Declaration Owner
Pittsburgh Corning, LLC
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Products
FOAMGLAS® Insulation (Industrial Applications)

Declared Unit
1 m² of insulation material as delivered to the job site. The declared unit considers the product with a building service life (ESL) of 75 years with packaging included.

EPD Number and Period of Validity
SCS-EPD-10169
EPD Valid May 23, 2024 through May 22, 2029

Product Category Rule
PCR Guidance for Building-Related Products and Services Part A: Life Cycle Assessment Calculation Rules and Report Requirements. Version 4.0. Mar. 2022

PCR Guidance for Building-Related Products and Services Part B: Mechanical, Specialty, Thermal, and Acoustic Insulation Product EPD Requirements. Version 1.0. September 2019

Program Operator
SCS Global Services
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Declaration Owner:	Pittsburgh Corning, LLC
Address:	One Owens Corning Parkway, Toledo, OH, USA
Declaration Number:	SCS-EPD-10169
Declaration Validity Period:	EPD Valid May 23, 2024 through May 22, 2029
Version:	May 23, 2024
Product:	FOAMGLAS® Insulation
Program Operator:	SCS Global Services
Declaration URL Link:	https://www.scsglobalservices.com/certified-green-products-guide
LCA Practitioner:	Katerina Softa (Owens Corning)
LCA Software:	SimaPro 9.5.0.0
LCI Database & Version Number	EcoInvent 3.9.1
LCIA Methodology & Version Number	TRACI 2.1 v1.08; CML I-A baseline v4.7; IPCC (2013, 2021)
Market(s) of Applicability	North America
EPD Type	Product-specific
EPD Scope	Cradle-to-Gate with Options
Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071	☐ internal X external
LCA Reviewer:	Beth Cassese, SCS Global Services
Part A Product Category Rule:	PCR Guidance for Building-Related Products and Services Part A: Life Cycle Assessment Calculation Rules and Report Requirements. Version 4.0. UL Environment. Mar. 2022
PCR Review conducted by:	Lindita Bushi, PhD (Chair); Hugues Imbeault-Tétreault, ing., M.Sc.A.; Jack Geibig
Part B Product Category Rule:	PCR Guidance for Building-Related Products and Services Part B: Mechanical, Specialty, Thermal, and Acoustic Insulation Product EPD Requirements. Version 1.0. September 2019
Part B PCR Review conducted by:	Hugues Imbeault-Tétreault, (Chair), Group AGECO; Thomas Gloria, Industrial Ecology Consultants; Andre Omer Desjarlais,Oak Ridge National Laboratory
Independent verification of the declaration and data, according to ISO 14025, ISO 21930, and the PCR	☐ internal X external
EPD Verifier:	Beth Cassese, SCS Global Services
Declaration Contents:	

Disclaimers: *This EPD conforms to ISO 14025, 14040, 14044, and 21930.*

Scope of Results Reported: *The PCR requirements limit the scope of the LCA metrics such that the results exclude environmental and social performance benchmarks and thresholds, and exclude impacts from the depletion of natural resources, land use ecological impacts, ocean impacts related to greenhouse gas emissions, risks from hazardous wastes and impacts linked to hazardous chemical emissions.*

Accuracy of Results: *Due to PCR constraints, this EPD provides estimations of potential impacts that are inherently limited in terms of accuracy.*

Comparability: *The PCR this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the final results, due to and not limited to, the practitioner's assumptions, the source of the data used in the study, and the specifics of the product modeled.*

In accordance with ISO 21930:2017, EPDs are comparable only if they comply with the core PCR, use the same sub-category PCR where applicable, include all relevant information modules and are based on equivalent scenarios with respect to the context of construction works.

1. About Owens Corning

Founded in 1938, Owens Corning is a global building and construction materials leader committed to building a sustainable future through material innovation. Our three integrated businesses – Composites, Insulation, and Roofing – provide durable, sustainable, energy-efficient solutions that leverage our unique material science, manufacturing, and market knowledge to help our customers win and grow.

Pittsburgh Corning, LLC is part of Owens Corning.

This Environmental Product Declaration is representative of products produced at the location listed below.

2. Product

2.1 Product Description and Application

FOAMGLAS® cellular glass insulation is a lightweight, rigid and durable material composed of glass cells. It's non-combustible, provides superior compressive strength, moisture resistance, dimensional stability and offers long-lasting thermal performance.

FOAMGLAS® insulation is available in a wide range of products offerings, shapes and sizes for building and industrial specifications. It offers ideal properties for process piping and equipment, chilled water systems, storage tanks, fire suppression systems, and more. The service temperature ranges from cryogenic/cold to hot (-450° F to 900° F).

The following product names reflect differences in final product dimensions, application, thermal conductivity, and compressive strength. All FOAMGLAS® Insulation products included in this study are made using consistent batch and additive materials and manufacturing processes, making it appropriate to group them within a single EPD.

FOAMGLAS® cellular glass insulation products	FOAMGLAS® HLB 800 Insulation
	FOAMGLAS® HLB 1000 Insulation
	FOAMGLAS® HLB 1200 Insulation
	FOAMGLAS® HLB 1400 Insulation
	FOAMGLAS® HLB 1600 Insulation
	FOAMGLAS® ONE™ Insulation
	STRATAFAB® Insulation

The Construction Specification Institute (CSI) codes covered by the subcategory PCR applicable to FOAMGLAS® Insulation are listed below:

- 23 07 00 HVAC Insulation
- 220716 - Plumbing Equipment Insulation

The associated UNSPC code is 30 14 00 00 Insulation.

FOAMGLAS® HLB insulation: is specially designed for high load-bearing industrial applications. Its unique combination of high compressive strength and low thermal conductivity makes it ideal for a wide range of tank base construction and other industrial load-bearing applications. Suitable applications are listed below:

- Cold and cryogenic tank bases
- Hot and high temperature tank bases

- Load-bearing pipe supports.
- Secondary containment corner protection
- Special load-bearing applications

FOAMGLAS® ONE insulation: Suitable for a wide range of industrial applications listed below:

- Cryogenic systems
- Low temperature pipe, equipment, tanks and vessels
- Medium and high temperature pipes and equipment
- Hot oil and hot asphalt storage tanks
- Heat transfer fluid systems
- Hydrocarbon processing systems
- Chemical processing systems
- Steam and chilled water piping, Commercial piping and ductwork, Direct burial / underground

STRATAFAB®: The StrataFab® Insulation Billet is manufactured using a proprietary bonding adhesive to create a uniform, multi-layered stack of FOAMGLAS® ONE™ insulation block. The StrataFab® Insulation billet is then fabricated into a wide range of shapes and sizes to satisfy industrial and commercial insulation requirements. Suitable applications are listed below:

- Low-Temperature piping
- Medium and high-temperature piping
- Heat-transfer fluid piping
- Direct burial and underground
- Cyclical piping
- Live application
- Retrofit or maintenance

2.2 Methodological Framework

This declaration is a product-specific EPD and is cradle-to-installation with use stage and end-of-life. The underlying LCA upon which this EPD is based included the following life cycle modules: *Raw Material supply* (A1); *Inbound Transportation* (A2); *Manufacturing* (A3); *Distribution* (A4); *Installation* (A5); *Transport* (C2); and *End-of-life, Disposal* (C4). No known flows have been deliberately excluded. The product is expected to perform as claimed for the 75-year reference service life (RSL).

2.3 Technical Data

The following table provides technical specifications of the products commonly used.

Table 1. *Technical specifications for FOAMGLAS® insulation*

Properties	Test method	FOAMGLAS® HLB 800 insulation	FOAMGLAS® HLB 1000 insulation	FOAMGLAS® HLB 1200 insulation	FOAMGLAS® HLB 1400 insulation	FOAMGLAS® HLB 1600 insulation	FOAMGLAS® ONE & STRATAFAB insulation
Absorption of Moisture	C240	< 0.2% by Vol					
Capillarity	-	None					
Chemical Resistance	-	Impervious to common acids and their fumes					
Coefficient of Linear Thermal Expansion	E228	25 to 300°C, 9.0 x 10-6/K -170 to 25°C, 6.6 x 10-6/K					
Combustibility	E136	Non combustible					
Composition	-	Soda-lime glass. Inorganic. No fibers or binders					
Compressive Strength	C165/C240 /C552	LSLlot avg = 800 kPa LSLind = 552 kPa	LSLlot avg =1000 kPa LSLind = 689 kPa	LSLlot avg = 1200 kPa LSLind = 827 kPa	LSLlot avg = 1400 kPa LSLind = 965 kPa	LSLlot avg = 1600 kPa LSLind = 1103 kPa	AVG = 620 kPa LSL = 414 kPa
Corrosion, Water Soluble Ions, and pH	C871 C692 C1617	Acceptable for use with stainless steel Pass < DI Water					
Density (±15%)	C303	120 kg/m^3	130 kg/m^3	140 kg/m^3	150 kg/m^3	160 kg/m^3	115 kg/m^3
Dimensional Stability	-	Excellent — does not shrink or swell.					
Flexural Strength	C203/C240	LSL = 310 kPa	LSL = 351 kPa	LSL = 386 kPa	LSL = 434 kPa	LSL = 476 kPa	LSL = 283 kPa
Hygroscopicity	-	No increase in weight at 90% relative humidity					
Modulus of Elasticity, Approximate (v = 0.25)	C623	1110 MPa	1234 MPa	1358 MPa	1358 MPa	1627 MPa	900 MPa
Service Temperature	Without Load	-268 to 482°C					-268 to 482°C
	With Load	-268 to 400°C					
Specific Heat	E1461	0.77 kJ/kg·K @ 25°C					
Surface Burning Characteristics	E84	Flame Spread Index 0/Smoke Development Index 0					
Water Vapor Permeability	E96 Wet Cup	0.00 ng/Pa·s·m					

Note: *Values represent typical physical and thermal properties. Type 1 Block limit values, where applicable, are specified by ASTM C552 Standard Specification for Cellular Glass Thermal Insulation.*

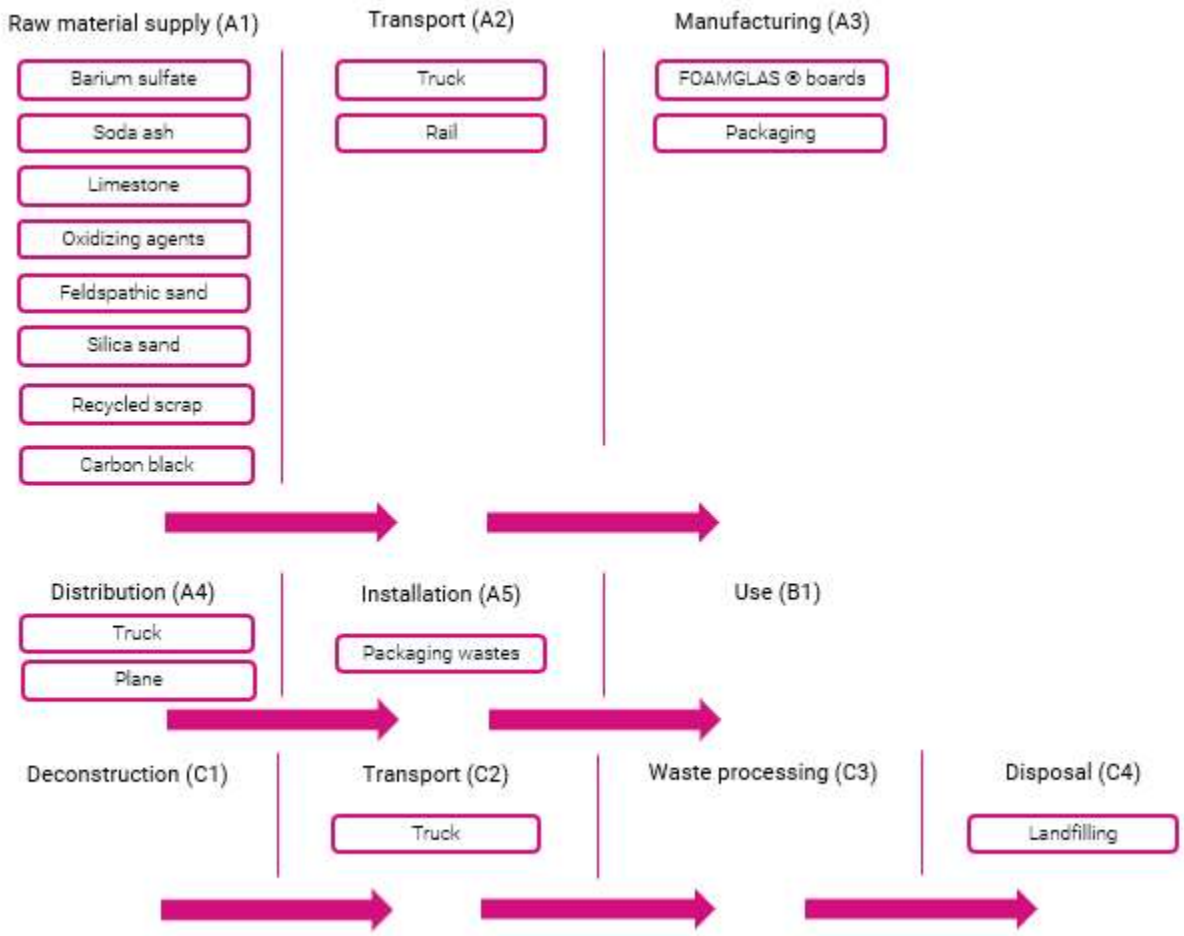
2.4 Properties of Declared Product as Delivered

When installed in typical building and construction assemblies according to all applicable Owens Corning® specifications, recommendations, and guidelines, FOAMGLAS® Insulation delivers its advertised R-value. For additional product property details, visit the specific product pages through www.owenscorning.com.

Table 2. *FOAMGLAS® Insulation Product Properties as Delivered*

Product	Width	Length	Thickness
FOAMGLAS® HLB 800 insulation	24" (600 mm)	18" (450 mm)	2"-7" (1" increments)
FOAMGLAS® HLB 1000 insulation	24" (600 mm)	18" (450 mm)	2"-7" (1" increments)
FOAMGLAS® HLB 1200 insulation	24" (600 mm)	18" (450 mm)	2"-7" (1" increments)
FOAMGLAS® HLB 1400 insulation	24" (600 mm)	18" (450 mm)	2"-7" (1" increments)
FOAMGLAS® HLB 1600 insulation	24" (600 mm)	18" (450 mm)	2"-7" (1" increments)
FOAMGLAS® ONE™ insulation	24" (600 mm)	18" (450 mm)	1.5"-7" (1/2" increments)
STRATAFAB® insulation	24" (600 mm)	18" (450 mm)	24"

2.5 Flow Diagram



2.6 Material Composition

FOAMGLAS® Insulation consits of two major components, the batch and additive materials. Although the majority of the batch is composed by sand, soda ash, limestone and an appreciable amount of pre-consumer recycled foamglas insulation scrap, the remainder of the material is composed of peformance additives, oxidizing agents and colorant.

Table 3. *FOAMGLAS® insulation composition*

Component	Composition % (by Mass)
Barium sulfate	<1%
Soda ash	10-15%
Oxidizing agents	1-5%
Limestone	10-15%
Feldspathic sand	40-45%
Silica sand	4-10 %
Onsite Recycled scrap	20-25%
Carbon black	< 1%

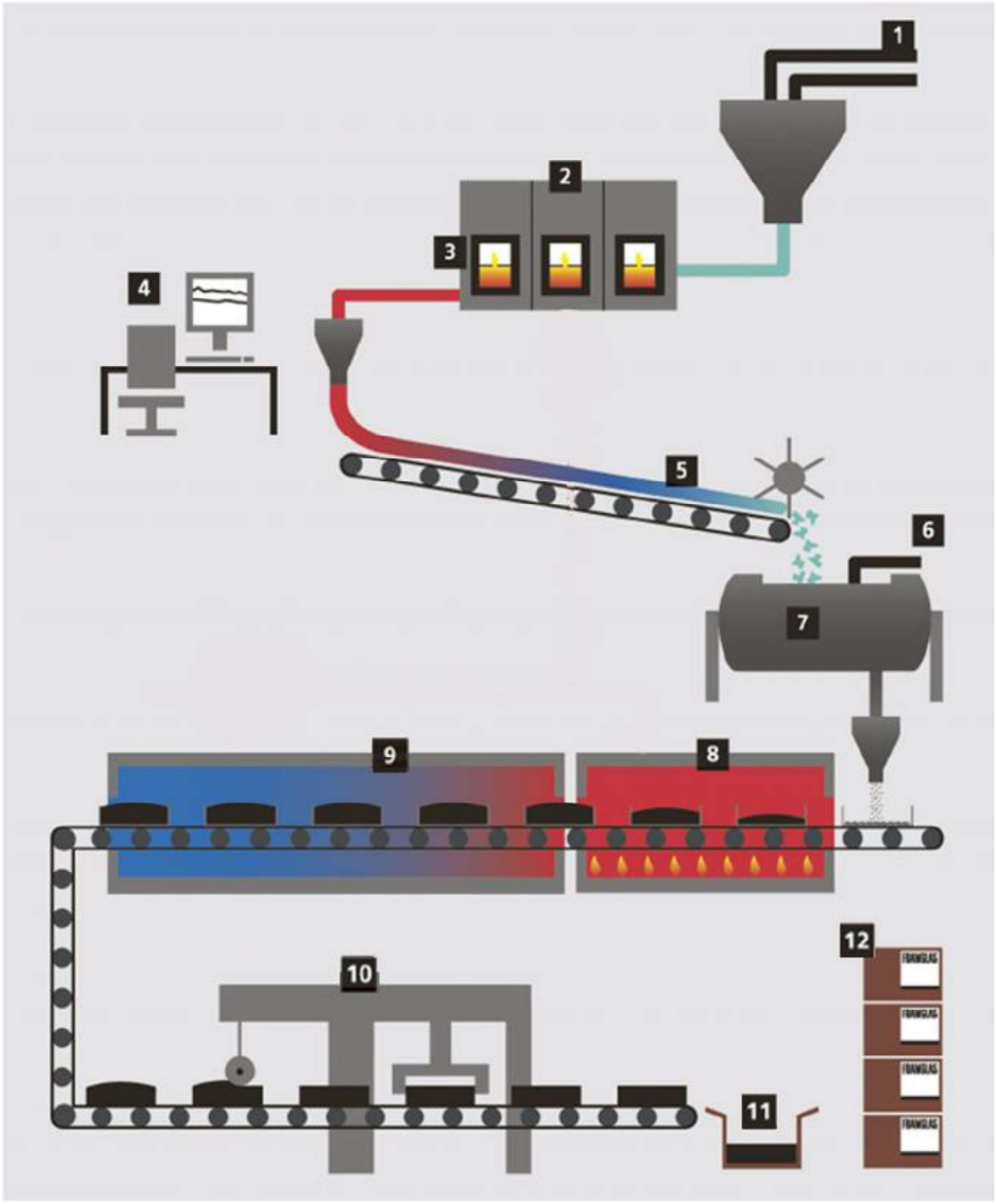
There are no hazardous substances contained in the product per the North American regional definition of hazardous wastes.

The product does not release any dangerous, regulated substances.

2.7 Manufacture

Owens Corning® FOAMGLAS® Insulation is manufactured in Sedalia, Missouri, USA. The manufacturing steps are listed below:

1. Mixing and batching of the raw materials: barium sulfate, soda ash, oxidizing agents, limestone, field spathic sand, silica sand and recycled scrap.
2. The melting furnace has a constant temperature of 1300°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 molds.
8. The filled molds pass through a cellulating oven (foaming furnace) with a temperature of 850°C. This is where the material gains its unique cell structure.
9. The FOAMGLAS® insulation blocks pass through an annealing oven to allow carefully controlled cooling without thermal stress.
10. The blocks are cut to size and sorted by batch. Production waste is recycled.
11. FOAMGLAS® insulation slabs are then packaged, labelled and palletized.
12. Finished FOAMGLAS® insulation products are stored and prepared for transport.



The diagram above represents the manufacturing process for FOAMGLAS® Insulation used in the manufacturing facility.

2.8 Packaging

FOAMGLAS® Insulation is packaged and shipped in cardboard boxes which are shrink wrapped in two directions before they are put on a wooden pallet. Then the entire pallet is stretch wrapped to keep the boxes from shifting in transit. Regional disposal scenario for the US was used as a default assumption for the packaging waste generated during installation. Disposal rates used by raw material type and waste treatment method are shown in the tables below.

Table 4. *Packaging for 1 m² of FOAMGLAS® Insulation*

Packaging Material
Corrugated carton (cardboard)
Film (LDPE)
Labels (paper)
Corrugated pad (cardboard)
Pallet pad (wood)
Pallets (wood)

Per the PCR regional packaging scenarios, the following dispositions are assumed:

Table 5. *Waste Treatment of Packaging*

Country/Region	Material Type	Recycling Rate	Landfill Rate	Incineration Rate
United States	Plastics	15%[1]	68%	17%
	Pulp (cardboard, paper)	75%[2]	20%	5%

1 *The percentage was corrected from 9% to 15% in order to have a total of 100%.*

2 *The percentage was corrected to 75% in order to have a total of 100%.*

The wooden packaging items were assumed to get landfilled.

2.9 Transportation

The outbound transportation or distribution includes the transportation of the finished product to customers by diesel semi-truck. The weighted average outbound transportation distance from the specified location to the building site is 1165 km.

2.10 Product Installation

General

In general, FOAMGLAS® insulation products can be integrated into various industrial applications. Each application can require unique ancillaries and tools depending on the case. Compressive strength requirements for any application should always be confirmed with a structural engineer to ensure the correct product specification.

Reference Documents

Find specifications, case studies, reports, assemblies and other information at https://owenscorning.com/foamglas

2.11 Use

Insulation is a passive device that requires no extra utilities or maintenance to operate over its useful life.

2.12 Reference Service Life and Estimated Building Service Life

As prescribed in the applicable PCR, the Reference Service Life (RSL) of the insulation product is 75 years, which aligns with an assumed building Estimated Service Life (ESL) of 75 years, for the purposes of this study.

2.13 Re-use Phase

Although reuse of FOAMGLAS® insulation boards at its end of life is possible, there are no formal programs for collection and transport. It is assumed that all product is sent to landfill at end of life.

2.14 Disposal

It was assumed that all materials removed from the decommissioning of a building were taken to a local construction waste landfill, using 100 miles (or 161 km) as the average distance to landfill.

3. LCA: Calculation Rules

3.1 Declared Unit

1 m^2 of insulation material as delivered to the job site, with a building service life of 75 years, including packaging.

Product Average

The results of this declaration represent an average performance for the listed products. Reported area weights for included products were taken from quality control data to create a weighted average which was used to determine the declared unit mass for the LCA.

Table 6. *Declared unit and reference flows*

Declared Unit	Product	Thickness to Achieve FU (m)	Reference flow (kg/m^2)	Density (kg/ m^3)
1 m^2 of insulation material as delivered to the job site	FOAMGLAS® Insulation	4.30E-02	5.03E+00	1.17E+02

3.2 System Boundary

This declaration is a product-specific EPD and is cradle-to-installation with use and end-of-life. Details of the system boundaries may be found in the diagrams below.

Table 7. *System boundary*

Product			Construction Process		Use							End-of-life				Benefits and loads beyond the system boundary
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw material extraction and processing	Transport to manufacturer	Manufacturing	Transport	Construction - installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal	Reuse, recovery and/or recycling potential
X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	X	MND	X	MND

x = Included in system boundary | MND = Module not declared

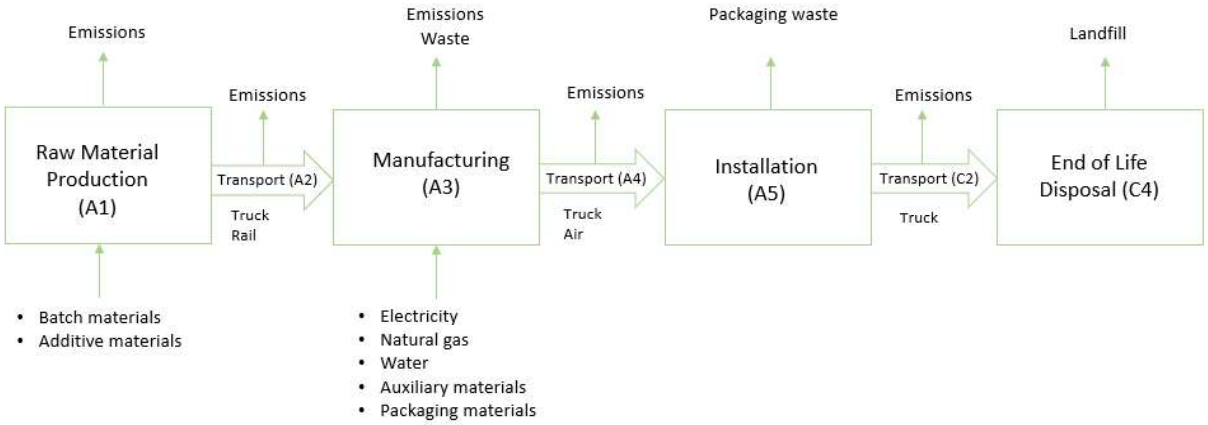


Figure 1. *Flow diagram/System Boundary for FOAMGLAS® Insulation*

3.3 Estimates and Assumptions

Since insulation is a passive device, it is assumed that no utility source or maintenance is needed during the use stage.

3.4 Cut-off criteria

The underlying LCA study is in compliance with the cut-off criteria specified in the PCR. Due to the long lifetime of equipment, capital goods and infrastructure flows were excluded as having a negligible impact on the conclusions of the LCA.

3.5 Background Data

Primary manufacturing data was collected from the included manufacturing locations listed in the Manufacturing section. Secondary data primarily reference the EcoInvent 3.9.1 database.

Table 8. *Data Sources*

Flow		Dataset	Database Source(s)
Product Materials			
Barium sulfate	Batch	Barium sulfide {GLO}| barium sulfide production | Cut-off, U	Ecoinvent 3.9.1
Natural Soda ash, dense	Batch	Natural Soda ash (based on USLCI)	Ecoinvent 3.9.1
Oxidizing agents	Batch & Additives	Various	Ecoinvent 3.9.1
Limestone	Batch	Limestone, crushed, for mill {RoW}| limestone production, crushed, for mill | Cut-off, U	Ecoinvent 3.9.1
Feldspathic sand	Batch	Feldspar {RoW}| feldspar production | Cut-off, U	Ecoinvent 3.9.1
Silica sand	Batch	Silica sand {RoW}| silica sand production | Cut-off, U	Ecoinvent 3.9.1
Carbon black	Additives	Carbon black {GLO}| carbon black production | Cut-off, U	Ecoinvent 3.9.1
LDPE film	Packaging	Packaging film, low density polyethylene {RoW}| packaging film production, low density polyethylene | Cut-off, U	Ecoinvent 3.9.1
Corrugated Carton	Packaging	Corrugated board box {RoW}| corrugated board box production | Cut-off, U	Ecoinvent 3.9.1
Labels	Packaging	Printed paper {GLO}| market for printed paper | Cut-off, U	Ecoinvent 3.9.1
Corrugated pad	Packaging	Corrugated board box {RoW}| corrugated board box production | Cut-off, U	Ecoinvent 3.9.1
Pallet pad	Packaging	EUR-flat pallet {RoW}| EUR-flat pallet production | Cut-off, U	Ecoinvent 3.9.1
Pallet	Packaging	EUR-flat pallet {RoW}| EUR-flat pallet production | Cut-off, U	Ecoinvent 3.9.1

Flow	Dataset	Database Source(s)
Electricity/Heat/Resources for Manufacturing		
Electricity	Electricity, medium voltage {MRO, US only}| market for electricity, medium voltage	Cut-off, U	Ecoinvent 3.9.1
Natural Gas	Natural gas, high pressure {US}| market for natural gas, high pressure	Cut-off, U	Ecoinvent 3.9.1
Water	Tap water {RoW}| market for tap water	Cut-off, U	Ecoinvent 3.9.1
Direct emissions		
Air emissions	Direct air emissions reported from the plant	Plant specific data
Production waste treatment		
Non-hazardous wastes to landfill	Waste glass {CH}| treatment of waste glass, inert material landfill	Cut-off, U	Ecoinvent 3.9.1
Wastewater treatment	Wastewater, average {RoW}| market for wastewater, average	Cut-off, U	Ecoinvent 3.9.1
Transportation		
Truck	Transport, freight, lorry >32 metric ton, EURO6 {RoW}| market for transport, freight, lorry >32 metric ton, EURO6	Cut-off, U	Ecoinvent 3.9.1
Rail	Transport, freight train {US}| transport, freight train, diesel	Cut-off, U	Ecoinvent 3.9.1
Packaging end of life treatment		
Cardboard wastes recycling	Waste paperboard (dummy flow) for recycling	Ecoinvent 3.9.1
LDPE film recycling	Waste plastic (dummy flow) for recycling	Ecoinvent 3.9.1
Pallet recycling	Waste wood (dummy flow) for recycling	Ecoinvent 3.9.1
Cardboard wastes incineration	Waste paperboard {RoW}| treatment of waste paperboard, municipal incineration	Cut-off, U	Ecoinvent 3.9.1
LDPE film incineration	Waste polyethylene {RoW}| treatment of waste polyethylene, municipal incineration	Cut-off, U	Ecoinvent 3.9.1
Pallet incineration	Waste wood, untreated {RoW}| treatment of waste wood, untreated, municipal incineration	Cut-off, U	Ecoinvent 3.9.1
Cardboard wastes landfilling	Waste paperboard {RoW}| treatment of waste paperboard, inert material landfill	Cut-off, U	Ecoinvent 3.9.1
LDPE film landfilling	Waste polyethylene {RoW}| treatment of waste polyethylene, sanitary landfill	Cut-off, U	Ecoinvent 3.9.1
Pallet landfilling	Waste wood, untreated {RoW}| treatment of waste wood, untreated, sanitary landfill	Cut-off, U	Ecoinvent 3.9.1
Product end of life		
Product landfilling	Waste glass {GLO}| treatment of waste glass, sanitary landfill	Cut-off, U	Ecoinvent 3.9.1

3.6 Data Quality

Primary data was based on measured and calculated data from Sedalia manufacturing plant, that was producing 100% of FOAMGLAS® Insulation boards in 2023 in US. It meets requirements for completeness along with temporal, geographical and technological representativeness. Background data was taken from the EcoInvent database, which is on the approved database list in the PCR.

Table 9. *Data quality assessment*

Data Quality Parameter	Data Quality Discussion
Time-related Coverage: Age of data and the minimum length of time over which data is collected	Primary data were based on facility's annual operations during calendar year 2022 (2023 for ancillary materials), consistent with the goal and scope of this analysis. The time coverage of secondary data used from the LCI databases is discussed in the Background Data section.
Geographical Coverage: Geographical area from which data for unit processes is collected to satisfy the goal of the study	The geographical coverage for this study is Sedalia, Missouri, USA. As such, data was sourced from the Sedalia plant that produce 100% of FOAMGLAS® insulation products for US. The geographical coverage of the secondary data used from the LCI databases is discussed in the Background Data section.
Technology Coverage: Specific technology or technology mix	Technological representativeness was based on primary manufacturing data from the Owens Corning facility included in the study.
Precision: Measure of the variability of the data values for each data expressed	Primary data were based on measured and calculated data from the Owens Corning plant which manufactures products covered by this study. The facility data was collected for the reference year 2022 (2023 for ancillary materials), and several sources were used to compare collected values and ensure precision. The data precision is therefore deemed to be of high quality for all measured and calculated data.
Completeness: Percentage of flow that is measured or estimated	All relevant process steps within the system boundary were considered. The primary data provided for FOMGLAS® insulation manufacturing were benchmarked with data collected for previous models which have undergone third party review.
Representativeness: Qualitative assessment of the degree to which the data set reflects the true population of interest	Data sets used in the underlying LCA study were selected based on the most appropriate temporal, geographical, and technological representation of the actual processes and technology. These data sets reflect average processes from multiple sources, and thus generally represent the actual technology utilized to produce the materials. Still, it is often unknown the extent to which secondary data sets deviate from the specific system being studied.
Consistency: Qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis	To ensure consistency, only primary data of the same level of detail and equivalent time interval (i.e., one calendar year) were used, and allocation was conducted similarly for all data categories and life cycle stages. All background data were sourced from the EcoInvent 3.9.1 database selecting the most appropriate geography.
Reproducibility: Qualitative assessment of the extent to which information about the methodology and data values would allow an independent practitioner to reproduce the results reported in the study	The reproducibility of the study results is merited by the scope information provided in the underlying LCA report. Due to confidentiality of the data values, however, certain details were omitted from this public facing EPD, which may limit reproducibility by the public.
Sources of the Data: Description of all primary and secondary data sources	Primary data for raw material consumption, inbound transportation, annual production, energy consumption, water consumption, emissions to air, waste generation, packaging usage, distribution of finished goods, waste generation during installation, and installation practices were used in this study. Secondary data sets were selected from the EcoInvent 3.9.1 database.
Uncertainty of the Information: Uncertainty related to data, models, and assumptions	Because the quality of secondary data is not as good as primary data, the use of secondary data becomes an inherent limitation of the study. Secondary data may cover a broad range of technologies, time periods, and geographical locations. Because hundreds of data sets are linked together and because it is often unknown how much the secondary data used deviate from the specific system being studied, quantifying data uncertainty for the complete system becomes very challenging. As a result, it is not possible to provide a reliable quantified assessment of overall data uncertainty for this study.

3.7 Period under review

The period of review is calendar year 2022.

3.8 Allocation

Allocation of primary data was used in this study. In some cases, primary data collected from the manufacturing site were provided on a facility-wide basis and then allocated to the specific insulation product based on production volume (by mass). The types of production activities for the products manufactured at the given manufacturing facility are similar, so mass allocation is considered an acceptable allocation strategy.

3.9 Comparability

The PCR that this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the uncertainty in the final results, due to and not limited to, the practitioner's assumptions, the source of the data used in the study, and the specifics of the product modeled. In addition, comparability of EPDs is limited to those applying a functional unit.

Environmental declarations from different programs (ISO 14025) may not be comparable. Comparison of the environmental performance of Mechanical, Specialty, Thermal, and Acoustic Insulation products using EPD information shall be based on the product's use and impacts at the construction works level, and therefore EPDs may not be used for comparability purposes when not considering the construction works energy use phase as instructed under this PCR. Full conformance with the PCR for Mechanical, Specialty, Thermal, and Acoustic Insulation products allows EPD comparability only when all stages of a life cycle have been considered, when they comply with all referenced standards, use the same sub-category Part B PCR, and use equivalent scenarios with respect to construction works. However, variation and deviations are possible.

4. LCA: Scenarios and Additional Technical Information

4.1 Transport to the Building Site (A4)

Table 10. *Product distribution parameters, per declared unit, for FOAMGLAS® insulation*

Name	Unit	FOAMGLAS® Insulation
Vehicle type	-	EURO6, lorry >32 metric ton
Fuel type	-	low-sulfur diesel
Liters of fuel	l/100km	1.31E-02
Transport distance	km	1.165E+03
Capacity utilization	%	50%
Gross density of products transported	kg/m^3	1.17E+02
Capacity utilization volume factor	-	= 1

4.2 Installation into the Building (A5)

Table 11. *Installation summary, per declared unit, for FOAMGLAS® insulation*

Name	Unit	FOAMGLAS® Insulation
Ancillary materials (per m^2)	kg	0.00E+00
Water consumption specified by water source and fate	m^3	0.00E+00
Other resources	kg	0.00E+00
Electricity consumption	kwh	0.00E+00
Other energy carriers	MJ	0.00E+00
Product loss per declared unit	kg	0.00E+00
Waste materials at the construction site before waste processing, generated by product installation	kg	7.61E-01
Output materials resulting from on-site waste processing	kg	0.00E+00
Mass of packaging waste specified by type	kg	7.61E-01
Recycle	kg	2.09E-01
Landfill	kg	5.31E-01
Incineration	kg	2.15E-02
Biogenic carbon contained in packaging	kg CO_2	1.23E+00
Direct emissions to ambient air, soil, and water	kg	0.00E+00
VOC content	µg/m^3	None detected

4.3 Reference Service Life

Table 12. *Reference Service Life, per declared unit, for FOAMGLAS® Insulation*

Name	FOAMGLAS® Insulation	Comment
RSL	75 years	N/A
Declared product properties (at the gate) and finishes, etc	Not applicable	Insulation properties require installation into a building
Design application parameters (if instructed by the manufacturer), including references to the appropriate practices and application codes	Install per instructions	N/A
An assumed quality of work, when installed in accordance with the manufacturer's instructions	Will meet the product properties	Installer should install per manufacturer instructions
Outdoor environment, (if relevant for outdoor applications), e.g. weathering, pollutants, UV and wind exposure, building orientation, shading, temperature	Not specific instructions	Slabs are used throughout the entire internal and external building envelope.
Indoor environment, (if relevant for indoor applications), e.g. temperature, moisture, chemical exposure	Not specific instructions	Slabs are used throughout the entire internal and external building envelope.
Use conditions, e.g. frequency of use, mechanical exposure	Not applicable	Insulation is a passive product which is not used directly during life
Maintenance, e.g. required frequency, type and quality of replacement components	None needed	Insulation does not need maintenance during its use

4.4 End-of-Life (C1-C4)

Table 13. *End-of-Life summary, per declared l unit, for FOAMGLAS® Insulation*

End-of-life		Unit	FOAMGLAS® Insulation
Assumptions for scenario development		Although reuse and recycling of FOAMGLAS® insulation boards at its end of life is possible, there are no formal programs for collection and transport. It is assumed that all product is sent to landfill at end of life.	
Collection process	Collected separately	kg	0.00E+00
	Collected with mixed construction waste	kg	5.03E+00
Disposition	Reuse	kg	0.00E+00
	Recycling	kg	0.00E+00
	Energy recovery	kg	0.00E+00
	Landfill	kg	5.03E+00
Removals of biogenic carbon (excluding packaging)		kg CO_2	0.00E+00

5. LCA: Results

Results of the Life Cycle Assessment are presented below. It is noted that LCA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks. All values in the tables below are rounded to three significant digits. The following impact indicators, specified by the PCR, are reported below.

Table 14. *Life Cycle Impact Assessment Indicators and characterization methods used*

Abbreviation	Impact Category	Unit	Characterization Method
GWP 100a	Global Warming Potential, IPCC 2013	[kg CO_2]	IPCC 2013 (AR5)
ODP	Ozone Depletion Potential	kg CFC-11 eq	TRACI 2.1
AP	Acidification Potential	kg SO2 eq	TRACI 2.1
EP	Eutrophication Potential	Kg N eq	TRACI 2.1
SFP	Smog Formation Potential	kg O3 eq	TRACI 2.1
ADP_{fossil}	Abiotic Resource Depletion Potential of Non-renewable (fossil) energy resources (ADPfossil)	MJ, LHV	CML-baseline v4.7
GWP 100a	Global Warming Potential, IPCC 2021	kg CO_2 eq	IPCC 2021 (AR6)

These impact categories are globally deemed mature enough to be included in Type III environmental declarations. Other categories are being developed and defined and LCA should continue making advances in their development, however the EPD users shall not use additional measures for comparative purposes.

Table 15. *Additional transparency indicators used*

Resources	Unit	Waste and Outflows	Unit
RPR_E: Renewable primary energy used as energy carrier (fuel)	[MJ, LHV]	**HWD**: Hazardous waste disposed	[kg]
RPR_M: Renewable primary resources with energy content used as material	[MJ, LHV]	**NHWD**: Non-hazardous waste disposed	[kg]
$NRPR_E$: Non-renewable primary resources used as an energy carrier (fuel)	[MJ, LHV]	**HLRW**: High-level radioactive waste, conditioned, to final repository	[kg] or [m^3]
$NRPR_M$: Non-renewable primary resources with energy content used as material	[MJ, LHV]	**ILLRW**: Intermediate- and low-level radioactive waste, conditioned, to final repository	[kg] or [m^3]
SM: Secondary materials	[kg]	**CRU**: Components for re-use	[kg]
RSF: Renewable secondary fuels	[MJ, LHV]	**MR**: Materials for recycling	[kg]
NRSF: Non-renewable secondary fuels	[MJ, LHV]	**MER**: Materials for energy recovery	[kg]
RE: Recovered energy	[MJ, LHV]	**EE**: Recovered energy exported from the product system	MJ, heating value ([Hi] lower heating value) per energy carrier
FW: Use of net fresh water resources	[m^3]		

Table 16. *Carbon Emissions and Removals*

Parameter	Unit
BCRP: Biogenic Carbon Removal from Product	[kg CO2]
BCEP: Biogenic Carbon Emission from Product	[kg CO2]
BCRK: Biogenic Carbon Removal from Packaging	[kg CO2]
BCEK: Biogenic Carbon Emission from Packaging	[kg CO2]
BCEW: Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes	[kg CO2]
CCE: Calcination Carbon Emissions	[kg CO2]
CCR: Carbonation Carbon Removals	[kg CO2]
CWNR: Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes	[kg CO2]

Table 17. *North American Life Cycle Impact Assessment (LCIA) results for 1 m² FOAMGLAS® Insulation*

Impact Category	Unit	A1 – A3	A4	A5	C2	C4
GWP 100[1]	[kg CO_2 eq]	2.41E+01	6.87E-01	7.45E-02	8.25E-02	5.33E-02
ODP	[kg CFC-11 eq]	1.91E-07	1.28E-08	3.93E-10	1.53E-09	1.46E-09
AP	[kg SO_2 eq]	1.34E-01	1.62E-03	7.18E-05	1.94E-04	3.54E-04
EP	[kg N eq]	7.03E-02	5.84E-04	3.70E-03	7.01E-05	7.39E-05
SFP	[kg O_3 eq]	2.38E+00	2.90E-02	1.66E-03	3.49E-03	9.39E-03
ADP_{fossil}	[MJ, LHV]	3.20E+02	1.02E+01	3.01E-01	1.22E+00	1.18E+00
IPCC GWP 100a (2021)[2]	[kg CO_2 eq]	2.41E+01	6.86E-01	7.45E-02	8.25E-02	5.33E-02

[1]*The GWP 100 impacts are based on 100-year time horizon GWP factors provided by the IPCC 2013 Fifth Assessment Report (AR5).*
[2]*100-year time horizon GWP factors as provided by the Sixth Assessment Report (AR6) shall be used for conformance with ISO 21930, Section 7.3.*

Table 18. *Resource Use Indicator Results for 1 m² FOAMGLAS® Insulation*

Resource Use	Unit	A1 – A3	A4	A5	C2	C4
RPR_E	[MJ, LHV]	4.88E+01	1.31E-01	4.65E-03	1.57E-02	1.37E-02
RPR_M	[MJ, LHV]	1.12E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
$NRPR_E$	[MJ, LHV]	3.35E+02	1.04E+01	3.06E-01	1.24E+00	1.20E+00
$NRPR_M$	[MJ, LHV]	1.93E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	[MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	[MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE	[MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	[m^3]	7.52E-02	1.65E-03	1.80E-04	1.98E-04	1.27E-03

Table 19. *Waste and Output Flow Indicator Results for 1 m² FOAMGLAS® Insulation*

Resource Use	Unit	A1 – A3	A4	A5	C2	C4
HWD	[kg]	1.31E-03	6.53E-05	1.77E-06	7.84E-06	6.20E-06
NHWD	[kg]	3.34E+00	9.00E-01	5.47E-01	1.08E-01	5.04E+00
HLRW	[kg]	4.49E-05	6.57E-07	2.34E-08	7.89E-08	6.14E-08
ILLRW	[kg]	1.64E-04	1.60E-06	5.82E-08	1.92E-07	1.53E-07
CRU	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 20. *Carbon Emissions and Removals Indicator Results for 1 m² FOAMGLAS® Insulation*

Resource Use	Unit	A1 – A3	A4	A5	C2	C4
BCRP	[kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEP	[kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCRK	[kg CO_2]	1.23E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEK	[kg CO_2]	0.00E+00	0.00E+00	1.23E+00	0.00E+00	0.00E+00
BCEW	[kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCE	[kg CO_2]	4.78E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCR	[kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CWNR	[kg CO_2]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Calculating Environmental Impact Values for products with a specific thickness and density

Results presented above are representative of an average product based on a weighted averaged thickness and density of the products in scope for the EPD corresponding to the declared unit of 1 m^2. In order to determine the impact of the different products in scope, the scaling factors of the appropriate product listed in the chart below should be used to multiply the impact category value as listed for the declared unit in the Impact Assessment Results tables above.

$$Impacts_{Adapted} = Impacts_{Declared\ Unit} \times d_{factor}$$

With

- $Impacts_{Adapted}$: the adapted impact category value
- $Impacts_{Declared\ Unit}$: the impact category value of the declared unit
- d_{factor} : the multiplier for a specific thickness and density

Table 21. *Multiplier factor to adjust results to a given product*

Product	Scaling Factor (Multiply by Declared Unit Results) (d_{factor})
Weighted average product (declared unit)	1.00
FOAMGLAS® HLB 800 Insulation	1.07
FOAMGLAS® HLB 1000 Insulation	1.16
FOAMGLAS® HLB 1200 Insulation	1.31
FOAMGLAS® HLB 1400 Insulation	1.43
FOAMGLAS® HLB 1600 Insulation	1.56
FOAMGLAS® ONE™ Insulation	0.96
STRATAFAB® Insulation	1.10

The total impacts for a given product can be thus calculated using the following data.

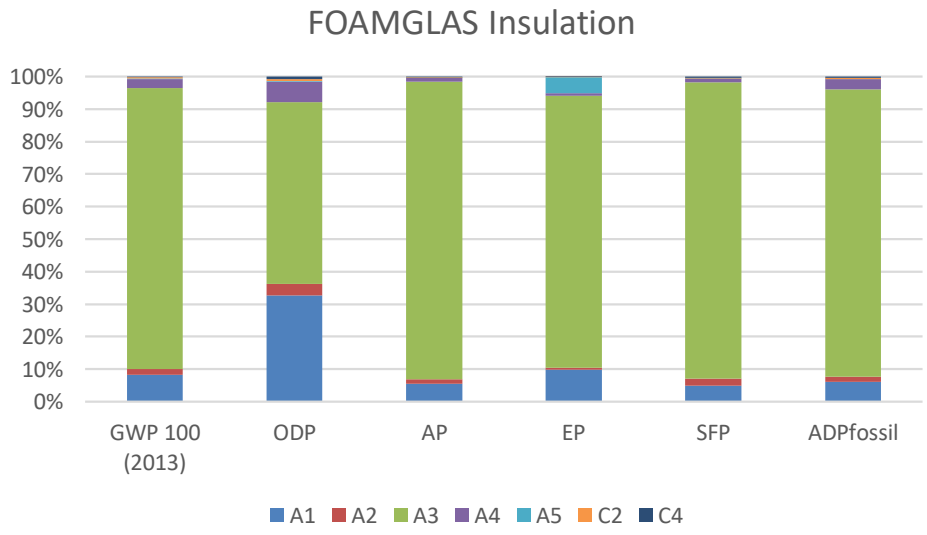
Impacts =

$Impacts_{Declared\ Unit}$	
GWP 100 [kg CO2 eq]	2.50E+01
ODP [kg CFC-11 eq]	2.07E-07
AP [kg SO2 eq]	1.37E-01
EP [kg N eq]	7.47E-02
SFP [kg O3 eq]	2.43E+00
ADP_{fossil} [MJ, LHV]	3.33E+02

X d_{factor}

6. LCA: Interpretation

The manufacturing stage (A3) is clearly the key contribution to all the impact categories. The raw material supply (A1) is the second higher contributor to all the required impact categories, following the manufacturing stage (A3).



6.1 Sensitivity Analysis

Since all the products covered in this EPD are coming from the same manufacturing site, variations mostly come from differences between products, mainly product density and thickness. Despite these variations it is still appropriate to group the FOAMGLAS® insulation products into a single average because the data reflect a consistent time window and there is no significant variation in methods or materials used to manufacture the products.

6.2 Assumptions and Limitations

The ability of LCA to consider the entire life cycle of products makes it an attractive tool for the assessment of potential environmental impacts. Nevertheless, similar to other environmental management analysis tools, LCA has several limitations related to data quality and unavailability of potentially relevant data. It should be kept in mind that the impact assessment results are relative expressions and do not predict impacts on category endpoints, exceeding thresholds, or risks.

The study was conducted by including the relevant system boundaries and best available data for FOAMGLAS® insulation products, using a consistent data collection method and timeframe. In cases where data were reported for the entire facility rather than for the specific insulation materials product, mass allocation was used to allocate the facility-wide impacts to the specific product. This assumes that all products equally consume facility inputs and contribute to facility outputs.

7. Additional Environmental Information

7.1 Environment and Health during Manufacture

Owens Corning manufacturing facility of FOAMGLAS® Insulation in Sedalia, Missouri, USA has the third part certifications of declare label for FOAMGLAS® FG ONE Cellular Glass Insulation.

7.2 Energy Savings During Use

Insulation is a passive product that requires no extra utilities to operate over its useful life. Insulation of a building is responsible for reducing the energy burden associated with heating and cooling of a building. Due to the variety of use applications of the product, the energy savings of the product may vary. The product is capable of maintaining thermal performance for the life of the building; however, if it becomes damaged during use or servicing of other building components, it will need to be replaced. Since these circumstances may vary widely, no attempt has been made in this study to estimate a reference service life and energy savings during use.

7.3 Environment and Health during Installation

This product is considered an article. 29 CFR 1910.1200(c) definition of an article is as follows: "Article" means a manufactured item other than a fluid or particle: (i) which is formed to a specific shape or design during manufacture; (ii) which has end use function(s) dependent in whole or in part upon its shape or design during end use; and (iii) which under normal conditions of use does not release more than very small quantities, e.g., minute or trace amounts of a hazardous chemical (as determined under paragraph (d) of this section), and does not pose a physical hazard or health risk to employees.

7.4 Extraordinary Effects

No extraordinary effects or environmental impacts are expected due to destruction of the product by fire, water, or mechanical means.

7.5 Delayed Emissions

No delayed emissions are expected from this product.

7.6 Environmental Activities and Certifications

FOAMGLAS® Insulation products have the following certifications and sustainable features:

- Declare label for FOAMGLAS® FG ONE Cellular Glass Insulation

7.7 Further Information

Further information on the product can be found on the manufacturers' website at www.owenscorning.com.

8. References

- Life Cycle Assessment of Owens Corning Cellular glass insulation products: FOAMGLAS®
- ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations – Principles and Procedures.
- ISO 14040: 2006 Environmental Management – Life cycle assessment – Principles and Framework
- ISO 14044: 2006/AMD 1:2017/ AMD 2:2020 Environmental Management – Life cycle assessment – Requirements and Guidelines.
- PCR Guidance for Building-Related Products and Services Part A: Life Cycle Assessment Calculation Rules and Report Requirements. Version 4.0. UL Environment. Mar. 2022
- PCR Guidance for Building-Related Products and Services Part B: Mechanical, Specialty, Thermal, and Acoustic Insulation Product EPD Requirements. Version 1.0. September 2019.
- ISO 21930: 2017 Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services.
- SCS Type III Environmental Declaration Program: Program Operator Manual. V12.0 December 2023. SCS Global Services.
- ASTM C203 Standard Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation
- ASTM C303-21 Standard Test Method for Dimensions and Density of Preformed Block and Board–Type Thermal Insulation
- ASTM C240-21 Standard Test Methods for Testing Cellular Glass Insulation Block
- ASTM C1617 Standard Practice for Quantitative Accelerated Laboratory Evaluation of Extraction Solutions Containing Ions Leached from Thermal Insulation on Aqueous Corrosion of Metals
- ASTM E228 Standard Test Method for Linear Thermal Expansion of Solid Materials With a Push-Rod Dilatometer
- ASTM C165 Standard Test Method for Measuring Compressive Properties of Thermal Insulations
- ASTM C240 Standard Test Methods for Testing Cellular Glass Insulation Block
- ASTM C623 Standard Test Method for Young's Modulus, Shear Modulus, and Poisson's Ratio for Glass and Glass-Ceramics by Resonance
- ASTM E136 Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 °C
- ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials
- ASTM C552 Standard Specification for Cellular Glass Thermal Insulation
- ASTM C871 Standard Test Methods for Chemical Analysis of Thermal Insulation Materials for Leachable Chloride, Fluoride, Silicate, and Sodium Ions
- ASTM C692 Standard Test Method for Evaluating the Influence of Thermal Insulations on External Stress Corrosion Cracking Tendency of Austenitic Stainless Steel
- ASTM E1461 Standard Test Method for Thermal Diffusivity by the Flash Method
- US EPA Greenhouse Gas Equivalencies Calculator (https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator)

For more information, contact:

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