KNAUF INSULATION

Earthwool® Insulation Board

Unfaced, ASJ+, FSK

Knauf Insulation Earthwool® Insulation Board is a versatile product for thermal and acoustical applications such as heating and air conditioning ducts, power and process equipment, boiler and stack installation, and more. It is bonded with ECOSE® Technology and is available plain or with a factory applied foil-scrim-kraft (FSK) or all service jacket (ASJ+) facing.

Performance dashboard

Features & functionality

Excellent thermal efficiency results in lower operating costs

FSK and ASJ+ vapor-retardant facings provide a neat finished appearance in mechanical rooms

Low emitting and formaldehyde-free for indoor air quality considerations

Excellent acoustical properties effectively reduce noise

Visit Knauf for more product information

Earthwool® Insulation Board unfaced
Earthwool® Insulation Board FSK-faced
Earthwool® Insulation Board ASJ+-faced

Environment & materials

Improved by:

Utilization of recycled glass

Knauf's original bio-based ECOSE® Technology binder technology

Certification & rating systems:

HPD v2.2 (Unfaced), v2.3 (ASJ+ and FSK)

UL GREENGUARD Gold certified

UL Validated recycled content

UL Validated formaldehyde-free

Audited, European Certification Board for Mineral Wool Products exoneration process

ASTM C612: Type IA (1.6, 2.25, 3.0, 4.25, 6.0 pcf), Type IB (3.0, 4.25, 6.0 pcf); ASTM C795; ASTM C1136: Type I, II, III, IV, VIII (ASJ+), Type II, IV (FSK)

MasterFormat® 07 21 13
Earthwool® Insulation Board Guide Spec, Technical Data Sheet
For spec help, contact us or call 317 421 8727

See LCA, interpretation & rating systems

See materials, interpretation & rating systems

SM Transparency Report (EPD)™ + Material Health Overview™

EPD	LCA
3rd-party verified	✓
	Transparency Report (EPD)
3rd-party verified	✓

Validity: 12/12/23 – 12/12/28
KNA – 12122023 – 008

MATERIAL HEALTH	Material evaluation
Self-declared	✓

This environmental product declaration (EPD) was externally verified by Harmony Environmental, LLC, according to ISO 21930:2017; UL Part A; UL Part B for Building Envelope Thermal Insulation Products; and ISO 14025:2006.

Harmony Environmental, LLC
16362 W. Briarwood Ct.
Olathe, KS 66062
www.harmonyenviro.com

(913) 780-3328

Harmony Environmental, LLC
Management • Analysis • Communication
Beyond Sustainability, Striving for Harmony

SUMMARY

Reference PCR
UL Part B: Building Envelope Thermal Insulation v2.0

Regions; system boundaries
North America; Cradle-to-grave

Functional unit / ESL:
1 m^2 installed insulation material, packaging included, with thickness that gives average thermal resistance of $R_{SI} = 1m^2 \cdot K/W$ over an estimated service life (ESL) of 75 years

LCIA methodology: TRACI 2.1

LCA software; LCI database
LCA for Experts v10.7; LCA for Experts 2023

In accordance with ISO 14044 and the reference PCR, this life cycle assessment was conducted by Sustainable Minds and verified by Harmony Environmental, LLC.

Public LCA:
Knauf Insulation North America and Manson Insulation Products

Knauf Insulation, Inc.
One Knauf Drive
Shelbyville, IN 46176
www.knaufinsulation.us
317 398 4434

Contact us

LCA results & interpretation

Earthwool® Insulation Board

Unfaced | FSK faced | ASJ+ faced | EPD additional content | Material health

Scope and summary

○ Cradle to gate ○ Cradle to gate with options ✔ **Cradle to grave**

Application

Versatile product for thermal and acoustical applications such as: heating & air conditioning ducts, power and process equipment, boiler and stack installations, metal and masonry walls, wall and roof panel systems, curtain wall assemblies, and cavity walls.

Functional unit

One square meter of installed insulation material, packaging included, with a thickness that gives an average thermal resistance of $R_{SI} = 1m^2 \cdot K/W$ with a building service life of 75 years.

Reference service life: 75 years when installed per manufacturer's instructions
Reference flow: 2.04 kg of unfaced product.

A thickness of 0.0330m achieves the functional unit. (ASTM C518)

Manufacturing data

Reporting period: January 2022 – December 2022
Location: Shelbyville, IN

Default installation, packaging, and disposal scenarios

At the installation site, insulation products are unpackaged and installed. Staples may be used to install board products. The potential impact of the staples is assumed to be negligible since their use is spread out over hundreds of sheets of product; therefore, they were not included in the model.

No material is assumed to be lost or wasted. Scraps are typically used to fill corners or crevices. Plastic packaging waste is disposed (9% to recycling, 68% to landfill, and 17% to incineration), paper-based packaging waste is disposed (68% to recycling, 20% to landfill, and 5% to incineration), and no maintenance or replacement is required over the life of the building. After removal, the insulation is assumed to be landfilled. Insulation and packaging waste are assumed to be transported 100 miles for disposal.

What's causing the greatest impacts

All life cycle stages

The manufacturing stage dominates all impact categories except ozone depletion, where the raw material acquisition stage takes precedence. The energy required to melt the glass and produce the glass fibers is the largest contributor to the manufacturing stage. The impact of the raw material acquisition stage is mostly due to the batch and binder materials. The contributions to outbound transportation are caused by the use of trucks and rail transport. The only impacts associated with installation and maintenance are due to the disposal of packaging waste, which is the smallest contributor of all the stages. At the end of life, insulation is manually removed from the building and landfilled. For all products, waste is dominated by the final disposal of the product. Non-hazardous waste accounts for waste generated during manufacturing and installation.

Raw materials acquisition and transportation

The raw material acquisition stage is the second highest contributor for most impact categories, but ozone depletion potential is almost entirely generated from this stage. The raw materials acquisition stage impact is largely due to the borax, manganese oxide, and soda ash in the batch and the sugars in the binder. Third-party verified ISO 14040/44 secondary LCI data sets contribute more than 80% of the total impacts to ozone depletion.

Manufacturing stage

The manufacturing stage has the most significant contribution to all impact categories, primarily due to the energy required to melt the glass and produce the glass fibers. Since some batch ingredients significantly contribute to the respiratory effects category, they can lead to higher impact results in the raw materials acquisition stage. However, since sand and borax are melted in the oven with the other batch materials, they are not released into the air as fine particulates. Therefore, the calculated potential impacts as shown in the results tables are likely much larger than the actual impacts in the raw material acquisition stage. This implies that the manufacturing stage may have a greater share of the impact than what is displayed in the total impacts by life cycle stage.

Distribution

Outbound transportation is the third highest contributor to smog impacts.

End of life

The end-of-life impacts are largely due to landfilling of the product after it has been removed from the building and transported to a landfill. Since materials are assumed to be landfilled at the end of life rather than incinerated or reused/recycled, no materials are available for energy recovery or reuse/recycling.

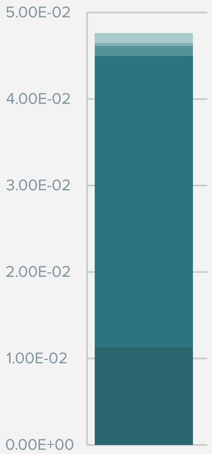
Embodied carbon

Embodied carbon can be defined as the cradle-to-gate (A1-A3) global warming potential impacts. The total embodied carbon per functional unit of unfaced Earthwool® Insulation Board Insulation manufactured in Shelbyville, IN is 3.41E+00 kg CO_2-eq.

Material composition greater than 1% by weight

PART	MATERIAL	%WT.
Batch	Cullet	30-35%
Batch	Sand	5-8%
Batch	Borates	2-5%
Batch	Soda ash	2-5%
Batch	Feldspar	1-2%
Batch	Limestone	1-2%
Batch	Oxides	<1%
Binder	Water	15-20%
Binder	Sugars	10-15%
Binder	Additives	2-5%
Packaging	Plastic	<1%
Packaging	Cardboard	15-20%

Total impacts by life cycle stages [mPts/per func unit]



LIFE CYCLE STAGE	MPTS/FUNC. UNIT
Raw material acquisition	1.18E-02
Manufacturing	3.30E-02
Transportation	1.11E-03
Installation and maintenance	4.87E-04
Disposal/reuse/recycling	1.31E-03

Total impacts = 4.78E-02 mPts
per 75 years installed

How our product compares to previous years' results

In 2018, Knauf Insulation North America published a product-specific Type III EPD for Earthwool® Insulation Board. The 2018 EPD and this 2023 EPD both followed the UL PCR Part A and Part B for Building Envelope Thermal Insulation. The life cycle results considered for benchmarking in each EPD were consistent; the data sources were consistent as they pertained to priority of primary and secondary data sources and application of specific secondary, non-LCI data; cut-off criteria were consistently applied; and product-specific use phase and end-of-life calculations were consistently applied. To ensure comparability, the 2018 benchmark EPD results were recalculated using the most recent LCA software version and most recently updated LCI data sets, then used for benchmarking with the 2023 updated EPD. The updated unfaced 2018 total results from cradle to grave were as follows: global warming 5.09E+00 kg CO_2-eq, ozone depletion potential 3.52E-10 kg CFC-11 eq, fossil fuel depletion 6.74E+00 MJ surplus, and eutrophication 1.13E-03 kg N eq.

Earthwool® Insulation Board results from 2023 show improvements across the global warming potential and ozone depletion potential impact categories. The next highest performing impact category was fossil fuel depletion, which showed only a 1% increase in impacts. The impact reductions for GWP and ODP primarily stem from A3. Differences in manufacturing activities contribute significantly when comparing the 2023 results to the 2018 results and identifying the contributors to performance improvement.

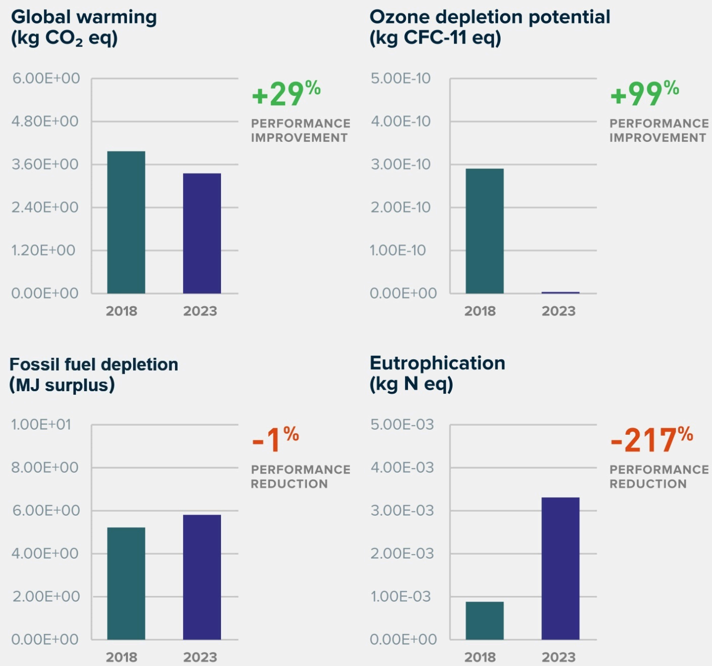
The lowest performing impact category compared (higher impact results than in 2018) was eutrophication. The biggest contributors to eutrophication are the sugars in the binder and the water used in the fiberizing step during manufacturing. More water was consumed in this step as compared to previous years.

About 2018 results

The 2018 Transparency Report for Earthwool® Insulation Board serves as a benchmark to which the 2023 results can be compared. One impact category was used for comparison to satisfy the LEED LCA optimization credit: global warming potential. Its reduction alone can contribute towards satisfying credits under LEED. The reduction in this impact category reflects that this report is valued at 1.5 products.

Total impacts: 2018 to 2023 comparison

Highest and lowest performing impact categories



How we're making it greener

Knauf Insulation North America (KINA) is committed to providing products that conserve energy and preserve natural resources.

- Our products with ECOSE® Technology contain a bio-based binder adhesive instead of a fossil fuel-based binder.
- Our fiberglass contains on average over 60% recycled glass, which requires about 20% less energy required to form glass fibers, and results in about 25% reduction in embodied carbon.
- Our glass is audited by a 3rd party to ensure biosoluble chemistry from a health and safety standpoint.

See how we make it greener

LCA results

LIFE CYCLE STAGE	RAW MATERIAL ACQUISITION	MANUFACTURING	TRANSPORTATION	INSTALLATION AND MAINTENANCE	DISPOSAL/ REUSE/ RECYCLING
	(X) A1 Raw materials	(X) A3 Manufacturing	(X) A4 Distribution	(X) A5 Installation	(X) C1 Deconstruction
	(X) A2 Transportation			(X) B1 Use	(X) C2 Transportation
				(X) B2 Maintenance	(X) C3 Waste processing
				(X) B3 Repair	(X) C4 Disposal
Information modules: **Included (X)** | Excluded (MND)*				(X) B4 Replacement	
*Module D is also excluded from this system boundary (MND).				(X) B5 Refurbishment	
				(X) B6 Operational energy use	
				(X) B7 Operational water use	
					

SM Single Score

Learn about SM Single Score results

Impacts per 1 square meter of insulation material	1.18E-02 mPts	3.30E-02 mPts	1.11E-03 mPts	4.87E-04 mPts	1.31E-03 mPts
Materials or processes contributing >20% to total impacts in each life cycle stage	Batch material and binder material production.	Energy required to melt the glass and produce the glass fibers.	Truck and rail transportation used to transport product to building site.	Transportation to landfill and landfilling of packaging materials.	Transportation to landfill and landfilling of product at end of life.

TRACI v2.1 results per functional unit (unfaced Earthwool® Insulation Board - Shelbyville, IN)

LIFE CYCLE STAGE		RAW MATERIAL ACQUISITION	MANUFACTURING	TRANSPORTATION	INSTALLATION AND MAINTENANCE	DISPOSAL/ REUSE/ RECYCLING

Ecological damage

Impact category	Unit					
Global warming	**kg CO_2 eq**	2.11E-01	3.20E+00	5.98E-02	7.74E-02	6.32E-02
Ozone depletion	**kg CFC-11 eq**	2.31E-12	4.32E-13	1.33E-16	1.27E-16	1.82E-15
Acidification	**kg SO_2 eq**	2.62E-03	6.16E-03	3.07E-04	1.65E-04	2.65E-04
Eutrophication	**kg N eq**	1.74E-03	1.77E-03	2.63E-05	2.70E-05	1.63E-05

Human health damage

Impact category	Unit					
Smog	**kg O_3 eq**	2.76E-02	1.19E-01	1.05E-02	9.74E-04	5.18E-03
Respiratory effects	**kg $PM_{2.5}$ eq**	1.90E-04	3.67E-04	1.50E-05	3.88E-06	1.79E-05

Additional environmental information

Impact category	Unit					
Carcinogenics	**CTU_h**	7.7%	89.8%	0.2%	0.1%	2.2%
Non-carcinogenics	**CTU_h**	12.6%	81.7%	0.4%	0.3%	5.1%
Ecotoxicity	**CTU_e**	23.7%	74.9%	0.7%	0.1%	0.6%
Fossil fuel depletion	**MJ surplus**	1.16E+00	5.38E+00	1.12E-01	1.14E-02	1.24E-01

LCA results & interpretation

Earthwool® Insulation Board

Unfaced | **FSK faced** | ASJ+ faced | EPD additional content | Material health

Scope and summary

○ Cradle to gate ○ Cradle to gate with options ✔ **Cradle to grave**

Application

Versatile product for thermal and acoustical applications such as: heating & air conditioning ducts, power and process equipment, boiler and stack installations, metal and masonry walls, wall and roof panel systems, curtain wall assemblies, and cavity walls.

Functional unit

One square meter of installed insulation material, packaging included, with a thickness that gives an average thermal resistance of $R_{SI} = 1m^2 \cdot K/W$ with a building service life of 75 years.

Reference service life: 75 years when installed per manufacturer's instructions
Reference flow: 2.19 kg of product with foil skrim kraft (FSK) facer.

A thickness of 0.0330m achieves the functional unit. (ASTM C518)

Manufacturing data

Reporting period: January 2022 – December 2022
Location: Shelbyville, IN

Default installation, packaging, and disposal scenarios

At the installation site, insulation products are unpackaged and installed. Staples may be used to install board products. The potential impact of the staples is assumed to be negligible since their use is spread out over hundreds of sheets of product; therefore, they were not included in the model.

No material is assumed to be lost or wasted. Scraps are typically used to fill corners or crevices. Plastic packaging waste is disposed (9% to recycling, 68% to landfill, and 17% to incineration), paper-based packaging waste is disposed (68% to recycling, 20% to landfill, and 5% to incineration), and no maintenance or replacement is required over the life of the building. After removal, the insulation is assumed to be landfilled. Insulation and packaging waste are assumed to be transported 100 miles for disposal.

What's causing the greatest impacts

All life cycle stages

The manufacturing stage dominates all impact categories except ozone depletion, where the raw material acquisition stage takes precedence. The energy required to melt the glass and produce the glass fibers is the largest contributor to the manufacturing stage. The impact of the raw material acquisition stage is mostly due to the batch and binder materials. The contributions to outbound transportation are caused by the use of trucks and rail transport. The only impacts associated with installation and maintenance are due to the disposal of packaging waste, which is the smallest contributor of all the stages. At the end of life, insulation is manually removed from the building and landfilled. For all products, waste is dominated by the final disposal of the product. Non-hazardous waste accounts for waste generated during manufacturing and installation.

Raw materials acquisition and transportation

The raw material acquisition stage is the second highest contributor for most impact categories, but ozone depletion potential is almost entirely generated from this stage. The raw materials acquisition stage impact is largely due to the borax, manganese oxide, and soda ash in the batch and the sugars in the binder. Third-party verified ISO 14040/44 secondary LCI data sets contribute more than 80% of the total impacts to ozone depletion.

Manufacturing stage

The manufacturing stage has the most significant contribution to all impact categories, primarily due to the energy required to melt the glass and produce the glass fibers. Since some batch ingredients significantly contribute to the respiratory effects category, they can lead to higher impact results in the raw materials acquisition stage. However, since sand and borax are melted in the oven with the other batch materials, they are not released into the air as fine particulates. Therefore, the calculated potential impacts as shown in the results tables are likely much larger than the actual impacts in the raw material acquisition stage. This implies that the manufacturing stage may have a greater share of the impact than what is displayed in the total impacts by life cycle stage.

Distribution

Outbound transportation is the third highest contributor to smog impacts.

End of life

The end-of-life impacts are largely due to landfilling of the product after it has been removed from the building and transported to a landfill. Since materials are assumed to be landfilled at the end of life rather than incinerated or reused/recycled, no materials are available for energy recovery or reuse/recycling.

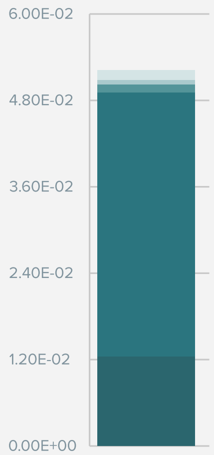
Embodied carbon

Embodied carbon can be defined as the cradle-to-gate (A1-A3) global warming potential impacts. The total embodied carbon per functional unit of FSK-faced Earthwool® Insulation Board Insulation manufactured in Shelbyville, IN is 4.60E+00 kg CO_2-eq.

Material composition greater than 1% by weight

PART	MATERIAL	%WT.
Batch	Cullet	30-35%
Batch	Sand	5-8%
Batch	Borates	2-5%
Batch	Soda ash	2-5%
Batch	Feldspar	1-2%
Batch	Limestone	1-2%
Batch	Oxides	<1%
Binder	Water	15-20%
Binder	Sugars	10-15%
Binder	Additives	2-5%
Facer	FSK facer	8-10%
Packaging	Plastic	<1%
Packaging	Cardboard	15-20%

Total impacts by life cycle stages [mPts/per func unit]



LIFE CYCLE STAGE	MPTS/FUNC. UNIT
Raw material acquisition	1.22E-02
Manufacturing	3.71E-02
Transportation	1.19E-03
Installation and maintenance	5.23E-04
Disposal/reuse/recycling	1.40E-03

Total impacts = 5.24E-02 mPts
per 75 years installed

How our product compares to previous years' results

In 2018, Knauf Insulation North America published a product-specific Type III EPD for Earthwool® Insulation Board. The 2018 EPD and this 2023 EPD both followed the UL PCR Part A and Part B for Building Envelope Thermal Insulation. The life cycle results considered for benchmarking in each EPD were consistent; the data sources were consistent as they pertained to priority of primary and secondary data sources and application of specific secondary, non-LCI data; cut-off criteria were consistently applied; and product-specific use phase and end-of-life calculations were consistently applied. To ensure comparability, the 2018 benchmark EPD results were recalculated using the most recent LCA software version and most recently updated LCI data sets, then used for benchmarking with the 2023 updated EPD. The updated FSK-faced 2018 total results from cradle to grave were as follows: global warming 5.48E+00 kg CO_2-eq, ozone depletion potential 2.49E-09 kg CFC-11 eq, acidification 9.11E-03 kg SO_2-eq, and eutrophication 1.24E-03 kg N eq.

Earthwool® Insulation Board results from 2023 show improvements across the global warming potential and ozone depletion potential impact categories. The next highest performing impact category was acidification, which showed only a 14% increase in impacts. The impact reductions for GWP and ODP primarily stem from A3. Differences in manufacturing activities contribute significantly when comparing the 2023 results to the 2018 results and identifying the contributors to performance improvement.

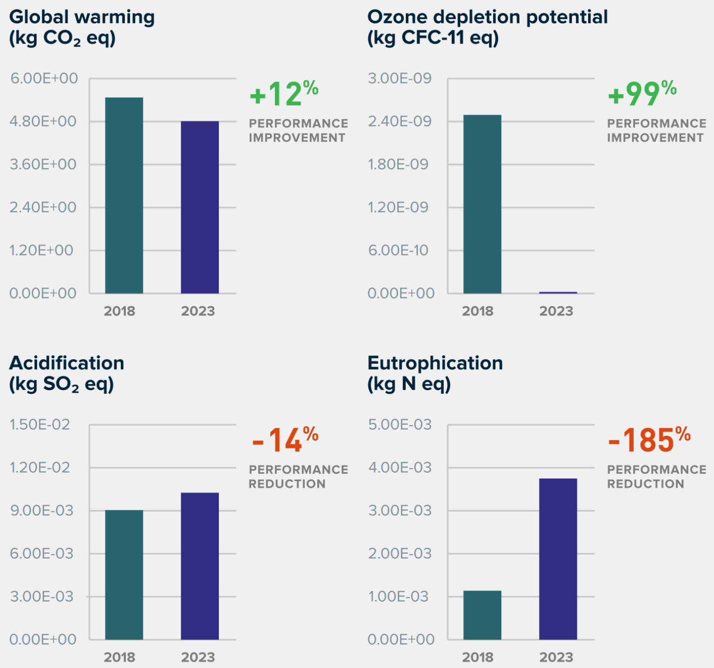
The lowest performing impact category compared (higher impact results than in 2018) was eutrophication. The biggest contributors to eutrophication are the sugars in the binder and the water used in the fiberizing step during manufacturing. More water was consumed in this step as compared to previous years.

About 2018 results

The 2018 Transparency Report for Earthwool® Insulation Board serves as a benchmark to which the 2023 results can be compared. One impact category was used for comparison to satisfy the LEED LCA optimization credit: global warming potential. Its reduction alone can contribute towards satisfying credits under LEED. The reduction in this impact category reflects that this report is valued at 1.5 products.

Total impacts: 2018 to 2023 comparison

Highest and lowest performing impact categories



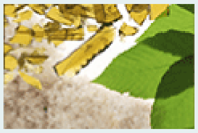
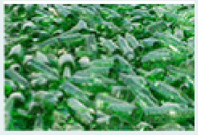
How we're making it greener

Knauf Insulation North America (KINA) is committed to providing products that conserve energy and preserve natural resources.

- Our products with ECOSE® Technology contain a bio-based binder adhesive instead of a fossil fuel-based binder.
- Our fiberglass contains on average over 60% recycled glass, which requires about 20% less energy required to form glass fibers, and results in about 25% reduction in embodied carbon.
- Our glass is audited by a 3rd party to ensure biosoluble chemistry from a health and safety standpoint.

See how we make it greener

LCA results

LIFE CYCLE STAGE	RAW MATERIAL ACQUISITION	MANUFACTURING	TRANSPORTATION	INSTALLATION AND MAINTENANCE	DISPOSAL/ REUSE/ RECYCLING
Information modules: **Included (X)** I Excluded (MND)* *Module D is also excluded from this system boundary (MND).	**(X) A1 Raw materials**	**(X) A3 Manufacturing**	**(X) A4 Distribution**	**(X) A5 Installation**	**(X) C1 Deconstruction**
	(X) A2 Transportation			**(X) B1 Use**	**(X) C2 Transportation**
				(X) B2 Maintenance	**(X) C3 Waste processing**
				(X) B3 Repair	**(X) C4 Disposal**
				(X) B4 Replacement	
				(X) B5 Refurbishment	
				(X) B6 Operational energy use	
				(X) B7 Operational water use	
					

SM Single Score

Learn about SM Single Score results

Impacts per 1 square meter of insulation material	1.22E-02 mPts	3.71E-02 mPts	1.19E-03 mPts	5.23E-04 mPts	1.40E-03 mPts
Materials or processes contributing >20% to total impacts in each life cycle stage	Batch material and binder material production.	Energy required to melt the glass and produce the glass fibers.	Truck and rail transportation used to transport product to building site.	Transportation to landfill and landfilling of packaging materials.	Transportation to landfill and landfilling of product at end of life.

TRACI v2.1 results per functional unit (FSK-faced Earthwool® Insulation Board - Shelbyville, IN)

LIFE CYCLE STAGE		RAW MATERIAL ACQUISITION	MANUFACTURING	TRANSPORTATION	INSTALLATION AND MAINTENANCE	DISPOSAL/ REUSE/ RECYCLING

Ecological damage

Impact category	Unit					
Global warming	**kg CO_2 eq**	2.18E-01	4.38E+00	6.42E-02	8.31E-02	6.79E-02
Ozone depletion	**kg CFC-11 eq**	2.39E-12	1.05E-11	1.43E-16	1.36E-16	1.96E-15
Acidification	**kg SO_2 eq**	2.71E-03	6.89E-03	3.29E-04	1.77E-04	2.85E-04
Eutrophication	**kg N eq**	1.80E-03	1.67E-03	2.82E-05	2.90E-05	1.75E-05

Human health damage

Impact category	Unit					
Smog	**kg O_3 eq**	2.86E-02	1.36E-01	1.13E-02	1.05E-03	5.56E-03
Respiratory effects	**kg $PM_{2.5}$ eq**	1.97E-04	3.66E-04	1.61E-05	4.17E-06	1.92E-05

Additional environmental information

Impact category	Unit					
Carcinogenics	**CTU_h**	7.5%	90.0%	0.2%	0.1%	2.2%
Non-carcinogenics	**CTU_h**	12.4%	81.8%	0.4%	0.3%	5.2%
Ecotoxicity	**CTU_e**	22.6%	76.0%	0.7%	0.1%	0.6%
Fossil fuel depletion	**MJ surplus**	1.20E+00	8.87E+00	1.20E-01	1.23E-02	1.33E-01

References

LCA Background Report
Knauf Insulation North America and Manson Insulation Products LCA Background Report (public version), Knauf Insulation North America (KINA) 2023; developed using the TRACI v2.1 and CML impact assessment methodologies, and LCA for Experts modeling software.

ISO 14025, "Sustainability in buildings and civil engineering works -- Core rules for environmental product declarations of construction products and services"

ISO 21930:2017 serves as the core PCR along with UL Part A.

UL Part A: Life Cycle Assessment Calculation Rules and Report Requirements v4.0
March, 2022. PCR review conducted by Lindita Bushi, PhD, Chair (Athena Sustainable Materials Institute), lindita.bushi@athenasmi.org; Hugues Imbeault-Tétreault (Group AGECO); and Jack Geibig (Ecoform).

UL Part B: Building Envelope Thermal Insulation EPD Requirements, v2.0
April, 2018. PCR review conducted by Thomas Gloria, PhD, Chair (Industrial Ecology Consultants) t.gloria@industrial-ecology.com; Christoph Koffler, PhD (thinkstep); Andre Desjarlais (Oak Ridge National Laboratory).

2018 Transparency Report for Earthwool® Insulation Board, Knauf Insulation North America (KINA) 2018.

UL Environment General Program Instructions v2.4, July 2018 (available upon request)

Download PDF SM Transparency Report / EPD

SM Transparency Reports (TR) are ISO 14025 Type III environmental declarations (EPD) that enable purchasers and users to compare the potential environmental performance of products on a life cycle basis. Environmental declarations from different programs (ISO 14025) may not be comparable. Comparison of the environmental performance of products using EPD information shall be based on the product's use and impacts at the building level, and therefore EPDs may not be used for comparability purposes when not considering the building energy use phase as instructed under this PCR. Full conformance with the PCR for Building Envelope Thermal Insulation 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.

Rating systems

The intent is to reward project teams for selecting products from manufacturers who have verified improved life-cycle environmental performance.

LEED BD+C: New Construction | v4 - LEED v4
Building product disclosure and optimization

Environmental product declarations

○	Industry-wide (generic) EPD	½product
✔	Product-specific Type III EPD	1 product

Option 2: Multi-attribute optimization

✔	Product-specific Type III EPD	

LEED BD+C: New Construction | v4.1 - LEED v4.1
Building product disclosure and optimization

Environmental product declarations

○	Option 1: Industry-wide (generic) EPD	1 product
✔	Option 1: Product-specific Type III EPD	1.5 product
✔	Option 2: Embodied carbon / LCA optimization	1.5 products

Collaborative for High Performance Schools National Criteria
MW C5.1 – Environmental Product Declarations

✔	Third-party certified type III EPD	2 point

Green Globes for New Construction and Sustainable Interiors
Materials and resources

✔	NC 3.5.1.2 Path B: Prescriptive Path for Building Core and Shell
✔	NC 3.5.2.2 and SI 4.1.2 Path B: Prescriptive Path for Interior Fit-outs

BREEAM New Construction 2018
Mat 02 - Environmental impacts from construction products

Environmental Product Declarations (EPD)

○	Industry-average EPD	.5 point
○	Multi-product specific EPD	.75 points
✔	Product-specific EPD	1 point

LCA results & interpretation

Earthwool® Insulation Board

Unfaced | FSK faced | ASJ+ faced | EPD additional content | Material health

Scope and summary

○ Cradle to gate ○ Cradle to gate with options ✔ **Cradle to grave**

Application

Versatile product for thermal and acoustical applications such as: heating & air conditioning ducts, power and process equipment, boiler and stack installations, metal and masonry walls, wall and roof panel systems, curtain wall assemblies, and cavity walls.

Functional unit

One square meter of installed insulation material, packaging included, with a thickness that gives an average thermal resistance of $R_{SI} = 1m^2 \cdot K/W$ with a building service life of 75 years.

Reference service life: 75 years when installed per manufacturer's instructions
Reference flow: 2.30 kg of product with all-service jacket (ASJ+) facer.

A thickness of 0.0330m achieves the functional unit. (ASTM C518)

Manufacturing data

Reporting period: January 2022 – December 2022
Location: Shelbyville, IN

Default installation, packaging, and disposal scenarios

At the installation site, insulation products are unpackaged and installed. Staples may be used to install board products. The potential impact of the staples is assumed to be negligible since their use is spread out over hundreds of sheets of product; therefore, they were not included in the model.

No material is assumed to be lost or wasted. Scraps are typically used to fill corners or crevices. Plastic packaging waste is disposed (9% to recycling, 68% to landfill, and 17% to incineration), paper-based packaging waste is disposed (68% to recycling, 20% to landfill, and 5% to incineration), and no maintenance or replacement is required over the life of the building. After removal, the insulation is assumed to be landfilled. Insulation and packaging waste are assumed to be transported 100 miles for disposal.

What's causing the greatest impacts

All life cycle stages

The manufacturing stage dominates all impact categories except ozone depletion, where the raw material acquisition stage takes precedence. The energy required to melt the glass and produce the glass fibers is the largest contributor to the manufacturing stage. The impact of the raw material acquisition stage is mostly due to the batch and binder materials. The contributions to outbound transportation are caused by the use of trucks and rail transport. The only impacts associated with installation and maintenance are due to the disposal of packaging waste, which is the smallest contributor of all the stages. At the end of life, insulation is manually removed from the building and landfilled. For all products, waste is dominated by the final disposal of the product. Non-hazardous waste accounts for waste generated during manufacturing and installation.

Raw materials acquisition and transportation

The raw material acquisition stage is the second highest contributor for most impact categories, but ozone depletion potential is almost entirely generated from this stage. The raw materials acquisition stage impact is largely due to the borax, manganese oxide, and soda ash in the batch and the sugars in the binder. Third-party verified ISO 14040/44 secondary LCI data sets contribute more than 80% of the total impacts to ozone depletion.

Manufacturing stage

The manufacturing stage has the most significant contribution to all impact categories, primarily due to the energy required to melt the glass and produce the glass fibers. Since some batch ingredients significantly contribute to the respiratory effects category, they can lead to higher impact results in the raw materials acquisition stage. However, since sand and borax are melted in the oven with the other batch materials, they are not released into the air as fine particulates. Therefore, the calculated potential impacts as shown in the results tables are likely much larger than the actual impacts in the raw material acquisition stage. This implies that the manufacturing stage may have a greater share of the impact than what is displayed in the total impacts by life cycle stage.

Distribution

Outbound transportation is the third highest contributor to smog impacts.

End of life

The end-of-life impacts are largely due to landfilling of the product after it has been removed from the building and transported to a landfill. Since materials are assumed to be landfilled at the end of life rather than incinerated or reused/recycled, no materials are available for energy recovery or reuse/recycling.

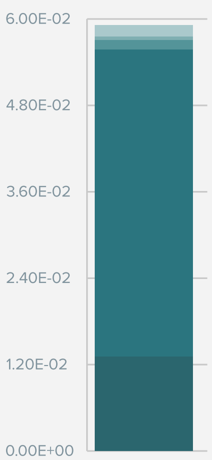
Embodied carbon

Embodied carbon can be defined as the cradle-to-gate (A1-A3) global warming potential impacts. The total embodied carbon per functional unit of ASJ+ faced Earthwool® Insulation Board Insulation manufactured in Shelbyville, IN is 5.08E+00 kg CO_2-eq.

Material composition greater than 1% by weight

PART	MATERIAL	%WT.
Batch	Cullet	25-30%
Batch	Sand	2-5%
Batch	Borates	2-5%
Batch	Soda ash	2-5%
Batch	Feldspar	1-2%
Batch	Limestone	1-2%
Batch	Oxides	<1%
Binder	Water	15-20%
Binder	Sugars	8-10%
Binder	Additives	2-5%
Facer	ASJ+ facer	10-15%
Packaging	Plastic	<1%
Packaging	Cardboard	15-20%

Total impacts by life cycle stages [mPts/per func unit]



LIFE CYCLE STAGE	MPTS/FUNC. UNIT
Raw material acquisition	1.32E-02
Manufacturing	4.28E-02
Transportation	1.25E-03
Installation and maintenance	5.50E-04
Disposal/reuse/recycling	1.47E-03

Total impacts = 5.92E-02 mPts
per 75 years installed

How our product compares to previous years' results

In 2018, Knauf Insulation North America published a product-specific Type III EPD for Earthwool® Insulation Board. The 2018 EPD and this 2023 EPD both followed the UL PCR Part A and Part B for Building Envelope Thermal Insulation. The life cycle results considered for benchmarking in each EPD were consistent; the data sources were consistent as they pertained to priority of primary and secondary data sources and application of specific secondary, non-LCI data; cut-off criteria were consistently applied; and product-specific use phase and end-of-life calculations were consistently applied. To ensure comparability, the 2018 benchmark EPD results were recalculated using the most recent LCA software version and most recently updated LCI data sets, then used for benchmarking with the 2023 updated EPD. The updated ASJ+ faced 2018 total results from cradle to grave were as follows: global warming 5.76E+00 kg CO_2-eq, ozone depletion potential 2.88E-09 kg CFC-11 eq, acidification 9.66E-03 kg SO_2-eq, and eutrophication 1.30E-03 kg N eq.

Earthwool® Insulation Board results from 2023 show improvements across the global warming potential and ozone depletion potential impact categories. The next highest performing impact category was acidification, which showed only a 22% increase in impacts. The impact reductions for GWP and ODP primarily stem from A3. Differences in manufacturing activities contribute significantly when comparing the 2023 results to the 2018 results and identifying the contributors to performance improvement.

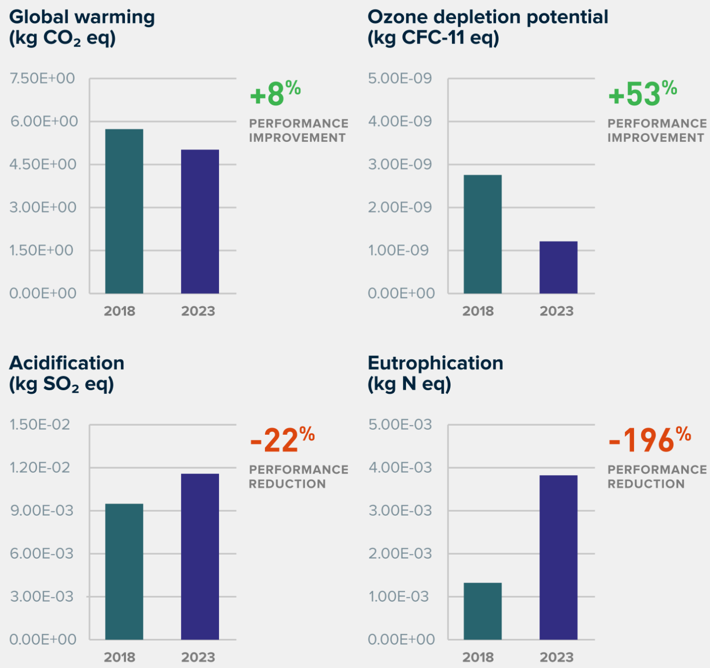
The lowest performing impact category compared (higher impact results than in 2018) was eutrophication. The biggest contributors to eutrophication are the sugars in the binder and the water used in the fiberizing step during manufacturing. More water was consumed in this step as compared to previous years.

About 2018 results

The 2018 Transparency Report for Earthwool® Insulation Board serves as a benchmark to which the 2023 results can be compared. One impact category was used for comparison to satisfy the LEED LCA optimization credit: global warming potential. Its reduction alone can contribute towards satisfying credits under LEED. The reduction in this impact category reflects that this report is valued at 1 product.

Total impacts: 2018 to 2023 comparison

Highest and lowest performing impact categories



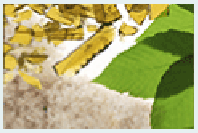
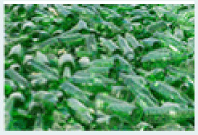
How we're making it greener

Knauf Insulation North America (KINA) is committed to providing products that conserve energy and preserve natural resources.

- Our products with ECOSE® Technology contain a bio-based binder adhesive instead of a fossil fuel-based binder.
- Our fiberglass contains on average over 60% recycled glass, which requires about 20% less energy required to form glass fibers, and results in about 25% reduction in embodied carbon.
- Our glass is audited by a 3rd party to ensure biosoluble chemistry from a health and safety standpoint.

See how we make it greener

LCA results

LIFE CYCLE STAGE	RAW MATERIAL ACQUISITION	MANUFACTURING	TRANSPORTATION	INSTALLATION AND MAINTENANCE	DISPOSAL/ REUSE/ RECYCLING
Information modules: **Included (X)** | Excluded (MND)* *Module D is also excluded from this system boundary (MND).	**(X) A1 Raw materials**	**(X) A3 Manufacturing**	**(X) A4 Distribution**	**(X) A5 Installation**	**(X) C1 Deconstruction**
	(X) A2 Transportation			**(X) B1 Use**	**(X) C2 Transportation**
				(X) B2 Maintenance	**(X) C3 Waste processing**
				(X) B3 Repair	**(X) C4 Disposal**
				(X) B4 Replacement	
				(X) B5 Refurbishment	
				(X) B6 Operational energy use	
				(X) B7 Operational water use	
					

SM Single Score

Learn about SM Single Score results

Impacts per 1 square meter of insulation material	1.32E-02 mPts	4.28E-02 mPts	1.25E-03 mPts	5.50E-04 mPts	1.47E-03 mPts
Materials or processes contributing >20% to total impacts in each life cycle stage	Batch material and binder material production.	Energy required to melt the glass and produce the glass fibers.	Truck and rail transportation used to transport product to building site.	Transportation to landfill and landfilling of packaging materials.	Transportation to landfill and landfilling of product at end of life.

TRACI v2.1 results per functional unit (ASJ+ faced Earthwool® Insulation Board - Shelbyville, IN)

LIFE CYCLE STAGE		RAW MATERIAL ACQUISITION	MANUFACTURING	TRANSPORTATION	INSTALLATION AND MAINTENANCE	DISPOSAL/ REUSE/ RECYCLING
Ecological damage						
Impact category	Unit					
Global warming	**kg CO_2 eq**	2.34E-01	4.85E+00	6.75E-02	8.74E-02	7.14E-02
Ozone depletion	**kg CFC-11 eq**	2.57E-12	1.35E-09	1.51E-16	1.43E-16	2.06E-15
Acidification	**kg SO_2 eq**	2.91E-03	8.01E-03	3.46E-04	1.86E-04	2.99E-04
Eutrophication	**kg N eq**	1.94E-03	1.84E-03	2.97E-05	3.05E-05	1.84E-05
Human health damage						
Impact category	Unit					
Smog	**kg O_3 eq**	3.07E-02	1.53E-01	1.19E-02	1.10E-03	5.85E-03
Respiratory effects	**kg $PM_{2.5}$ eq**	2.12E-04	4.37E-04	1.69E-05	4.38E-06	2.02E-05
Additional environmental information						
Impact category	Unit					
Carcinogenics	**CTU_h**	7.4%	90.1%	0.2%	0.1%	2.1%
Non-carcinogenics	**CTU_h**	12.1%	82.3%	0.4%	0.3%	5.0%
Ecotoxicity	**CTU_e**	22.4%	76.3%	0.7%	0.1%	0.6%
Fossil fuel depletion	**MJ surplus**	1.29E+00	9.79E+00	1.27E-01	1.29E-02	1.40E-01

See the additional content required by the NSF PCR for architectural coatings on page 4 of the Transparency Report PDF.

EPD additional content

Earthwool® Insulation Board

Data

Background This product-specific plant-specific declaration was created byR collecting production data from the Shelbyville, IN production location.R Secondary data sources include those available in LCA for Experts 2023R databases.

Allocation The PCR prescribes where and how allocation occurs. Since onlyR facility-level data were available, allocation among the facilities' other co-products was necessary to determine the input and output flows associatedR with the product. Allocation of batch materials and energy was done on aR product output mass basis, binder materials were allocated based on the massR calculated from the bill of materials and binder formulations, facers wereR allocated based on product area, and packaging was allocated based on massR per package of product. Allocation of transportation was based on eitherR weight or volume, depending on which was found to restrict the amount ofR cargo; the limiting factor was used in allocating transportation.

Cut-off criteria for the inclusion of mass and energy flows are 1% of renewableR primary resource (energy) usage, 1% nonrenewable primary resource (energy)R usage, 1% of the total mass input of that unit process, and 1% of environmentalR impacts. The total of neglected input flows per module does not exceed 5% ofR energy usage, mass, and environmental impacts. The only exceptions to theseR criteria are substances with hazardous and toxic properties, which must beR listed even when the given process unit is under the cut-off criterion of 1% ofR the total mass. No known flows are deliberately excluded from this declaration;R therefore, these criteria have been met. Biogenic carbon is included in reportedR results.

Quality Temporal and technological representativeness are considered to beR high. Geographical representativeness is considered to be high. All relevantR process steps for the product system were considered and modeled. TheR process chain is considered sufficiently complete with regards to the goal andR scope of this study. The product system was checked for mass balance andR completeness of the inventory. Capital goods were excluded since they areR assumed not to significantly affect the conclusions of the LCA. Otherwise, noR data were knowingly omitted. For more information on data quality, see the LCAR background report.

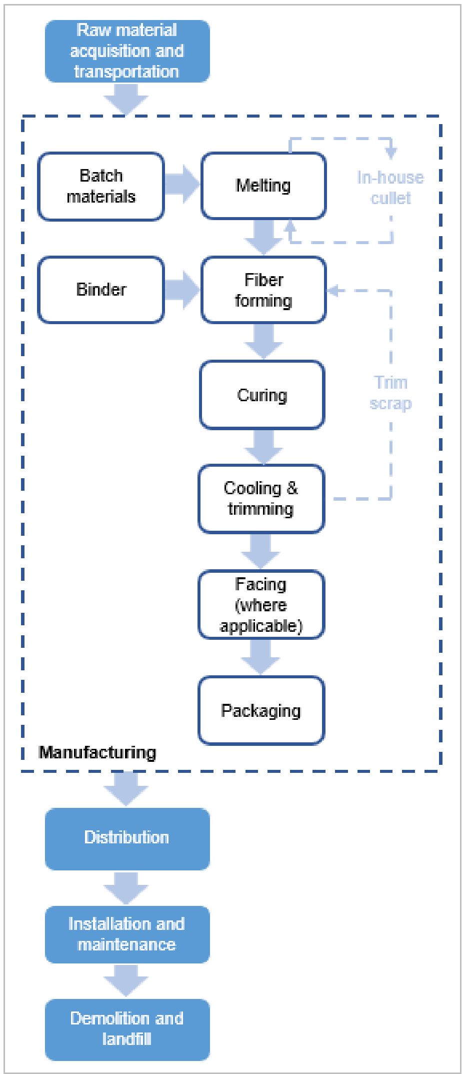
LCIA impact factors required by the PCR are global warming, ozone depletion,R acidification, eutrophication, smog, and fossil fuel depletion; "These six impactR categories are globally deemed mature enough to be included in Type IIIR environmental declarations. Other categories are being developed and definedR and LCA should continue making advances in their development. However, theR EPD users shall not use additional measures for comparative purposes."

Scenarios and additional technical information

PARAMETER	VALUE	UNIT
Transport to the building site [A4]		
Vehicle type	Truck and trailer	-
Fuel type	Diesel	-
Average distance from manufacturing to installation site	161	km
Capacity utilization	27	%
Gross density	48.1	kg/m^3
Capacity utilization volume factor	1	-
Installation into the building [A5]		
Mass of plastic packaging waste	0.00543	kg
Biogenic carbon content of packaging	0.451	kg CO_2
End of life [C1-C4]		
Assumptions for scenario development	Following manual removal of the insulation, it was assumed to be transported 100 miles to disposal. The PCR prescribes that 100% of the insulation is sent to landfill, where no prior waste processing is required.	
Collection process	Collected with mixed construction waste	Unfaced: 1.75 kg FSK: 1.90 kg ASJ+: 2.01 kg
Disposal	Product for final deposition in landfill	Unfaced: 1.75 kg FSK: 1.90 kg ASJ+: 2.01 kg

Technical properties	
Dimensions/quantities delivered to installation site	Earthwool® Insulation Board is sold in sheets. One carton contains eight pieces wrapped in stretch wrap. The dimensions for each roll of the product are 1.5" – 2" thick, 24" in width, and 48" in length.
ASTM or ANSI product specification	• ASTM C612: Type IA (1.6, 2.25, 3.0, 4.25, 6.0 pcf), Type IB (3.0, 4.25, 6.0 pcf) • ASTM C795 • ASTM C1136: Type I, II, III, IV, VIII (ASJ+), Type II, IV (FSK)
Corrosion	ASTM C1617; Pass
Puncture Resistance	TAPPI Test T803, Beach Units FSK facing: 25, ASJ+ facing: 120

Flow diagram



Technical properties	
Water vapor sorption (by weight)	ASTM C1104; Less than 5%
Shrinkage	ASTM C356; Less than 0.3%
Mold growth	ASTM C1338; Pass
Surface burning characteristics (flame spread/smoke developed)	ASTM E84, UL 723, CAN/ULC S102, NFPA 90A and 90B; UL/ULC Classified FHC 25/50

Major system boundary exclusions

- Capital goods and infrastructure; maintenance of operation and support equipment;
- Manufacture & transport of packaging materials not associated with final product;
- Human labor and employee transport;
- Building operational energy and water use not associated with final product.

Major assumptions and limitations

- Due to the nature of fiberglass insulation, it is anticipated that it will last for the lifetime of the building, so the reference service life (RSL) is considered to be the same as the building estimated service life (ESL) of 75 years.
- Generic data sets used for material inputs, transport, and waste processing are considered good quality, but actual impacts from material suppliers, transport carriers, and local waste processing may vary.
- The impact assessment methodology categories do not represent all possible environmental impact categories.
- Characterization factors used within the impact assessment methodology may contain varying levels of uncertainty.
- LCA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

Unfaced Earthwool® Insulation Board produced in Shelbyville, IN: LCIA results, resource use, output and waste flows, and carbon emissions & removals per functional unit

Parameter	Unit	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	Total
LCIA results										
Global warming	kg CO_2 eq	3.41E+00	5.98E-02	7.74E-02	0	0	2.75E-02	0	3.58E-02	**3.61E+00**
Ozone depletion	kg CFC-11 eq	2.74E-12	1.33E-16	1.27E-16	0	0	6.14E-17	0	1.76E-15	**2.75E-12**
Acidification	kg SO2 eq	8.78E-03	3.07E-04	1.65E-04	0	0	7.52E-05	0	1.90E-04	**9.51E-03**
Eutrophication	kg N eq	3.51E-03	2.63E-05	2.70E-05	0	0	7.97E-06	0	8.33E-06	**3.58E-03**
Smog	kg O_3 eq	1.47E-01	1.05E-02	9.74E-04	0	0	1.72E-03	0	3.46E-03	**1.63E-01**
Respiratory effects	kg PM2.5 eq	5.58E-04	1.50E-05	3.88E-06	0	0	3.23E-06	0	1.46E-05	**5.94E-04**
Additional environmental information										
Carcinogenics	CTUh	97.5%	0.2%	0.1%	0.0%	0.0%	0.1%	0.0%	2.1%	**100.0%**
Non-carcinogenics	CTUh	94.2%	0.4%	0.3%	0.0%	0.0%	0.2%	0.0%	4.9%	**100.0%**
Ecotoxicity	CTUe	98.6%	0.7%	0.1%	0.0%	0.0%	0.3%	0.0%	0.3%	**100.0%**
Fossil fuel depletion	MJ surplus	6.54E+00	1.12E-01	1.14E-02	0	0	5.15E-02	0	7.21E-02	**6.79E+00**
Resource use indicators										
Renewable primary energy used as energy carrier (fuel)	MJ, LHV	2.72E+01	3.30E-02	6.62E-03	0	0	1.52E-02	0	6.71E-02	**2.73E+01**
Renewable primary resources with energy content used as material	MJ, LHV	1.11E-07	-2.73E-12	8.39E-13	0	0	-1.25E-12	0	1.34E-11	**1.11E-07**
Non-renewable primary resources used as an energy carrier (fuel)	MJ, LHV	7.38E+01	8.47E-01	9.13E-02	0	0	3.89E-01	0	5.73E-01	**7.57E+01**
Non-renewable primary resources with energy content used as material	MJ, LHV	7.22E-07	3.37E-09	3.09E-10	0	0	1.55E-09	0	1.43E-09	**7.29E-07**

Parameter	Unit	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	Total
Secondary materials	kg	5.87E-01	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**5.87E-01**
Renewable secondary fuels	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Non-renewable secondary fuels	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Recovered energy	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Use of net fresh water resources	m^3	1.41E+00	1.15E-04	6.95E-05	0	0	5.27E-05	0	7.10E-05	**1.41E+00**
Abiotic depletion potential, fossil	MJ, LHV	5.93E+01	8.41E-01	8.83E-02	0	0	3.87E-01	0	5.55E-01	**6.11E+01**
Output flows and waste category indicators										
Hazardous waste disposed	kg	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Non-hazardous waste disposed	kg	2.69E-01	0.00E+00	6.77E-02	0	0	0.00E+00	0	1.71E+00	**2.05E+00**
High-level radioactive waste	kg	5.24E-06	2.47E-09	1.26E-09	0	0	1.13E-09	0	7.09E-09	**5.25E-06**
Intermediate- and low-level radioactive waste, conditioned, to final repository	kg	5.07E-03	2.08E-06	1.07E-06	0	0	9.55E-07	0	6.34E-06	**5.08E-03**
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Materials for recycling	kg	0.00E+00	0.00E+00	2.39E-01	0	0	0.00E+00	0	0.00E+00	**2.39E-01**
Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Exported energy	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Carbon emissions and removals										
Biogenic carbon removal from product	kg CO_2	8.51E-01	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**8.51E-01**
Biogenic carbon emission from product	kg CO_2	3.54E-01	0.00E+00	0.00E+00	0	0	0.00E+00	0	2.94E-03	**3.57E-01**
Biogenic carbon removal from packaging	kg CO_2	6.06E-01	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**6.06E-01**
Biogenic carbon emission from packaging	kg CO_2	0.00E+00	0.00E+00	1.37E-02	0	0	0.00E+00	0	0.00E+00	**1.37E-02**
Biogenic carbon emission from combustion of waste	kg CO_2	0.00E+00	0.00E+00	2.18E-02	0	0	0.00E+00	0	0.00E+00	**2.18E-02**
Calcination carbon emissions	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Carbonation carbon removals	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Carbon emissions from combustion of waste from non renewable sources used in production processes + Carbon emissions from combustion of waste from renewable sources used in production processes	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**

FSK-faced Earthwool® Insulation Board produced in Shelbyville, IN: LCIA results, resource use, output and waste flows, and carbon emissions & removals per functional unit

Parameter	Unit	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	Total
LCIA results										
Global warming	kg CO_2 eq	4.60E+00	6.42E-02	8.31E-02	0	0	2.95E-02	0	3.84E-02	**4.82E+00**
Ozone depletion	kg CFC-11 eq	1.29E-11	1.43E-16	1.36E-16	0	0	6.59E-17	0	1.89E-15	**1.29E-11**
Acidification	kg SO2 eq	9.59E-03	3.29E-04	1.77E-04	0	0	8.07E-05	0	2.04E-04	**1.04E-02**
Eutrophication	kg N eq	3.47E-03	2.82E-05	2.90E-05	0	0	8.55E-06	0	8.94E-06	**3.55E-03**
Smog	kg O_3 eq	1.64E-01	1.13E-02	1.05E-03	0	0	1.84E-03	0	3.72E-03	**1.82E-01**
Respiratory effects	kg PM2.5 eq	5.63E-04	1.61E-05	4.17E-06	0	0	3.46E-06	0	1.57E-05	**6.03E-04**
Additional environmental information										
Carcinogenics	CTUh	97.4%	0.2%	0.1%	0.0%	0.0%	0.1%	0.0%	2.1%	**100.0%**
Non-carcinogenics	CTUh	94.1%	0.4%	0.3%	0.0%	0.0%	0.2%	0.0%	5.0%	**100.0%**
Ecotoxicity	CTUe	98.6%	0.7%	0.1%	0.0%	0.0%	0.3%	0.0%	0.3%	**100.0%**
Fossil fuel depletion	MJ surplus	1.01E+01	1.20E-01	1.23E-02	0	0	5.53E-02	0	7.74E-02	**1.03E+01**
Resource use indicators										

Parameter	Unit	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	Total
Renewable primary energy used as energy carrier (fuel)	MJ, LHV	2.13E+01	3.54E-02	7.11E-03	0	0	1.63E-02	0	7.20E-02	**2.14E+01**
Renewable primary resources with energy content used as material	MJ, LHV	1.90E-07	-2.93E-12	9.01E-13	0	0	-1.35E-12	0	1.43E-11	**1.90E-07**
Non-renewable primary resources used as an energy carrier (fuel)	MJ, LHV	1.01E+02	9.09E-01	9.81E-02	0	0	4.18E-01	0	6.15E-01	**1.03E+02**
Non-renewable primary resources with energy content used as material	MJ, LHV	5.84E-07	3.62E-09	3.32E-10	0	0	1.66E-09	0	1.53E-09	**5.91E-07**
Secondary materials	kg	6.30E-01	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**6.30E-01**
Renewable secondary fuels	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Non-renewable secondary fuels	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Recovered energy	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Use of net fresh water resources	m^3	1.46E+00	1.23E-04	7.47E-05	0	0	5.65E-05	0	7.62E-05	**1.46E+00**
Abiotic depletion potential, fossil	MJ, LHV	8.50E+01	9.03E-01	9.48E-02	0	0	4.15E-01	0	5.96E-01	**8.70E+01**
Output flows and waste category indicators										
Hazardous waste disposed	kg	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Non-hazardous waste disposed	kg	2.89E-01	0.00E+00	7.27E-02	0	0	0.00E+00	0	1.84E+00	**2.20E+00**
High-level radioactive waste	kg	5.79E-06	2.65E-09	1.35E-09	0	0	1.22E-09	0	7.61E-09	**5.80E-06**
Intermediate- and low-level radioactive waste, conditioned, to final repository	kg	5.51E-03	2.23E-06	1.15E-06	0	0	1.03E-06	0	6.81E-06	**5.52E-03**
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Materials for recycling	kg	0.00E+00	0.00E+00	2.57E-01	0	0	0.00E+00	0	0.00E+00	**2.57E-01**
Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Exported energy	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Carbon emissions and removals										
Biogenic carbon removal from product	kg CO_2	8.80E-01	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**8.80E-01**
Biogenic carbon emission from product	kg CO_2	3.66E-01	0.00E+00	0.00E+00	0	0	0.00E+00	0	3.16E-03	**3.69E-01**
Biogenic carbon removal from packaging	kg CO_2	1.25E-02	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**1.25E-02**
Biogenic carbon emission from packaging	kg CO_2	0.00E+00	0.00E+00	1.47E-02	0	0	0.00E+00	0	0.00E+00	**1.47E-02**
Biogenic carbon emission from combustion of waste	kg CO_2	0.00E+00	0.00E+00	2.34E-02	0	0	0.00E+00	0	0.00E+00	**2.34E-02**
Calcination carbon emissions	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Carbonation carbon removals	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Carbon emissions from combustion of waste from non renewable sources used in production processes + Carbon emissions from combustion of waste from renewable sources used in production processes	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**

ASJ+ faced Earthwool® Insulation Board produced in Shelbyville, IN: LCIA results, resource use, output and waste flows, and carbon emissions & removals per functional unit

Parameter	Unit	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	Total
LCIA results										
Global warming	kg CO_2 eq	5.08E+00	6.75E-02	8.74E-02	0	0	3.10E-02	0	4.04E-02	**5.31E+00**
Ozone depletion	kg CFC-11 eq	1.36E-09	1.51E-16	1.43E-16	0	0	6.93E-17	0	1.99E-15	**1.36E-09**
Acidification	kg SO2 eq	1.09E-02	3.46E-04	1.86E-04	0	0	8.49E-05	0	2.14E-04	**1.18E-02**

Parameter	Unit	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	Total
Eutrophication	kg N eq	3.78E-03	2.97E-05	3.05E-05	0	0	8.99E-06	0	9.40E-06	**3.86E-03**
Smog	kg O_3 eq	1.84E-01	1.19E-02	1.10E-03	0	0	1.94E-03	0	3.91E-03	**2.03E-01**
Respiratory effects	kg PM2.5 eq	6.48E-04	1.69E-05	4.38E-06	0	0	3.64E-06	0	1.65E-05	**6.90E-04**
Additional environmental information										
Carcinogenics	CTUh	97.5%	0.2%	0.1%	0.0%	0.0%	0.1%	0.0%	2.0%	**100.0%**
Non-carcinogenics	CTUh	94.4%	0.4%	0.3%	0.0%	0.0%	0.2%	0.0%	4.8%	**100.0%**
Ecotoxicity	CTUe	98.7%	0.7%	0.1%	0.0%	0.0%	0.3%	0.0%	0.3%	**100.0%**
Fossil fuel depletion	MJ surplus	1.11E+01	1.27E-01	1.29E-02	0	0	5.82E-02	0	8.14E-02	**1.14E+01**
Resource use indicators										
Renewable primary energy used as energy carrier (fuel)	MJ, LHV	2.40E+01	3.72E-02	7.48E-03	0	0	1.71E-02	0	7.58E-02	**2.41E+01**
Renewable primary resources with energy content used as material	MJ, LHV	1.03E-05	-3.08E-12	9.47E-13	0	0	-1.42E-12	0	1.51E-11	**1.03E-05**
Non-renewable primary resources used as an energy carrier (fuel)	MJ, LHV	1.11E+02	9.56E-01	1.03E-01	0	0	4.39E-01	0	6.47E-01	**1.13E+02**
Non-renewable primary resources with energy content used as material	MJ, LHV	6.31E-07	3.81E-09	3.49E-10	0	0	1.75E-09	0	1.61E-09	**6.39E-07**
Secondary materials	kg	6.62E-01	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**6.62E-01**
Renewable secondary fuels	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Non-renewable secondary fuels	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Recovered energy	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Use of net fresh water resources	m^3	1.57E+00	1.29E-04	7.85E-05	0	0	5.95E-05	0	8.02E-05	**1.57E+00**
Abiotic depletion potential, fossil	MJ, LHV	9.36E+01	9.49E-01	9.97E-02	0	0	4.36E-01	0	6.27E-01	**9.57E+01**
Output flows and waste category indicators										
Hazardous waste disposed	kg	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Non-hazardous waste disposed	kg	3.04E-01	0.00E+00	7.64E-02	0	0	0.00E+00	0	1.93E+00	**2.31E+00**
High-level radioactive waste	kg	6.34E-06	2.78E-09	1.42E-09	0	0	1.28E-09	0	8.00E-09	**6.35E-06**
Intermediate- and low-level radioactive waste, conditioned, to final repository	kg	6.05E-03	2.35E-06	1.21E-06	0	0	1.08E-06	0	7.16E-06	**6.06E-03**
Components for re-use	kg	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Materials for recycling	kg	0.00E+00	0.00E+00	2.70E-01	0	0	0.00E+00	0	0.00E+00	**2.70E-01**
Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Exported energy	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Carbon emissions and removals										
Biogenic carbon removal from product	kg CO_2	9.46E-01	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**9.46E-01**
Biogenic carbon emission from product	kg CO_2	3.93E-01	0.00E+00	0.00E+00	0	0	0.00E+00	0	3.32E-03	**3.97E-01**
Biogenic carbon removal from packaging	kg CO_2	1.32E-02	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**1.32E-02**
Biogenic carbon emission from packaging	kg CO_2	0.00E+00	0.00E+00	1.54E-02	0	0	0.00E+00	0	0.00E+00	**1.54E-02**
Biogenic carbon emission from combustion of waste	kg CO_2	0.00E+00	0.00E+00	2.46E-02	0	0	0.00E+00	0	0.00E+00	**2.46E-02**
Calcination carbon emissions	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Carbonation carbon removals	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Carbon emissions from combustion of waste from non renewable sources used in production processes + Carbon emissions from combustion of waste from	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**

LCA & material health results & interpretation

Earthwool® Insulation Board

Unfaced | FSK faced | ASJ+ faced | EPD additional content | Material health

Evaluation programs

The Health Product Declaration®
The HPD Open Standard provides a consistent, and transparent format to accurately disclose the material contents and associated hazard classifications for a building product.

How it works
Material ingredients are screened and categorized according to the hazards that international governmental bodies and toxicology experts have associated with them, based on two listings:

- Authoritative lists maintained or recognized by government bodies
- Screening lists, which include chemicals that government bodies determined need further scrutiny, as well as chemical lists not recognized by any government body.

Assessment scope and results

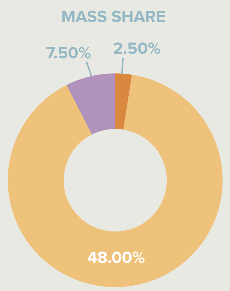
Health Product Declaration®

Earthwool® Insulation Board Unfaced

Full disclosure known hazards: Yes

Based on the selected content inventory threshold:

✔ Characterized ✔ Screened ○ Identified



GreenScreen® List Translator Scores

- List Translator Likely Benchmark 1 / Benchmark 1
- List Translator Possible Benchmark 1
- List Translator Benchmark Unknown
- Benchmark 2
- Benchmark 3
- Benchmark 4
- No GS data available

Learn about the GreenScreen® List Translator

Total VOC Content

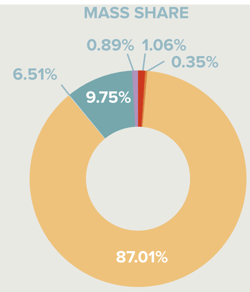
VOC Content data is not applicable for this product category.

Earthwool® Insulation Board ASJ+

Full disclosure known hazards: Yes

Based on the selected content inventory threshold:

✔ Characterized ✔ Screened ○ Identified



Total VOC Content

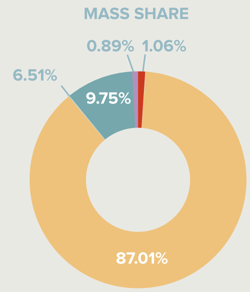
VOC Content data is not applicable for this product category.

Earthwool® Insulation Board FSK

Full disclosure known hazards: Yes

Based on the selected content inventory threshold:

✔ Characterized ✔ Screened ○ Identified



Total VOC Content

VOC Content data is not applicable for this product category.

What's in this product and why

Earthwool® Insulation Board products without a facer do not contain anyR chemicals that are on the Red List. The Red List is a list of chemicals that areR not allowed in Living Building Challenge buildings. Being Red List free is ourR design benchmark at Knauf.

Earthwool® utilizes a bio-based binder chemistry derived from corn that isR formaldehyde-free (FF) and more interior friendly than phenol-formaldehydeR (P/F) systems.

The ingredients of the unfaced variant avoids the 800+ chemicals of theR Living Building Challenge Red List. This is primarily because of its bio-basedR binder adhesive chemistry known as ECOSE® Technology. ECOSE is based onR dextrose or high fructose corn syrup instead of phenol and formaldehyde.R Dextrose and fructose can be used interchangeably. The ECOSE binderR allows the product to be validated by the UL Environment as formaldehyde-free. Formaldehyde is a Red List chemical.

The Earthwool® Board ASJ+ and FSK facers do not meet Red List freeR because the facer contains a halogenated fire retardant (HFR). This is why weR disclose the ingredients as an HPD rather than Declare used for all otherR product variants.

Red List Free is our development benchmark and we constantly challengeR ourselves on elimination of Red List chemicals. An HFR is used on the facedR variants because the products are for exposed applications and must meetR stringent fire performance requirements. We are very aware of the concernsR associated with HFRs and continually work with vendors on this issue. At theR same time, fire performance is critical and current events relating to fireR performance of building materials only support the importance of fire-safeR products.

At this time, the product is landfilled at end of life. We take extended producerR responsibility very seriously and have active programs to address end of life.R There is no option other than landfills at this time.

How we're making it healthier

Knauf engages very closely with its vendors to eliminate and avoid chemicals of concern. No competitor has as many Red List free products as Knauf Insulation. We continually reduce our environmental impacts through recycled content and optimize our products by designing them to be transformative.

See how we make it greener

References

Health Product Declaration®
Earthwool® Insulation Board - Unfaced
Earthwool® Insulation Board ASJ+
Earthwool® Insulation Board FSK

Health Product Declaration Open Standard - all versions
The standard provides guidance to accurately disclose the material contents of a building product using a standard, consistent, and transparent format.

Rating systems

LEED BD+C: New Construction | v4 - LEED v4
Building product disclosure and optimization
Material Ingredients

Credit value options — 1 product each

✔ 1. Reporting ○ 2. Optimization ○ 3. Supply Chain Optimization

LEED BD+C: New Construction | v4.1 - LEED v4.1
Materials and resources
Material Ingredients

Credit value options — 1 product each

✔ 1. Reporting ○ 2. Optimization ○ 3. Supply Chain Optimization

Living Building Challenge
Materials petals imperatives

○ 10. Red List Free ○ 12. Responsible Industry ○ 13. Living Economy Sourcing

WELL Building Standard®
Air and Mind Features

✔ **X07** Materials Transparency

How we make it greener

Earthwool® Insulation Board

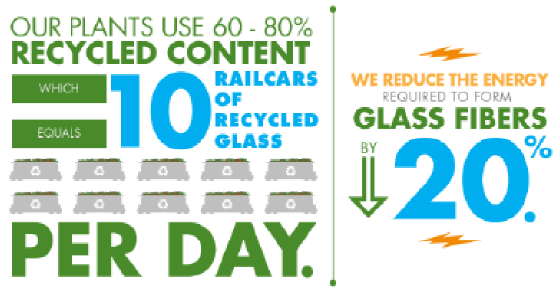
Collapse all

RAW MATERIALS ACQUISITION

Utilize recycled content

By leveraging recycled content, we reduce the energy required to form glass fibers.

- We use about 10 railcars of recycled glass per day.



MANUFACTURING

Lead green chemistry efforts

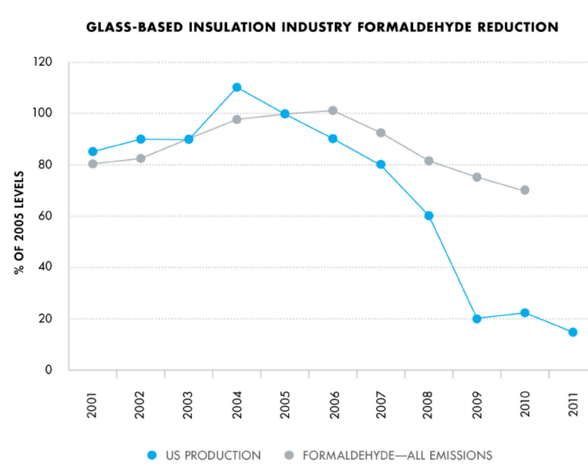
Following the launch of our ECOSE® Technology in 2008, we had transformed most of our products and processes to this new technology. Using our bio-based ECOSE® Technology has removed phenol and formaldehyde from our stack emissions. This initiative not only established Knauf Insulation North America in a leadership position, but it had a transformative impact on our industry in general.

Reduce scrap generation and energy consumption

Continuous improvement is the methodology we utilize to engage the entire Knauf team in our manufacturing excellence and sustainability journey.

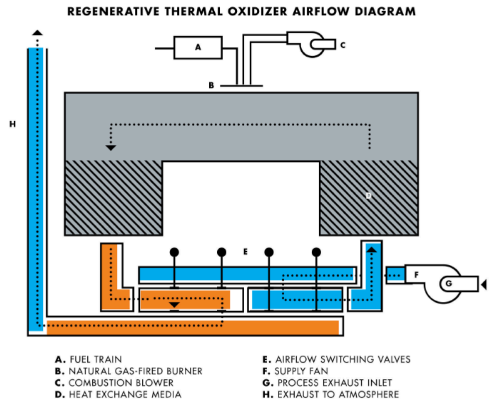
Knauf Insulation, comprised of Knauf Insulation North America (KINA) and Knauf Insulation Europe, Middle East, Asia, Asia Pacific (KI EMEA & APAC), share an overall global certification for ISO 45001 Health & Safety, ISO 14001 Environmental, ISO 50001 Energy, and ISO 9001 Quality through a third-party Certification Body.

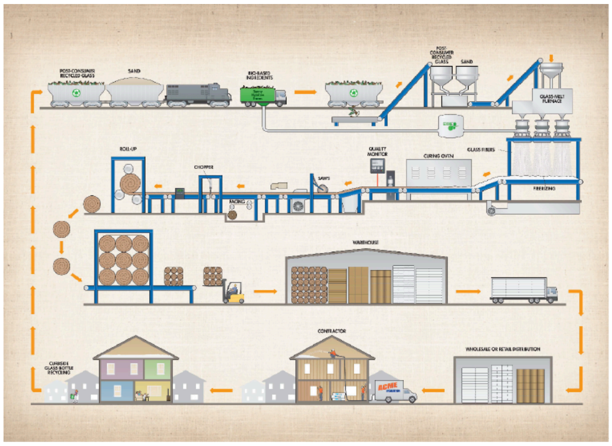
Our Continuous Improvement Program, with all its tools and systems associated with it, provide a formal process where we are constantly monitoring our manufacturing and sustainability Key Performance Indicators (KPIs) with an eye towards improvement. This Continuous Improvement centric management system has proven to be effective in improving our sustainability by reducing scrap generation and energy consumption.



Green manufacturing Processes

Regenerative thermal oxidizers We use regenerative thermal oxidizers (RTO) to capture and recycle much of the energy we use to cure our products. RTO is equipment used for the treatment of exhaust air. Our ovens exhaust into a ceramic heat exchange media to capture and reuse the heat in the exhausted air. Therefore, the amount of energy required to cure our product is reduced substantially.

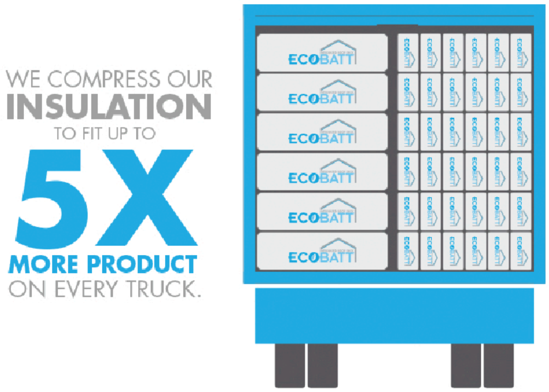




TRANSPORTATION

Leverage compression packaging

Glass is a high modulus material, which helps to facilitate compression packaging. We compress our insulation to fit up to five times more product on every truck, thereby reducing the amount of deliveries that need to be made, which saves time and emissions from transportation.



INSTALLATION AND MAINTENANCE

Be confident in glass fiber's safety

In the past, a label regarding the carcinogenic potential of insulation made from glass fibers was required on all packaging. Following forty years of research, fiberglass has been exonerated entirely. Our fiberglass is comprised of fibers that are biosoluble, meaning that the fibers dissolve in the body in a short period of time and exit the body with normal bodily functions. The scrutiny fiberglass has undergone is now seen as proof of its safety.

Meet and exceed green standards

GREENGUARD certified On the forefront of indoor air quality, Knauf Insulation North America had the first GREENGUARD certified product in 2002. This achievement led us to understand the impact our formaldehyde-free products could have on the indoor environment. The formaldehyde-free claim is third party validatedRby UL Environment.

3rd Party UL Environmental Claim Validation states that KnaufR Insulation products manufactured in North America contain anR average of 61% recycled content, consisting of 20% post-consumerRand 41% pre-consumer recycled glass.

EUCEB tested Glass fiber is a widely studied building material.R
All of our processes and formulations are voluntarily third-partyR audited for compliance with the health and safety exonerationR criteria for glass and rock based fiber through the EuropeanR Certification Board for Mineral Wool Products (EUCEB)R exoneration process. This guarantees the formulations are biosoluble and pose no health concerns. Having over 35 yearsR of research behind its safety, fiberglass products have beenR thoroughly evaluated and therefore we believe it is one of theR safest building materials available today.

Green building rating systems

Our products offer a vast array of potential credits for major green building rating systems, including: WELL, LEED v4, International Green Construction Code, Green Guide for Heath Care, NAHB Green Building Standard, and more.

Visit the green building rating systems page to see all the credits you can earn using Manson and Knauf Insulation products

Green building rating system credits

Find out all the credits you can earn with Knauf products.

Learn more

DISPOSAL

Promote Recycling

By taking a comprehensive approach of the benefits of recycling, Knauf Insulation North America advocates and promotes local recycling initiatives as well as actively participates in state and local government policy development. In addition, as a member of the North American Insulation Manufacturers Association (NAIMA) and Glass Recycling Coalition (GRC), we encourage regulatory and legislative initiatives that focus on glass recycling infrastructure deployment to increase the availability of post-consumer recycled glass.

GLASS RECYCLING COALITION
MEMBER
glassrecycles.org

SM Transparency Report (EPD)™ + Material Health Overview™

EPD	LCA
3rd-party verified	✓
	Transparency Report (EPD)
3rd-party verified	✓

Validity: 12/12/23 – 12/12/28
KNA – 12122023 – 008

MATERIAL HEALTH	Material evaluation
Self-declared	✓

This environmental product declaration (EPD) was externally verified by Harmony Environmental, LLC, according to ISO 21930:2017; UL Part A; UL Part B for Building Envelope Thermal Insulation Products; and ISO 14025:2006.

Harmony Environmental, LLC
16362 W. Briarwood Ct.
Olathe, KS 66062
www.harmonyenviro.com
(913) 780-3328

Harmony Environmental, LLC
Management • Analysis • Communication
Beyond Sustainability, Striving for Harmony

SUMMARY

Reference PCR
UL Part B: Building Envelope Thermal Insulation v2.0

Regions; system boundaries
North America; Cradle-to-grave

Functional unit / ESL:
1 m^2 installed insulation material, packaging included, with thickness that gives average thermal resistance of R_{SI} = 1m^2·K/W over an estimated service life (ESL) of 75 years

LCIA methodology: TRACI 2.1

LCA software; LCI database
LCA for Experts v10.7; LCA for Experts 2023

In accordance with ISO 14044 and the reference PCR, this life cycle assessment was conducted by Sustainable Minds and verified by Harmony Environmental, LLC.

Public LCA:
Knauf Insulation North America and Manson Insulation Products

Knauf Insulation, Inc.
One Knauf Drive
Shelbyville, IN 46176
www.knaufinsulation.us
317 398 4434

Contact us