B-EPD ENVIRONMENTAL PRODUCT DECLARATION

Pittsburgh Corning Europe
FOAMGLAS® T3+

FOAMGLAS® T3+ (density=95 kg/m³) for thermal insulation of 1m² of building perimeters, facades, roofs and ceiling - thermal resistance (R-value) of 1 (m²·K/W) - thickness of 3.6 cm - life span of 100 years

Issued 30.10.2020
Valid until 30.10.2025

Third party verified
Conform to EN 15804+A2, NBN/DTD B08-001 and ISO14025

Modules declared (cradle to grave)					
A123	A4	A5	B	C	D
●	●	●	●	●	●

[B-EPD n° 200010_001_EN]

OWNER OF THIS ENVIRONMENTAL PRODUCT DECLARATION
Pittsburgh Corning Europe NV/SA

EPD PROGRAM OPERATOR
Federal Public Service of Health, Food Chain Safety and Environment
www.b-epd.be

The intended use of this EPD is to communicate scientifically based environmental information for construction products, for the purpose of assessing the environmental performance of buildings. This EPD is only valid when registered on www.b-epd.be. The FPS Public Health cannot be held responsible for the information provided by the owner of the EPD.

PRODUCT DESCRIPTION

PRODUCT NAME

FOAMGLAS® T3+

PRODUCT DESCRIPTION AND INTENDED USE

FOAMGLAS® T3+ is an insulation product made of cellular glass for buildings. The product is applied to the required dimensions in the form of slabs, panels, or other specific formats.

FOAMGLAS® T3+ is, in general unfaced.
Depending on the end-use, the slabs can be faced on top with bitumen and PE-foil (READY BOARDS) or a white mineral liner (ROOF BLOCK & ROOF BOARDS). The white liner can also be applied at the bottom (cf. BOARDS).

INTENDED USE

FOAMGLAS® T3+ can be used for perimeters, facades (in/outside), roofs and ceiling.

FUNCTIONAL UNIT/ REFERENCE FLOW / DECLARED UNIT

"Thermally insulate 1m^2 of building perimeter, facade, roof and ceiling, with the FOAMGLAS® T3+ product, with a density of 95 kg/m3 that provides an overall thermal resistance (R-value) of 1 (m2.K/W) (36 mm thickness), with a lifespan of 100 years."

- The packaging is included in this EPD,
- The weight per functional unit is 3.42 kg/m^2,
- The density of the product is 95 kg/m^3.

EPD results are reported in this report for a thermal resistance (R-value) of 1 (m^2.K/W) (36 mm thickness). Depending on the applied thicknesses, EPD results can be updated using the conversion factors provided in the table below.

Functional Units	Product Reference	T3+
R = 1 m^{2}K/W For 1 m^2 surface	The thickness for FU (mm)	36
	Weight of product needed (kg)	3.42
Thickness = 36 mm (R=1.00 m²K/W) For 1 m2 surface	Weight (kg)	3.42
	Conversion factor	1.000
Thickness = 50 mm (R=1.39 m²K/W) For 1 m2 surface	Weight (kg)	4.75
	Conversion factor	1.389
Thickness = 100 mm (R=2.78 m²K/W) For 1 m2 surface	Weight (kg)	9.50
	Conversion factor	2.778
Thickness = 144 mm (R=4.00 m²K/W) For 1 m2 surface	Weight (kg)	13.68
	Conversion factor	4.000
Thickness = 200 mm (R=5.56 m²K/W) For 1 m2 surface	Weight (kg)	19.00
	Conversion factor	5.556

Product description (unit)	Average gross installed density (kg/m³)	Lambda value λ (W/m·K)	Thickness range (mm)	The thickness for R=1 (m².K/W) (mm)
FOAMGLAS® T3+	95 +/- 14.25	0.036	50-200	36

Environmental impacts of the coated or faced product are to be assessed with a markup factor of ~13%, independent of the thickness of the FOAMGLAS® core material.

INSTALLATION

The environmental impact of fixation and installation materials is not included due to their significant variability. This EPD only includes the environmental impact related to the product itself (without facer), including material losses and packaging end-of-life. Detailed information for the installation can be retrieved from https://www.foamglas.com depending on language & region. FOAMGLAS® products can be integrated into various building elements. Further information on these scenarios and fixation and installation materials can be found in the chapter "Additional technical information for scenario development at building".

Depending on the requirements, FOAMGLAS® products are applied dry or using mineral or organic adhesives. The insulating slabs are staggered and butt-jointed with or without glue. The professional liability associations' rules apply. When applying the products, conventional industrial protection measures must be observed following information supplied by the manufacturer. Dust incurred during sawing is inert and non-crystalline. According to the present state of knowledge, there are no particular hazards for water, air or soil if FOAMGLAS® is applied as specified.

IMAGES OF THE PRODUCT AND ITS INSTALLATION

Fig 1: Raw material

Fig 2: FOAMGLAS® T3+ product

Fig 3: FOAMGLAS® applications

COMPOSITION AND CONTENT

Components	Composition / content / ingredients	Quantity
Product ***(average PCE and PCCR)***	*-Sand* *-Feldspar* *-Recycled content (glass/scrap)* *-Others*	*15%* *20%* *50% to 60%* *5% to 15%*
Fixation materials ***(More information can be found on page 16)***	*-Adhesives depending end-use (e.g. bitumen, PU-glue and accessories-private labels, e.g. PC11, PC56, PC800, PC600, etc.)* *-mechanical fastening (e.g. screws, F-anchors, etc.)*	*According to https://www.foamglas.com*
Jointing materials	*-Depending on the end-use, can be applied together with the adhesive*	*According to https://www.foamglas.com*
Treatments	*Not applicable for this product*	*-*
Packaging	*-PE foil* *-Pallets* *-Cardboard* *-Paper strip*	*5.66E-02 kg/FU* *1.57E-01 kg/FU* *2.21E-02 kg/FU* *4,22E-04 kg/FU*

The product does not contain concentrations of substances or materials listed in the “Candidate List of Substances of Very High Concern for authorisation”, SVHC or CMR.

REFERENCE SERVICE LIFE

FOAMGLAS® has already been installed in existing buildings across Europe due to its intrinsic material properties with good long-term performances. Several buildings in Belgium, Switzerland and Germany contain the product from decades ago. Examples are provided in the LCA background report.

The reference service life is estimated at 100 years if the product is installed according to the manufacturers’ and suppliers’ guidelines. The reference service life is based on available average EPDs, expert judgment, and corresponds to the average lifespan of a building.

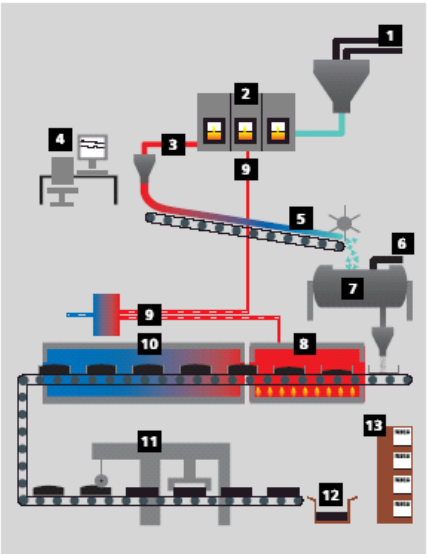
DESCRIPTION OF GEOGRAPHICAL REPRESENTATIVITY

The EPD is representative for the Belgian and Luxembourg market.

DESCRIPTION OF THE PRODUCTION PROCESS AND TECHNOLOGY

Primary data is used to model A1, A2, A3, A4 and A5 modules. The product is made following the protocol of the company as follows:

- Glass constituents (recycled glass, sand, sodium carbonate, feldspath, sodium sulfate, sodium nitrate, iron oxide, and FOAMGLAS®-scrap) are melted at 1250°C in a furnace and drawn into the shape of a thin-walled tube for efficient grinding.
- Melted glass is put in grinders to produce fine glass powder. In the grinding process, additives are added to allow for the glass foaming processes.
- In the foaming furnace, cellular glass blocks are made in moulds by heating the glass powder after the grinding process (sintering towards around 850°C).
- After the foaming process, the annealing process starts by moving the foamed blocks on the lehr where they cool according to a precisely determined curve.
- The cooled blocks are cut into rectangular blocks and if necessary, ground or cut to thinner sizes.
- The produced material is released, labelled, marked, and packed for commercialisation and various end-use applications (floor, roof, wall, façade, and other construction elements).



1. Mixing and batching of the raw materials.
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 grounds all ingredients into a fine powder before putting into stainless steel moulds
8. The filled moulds pass through a cellulating oven (foaming furnace) with a temperature of 850° C.
This step is where the material gains its unique cell structure
9-10. The FOAMGLAS® blocks pass through an annealing oven to allow carefully controlled cooling of the block without thermal stress.
9. Energy recovery of heat (in the study)
11. The blocks are cut to size and sorted by batch. Production Waste returns into the process.
12. FOAMGLAS® slabs are then packaged, labelled, and palletised.
Finished FOAMGLAS® products are stored and prepared for transport.
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TECHNICAL DATA / PHYSICAL CHARACTERISTICS

FOAMGLAS® T3+ (SLABS & BOARDS)

Technical properties following product standard EN 13167	Standard	Value	Unit	Comment
Thickness range	EN 823	50-200	mm	
Length x Width	EN 822	450x600 (slabs/blocks) 1200x600 (boards)	mm	Slabs & blocks Boards
Thermal conductivity (λ_D)	EN ISO 10456	0,036	W/mK	
Density	EN 1602	95± 15%	kg/m³	
Reaction to fire – unfaced	EN 13501-1	Class A1	-	Non-combustible Faced products – class E
Dimensional stability at 70°C; 90%RH	EN 1604	DS 70/90 (≤ 0.5 mm)	-	
Vapour resistance (μ-value)	EN ISO 12572	infinite (∞)		
Water absorption (short/long)	EN 1609 EN 12087	≤ 0.5	kg/m²	
Compressive strength	EN 823	CS ≥ 500 kPa	kPa	
Point load	EN 12430	PL ≤ 1.5 mm	mm	
Tensile strength	EN 1607	TR ≥ 150 kPa	kPa	
Bending strength	EN 12089	BS ≥ 400 kPa	kPa	
Compressive creep (long behaviour)	EN 1606	CC (1.5/1/50) 225	kPa	

LCA STUDY

DATE OF LCA STUDY
The LCA study was conducted between September and October 2020. The information contained in this document is provided under the responsibility of FOAMGLAS® according to EN 15804:A2 and additional requirements from NBN/DTD B 08-001.

SOFTWARE
SimaPro 9.1.0.7 was used for all LCA calculations.

INFORMATION ON ALLOCATION
No allocation was conducted.

INFORMATION ON CUT OFF
Specific company data was used for the assessments. In all cases, it is assumed that the cut-off criteria of EN 15804 are met.

INFORMATION ON EXCLUDED PROCESSES
The following processes were excluded from the inventory:

- capital goods and infrastructural processes,
- human-related activities, such as employee transport and administration.

INFORMATION ON BIOGENIC CARBON MODELLING
The product does not contain biogenic carbon. Pallets used for transport contain a negligible amount of biogenic carbon content included in the study.

INFORMATION ON CARBON OFFSETTING
Carbon offsetting is not allowed in the EN 15804 and hence not considered in the calculations.

ADDITIONAL OR DEVIATING CHARACTERISATION FACTORS
In accordance with EN 15804+A2, the characterisation factors from EC-JRC were applied. No additional or deviating characterisation factors were used.

DESCRIPTION OF THE VARIABILITY
This EPD is valid for the assessment of products with a thickness range of 50-200mm. Within this range, the impact may be obtained using a linear correlation compared to the thickness used in the functional unit. Depending on the applied thicknesses, EPD results can be updated using the conversion factors provided in the chapter “Product Description”.

DATA

SPECIFICITY
Data used for the LCA are specific for this product. The product is manufactured by a single manufacturer in two different manufacturing sites.

PERIOD OF DATA COLLECTION
Manufacture-specific data has been collected for the year 2019.

INFORMATION ON DATA COLLECTION
Primary data is used for modules A1, A2, A3, A4, and A5. The rest of the study is based on scenarios (modules B1-B7, modules C1-C4, and module D). Data collection was undertaken for both manufacturing sites covering their full production volume. The results are the average obtained based on the sales volume of each manufacturing site for the Belgian market.

DATABASE USED FOR BACKGROUND DATA
Eco-invent version 3.6 released in September 2019 was used.

ENERGY MIX
Company-specific energy mix was used to produce the insulation product. The verifier has checked the green electricity certificate, and a copy is provided in the Foamglas® Background LCA report. The Belgian energy mix is considered to declare the benefits beyond the system boundaries (module D).

PRODUCTION SITES

The FOAMGLAS® cellular glass insulation material that is assessed in the LCA-study is produced at the following two production sites:

- PCE - Pittsburgh Corning Europe SA/NV, Albertkade 1 B 3980 Tessenderlo / Belgium,
- PCCR - Pittsburgh Corning CR, s.r.o. IP Verne, Průmyslová 3 Cz 431 51 Klášterec nad Ohří / Czech Republic.

SYSTEM BOUNDARIES

Product stage			Construction installation stage		Use stage							End-of-life stage					Beyond the system boundaries
Raw materials	Transport	Manufacturing	Transport	Construction installation stage	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal		Re-use-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4		D
☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒		☒

X = included in the EPD
MND = module not declared

POTENTIAL ENVIRONMENTAL IMPACTS PER REFERENCE FLOW

The functional unit is: “Thermally insulate 1m^2 of building perimeter, facade, roof and ceiling, with the FOAMGLAS® T3+ product, with a density of 95 kg/m3 that provides an overall thermal resistance (R-value) of 1 (m2.K/W) (36 mm thickness), with a lifespan of 100 years.” Additional end-of-life optimisation scenarios for T3+ are presented in the chapter “Alternatives for end-of-life.

	Production			Construction process stage		Use stage							End-of-life stage				
	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 De-construction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Re-use, recovery, recycling
GWP total (kg CO2 equiv/FU)	7,50E-01	1,11E-01	3,49E+00	4,85E-01	2,61E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,23E-02	5,56E-02	2,27E-03	4,78E-02	-1,84E-01
GWP fossil (kg CO2 equiv/FU)	7,34E-01	1,11E-01	3,52E+00	4,84E-01	1,66E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,23E-02	5,56E-02	2,27E-03	4,40E-02	-3,24E-01
GWP biogenic (kg CO2 equiv/FU)	1,54E-02	5,40E-05	-1,10E-01	2,57E-04	9,43E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	3,43E-06	2,97E-05	5,13E-06	3,76E-03	1,41E-01
GWP luluc (kg CO2 equiv/FU)	4,82E-04	4,13E-05	8,46E-02	1,71E-04	9,53E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	9,71E-07	1,94E-05	8,98E-07	1,73E-05	-9,81E-04
ODP (kg CFC 11 equiv/FU)	9,55E-08	2,50E-08	4,43E-07	1,10E-07	9,21E-09	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,66E-09	1,26E-08	4,86E-10	1,18E-08	-4,02E-08
AP (mol H+ equiv/FU)	4,58E-03	5,77E-04	1,59E-02	1,98E-03	3,00E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,29E-04	2,27E-04	2,12E-05	3,23E-04	-1,20E-03
EP - freshwater (kg (PO4)3- equiv/FU)	4,74E-05	8,56E-07	6,06E-05	3,83E-06	1,30E-06	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	4,48E-08	4,36E-07	1,58E-08	7,30E-07	-1,23E-05
EP - marine (kg N equiv/FU)	2,30E-03	1,61E-04	4,51E-03	5,85E-04	1,02E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	5,69E-05	6,74E-05	9,15E-06	1,07E-04	-2,30E-04
EP - terrestrial (mol N equiv/FU)	1,17E-02	1,78E-03	4,48E-02	6,47E-03	9,17E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	6,24E-04	7,45E-04	1,01E-04	1,18E-03	-2,64E-03
POCP (kg Ethene equiv/FU)	2,41E-03	5,30E-04	1,32E-02	1,98E-03	2,61E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,72E-04	2,28E-04	2,76E-05	3,53E-04	-9,08E-04

ADP Elements (kg Sb equiv/FU)	1,80E-05	2,11E-07	1,91E-06	9,60E-07	2,34E-07	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	3,15E-09	1,08E-07	1,38E-09	6,29E-08	-3,98E-07
ADP fossil fuels (MJ/FU)	1,02E+01	1,66E+00	5,69E+01	7,29E+00	9,45E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,70E-01	8,38E-01	3,93E-02	9,16E-01	-8,48E+00
WDP (m³ water eq deprived /FU)	5,84E-01	4,56E-03	4,08E-01	2,04E-02	1,04E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,27E-04	2,33E-03	1,56E-04	7,78E-03	-2,08E-01

GWP total = total Global Warming Potential (Climate Change); GWP-luluc = Global Warming Potential (Climate Change) land use and land use change; ODP = Ozone Depletion Potential; AP = Acidification Potential for Soil and Water; EP = Eutrophication Potential; POCP = Photochemical Ozone Creation; ADPE = Abiotic Depletion Potential – Elements; ADPF = Abiotic Depletion Potential – Fossil Fuels; WDP = water use (Water (user) deprivation potential, deprivation-weighted water consumption)

RESOURCE USE

	Production			Construction process		Use stage							End-of-life stage				
	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 De-construction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Re-use, recovery, recycling
PERE (MJ/FU, net calorific value)	5,55E-01	2,30E-02	4,77E+01	1,04E-01	4,93E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	9,17E-04	1,18E-02	1,53E-03	1,49E-02	-2,71E+00
PERM (MJ/FU, net calorific value)	0,00E+00	0,00E+00	2,66E+00	0,00E+00	-2,66E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT (MJ/FU, net calorific value)	5,55E-01	2,30E-02	5,03E+01	1,04E-01	-2,17E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	9,17E-04	1,18E-02	1,53E-03	1,49E-02	-2,71E+00
PENRE (MJ/FU, net calorific value)	1,16E+01	1,67E+00	6,41E+01	7,36E+00	1,04E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,69E-01	8,45E-01	3,99E-02	9,53E-01	-9,30E+00
PENRM (MJ/FU, net calorific value)	0,00E+00	0,00E+00	2,31E+00	0,00E+00	-2,31E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT (MJ/FU, net calorific value)	1,16E+01	1,67E+00	6,64E+01	7,36E+00	-1,27E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,69E-01	8,45E-01	3,99E-02	9,53E-01	-9,30E+00
SM (kg/FU)	3,32E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
RSF (MJ/FU, net calorific value)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF (MJ/FU, net calorific value)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW (m^3 water eq/FU)	1,23E-02	1,25E-04	6,10E-02	5,61E-04	8,38E-04	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	6,07E-06	6,41E-05	4,55E-06	1,62E-04	-5,35E-03

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Net use of fresh water

WASTE CATEGORIES & OUTPUT FLOWS

	Production			Construction process stage		Use stage							End-of-life stage				
	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 De-construction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Re-use, recovery, recycling
Hazardous waste disposed (kg/FU)	1,04E-05	4,24E-06	6,56E-05	1,91E-05	1,50E-06	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	4,62E-07	2,20E-06	8,31E-08	1,66E-06	-8,97E-06
Non-hazardous waste disposed (kg/FU)	0,00E+00	0,00E+00	5,03E-01	0,00E+00	2,83E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	3,08E+00	0,00E+00
Radioactive waste disposed (kg/FU)	3,98E-05	1,13E-05	1,23E-04	4,97E-05	3,29E-06	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,18E-06	5,71E-06	3,06E-07	5,32E-06	-4,53E-05
Components for re-use (kg/FU)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Materials for recycling (kg/FU)	0,00E+00	0,00E+00	2,96E-02	0,00E+00	1,04E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	3,42E-01	0,00E+00	0,00E+00
Materials for energy recovery (kg/FU)	0,00E+00	0,00E+00	1,63E-02	0,00E+00	9,78E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Exported energy (MJ/FU)	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,12E+00

IMPACT CATEGORIES ADDITIONAL TO EN 15804

	Production			Construction process		Use stage							End-of-life stage				
	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 De-construction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Re-use, recovery, recycling
PM (disease incidence)	4,90E-08	7,51E-09	8,10E-08	3,34E-08	2,63E-09	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	3,41E-09	3,87E-09	5,43E-10	8,05E-09	-1,31E-08
IRHH (kg U235 eq/FU)	3,29E-02	7,25E-03	1,30E-01	3,19E-02	2,71E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	7,26E-04	3,66E-03	2,55E-04	3,45E-03	-5,32E-02
ETF (CTUe/FU)	6,16E+01	1,32E+00	3,18E+01	5,86E+00	1,17E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,02E-01	6,71E-01	2,20E-02	9,48E-01	-3,54E+00
HTCE (CTUh/FU)	6,54E-10	3,92E-11	1,11E-09	1,66E-10	2,97E-11	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	3,57E-12	1,89E-11	7,71E-13	4,85E-11	-1,38E-10
HTnCE (CTUh/FU)	1,82E-08	1,43E-09	3,77E-08	6,37E-09	1,03E-09	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	8,77E-11	7,32E-10	1,78E-11	8,55E-10	-2,77E-09
Land Use Related impacts (dimension less)	3,78E+00	1,11E+00	8,69E+01	4,99E+00	1,02E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,16E-02	5,78E-01	1,18E-02	1,70E+00	-1,39E+01

HTCE = Human Toxicity – cancer effects; HTnCE = Human Toxicity – non cancer effects; ETF = Ecotoxicity – freshwater; (potential comparative toxic unit)
PM = Particulate Matter (Potential incidence of disease due to PM emissions);
IRHH = Ionizing Radiation – human health effects (Potential Human exposure efficiency relative to U235);

	*Global Warming Potential*	*The global warming potential of a gas refers to the total contribution to global warming resulting from the emission of one unit of that gas relative to one unit of the reference gas, carbon dioxide, which is assigned a value of 1.* *It is split up in 4:* - *Global Warming Potential total (GWP-total) which is the sum of GWP-fossil, GWP-biogenic and GWP-luluc* - *Global Warming Potential fossil fuels (GWP-fossil) : The global warming potential related to greenhouse gas (GHG) emissions to any media originating from the oxidation and/or reduction of fossil fuels by means of their transformation or degradation (e.g. combustion, digestion, landfilling, etc).* - *Global Warming Potential biogenic (GWP-biogenic) : The global warming potential related to carbon emissions to air (CO2, CO and CH4) originating from the oxidation and/or reduction of aboveground biomass by means of its transformation or degradation (e.g. combustion, digestion, composting, landfilling) and CO2 uptake from the atmosphere through photosynthesis during biomass growth – i.e. corresponding to the carbon content of products, biofuels or above ground plant residues such as litter and dead wood.[1]* - *Global Warming Potential land use and land use change (GWP-luluc): The global warming potential related to carbon uptakes and emissions (CO2, CO and CH4) originating from carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (including soil carbon emissions).*
	*Ozone Depletion*	*Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbonsor halons), Which break down when they reach the stratosphere and then catalytically destroy ozone molecules.*
	*Acidification potential*	*Acid depositions have negative impacts on natural ecosystems and the man-made environment incl. buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport.*
	*Eutrophication potential*	*The potential to cause over-fertilisation of water and soil, which can result in increased growth of biomass and following adverse effects.* *It is split up in 3:* - *Eutrophication potential – freshwater: The potential to cause over-fertilisation of freshwater, which can result in increased growth of biomass and following adverse effects.* - *Eutrophication potential – marine: The potential to cause over-fertilisation of marine water, which can result in increased growth of biomass and following adverse effects.* - *Eutrophication potential – terrestrial: The potential to cause over-fertilisation of soil, which can result in increased growth of biomass and following adverse effects.*
	*Photochemical ozone creation*	*Chemical reactions brought about by the light energy of the sun creating photochemical smog. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.*
	*Abiotic depletion potential for non-fossil ressources*	*Consumption of non-renewable resources, thereby lowering their availability for future generations. Expressed in comparison to Antimonium (Sb).* *The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*
	*Abiotic depletion potential for fossil ressources*	*Measure for the depletion of fossil fuels such as oil, natural gas, and coal. The stock of the fossil fuels is formed by the total amount of fossil fuels, expressed in Megajoules (MJ).* *The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*
	*Ecotoxicity for aquatic fresh water*	*The impacts of chemical substances on ecosystems (freshwater).* *The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*
	*Human toxicity (carcinogenic effects)*	*The impacts of chemical substances on human health via three parts of the environment: air, soil and water.*

[1] Carbon exchanges from native forests shall be modelled under GWP - luluc (including connected soil emissions, derived products or residues), while their CO2 uptake is excluded.

		The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.
	*Human toxicity (non-carcinogenic effects)*	*The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*
	*Particulate matter*	*Accounts for the adverse health effects on human health caused by emissions of Particulate Matter (PM) and its precursors (NOx, SOx, NH3)*
	*Resource depletion (water)*	*Accounts for water use related to local scarcity of water as freshwater is a scarce resource in some regions, while in others it is not.* *The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*
	*Ionising radiation - human health effects*	*This impact category deals mainly with the eventual impact on human health of low dose ionising radiation of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionising radiation from the soil, from radon and from some construction materials is also not measured by this indicator.*
	*Land use related impacts*	*The indicator is the "soil quality index" which is the result of an aggregation of following four aspects:* - *Biotic production* - *Erosion resistance* - *Mechanical filtration* - *Groundwater* *The aggregation is done based on a JRC model. The four aspects are quantified through the LANCA model for land use.* *The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*

DETAILS OF THE UNDERLYING SCENARIOS USED TO CALCULATE THE IMPACTS

A1 – RAW MATERIAL SUPPLY

This module includes the production of raw materials and additives to produce FOAMGLAS® products.

A2 – TRANSPORT TO MANUFACTURING PLANT

Raw materials are transported to two different manufacturing plants. Pittsburgh Corning Europe provided distances for transport by truck and by boat. A large share of raw materials transportation is made by truck, and the specific size and type of trucks are considered in the model.

A3 – MANUFACTURING

This module incorporates:

1. The manufacturing process of FOAMGLAS® products, composed of multiple steps:
   - melting of the glass components,
   - cooling and milling,
   - addition of additives and milling,
   - foaming and annealing,
   - packing.
2. All incoming flows (energy consumption, water consumption, packaging, and infrastructure) and all outgoing flows (emissions in the air, soil, water and wastes) during the manufacturing process,
3. The transport of products between the plant located in the Czech Republic and Tessenderlo in Belgium,
4. The production and transport of packaging (raw material extraction, transportation to manufacturing plant, manufacturing, and transport to FOAMGLAS®).

A4 – TRANSPORT TO THE BUILDING SITE

The final product is packed and transported either to the construction site or to merchants. As the insulation product has a low density, transport is volume-based. Primary data provided by the company are used for all distances and vehicles.

Fuel type and consumption of vehicle or vehicle type used for transport	Transport, freight, lorry 16-32 metric ton, EURO5 {RER}| transport, freight, lorry 16-32 metric ton, EURO5 | Cut-off, S	Transport, freight, lorry 7.5-16 metric ton, EURO5 {RER}| transport, freight, lorry 7.5-16 metric ton, EURO5 | Cut-off, S
Distances	100 km to building site 70 km to merchant	50 km from merchant to building site
Capacity utilisation (including empty returns)	The default of the Ecoinvent v.3.6 database	
Bulk density of transported products	95 kg / m^3	
Volume capacity utilisation factor	The default of the Ecoinvent v.3.6 database	

A5 – INSTALLATION IN THE BUILDING

We consider 2% of material losses, applying the default scenario of the Belgian standard NBN/DTD B 08-001. The FOAMGLAS® insulation product is installed manually.

The impact at the end-of-life of packaging materials is included in this module, as packaging is collected at the construction site. Transportation and treatment at incineration and landfill are considered. The proportions of landfilling, incineration and recycling are based on the Belgian standard NBN/DTD B 08-001.

Fixation and installation materials are not included. Further information on fixation and installation materials can be found on page 16. Depending on requirements, FOAMGLAS® elements may be applied dry or using mineral or organic adhesives.

Parts of the installation	Quantity	Description
Fixation materials (kg/m²)	-	-
Jointing materials (kg/m²)	-	-
Material losses	*2%*	-
Packaging (kg/FU)	*5.66E-02* *1.57E-01* *2.21E-02* *4,22E-04*	*-PE foil* *-Pallets* *-Cardboard* *-Paper strip*

B – USE STAGE (EXCLUDING POTENTIAL SAVINGS)

If installed according to the manufacturers' and suppliers' guidelines, FOAMGLAS® insulation products need no further maintenance, repair, replacement or refurbishment during the life span of the product. If the product is applied following the installation instructions, the life span of 100 years is applicable.

C: END-OF-LIFE

It is considered that the product end-of-life is the same as the building in the most generic way. We assumed that 10% of the building sites were deconstructed for recycling of the product, and 90% were demolished, leading to landfilling (45%) and incineration without energy recovery (45%). Additional end-of-life optimisation scenarios for T3+ can be found in the chapter "Alternatives for end-of-life" (more information on page 16).

Module C1 includes energy consumption for the demolition of the building. Diesel consumption (0.0437 MJ per kg) in building machine is considered for demolishing.

Module C2 includes the following scenarios for transport at the end-of-life.

Module C2 – Transport to waste processing					
Type of vehicle (truck/boat/etc.)	Fuel consumption (litres/km)	Distance (km)	Capacity utilisation (%)	The density of products (kg/m^3)	Assumptions
Transport, freight, lorry 16-32 metric ton, EURO5 {RER}| Cut-off, S	Ecoinvent v3.6	30 km to the sorting plant, 50 km landfill, 100 km to incineration, 150 km to recycling (from collecting point)	Default factor of Ecoinvent v.3.6 database	95	-

Modules C3 and C4 apply the default scenario of the Belgian standard NBN/DTD B 08-001.

They include recycling, incineration (without energy recovery) and landfilling of FOAMGLAS® insulation products. Quantities are detailed in the table below.

End-of-life modules – C3 and C4		
Parameter	Unit	Value
Wastes collected separately	kg	0.342
Wastes collected as mixed construction waste	kg	3.078
Waste for re-use	kg	0
Waste for recycling	kg	0.342
Waste for incineration	kg	1.539
Waste for final disposal	kg	1.539

D – BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES

The impacts of module D were assessed based on the default scenario of the Belgian standard NBN/DTD B 08-001. Besides, alternative end-of-life scenarios are presented on page 16.

Benefits beyond the system include:

- avoided production of kaolin for bricks by recycling the FOAMGLAS® product,
- avoided production of virgin materials by recycling of packaging (PE, pallets, cardboard and paper),
- heat and electricity produced by incineration of packaging (25,56% of the energy produced is converted in heat, and 13% as electricity),
- re-use of pallets.

Loads beyond the system include:

- the end-of-life transport of FOAMGLAS® product and packaging from collecting point to recycling,
- the recycling process of FOAMGLAS® product and packaging.

ADDITIONAL INFORMATION ON RELEASE OF DANGEROUS SUBSTANCES TO INDOOR AIR, SOIL AND WATER DURING THE USE STAGE

INDOOR AIR

VOC and formaldehyde emissions

VOC emissions during service life: FOAMGLAS® cellular glass does not emit any VOCs. It has an A+ rating according to the French decree of April 19, 2011.

The following table provides the limit values according to Belgian legislation for FOAMGLAS®. (VITO):

Belgian Parameter	Concentration (µg/m3)	Threshold level after 28 days (µg/m3)
R-value (dimensionless)	/	≤ 1
TVOC	<5	≤ 1000
TSVOC	<5	≤ 100
Carcinogenic substances category 1A and 1B, as referred to in Article 36(1)(c) of Regulation (EC) No. 1272/2008 of the European Parliament and the Council of December 16, 2008, on classification, labelling and packaging of substances and mixtures.	<1	≤ 1
Acetaldehyde (EINECS 200-836-8; CAS 75-07-0)	<1	≤ 200
Toluene (EINECS 203-625-9; CAS 108-88-3)	<1	≤ 300
Formaldehyde (EINECS 200-001-8; CAS 50-00-0)	<1	≤ 100

Behaviour in the face of fungal and bacterial growth: not applicable.

FOAMGLAS® panels glued for interior thermal insulation or floor insulation are not in direct contact with the interior space as coating products cover them: plaster, paint, ceramic tiles, screed, etc.

Natural radioactive emissions from construction products: No characterisation according to the recommendations of the European Commission report “European Commission Radiation Protection 112” has been carried out on FOAMGLAS®.

The product also has the following certificates:

- Label Excell Zone Verte Gold according to certificate n°192-17367,
- NaturePlus certificate n ° 0406-1101-101-1,
- CEN KEYMARK certificate EN 13167,
- ATG,
- KOMO,
- ACERMI-Avis Technique,
- SIA,
- DCL.

SOIL AND WATER

Not applicable as this product is not in contact with drinking water, runoff water, seepage water, and surface water.

VERIFICATION

EN 15804+A2 serves as the core PCR
Independent verification of the environmental declaration and data according to standard EN ISO 14025:2010 Internal ☐ External☒
Third party verifier: Evert Vermaut Vinçotte Jan Olieslagerslaan 35 B-1800 Vilvoorde evermaut@vincotte.be October 2020

ADDITIONAL TECHNICAL INFORMATION FOR SCENARIO DEVELOPMENT

Detailed information for the installation can be retrieved from https://www.foamglas.com/en-gb depending language & region. In general, FOAMGLAS® T3+ products (unfaced & faced) can be integrated into various building elements:

	Perimeter	Roofs	Façades	Ceiling
FOAMGLAS® T3+	x	x	x	x
	For perimeter underground: special conditions may be needed depending on the groundwater-level	Roofs can be applied in several ways with several membranes (flat) or coverings (pitched)	Usage of F-anchors for ventilated façades, also ETICS- and (or) plinth-application are possible	For ceiling insulation: use of F-anchors and finishing depending on end-use
Usage/ quantity of adhesives and installation materials	Fully adherence (± 2.5 kg/m²) of cold glue Fully adherence (bitumen-based adhesive, generally available or specifically PC56)	Fully adhered (flat roof, sarking, pitch roof with metallic covering): - hot bitumen (≥ 4 kg/m²) generally available on the market - cold bitumen-based (≥ 4 kg/m²) usually available on the market or specifically PC500, PC600, PC800, PC56) Partially adhered on steel substrate (flat roof, pitch roof with metallic covering): - hot bitumen (≥ 2 kg/m²) generally available on the market - cold bitumen-based (≥ 2 kg/m²) generally available on the market or specifically PC11) - PU-glue 2 components (≥ 0.4 kg/m²) after checking compatibility	Fully adhered: - mineral inorganic adhesive (≥ 2 kg/m²), e.g. PC74A1 and PC164 - organic/bitumen based (≥ 2 kg/m²) e.g. PC56	Fully adhered: -mineral inorganic adhesive (≥ 3 kg/m²), e.g. PC74A1 and PC164 -organic/bitumen based (≥ 3 kg/m²) e.g. PC56

ALTERNATIVES FOR END-OF-LIFE

This chapter provides a sensitivity analysis of different end-of-life scenarios. These scenarios can be used to guide decision-makers to optimise the environmental performance at the end-of-life of their FOAMGLAS® products. Four end-of-life scenarios for FOAMGLAS® are described below:

- **Baseline (B-EPD):** 45% landfill + 45% incineration + 10 % recycling
1. **Intermediary:** 50% landfill + 25% recycling + 25 % re-use
2. **Optimised (B2B):** 10% landfill + 45% recycling + 45 % re-use
3. **Optimised+ (B2B):** 10% recycling + 90 % re-use

Normalised and weighted results (based on EN15804: A2 and PEF method) for summation of modules A-C compared to benefits from D for four scenarios are provided based on FU (R=1 (m²·K/W) for 1m2):

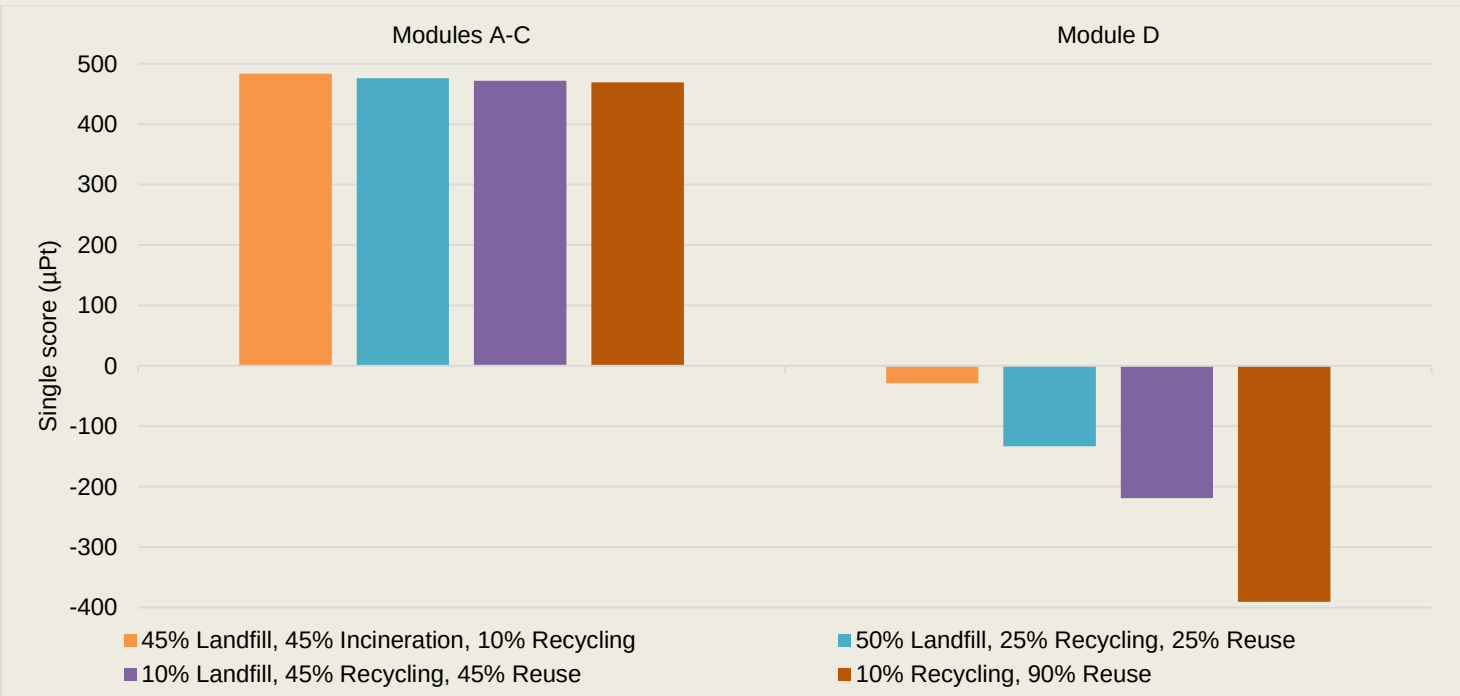

Fig 4: Sensitivity analysis of modules A-C compared to D based on single score[2] results for FOAMGLAS® T3+ for R=1 (m²·K/W) and 1m²

As illustrated in Figure 4, re-use has the highest avoided impacts followed by recycling. Therefore, the best option is to add a new layer to the old FOAMGLAS® insulation and re-use the old layer. For the remaining part, the product may be recycled substituting kaolin for production of bricks.

[2] Single score is the summation of normalized and weighted environmental impacts based on Product Environmental Footprint method of EU Commission (PEF method).
- weighting: converting and possibly aggregating indicator results across impact categories using numerical factors based on value-choices (ISO 14044)
- normalizing: calculating the magnitude of category indicator results relative to reference information (ISO 14044)

BIBLIOGRAPHY

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- FOAMGLAS® Environmental Product Declaration Background Report, October 2020, Loos-en-Gohelle, by WeLOOP.
- “Suggestions for updating the Product Environmental Footprint (PEF) method”, 2019.

General information

Owner of the EPD, Responsible for the data, LCA and information	**Pittsburgh Corning Europe** **Albertkade 1** **B 3980 Tessenderlo** **Belgium** *For more information, you can contact Piet VITSE* *Piet.Vitse@owenscorning.com*
EPD program Program operator Publisher of this EPD	**B-EPD** **Federal Public Service of Health & Environment** Victor Hortaplein 40 bus 10 1060 Brussels Belgium www.b-epd.be
Contact programma operator	epd@environment.belgium.be
Based on the following PCR documents	EN 15804+A2:2019 NBN/DTD B 08-001 and its complement
PCR review conducted by	Federal Public Service of Health and Environment & PCR Review committee
Author(s) of the LCA and EPD	**WeLOOP** Dr Naeem ADIBI Clément BOLLE Dr Carolina SZABLEWSKI Soline PEREIRA info@weloop.org
Identification of the project report	FOAMGLAS® LCA Background Report
Verification	External independent verification of the declaration and data according to EN ISO 14025 and relevant PCR documents
Name of the third party verifier Date of verification	Evert Vermaut, Vinçotte 30.10.2020
www.b-epd.be	**www.environmentalproductdeclarations.eu**

Comparing EPDs is not possible unless they are conform to the same PCR and taking into account the building context.
The program operator cannot be held responsible for the information supplied by the owner of the EPD nor LCA practitioner.

FOAMGLAS®

Owner of the EPD,
Owens Corning Europe

https://www.foamglas.com/

LCA practitioner

Building calculator of the regional authorities

www.totem-building.be

Federal Public Service of Health, Food Chain Safety and Environment

www.b-epd.be

Digitally signed by Dieter (De Lathauwer (Signature