorted products - even those still bearing adhesive - are suitable for re-use as filling material in civil engineering, road construction or for sound barriers, for example (material recycling).

2.16 Disposal

Where the recycling options referred to above are not practical, foam glass residue incurred on the construction site as well as residue from de-construction can be easily deposited without preliminary treatment in Class I landfills thanks to their non-leaching mineral components. Packaging can be utilised thermally. The waste code number as per the List of Wastes Ordinance (AVV)□for **FOAMGLAS®** (uncontaminated) is 17 06 04. In conjunction with bituminous waterproofing substances and adhesives, waste code number 17 09 04 applies for unsorted waste.

2.17 Further information

Further information on **FOAMGLAS®** insulating materials is available online on the manufacturer's website: www.foamglas.com.

3. LCA: Calculation rules

3.1 Declared Unit

The Declaration refers to the life cycle of 1kg **FOAMGLAS® F.** The gross density of the product is 165 kg/m³.

Declared unit

Name	Value	Unit
Declared unit	1	kg
Gross density	165	kg/m³

3.2 System boundary

Type of EPD: cradle to gate
The LCA addresses the life cycle stage of production. The product stage comprises Modules A1 (Raw material supply), A2 (Transport) and A3 (Production).
The following individual processes were included in the product stage **A1–A3** of production:
· Processes for providing preliminary products and energy
· Transporting the raw materials and preliminary materials to the plant
· Manufacturing process in the plant including energy-related expenses, disposal of residual materials and emissions
· Production of packaging
The packaging material volumes considered involve annual consumption / annual purchase volumes.

Module A4 takes account of transportation to the construction site. The utilisation of the packaging materials is assigned to Module **A5**.
Environmental effects caused by installation losses are not included in the LCA results, since these depend on the construction project and thus vary. To calculate the additional environmental burdens caused by the production and disposal of these installation losses, the LCA results for a specific installation loss can be calculated (e.g. installation loss 3%, multiplication of the LCA results by 1.03).
Landfilling with residual materials is assigned to Module **C4**.
Credits based on the thermal utilisation of the residual materials are assigned to Module **D**.

3.3 Estimates and assumptions

In the product system, external cullet or waste glass is used as a neutral preliminary product within the framework of the LCA. This recycled glass is regarded as a waste product and is therefore calculated as input without loads.
According to **Pittsburgh Corning Europe NV**, the average transportation distance was defined as 350 km.

3.4 Cut-off criteria

All operating data was taken into consideration in the analysis. Processes whose entire contribution towards the final manufacturing result in terms of mass and less than 1% were ignored.
It can be assumed that the processes ignored would each have contributed less than 5 % to the impact categories under review.
Machinery, plants and infrastructure required in the manufacturing process were not considered.

3.5 Background data

"**GaBi 6**" - the software system for comprehensive analysis (GaBi 6) developed by **thinkstep AG** - was used to model the **FOAMGLAS®** life cycle. The data sets contained in the GaBi data base are documented in the online GaBi documentation (GaBi 6 Doku). The basic data in the GaBi data base was applied for energy, transport, preliminary products and auxiliaries. No data records from other data bases were used. The Life Cycle Assessment was drawn up for Belgium as a reference area. This means that apart from the production processes under these marginal conditions, the upstream stages also of relevance for Belgium such as provision of energy carriers were used.
Pittsburgh Corning Europe NV procures electricity from Norwegian run-of-river power stations, for which the hydropower mix for 2009 was used.

3.6 Data quality

All of the background data sets of relevance for the LCA were taken from the **GaBi 6 software data base**. The background data used for the LCA was last revised less than 4 years ago.

Pittsburgh Corning Europe NV supplied current primary production data for 2013. This production data was examined for plausibility. According to the manufacturer, there is very good representativity of the declared product.
The corresponding data sets were available in the data base for al preliminary products used. The data quality can be regarded as very good.

3.7 Period under review

The data in this LCA are based on primary data on **FOAMGLAS® F** production in 2013 supplied by **Pittsburgh Corning Europe NV**. The volumes of raw materials, energy, auxiliaries and consumables used are considered as average annual values.

3.8 Allocation

The plastic waste incurred is burned in a waste incineration plant. It is modelled in an input-specific manner in the model, whereby any emissions incurred are taken consideration of in the model (Module A3). In line with its elementary composition and ensuing calorific values, thermal utilisation used as input is calculated in Module A3.
The energy resulting from the utilisation of plastic waste in Module A5 is credited in Module D.
First the weight of input consumed and output generated is recorded in the plant. These production data are then offset against the sales figures of the individual products by multiplying the cubic metres sold by the density of the product. Accordingly, allocation by weight was used.

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

Transport to construction site (A4)

Name	Value	Unit
Litres of fuel	1.1	l/100km
Transport distance	350	km
Capacity utilisation (including empty runs)	85	%

Construction installation process (A5)

Name	Value	Unit
Output substances following waste treatment on site (Paper)	0.0041	kg
Output materials following waste treatment on the building site (Plastic)	0,0045	kg

End of life (C1-C4)

Name	Value	Unit
Collected separately (cellular glass)	1	kg
Landfilling (cellular glass)	1	kg

Re-use, recovery and recycling potential (D), relevant scenario information

Name	Value	Unit
Thermal utilisation of plastic from the packaging	0,0062	kg

5. LCA: Results

The environmental impacts of the coated product "**FOAMGLAS® F**" are to be assessed with the help of a plus-factor in the amount of 13%. This plus- factor was calculated on the basis of the GWP and PENRT. This can therefore be relatively safely used for GWP and PENRT. There may be greater uncertainty with the other indicators. Environmental effects caused by installation losses are not included in the LCA results, since these depend on the construction project and thus vary. To calculate the additional environmental burdens caused by the production and disposal of these installation losses, the LCA results for a specific installation loss can be calculated (e.g. installation loss 3%, multiplication of the LCA results by 1.03).

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

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

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT: 1 kg FOAMGLAS® F

Parameter	Unit	A1-A3	A4	A5	C4	D
Global warming potential	[kg CO_2-Eq.]	1.48E+0	1.68E-2	1.14E-2	1.35E-2	-5.02E-3
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	2.33E-11	8.04E-14	1.37E-14	1.84E-13	-5.86E-12
Acidification potential of land and water	[kg SO_2-Eq.]	3.17E-3	7.68E-5	2.79E-6	8.62E-5	-5.77E-6
Eutrophication potential	[kg $(PO_4)^{3-}$-Eq.]	3.89E-4	1.76E-5	2.23E-7	1.18E-5	-8.23E-7
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	2.48E-4	-2.48E-5	1.51E-7	8.09E-6	-8.03E-7
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	7.57E-6	6.33E-10	1.63E-9	5.10E-9	-3.60E-10
Abiotic depletion potential for fossil resources	[MJ]	2.24E+1	2.32E-1	5.29E-3	1.78E-1	-8.18E-2

RESULTS OF THE LCA - RESOURCE USE: 1 kg FOAMGLAS® F

Parameter	Unit	A1-A3	A4	A5	C4	D
Renewable primary energy as energy carrier	[MJ]	1.04E+1	9.13E-3	5.50E-4	1.54E-2	-4.91E-3
Renewable primary energy resources as material utilization	[MJ]	0.00E+0	-	-	-	-
Total use of renewable primary energy resources	[MJ]	1.04E+1	9.13E-3	5.50E-4	1.54E-2	-4.91E-3
Non-renewable primary energy as energy carrier	[MJ]	2.30E+1	2.32E-1	6.02E-3	1.86E-1	-1.13E-1
Non-renewable primary energy as material utilization	[MJ]	0.00E+0	-	-	-	-
Total use of non-renewable primary energy resources	[MJ]	2.30E+1	2.32E-1	6.02E-3	1.86E-1	-1.13E-1
Use of secondary material	[kg]	5.30E-1	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Use of renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Use of non-renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Use of net fresh water	[m³]	1.76E-2	6.44E-6	2.79E-5	-7.11E-4	-1.24E-5

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES: 1 kg FOAMGLAS® F

Parameter	Unit	A1-A3	A4	A5	C4	D
Hazardous waste disposed	[kg]	5.20E-4	5.29E-7	7.57E-7	8.36E-6	-1.02E-5
Non-hazardous waste disposed	[kg]	5.14E-2	2.92E-5	1.15E-3	1.00E+0	-2.67E-5
Radioactive waste disposed	[kg]	2.23E-4	3.04E-7	2.91E-7	3.25E-6	-1.24E-5
Components for re-use	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-
Materials for recycling	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-
Materials for energy recovery	[kg]	0.00E+0	0.00E+0	4.50E-3	0.00E+0	-
Exported electrical energy	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-2.19E-2
Exported thermal energy	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	-5.27E-2

6. LCA: Interpretation

The greatest contribution to the **Global Warming Potential (GWP, 100 years)** is made by the production phase (approx. 97 %) (Module A1-A3), The energy supply accounts for approx. 57 % of this (96 % of this through thermal energy). The manufacture of the preliminary products contributes approx. 32 % to the GWP. Approx. 6 % is attributable to the actual production stage and approx. 3 % to the production of the auxiliaries and packaging.

At 99 %, the **Ozone Depletion Potential (ODP)** is dominated by the production phase (Module A1-A3). Of this, 39 % can be attributed to the manufacture of the preliminary products (in particular ferric oxide with 51 %), 16 % to the production of the auxiliary materials (in particular aluminium hydroxide with 99 %), 25 % to the production of the packaging (in particular packaging paper with 72 %), and 25 % to the supply of energy.

The **Acidification Potential (AP)** is characterised 52 % by Module A1 (raw materials) and 42 % by Module A3 (production). In terms of raw materials, sodium carbonate has the greatest influence at approx. 50 %.

During the production of FOAMGLAS® F, energy consumption accounts for 19 % and the production of auxiliaries makes a contribution of 7 %.
The greatest contribution (62 %) to the **Eutrification Potential (EP)** is made by the provision of raw materials, especially sodium carbonate (approx. 63 %). 29 % of the entire EP is incurred during the production phase, whereby energy supply (98 % through thermal energy) makes a contribution of 24 %.
The **Photochemical Ozone Creation Potential (POCP)** is characterised 42 % by Module A1 (raw materials) and 62 % by Module A3 (production). In terms of raw materials, sodium carbonate has the greatest influence at 68 %. During the production of **FOAMGLAS® F**, energy consumption represents the primary influence at 51 % (99 % through thermal energy). Sulphur dioxide, carbon monoxide and the group of NMVOC in particular contribute to the POCP. Transport leads to a credit in terms of POCP. This is due to the fact that nitrogen monoxide emissions occurring during transport have a negative characterisation factor in the impact estimate as per CML 2001 – valid as at 2013. With the result that not only the credits are negative for the creation of photo oxidants but also the loads. Despite the apparently paradox results that more transports would lead to an increased number of credits, the model does not contain any errors here. Methods other than the one selected (CML 2010) for estimating the impact of POCP (e.g. ReCiPe) have avoided negative characterisation factors in order to facilitate interpretation of the results and set the nitrogen monoxide characterisation factor to zero.
The **Abiotic Depletion Potential (ADP elementary)** is largely (96 %) caused by Module A1 (raw materials), Approx. 55 % is attributable to the production of sodium sulphate and 38 % is accounted for by sodium carbonate.
The **Abiotic Depletion Potential (ADPF)** is primarily the result of the upstream chains in Module A3 (66 %). Approx. 61 % of the ADP fossil is caused by the use of energy (99 % through thermal energy). Approx. 31 % is attributable to production of the preliminary products.
The **Total primary energy requirements** are divided among non-renewable energy carriers (approx. 70 %) and renewable energy (approx. 30 %).
The **Total use of renewable primary energy sources (PERT)** is largely (94 %) the result of using electrical energy during the production process. This is necessitated by **Pittsburgh Corning Europe NV** procuring electricity from hydropower.
When considering the **Total of non-renewable primary energy sources (PENRT)**, the upstream chains associated with manufacturing preliminary products and the use of energy account for approx. 32 % and 62 %, respectively. Iron oxide, kaolin and sodium carbonate (each 30 %) are manufactured using non-renewable energy sources. During the actual production stage, 99 % of the energy used is accounted for by natural gas (thermal energy).

7. Requisite evidence

FOAMGLAS® eluate test
Eidgenössische Materialprüfungs- und Forschungsanstalt EMPA
Eluate test report for **FOAMGLAS®** No.123544A
Process: Testing **FOAMGLAS®** pieces in accordance with the TOW directive (Technical Ordinance on Waste). Test report No. 123544
Results:
Where the recycling options referred to above are not practical, **FOAMGLAS®** residue incurred on the construction site as well as residue from de-construction can be easily deposited without preliminary treatment in Class I landfills thanks to their non-leaching mineral components.
FOAMGLAS® emissions test
Process: Testing the product emissions in line with the AgBB/DIBt method (DIN EN ISO 16000-6/9).
(Test report by Bremer Umweltinstitut H3989 FM and Laboratoire EXCELL No. 2010-10-050-1.

Results:
In accordance with official emission measurements for indoor air, **FOAMGLAS®** is an insulating material which does not display VOC (volatile organic compounds) or carcinogenic emissions after 3 and 28 days according to the AgBB scheme.

8. References

PCR 2012, Part B: Guidelines for building-related products and services, Part B: Requirements to be met by the EPD for PCR Mineral Insulating Materials, Institut Bauen und Umwelt e.V., www.bau-umwelt.com, 2102-07, version 1.1
GaBi 6 2013: PE INTERNATIONAL AG; GaBi 6 software system and data base for comprehensive analysis. Copyright, TM. Stuttgart, Leinfelden-Echterdingen, 1992-2013.

GaBi 6 2013D: GaBi 6: GaBi 6 documentation: data sets from the data base for comprehensive analysis Copyright, TM Stuttgart, Leinfelden-Echterdingen, 1992-2013. http://documentation.gabi-software.com/
AgBB: Evaluation scheme for VOC from construction products; procedure for health-related evaluation of emissions of volatile organic compounds (VOC and SVOC) from construction products, valid as at July 2004

AVV: Ordinance on the List of Wastes dated 10 December 2011 (BGBI. IS.3379) last amended by Article 5, section 22 of the law of 24 February 2012 (BGBI.IS.212)
EU Directive 97/69: 1997-12:Directive 97/69/EC of the Commission on the 23rd adaptation of Directive 67/548/EEC by the Council for approximating the legal and administrative guidelines for classifying, packaging and marking hazardous substances in line with technical progress.

Ordinance on Hazardous Substances (GefStoffV): 26 November 2010, ordinance governing protection from hazardous substances
(EU) No. 305/2011 Construction products regulation for "Laying down harmonised conditions for the marketing of construction products and repealing Council Directive 98/106/EEC" of 9.3.2011 (published on 4.4.2011).
TA Air: 24 July 2002, First General Administrative Regulation Pertaining to the Federal Immission Control Act (Technical Instructions on Air Quality Control – "TA Luft")
TOW: Technical Ordinance on Waste (814-600) of 10 December 1990 (as per 1 July 2011)
Product and safety data sheets for **FOAMGLAS®** insulation materials offered by **Pittsburgh Corning Europe NV**, available online at www.foamglas.com

DIN EN ISO 14001:2009-11, Environmental management systems – Requirements with guidance for use (ISO 14001:2004 + Cor. 1:2009); German and English versions EN ISO 14001:2004 + AC:2009

DIN EN ISO 14040:2009-11, Environmental Management – Life Cycle Assessment – Principles and Framework; German and English versions EN ISO 14044:2006

DIN EN ISO 14044:2006-10, Environmental Management – Life Cycle Assessment – Requirements and Instructions; German and English versions EN ISO 14044:2006
DIN EN ISO 16000-6:2012-11, Indoor air - Part 6: Determination of volatile organic compounds in indoor and test chamber air by active sampling on Tenax TA® sorbent, thermal desorption and gas chromatography using MS or MS-FID (ISO 16000-6:2011)

DIN EN ISO 50001:2011-12, Energy management systems – Requirements with guidance for use (ISO 50001:2011) The general aim of this standard is to support organisations in establishing systems and processes necessary to improve their energy performance.

DIN EN ISO 9001:2008-12, Quality management systems - Requirements; trilingual version EN ISO 9001:2008

DIN EN 826:1996-05, Thermal insulating products for building applications - Determination of compression behaviour; German version EN 826:1996

DIN EN 13501-1: 2010-01, Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests; German version EN 13501-1:2007 + A1:2009

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

DIN EN 13167:2013-03, Thermal insulation products for buildings - Factory-made cellular glass (CG) products

DIN 1602:1997-01, Thermal insulating products for building applications - Determination of the apparent density; German version EN 1602:1996

DIN 4102-1:1998-05, Fire behaviour of building materials and building components - Part 1: Building materials; concepts, requirements and tests

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 EN ISO 10456: 2010-05: Building materials and products - Hygrothermal properties - Tabulated design values and procedures for determining declared and design thermal values

DIN EN 12457-4:2003-01, Characterisation of waste – Leaching; Compliance test for leaching of granular waste materials and sludges - Part 4: One-stage batch test at a liquid-to-solid ratio of 10 l/kg for materials with particle size below 10 mm (without or with limited size reduction); German version EN 12457-4:2002

BS OHSAS 18001:2007 Occupational health and safety - Management systems - Requirements.
General principles
General Principles for the EPD range of Institut Bauen und Umwelt e.V. (IBU), 2013-04
Product Category Rules for Construction Products, Part A: Calculation rules for the Life Cycle Assessment and requirements on the Background Report, 2014-12
Technical approval:
Z-23.15-1403: 2014-06, General Building Inspection Approval by DIBt for **FOAMGLAS®** insulation materials by **Deutsche FOAMGLAS® GmbH**.
Certificates and documented evidence:
natureplus certificate: The products **FOAMGLAS® W+F, FOAMGLAS® T4+, FOAMGLAS® S3** and **FOAMGLAS® F** have been successfully tested. Certificate number 0406-1101-1
Test report by Bremer Umweltinstitut H3989 FM, Part 1 of March 2011. Testing the product emissions in accordance with the AgBB/DIBt method.
Test Report by Laboratoire EXCELL No. 2010-10-050-1 of May 2011. Testing the product emissions.
Eluate test EMPA: Eidgenössische Materialprüfungs- und Forschungsanstalt EMPA. Test report **FOAMGLAS®** Eluate test No. 123544A

Institut Bauen und Umwelt
Institut Bauen und Umwelt e.V., Berlin(pub.): Generation of Environmental Product Declarations (EPDs);

General principles
for the EPD range of Institut Bauen und Umwelt e.V. (IBU), 2013/04
www.bau-umwelt.de

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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