

ENVIRONMENTAL PRODUCT DECLARATION

THERMAFIBER® MINERAL WOOL UNBONDED LOOSEFILL

OWENS CORNING



Owens Corning® Thermafiber® Mineral Wool Insulation enhances comfort, energy savings and sustainability in new and existing structures.



Owens Corning, and its family of companies, is a leading global producer of residential and commercial building materials, glass fiber reinforcements, and engineered materials for composite systems. It uses a decision framework for managing the company as a sustainable enterprise. It is the foundation of the company's strategy of building market-leading businesses, global in scope – human in scale, and reflects the company's purpose: our people and products make the world a better place.

Owens Corning is committed to balancing economic growth with social progress and sustainable solutions to its building materials and composite customers around the world.

This Environmental Product Declaration is a component of our stated goal to provide life cycle information on all core products.

sustainability.owenscorning.com



ENVIRONMENTAL PRODUCT DECLARATION



Thermafiber® Mineral Wool Unbonded Loosefill
Granulated Wool and Blown-In Wool Insulation

According to ISO 14025,
EN 15804 and ISO 21930:2017

EPD PROGRAM AND PROGRAM OPERATOR NAME, ADDRESS, LOGO, AND WEBSITE	UL Environment 333 Pfingsten Road Northbrook, IL 60611 https://www.ul.com/ https://spot.ul.com
GENERAL PROGRAM INSTRUCTIONS AND VERSION NUMBER	General Program Instructions v.2.4 July 2018
MANUFACTURER NAME AND ADDRESS	Owens Corning, One Owens Corning Parkway, Toledo, OH, USA
DECLARATION NUMBER	4788956323.102.1
DECLARED PRODUCT & FUNCTIONAL UNIT OR DECLARED UNIT	Thermafiber Mineral Wool Unbonded Loosefill Granulated Wool and Blown-In Wool Insulation, 1 m ² insulation at R _{SI} -1
REFERENCE PCR AND VERSION NUMBER	Part B: Building Envelope Thermal Insulation EPD Requirements, UL 10010-1
DESCRIPTION OF PRODUCT APPLICATION/USE	Thermafiber® Mineral Wool is a type of slag wool insulation product used in a variety of building applications, both residential and commercial, requiring the use of thermal insulation.
PRODUCT RSL DESCRIPTION (IF APPL.)	75 years
MARKETS OF APPLICABILITY	Building Material
DATE OF ISSUE	October 1, 2019
PERIOD OF VALIDITY	5 Years
EPD TYPE	Product-specific
RANGE OF DATASET VARIABILITY	NA
EPD SCOPE	Cradle to gate with options (A4, A5, C1-C4)
YEAR(S) OF REPORTED PRIMARY DATA	2018
LCA SOFTWARE & VERSION NUMBER	SimaPro 9.0.0.35
LCI DATABASE(S) & VERSION NUMBER	ecoinvent 3.5
LCIA METHODOLOGY & VERSION NUMBER	TRACI 2.1 v1.05; Cumulative Energy Demand LHV (CED) V1.00

This PCR review was conducted by:	UL Environment
	PCR Review Panel
	epd@ulenvironment.com
This declaration was independently verified in accordance with ISO 14025: 2006. <input type="checkbox"/> INTERNAL <input checked="" type="checkbox"/> EXTERNAL	
	Grant R. Martin, UL Environment
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	
	Thomas P. Gloria, Industrial Ecology Consultants

LIMITATIONS

Exclusions: EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, environmental impact assessments, etc.

Accuracy of Results: EPDs regularly rely on estimations of impacts; the level of accuracy in estimation of effect differs for any particular product line and reported impact.

Comparability: EPDs from different programs may not be comparable. Full conformance with a PCR allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible". Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared.

ENVIRONMENTAL PRODUCT DECLARATION



Thermafiber® Mineral Wool Unbonded Loosefill
Granulated Wool and Blown-In Wool Insulation

According to ISO 14025,
EN 15804 and ISO 21930:2017

1. Product Definition and Information

1.1. Description of Company/Organization

Founded in 1938, Owens Corning has been a leader in insulation, roofing and fiberglass composites. It has a global presence with 20,000 employees in 33 countries. This Environmental Product Declaration is representative of product produced at the location listed below.

Wabash Plant Wabash, IN 46992

1.2. Product Description

Product Identification

Thermafiber® Unbonded Loosefill is an insulation product group consisting of granulated wool and blown-in wool insulation. Thermafiber® Granulated Wool consists of bulk wool and filler/reinforcement fiber used in commercial and industrial applications. Thermafiber® INSUL-FILL® Blown-In Attic Mineral Wool Insulation is a premium loosefill product specifically designed for blown applications in new and existing structures. It can be used as the primary building insulation or as additional insulation in walls and ceilings of existing structures. This loosefill product can be used to fill areas between cross bracing, truss bracing, and other uneven spaces that are difficult to insulate with traditional insulation batts. Thermafiber® INSUL-FILL® Blown-In Attic Mineral Wool products are non-combustible, moisture-resistant, and mildew-resistant¹.



Product Availability** - Thermafiber® Blown-In Wool Insulation

R-Value** (at mean temperature at 75°F)	Minimum Thickness (inches)	30 LB. Bag Min. No. Bags per 1000 SF	Maximum Coverage Per Bag	Weight Per SQ. Ft.
52	17.6	92.8	10.78	2.78
49	16.6	87.4	11.44	2.62
44	14.9	78.5	12.73	2.36
38	12.8	67.8	14.75	2.03
33	11.2	58.9	16.98	1.77
30	10.1	53.5	18.68	1.61
25	8.5	44.6	22.41	1.34
22	7.4	39.2	25.47	1.18
19	6.4	33.9	29.49	1.02
13	4.4	23.2	43.10	0.70
11	3.7	19.6	50.94	0.59

* This product shows negligible settling, with no impact on thermal performance. Volu-Matic® SE High Performance Insulation Blowing Machine was used to determine the coverage information on above. The machine was set up in 2nd gear, with a 33.3% open gate and a 4" hose, blowing the wool out in a 10 ft. arc.

** R-value [=] hr-ft²-°F/BTU

†. For additional information, visit www.thermafiber.com.

¹ Moisture and mold resistant when tested in accordance with ASTM C1338, Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings



ENVIRONMENTAL PRODUCT DECLARATION



Thermafiber® Mineral Wool Unbonded Loosefill
Granulated Wool and Blown-In Wool Insulation

According to ISO 14025,
EN 15804 and ISO 21930:2017

Product Specification

	Thermafiber® Granulated Wool	Thermafiber® INSUL-FILL™ Blown-In Attic Mineral Wool Insulation
Corrosion Resistance ASTM C665	Non-corrosive, Type I	Non-corrosive, Type I
Combustibility ASTM E136	Rated Non-combustible per NFPA Standard 220	Rated Non-combustible per NFPA Standard 220
Surface Burning Characteristics ASTM E84	Flame Spread 0, Smoke Developed 5	Flame Spread 0, Smoke Developed 5
Water Vapor Sorption ASTM C1104	Absorbs less than 2% by volume	Absorbs less than 1% by volume

Product Average

The results of this declaration represent an average performance for the listed products and manufacturing location. Reported densities for included products and production location are from manufacturing, facility-level data to create a production-weighted average, which was used to determine the mass of the functional unit for the LCA.

1.3. Application

Thermafiber® Unbonded Loosefill comprises both granulated wool, a bulk wool and filler/reinforcement fiber used in commercial and industrial applications as well as blown-in wool insulation, a premium loosefill product specifically designed for blown applications in new and existing structures. Thermafiber® INSUL-FILL® Blown-In Attic Mineral Wool Insulation can be used as the primary building insulation or as additional insulation in walls and ceilings of existing structures. This loosefill product can be used to fill areas between cross bracing, truss bracing, and other uneven spaces that are difficult to insulate with traditional insulation batts.

1.4. Declaration of Methodological Framework

This declaration is a product-specific EPD and is cradle-to-installation with 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); End-of-life, 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 if it remains clean and dry in its installed state.

1.5. Technical Requirements

At a minimum, Thermafiber® Unbonded Loosefill products meet or exceed one of the following:

- ❖ **Corrosion Resistance**
 - Type I when tested in accordance with ASTM C665, *Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing*
- ❖ **Combustibility**
 - Rated Non-combustible per NFPA Standard 220 when tested in accordance with ASTM E136, *Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C*
- ❖ **Surface Burning Characteristics**
 - Flame Spread 0, Smoke Developed 5 when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*
- ❖ **Water Vapor Sorption**
 - Absorption of less than 2% by volume when tested in accordance with ASTM C1104, *Standard Test Method for Determining the Water Vapor Sorption of Unfaced Mineral Fiber Insulation*



ENVIRONMENTAL PRODUCT DECLARATION



Thermafiber® Mineral Wool Unbonded Loosefill
Granulated Wool and Blown-In Wool Insulation

According to ISO 14025,
EN 15804 and ISO 21930:2017

1.6. Properties of Declared Product as Delivered

When installed in typical building and construction assemblies according to all applicable Owens Corning specifications, recommendations and guidelines, Thermafiber® Mineral Wool Unbonded Loosefill delivers its advertised R-value.

1.7. Material Composition

Thermafiber® Mineral Wool Unbonded Loosefill consists of two major components, charge and a processing aid. The primary raw material used is blast furnace slag, a by-product of the steel industry. The reuse of slag into mineral wool prevents this material from being discarded into landfills and results in a minimum total recycled content of 70% in the final product. These materials are sourced locally and transported to manufacturing facilities.

Material Component	Material Component%
Charge	
Slag	87-90%
Feldspar	11-14%
Trap rock	1-4%
Processing Aid	
Annealing oil	1-4%
Other	0-3%

1.8. Manufacturing

Manufacturing Locations

Owens Corning North American manufacturing locations can be found across the United States. Primary data from the manufacturing facility listed below was used for the underlying life cycle assessment. Results provided in this declaration are based on a production-weighted average of this manufacturing facility.

Wabash Plant Wabash, IN 46992



ENVIRONMENTAL PRODUCT DECLARATION



Thermafiber® Mineral Wool Unbonded Loosefill
Granulated Wool and Blown-In Wool Insulation

According to ISO 14025,
EN 15804 and ISO 21930:2017

Manufacturing Process

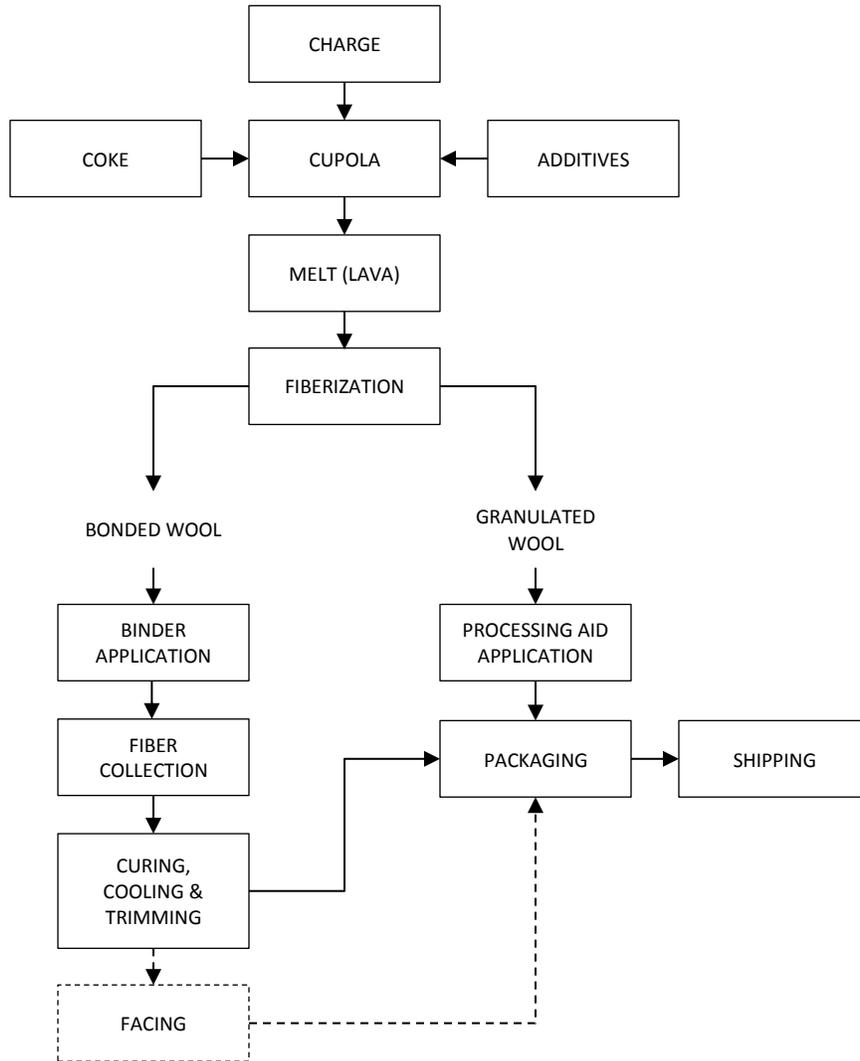


Figure 1. Process Flow Diagram for Manufacturing of Mineral Wool Insulation

The diagram above for Thermafiber® Mineral Wool Insulation is representative of the processes used by manufacturing facilities. Production of Thermafiber® Mineral Wool Unbonded Loosefill is represented by the "GRANULATED WOOL" process flow and applies to both Thermafiber® Granulated Wool and Thermafiber® Blown-In Wool Insulation.



ENVIRONMENTAL PRODUCT DECLARATION



Thermafiber® Mineral Wool Unbonded Loosefill
Granulated Wool and Blown-In Wool Insulation

According to ISO 14025,
EN 15804 and ISO 21930:2017

1.9. Packaging

Thermafiber® Mineral Wool Insulation products are packaged using LDPE (low-density polyethylene) film in the form of bags or plastic film. Regional disposal scenarios for the U.S. were used as a default assumption for the packaging waste generated during installation. Disposal rates used by material type and waste treatment method are shown in the table below.

Country/Region	Material Type	Recycling Rate	Landfill Rate	Incineration Rate
United States	Plastics	15%	68%	17%
	Metals	57%	34%	9%
	Pulp (cardboard, paper)	75%	20%	5%

1.10. Transportation

The product outbound transportation from manufacturing facility is by diesel-truck. The average distance from manufacturing facility to construction site for Thermafiber® Mineral Wool Unbonded Loosefill is 1,071 mi (1,723 km).

1.11. Product Installation

Thermafiber® INSUL-FILL® Blown-In Attic Mineral Wool is a loosefill product and can be applied to increase the R-value in new and existing structures. Specifically designed for blown applications, installation is performed pneumatically with an insulation blowing machine. When installed in accordance with the product label, the desired R-value is achieved by installing the required number of bags to the specified minimum thickness. For measuring insulation thickness and for further information, additional details can be found in Owens Corning publication "Thermafiber® INSUL-FILL® Blown-In Attic Insulation Ruler" (Pub. No. 10021304).

1.12. Use

Due to its nature, Thermafiber® Mineral Wool Insulation is a passive device requiring no utilities or maintenance over its useful life. Provided the mineral wool is used as intended, during the use phase, reductions in a building's energy consumption do occur; however, the energy savings from the use of thermal insulation have not been included within the system boundaries.

1.13. Reference Service Life and Estimated Building Service Life

The product is assumed to remain in service for the life of the building, 75 years.

1.14. Reuse, Recycling, and Energy Recovery

Thermafiber® Mineral Wool Insulation may be reused; however, no formal recycling programs currently exist for mineral wool insulation.

1.15. Disposal

The End of Life stage modeled for mineral wool insulation consisted of the transportation by tractor-trailer truck of the insulation for an assumed distance of 100 miles to a landfill and the subsequent disposal of the used insulation in the landfill.



ENVIRONMENTAL PRODUCT DECLARATION



Thermafiber® Mineral Wool Unbonded Loosefill
Granulated Wool and Blown-In Wool Insulation

According to ISO 14025,
EN 15804 and ISO 21930:2017

2. Life Cycle Assessment Background Information

2.1. Function and Functional Unit

The functional unit is 1 m² of insulation material with a thickness that gives an average thermal resistance $R_{SI} = 1 \text{ m}^2\text{K/W}$ and with a building service life of 75 years. Faced Thermafiber® Mineral Wool Insulation additionally has 1 m² of a facing add-on, which is applied to the top surface of the insulation material. For this study, the declared unit amount of the facing add-on is 1 m², and the amount of the declared unit required for the functional unit is 1 m².

Table 1. Functional Unit Properties of Thermafiber® Mineral Wool Insulation

Thermafiber® Mineral Wool Unbonded Loosefill Insulation	
Functional unit	1 m ² of insulation material with a thickness that gives an average thermal resistance $R_{SI} = 1 \text{ m}^2\text{K/W}$
Mass of Functional unit	1.49E+00 kg
Thickness to achieve Functional unit	4.87E-02 m

2.2. System Boundary

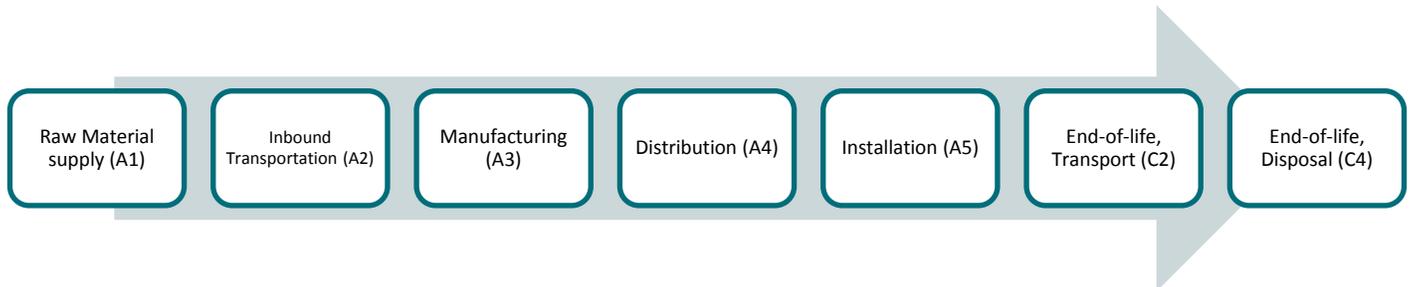


Figure 2. System Boundary of Thermafiber® Mineral Wool Unbonded Loosefill

The system boundaries for this study include inputs and outputs for the following life cycle stages for mineral wool insulation:

- ❖ Raw Material supply (A1)
 - extraction of resources and production of raw materials
 - collection and processing of recycled materials
 - extraction of resources and production of packaging materials for finished goods
- ❖ Inbound Transportation (A2)
 - transportation of all input materials to manufacturing facilities
- ❖ Manufacturing (A3)
 - electricity and water use and combustion of natural gas and coke (consumption and associated emissions)
 - transportation of fuels and consumable materials used in manufacturing
 - transportation of waste materials for recycling externally
 - transportation of waste-to-landfill waste to landfill as well as disposal in landfill
- ❖ Distribution (A4)
 - transportation from manufacturing facilities to distribution centers
 - transportation from distribution centers to construction site
- ❖ Installation (A5)
 - transportation and disposal of packaging waste
 - transportation and use of an insulation blowing wool machine
- ❖ End-of-life, Transport (C2)
 - transportation from building deconstruction site to landfill
- ❖ End-of-life, Disposal (C4)
 - disposal in landfill



ENVIRONMENTAL PRODUCT DECLARATION



Thermafiber® Mineral Wool Unbonded Loosefill
Granulated Wool and Blown-In Wool Insulation

According to ISO 14025,
EN 15804 and ISO 21930:2017

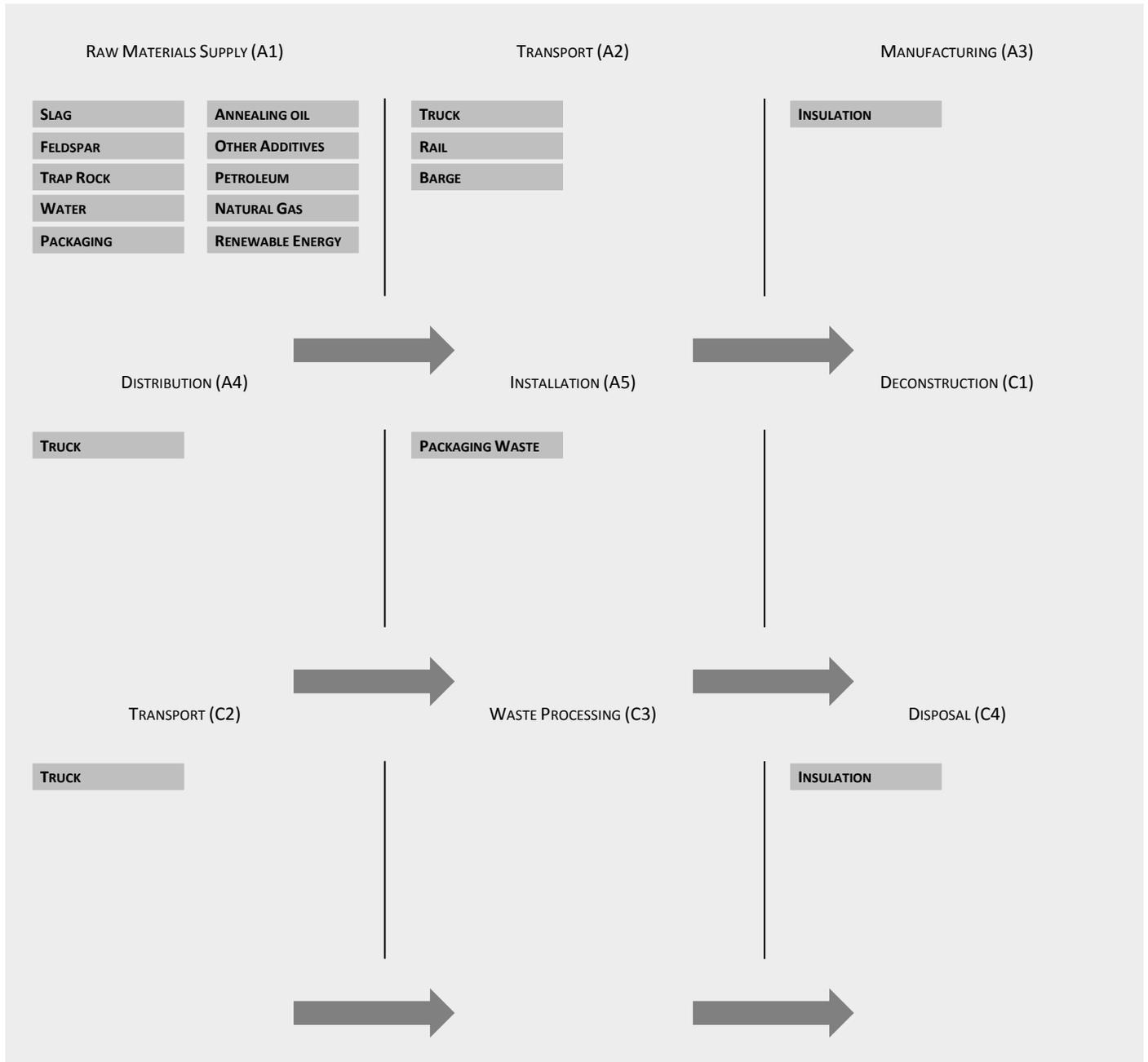


Figure 3. Flow Diagram of Thermafiber® Mineral Wool Insulation



ENVIRONMENTAL PRODUCT DECLARATION



Thermafiber® Mineral Wool Unbonded Loosefill
Granulated Wool and Blown-In Wool Insulation

According to ISO 14025,
EN 15804 and ISO 21930:2017

2.3. Estimates and Assumptions

Thermafiber® Mineral Wool Insulation is a passive device requiring no utilities or maintenance over its useful life; it is assumed that the product remains in service for the 75-year reference service.

2.4. Cut-off Criteria

Per section 2.9 of the governing PCR, the procedure detailed in ISO 21930, section 7.1.8 was followed regarding the exclusion of inputs and outputs. For energy, mass and environmental impacts, the cut-off criteria were 1% per the standard. Per the standard "the total of neglected input flows per module shall be a maximum of 5% of energy usage, mass and environmental impacts." Flows excluded for this study include infrastructure, capital goods and workforce burdens. Inputs and outputs associated with infrastructure (construction, maintenance and demolition of buildings/plants, road surfaces, transport equipment, etc.) are not included. This choice is based on experience from previous LCAs where the contribution from these items was negligible due to the long lifetime of the equipment compared to the high production volume of material during that lifetime. Although pallets are used in the transportation of packaged, finished mineral wool insulation boards, pallets have been excluded due to their high reuse rates since they would have a negligible impact if otherwise included.

2.5. Data Sources

Primary data was collected from the locations listed in the Manufacturing section. Life-cycle modeling and calculation of potential environmental impacts were conducted using the LCA software SimaPro 9, version 9.0.0.35, developed by PRé Consultants bv. The LCI database used for secondary data was the ecoinvent 3.5 database, provided with the Developer version of the software. In situations where LCI databases did not contain life-cycle inventory data for certain specific materials or processes used in either the manufacturing of precursor, input raw materials or the manufacturing of the mineral wool insulation itself, LCI data for a similar material or process was used as a substitute. In order to determine the most representative substitute, preliminary analyses were conducted.

2.6. Data Quality

To determine how representative the data used to model the life-cycle of Owens Corning® Thermafiber® Mineral Wool Insulation manufactured in 2018 is, the temporal, geographical and technological aspects of the data were assessed. For the Owens Corning facilities analyzed in the underlying LCA study, the data used adequately represents the technology used in 2018 in the United States.

2.7. Period under Review

For the manufacturing facilities considered in the LCA, Owens Corning primary data was collected for the 2018 calendar year.

2.8. Allocation

The products studied in this analysis are all members of the Thermafiber® Mineral Wool Insulation product family. Plants reported the total amount of Thermafiber® Mineral Wool Insulation produced as well as the amount produced of each individual product. In general, the characteristics that differentiate one product from another within the family are its density, form and the use and type of a binder. Particular product application can be considered another differentiating characteristic; however, these three attributes are the main physical properties that distinguish one product from another.

Exceptions to this are Faced Thermafiber® Mineral Wool Insulation. For these products, it was possible to avoid additional allocation by treating the facing materials as separate modular processes, the LCIs of which were analyzed separately. Aside from those mentioned, no other allocation modeling considerations were necessary.

ENVIRONMENTAL PRODUCT DECLARATION



Thermafiber® Mineral Wool Unbonded Loosefill
Granulated Wool and Blown-In Wool Insulation

According to ISO 14025,
EN 15804 and ISO 21930:2017

3. Life Cycle Assessment Scenarios

Table 2. Transport to the building site (A4)

	Thermafiber® Mineral Wool Unbonded Loosefill (1 m ² , R _S -1)	
Fuel type	diesel, low-sulfur	
Liters of fuel	6.75E-03	l/100km
Vehicle type	Transport, freight, lorry 16-32 metric ton, EURO3	
Transport distance	1.72E+03	km
Capacity utilization (including empty runs, mass based) [‡]	63%	%
Gross density of products transported	3.05E+01	kg/m ³
Weight of products transported (if gross density not reported)	1.49E+00	kg
Volume of products transported (if gross density not reported)	4.87E-02	m ³
Capacity utilization volume factor (factor: =1 or <1 or ≥ 1 for compressed or nested packaging products)	1	-

[‡] EcoTransIT. World. Ecological Transport Information Tool for Worldwide Transports Methodology and Data - Update 4th December 2014. (https://www.ecotransit.org/download/EcoTransIT_World_Methodology_Report_2014-12-04.pdf)



ENVIRONMENTAL PRODUCT DECLARATION



Thermafiber® Mineral Wool Unbonded Loosefill
Granulated Wool and Blown-In Wool Insulation

According to ISO 14025,
EN 15804 and ISO 21930:2017

Table 3. Installation into the building (A5)

	Thermafiber® Mineral Wool Unbonded Loosefill (1 m ² , R _{SI} -1)	
Ancillary materials	0.00E+00	kg
Net freshwater consumption specified by water source and fate (amount evaporated, amount disposed to sewer)	0.00E+00	m ³
Other resources	0.00E+00	kg
Electricity consumption	1.13E-02	kWh
Other energy carriers	0.00E+00	MJ
Product loss per functional unit	0.00E+00	kg
Waste materials at the construction site before waste processing, generated by product installation	3.55E-03	kg
Output materials resulting from on-site waste processing (specified by route; e.g. for recycling, energy recovery and/or disposal)	0.00E+00	kg
Biogenic carbon contained in packaging	0.00E+00	kg CO ₂
Direct emissions to ambient air, soil and water	0.00E+00	kg
VOC content [‡]	0.00E+00	µg/m ³

[‡] VOC content determined in accordance to "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers - version 1.2." CA Specification 01350.



ENVIRONMENTAL PRODUCT DECLARATION



Thermafiber® Mineral Wool Unbonded Loosefill
Granulated Wool and Blown-In Wool Insulation

According to ISO 14025,
EN 15804 and ISO 21930:2017

Table 4. Reference Service Life

RSL	75 years
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
An assumed quality of work, when installed in accordance with the manufacturer's instructions	Will meet R-value (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 applicable (Indoor or covered in outdoor applications)
Indoor environment, (if relevant for indoor applications), e.g. temperature, moisture, chemical exposure)	Product should be kept dry
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)

Table 5. End-of-life, Transport (C2)

		Thermafiber® Mineral Wool Unbonded Loosefill (1 m ² , R _s -1)	
Assumptions for scenario development (description of deconstruction, collection, recovery, disposal method and transportation)	Although reuse and recycling of mineral wool insulation 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 (specified by type)	Collected separately	0.00E+00	kg
	Collected with mixed construction waste	1.49E+00	kg
Recovery (specified by type)	Reuse	0.00E+00	kg
	Recycling	0.00E+00	kg
	Landfill	0.00E+00	kg
	Incineration	0.00E+00	kg
	Incineration with energy recovery	0.00E+00	kg
	Energy conversion efficiency rate	0.00E+00	
Disposal (specified by type)	Product or material for final deposition	0.00E+00	kg
Removals of biogenic carbon (excluding packaging)		0.00E+00	kg CO ₂



ENVIRONMENTAL PRODUCT DECLARATION



Thermafiber® Mineral Wool Unbonded Loosefill
Granulated Wool and Blown-In Wool Insulation

According to ISO 14025,
EN 15804 and ISO 21930:2017

Table 6. End-of-life, Disposal (C4)

		Thermafiber® Mineral Wool Unbonded Loosefill (1 m ² , R _{S1} -1)	
Assumptions for scenario development (description of deconstruction, collection, recovery, disposal method and transportation)	Although reuse and recycling of mineral wool insulation 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 (specified by type)	Collected separately	0.00E+00	kg
	Collected with mixed construction waste	0.00E+00	kg
Recovery (specified by type)	Reuse	0.00E+00	kg
	Recycling	0.00E+00	kg
	Landfill	0.00E+00	kg
	Incineration	0.00E+00	kg
	Incineration with energy recovery	0.00E+00	kg
	Energy conversion efficiency rate	0.00E+00	
Disposal (specified by type)	Product or material for final deposition	1.49E+00	kg
Removals of biogenic carbon (excluding packaging)		0.00E+00	kg CO ₂



ENVIRONMENTAL PRODUCT DECLARATION



Thermafiber® Mineral Wool Unbonded Loosefill
Granulated Wool and Blown-In Wool Insulation

According to ISO 14025,
EN 15804 and ISO 21930:2017

4. Life Cycle Assessment Results

Table 7. Description of the system boundary modules

	PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				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 supply	Transport	Manufacturing	Transport from gate to site	Assembly/Install	Use	Maintenance	Repair	Replacement	Refurbishment	Building Operational Energy Use During Product Use	Building Operational Water Use During Product Use	Deconstruction	Transport	Waste processing	Disposal	Reuse, Recovery, Recycling Potential	Reference Service Life
Thermafiber® Mineral Wool Unbonded Loosefill (1 m ² , R _{SI} -1)	x	x	x	x	x	MND	MND	MND	MND	MND	MND	MND	MND	x	MND	x	MND	75 years
EPD Type: Cradle to installation with end of life	Required					Optional (Based on scenarios)							Required				Required	

4.1. Life Cycle Impact Assessment Results

Table 8 LCIA Results for North America (TRACI) for Thermafiber® Mineral Wool Unbonded Loosefill Insulation (1 m², R_{SI}-1)

Thermafiber® Mineral Wool Unbonded Loosefill Insulation (1 m ² , R _{SI} -1)								
TRACI v2.1	A1 - A3	A4	A5	B1 - B7	C1	C2	C3	C4
GWP 100 [kg CO2 eq]	5.16E+00	4.20E-01	1.91E-02	MND	MND	3.92E-02	MND	7.80E-03
ODP [kg CFC-11 eq]	9.45E-07	1.04E-07	3.23E-09	MND	MND	9.68E-09	MND	3.77E-09
AP [kg SO2 eq]	3.85E-02	2.62E-03	9.71E-05	MND	MND	2.44E-04	MND	6.83E-05
EP [kg N eq]	1.25E-02	5.22E-04	1.01E-04	MND	MND	4.87E-05	MND	1.46E-05
POCP [kg O3 eq]	6.30E-01	7.09E-02	1.99E-03	MND	MND	6.62E-03	MND	1.62E-03
ADP _{fossil} [MJ, LHV]	8.22E+00	9.33E-01	2.69E-02	MND	MND	8.71E-02	MND	3.50E-02

[GWP 100 - Global Warming Potential]; [ODP - Ozone Depletion Potential]; [AP - Acidification Potential]; [EP - Eutrophication Potential]; [POCP - Smog Formation Potential]; [ADP_{fossil} - Abiotic Resource Depletion Potential of Non-renewable (fossil) energy resources]



ENVIRONMENTAL PRODUCT DECLARATION



Thermafiber® Mineral Wool Unbonded Loosefill
Granulated Wool and Blown-In Wool Insulation

According to ISO 14025,
EN 15804 and ISO 21930:2017

4.2. Life Cycle Inventory Results

Table 9 Resource Use for Thermafiber® Mineral Wool Unbonded Loosefill Insulation (1 m², R_{SI}-1)

Parameter	A1 - A3	A4	A5	B1 - B7	C1	C2	C3	C4
RPRE [MJ, LHV]	1.16E+00	6.39E-02	3.70E-03	MND	MND	5.97E-03	MND	1.97E-03
RPRM [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	MND	MND	0.00E+00	MND	0.00E+00
NRPRE [MJ, LHV]	7.14E+01	6.51E+00	2.88E-01	MND	MND	6.08E-01	MND	2.41E-01
NRPRM [MJ, LHV]	4.27E-01	0.00E+00	0.00E+00	MND	MND	0.00E+00	MND	0.00E+00
SM [kg]	1.91E+00	0.00E+00	0.00E+00	MND	MND	0.00E+00	MND	0.00E+00
RSF [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	MND	MND	0.00E+00	MND	0.00E+00
NRSF [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	MND	MND	0.00E+00	MND	0.00E+00
RE [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	MND	MND	0.00E+00	MND	0.00E+00
FW [m3]	1.78E-02	1.16E-03	5.74E-05	MND	MND	1.08E-04	MND	2.52E-04

[RPRE - Renewable primary energy used as energy carrier (fuel)]; [RPRM - Renewable primary resources with energy content used as material]; [NRPRE - Non-renewable primary resources used as an energy carrier (fuel)]; [NRPRM - Non-renewable primary resources with energy content used as material]; [SM - Secondary materials]; [RSF - Renewable secondary fuels]; [NRSF - Non-renewable secondary fuels]; [RE - Recovered energy]; [FW - Use of net fresh water resources]

Table 10 Output Flows and Waste Categories for Thermafiber® Mineral Wool Unbonded Loosefill Insulation (1 m², R_{SI}-1)

Parameter	A1 - A3	A4	A5	B1 - B7	C1	C2	C3	C4
HWD [kg]	0.00E+00	0.00E+00	0.00E+00	MND	MND	0.00E+00	MND	0.00E+00
NHWD [kg]	1.24E+00	0.00E+00	1.09E-03	MND	MND	0.00E+00	MND	1.49E+00
HLRW [kg] or [m3]	0.00E+00	0.00E+00	0.00E+00	MND	MND	0.00E+00	MND	0.00E+00
ILLRW [kg] or [m3]	0.00E+00	0.00E+00	0.00E+00	MND	MND	0.00E+00	MND	0.00E+00
CRU [kg]	0.00E+00	0.00E+00	0.00E+00	MND	MND	0.00E+00	MND	0.00E+00
R [kg]	1.24E-02	0.00E+00	2.73E-04	MND	MND	0.00E+00	MND	0.00E+00
MER [kg]	0.00E+00	0.00E+00	2.41E-04	MND	MND	0.00E+00	MND	0.00E+00
EE [MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	MND	MND	0.00E+00	MND	0.00E+00

[HWD - Hazardous waste disposed]; [NHWD - Non-hazardous waste disposed]; [HLRW - High-level radioactive waste, conditioned, to final repository]; [ILLRW - Intermediate- and low-level radioactive waste, conditioned, to final repository]; [CRU - Components for re-use]; [MR - Materials for recycling]; [MER - Materials for energy recovery]; [EE - Exported energy];

Table 11 Carbon Emissions and Removals for Thermafiber® Mineral Wool Unbonded Loosefill Insulation (1 m², R_{SI}-1)

Parameter	A1 - A3	A4	A5	B1 - B7	C1	C2	C3	C4
BCRP [kg CO2]	0.00E+00	0.00E+00	0.00E+00	MND	MND	0.00E+00	MND	0.00E+00
BCEP [kg CO2]	0.00E+00	0.00E+00	0.00E+00	MND	MND	0.00E+00	MND	0.00E+00
BCRK [kg CO2]	0.00E+00	0.00E+00	0.00E+00	MND	MND	0.00E+00	MND	0.00E+00
BCEK [kg CO2]	0.00E+00	0.00E+00	0.00E+00	MND	MND	0.00E+00	MND	0.00E+00
BCEW [kg CO2]	0.00E+00	0.00E+00	0.00E+00	MND	MND	0.00E+00	MND	0.00E+00
CCE [kg CO2]	0.00E+00	0.00E+00	0.00E+00	MND	MND	0.00E+00	MND	0.00E+00
CCR [kg CO2]	0.00E+00	0.00E+00	0.00E+00	MND	MND	0.00E+00	MND	0.00E+00
CWNR [kg CO2]	0.00E+00	0.00E+00	0.00E+00	MND	MND	0.00E+00	MND	0.00E+00

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



ENVIRONMENTAL PRODUCT DECLARATION



Thermafiber® Mineral Wool Unbonded Loosefill
Granulated Wool and Blown-In Wool Insulation

According to ISO 14025,
EN 15804 and ISO 21930:2017

4.3. Calculating Impact Category Results for Products with Specific Performance Properties

The impact category values found in Table 8 are for the functional unit amount of mineral wool insulation. This corresponds to mineral wool insulation with a surface area of 1 m² and having a thermal resistance of R_{SI} = 1. In Imperial units, this thermal resistance, or R-value, is equivalent to 5.68 hr·ft²·°F/BTU (i.e., R_{IP} = 5.68 or R - 5.68). However, blown-in mineral wool insulation can be installed to a specified thickness in order to achieve a desired R-value. In order to calculate impact values for Thermafiber® Mineral Wool Insulation having a specific thickness and desired R-value, the equation and chart below can be used with the impact values for the functional unit found in Table 8:

$$\text{Impact} = \left[\text{Impact of Functional unit} \right] \times \left[\text{Scaling Factor} \right]$$

R-value (hr·ft ² ·°F/BTU)	Thickness (inches)	Scaling Factor
52	17.6	9.2
49	16.6	8.7
44	14.9	7.8
38	12.8	6.7
33	11.2	5.8
30	10.1	5.3
25	8.5	4.4
22	7.4	3.9
19	6.4	3.3
13	4.4	2.3
11	3.7	1.9

5. LCA Interpretation

The underlying LCA upon which this EPD is based considered the following six environmental impact categories: Global Warming Potential (GWP 100); Ozone Depletion Potential (ODP); Acidification Potential (AP); Eutrophication Potential (EP); Smog Formation Potential (POCP); and Abiotic Resource Depletion Potential of Non-renewable (fossil) energy resources (ADP_{fossil}). The impact assessment results indicate that among the life cycle modules declared for Thermafiber® Mineral Wool Insulation, the *Manufacturing (A3)* life cycle module accounted for the majority of the potential environmental impact of each of these six impact categories.

Although the intended application of mineral wool is for building envelope thermal insulation, the affected reductions in a building's energy consumption when the mineral wool is used for this purpose were not included in the *Use* life cycle stage.



ENVIRONMENTAL PRODUCT DECLARATION



Thermafiber® Mineral Wool Unbonded Loosefill
Granulated Wool and Blown-In Wool Insulation

According to ISO 14025,
EN 15804 and ISO 21930:2017

6. Additional Environmental Information

6.1. Environment and Health During Manufacturing

Owens Corning manufacturing facilities of Thermafiber® Mineral Wool Insulation maintain quality management systems.

6.2. 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 WHMIS Regulatory Status This product is considered an article per the Canadian Hazardous Products Regulation SOR/2015-17.

Manufactured articles which meet the definition of the Canadian Hazardous Products Act (any article that is formed to a specific shape or design during manufacture, the intended use of which when in that form is dependent in whole or in part on its shape or design, and that, when being installed, if the intended use of the article requires it to be installed, and under normal conditions of use, will not release or otherwise cause an individual to be exposed to a hazardous product) are not regulated by the Canadian Hazardous Products Regulation SOR/2015-17. The product's Safe Use Instruction Sheet includes exposure guidelines, engineering controls and individual protection measures.

6.3. Extraordinary Effects

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

6.4. Delayed Emissions

No delayed emissions are expected from this product.

6.5. Environmental Activities and Certifications

Thermafiber® Mineral Wool Unbonded Loosefill has a minimum 70% recycled content as verified by ICC-ES.



ENVIRONMENTAL PRODUCT DECLARATION



Thermafiber® Mineral Wool Unbonded Loosefill
Granulated Wool and Blown-In Wool Insulation

According to ISO 14025,
EN 15804 and ISO 21930:2017

Made with Wind Energy and Reduced Carbon Footprint

Thermafiber® Mineral Wool Insulation products are available upon request carrying SCS Global Services certification for "Made with Wind Energy" and "Reduced Carbon Footprint". Impact category results when electricity used during manufacturing is matched with wind energy produced as part of Owens Corning's Power Purchase Agreement can be found in the tables below. Cradle-to-gate (A1 - A3) values shown are based on the results from this EPD, which reflect the 2018 production year and are based on NERC regional grid values from the ecoinvent 3.5 LCI database implemented in SimaPro. Dataset and other methodological differences introduce a degree of variability leading to the reduction values shown below to differ from those that appear on certificates.

Thermafiber® Mineral Wool Unbonded Loosefill Insulation (1 m ² , R _{SI} =1)			
TRACI v2.1	A1 - A3 STANDARD PRODUCT	A1 - A3 CERTIFIED PRODUCT	% CHANGE
GWP 100 [kg CO ₂ eq]	5.16E+00	4.71E+00	-9%
ODP [kg CFC-11 eq]	9.45E-07	9.11E-07	-4%
AP [kg SO ₂ eq]	3.85E-02	3.68E-02	-4%
EP [kg N eq]	1.25E-02	8.30E-03	-33%
POCP [kg O ₃ eq]	6.30E-01	6.18E-01	-2%
ADP _{fossil} [MJ, LHV]	8.22E+00	8.03E+00	-2%

6.6. Further Information

Additional information may be found at www.owenscorning.com



ENVIRONMENTAL PRODUCT DECLARATION



Thermafiber® Mineral Wool Unbonded Loosefill
Granulated Wool and Blown-In Wool Insulation

According to ISO 14025,
EN 15804 and ISO 21930:2017

7. References

Product Category Rules (PCR) Guidance for Building-Related Products and Services - Part B: Building Envelope Thermal Insulation EPD Requirements, UL 10010-1 Version 2.0, Second Edition, UL Environment, April 10, 2018.

Product Category Rules for Building Related Products and Services - Part A: Life Cycle Assessment Calculation Rules and Report Requirements, UL 10010 Version 3.2, Fifth Edition, UL Environment, December 12, 2018.

ISO 14025:2006(E), Environmental labels and declarations -Type III environmental declarations -Principles and procedures

ISO 14040:2006(E), Environmental management - Life cycle assessment - Principles and framework

ISO 14044:2006(E), Environmental management - Life cycle assessment - Requirements and guidelines

BS EN 15804:2012, Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products

ISO 21930:2017(E), Sustainability in buildings and civil engineering works - Core rules for environmental product declarations of construction products and services

PRé Consultants: SimaPro 9.0.0.35 LCA Software. 2019. The Netherlands.

ASTM C518-18: Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

ASTM C665-18: Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing

Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers - version 1.2, CA Specification 01350, January 2017.

