KNAUFINSULATION®

Jet Stream®

Ultra Blowing Wool Insulation

Knauf Insulation's Jet Stream® Ultra is an unbonded, virgin fibrous glass blowing insulation. It utilizes a high degree of recycled content, and offers optimal thermal properties, excellent coverage and blowing characteristics. Our blowing insulation can be installed in new and existing structures and is excellent for blow-in-blanket applications. It dense-packs in wall cavities with no settling.

Performance dashboard

Features & functionality

Fills all gaps, creating a thermal barrier against outside air and reducing utility bills

Resists heat flow with an R-value of R-15 in 2 x 4 construction and R-23 in 2 x 6 construction

Contains high degree of recycled content

Improves Sound Transmission Class (STC) ratings by 4 to 10 points

Visit Knauf for more product information
Jet Stream® Ultra Blowing Wool Insulation

Environment & materials

Improved by:

Utilization of recycled glass

Optimized compression packaging

Certification & rating systems:

Declare, Red List Free

UL GREENGUARD Gold certified

UL Validated recycled content

UL Validated formaldehyde-free

Audited, European Certification Board for Mineral Wool Products exoneration process

ASTM C764; Type I

MasterFormat® 07 21 26
Jet Stream Ultra Blowing Wool Insulation
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 – 003

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.

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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

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Shelbyville, IN 46176
www.knaufinsulation.us
317 398 4434

Contact us

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LCA results & interpretation

Jet Stream® Ultra Blowing Wool Insulation

Albion, MI | Lanett, AL | Shasta Lake, CA | Shelbyville, IN | EPD additional content | Material health

Scope and summary

○ Cradle to gate ○ Cradle to gate with options ✓ Cradle to grave

Application

At the installation site, loose fill is installed using a blowing wool machine and blown into open attics or closed cavities. It can be used to dense-pack sidewalls using the drill and fill technique common in retrofitting homes or in home weatherization activities.

Functional unit

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

Reference service life: 75 years when installed per manufacturer's instructions
Reference flow: 0.176 kg of product, at a thickness of 0.0664 m to achieve the functional unit. (ASTM C518)

Manufacturing data

Reporting period: January 2022 – December 2022
Location: Albion, MI

Default installation, packaging, and disposal scenarios

At the installation site, insulation products are unpackaged and installed. For loose fill products, an insulation blower or sprayer is typically used to install the product. The potential impact of the blower/sprayer is assumed to be negligible since its use is spread out over hundreds of bags of product; therefore, it was 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.

Material composition greater than 1% by weight

PART	MATERIAL	%WT.
Batch	Cullet	60-70%
Batch	Borates	10-15%
Batch	Soda ash	5-8%
Batch	Feldspar	5-8%
Batch	Limestone	1-2%
Batch	Oxides	<1%
Additives	Oils	1-2%
Additives	Others	<1%
Packaging	Plastic	1-2%

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

LIFE CYCLE STAGE	MPTS/FUNC. UNIT
Raw material acquisition	1.41E-03
Manufacturing	2.25E-03
Transportation	9.57E-05
Installation and maintenance	6.86E-06
Disposal/reuse/recycling	1.32E-04

Total impacts = 3.90E-03 mPts
per 75 years installed

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 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. 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 loose fill insulation manufactured in Albion, MI is 3.28E-01 kg CO_2-eq per functional unit.

How we're making it greener

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

- 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	
				(X) B5 Refurbishment	
*Module D is also excluded from this system boundary (MND).				(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	1.41E-03 mPts	2.25E-03 mPts	9.57E-05 mPts	6.86E-06 mPts	1.32E-04 mPts
Materials or processes contributing >20% to total impacts in each life cycle stage	Batch 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 (Jet Stream® - Albion, MI)

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	6.29E-02	2.65E-01	5.17E-03	1.34E-03	6.40E-03
Ozone depletion kg CFC-11 eq	1.20E-11	2.96E-14	1.15E-17	1.33E-17	1.84E-16
Acidification kg SO_2 eq	2.62E-04	3.98E-04	2.65E-05	7.94E-07	2.68E-05
Eutrophication kg N eq	2.86E-05	1.09E-04	2.27E-06	3.69E-07	1.65E-06
− Human health damage					
Impact category / Unit					
Smog kg O_3 eq	2.68E-03	6.99E-03	9.09E-04	1.04E-05	5.24E-04
Respiratory effects kg $PM_{2.5}$ eq	2.07E-05	2.25E-05	1.30E-06	3.93E-08	1.81E-06
− Additional environmental information					
Impact category / Unit					
Carcinogenics CTU_h	4.7%	91.7%	0.3%	0.1%	3.3%
Non-carcinogenics CTU_h	11.7%	79.6%	0.5%	0.2%	8.0%
Ecotoxicity CTU_e	6.9%	90.8%	1.1%	0.1%	1.2%
Fossil fuel depletion MJ surplus	9.23E-02	3.94E-01	9.69E-03	3.23E-04	1.25E-02

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 (Groupe 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).

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

LEED BD+C: New Construction | v4.1 - LEED v4.1

Building product disclosure and optimization

Environmental product declarations

○ Industry-wide (generic) EPD	1 product
✓ Product-specific Type III EPD	1.5 product

Collaborative for High Performance Schools National Criteria

MW CS.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

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 – 12\12\2023 – 003

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.

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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_{ip} = 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

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LCA results & interpretation

Jet Stream® Ultra Blowing Wool Insulation

Albion, MI | Lanett, AL | Shasta Lake, CA | Shelbyville, IN | EPD additional content | Material health

Scope and summary

○ Cradle to gate ○ Cradle to gate with options ● Cradle to grave

Application
At the installation site, loose fill is installed using a blowing wool machine and blown into open attics or closed cavities. It can be used to dense-pack sidewalls using the drill and fill technique common in retrofitting homes or in home weatherization activities.

Functional unit
One square meter of installed insulation material, packaging included, with a thickness that gives an average thermal resistance of R_{si} = 1m²·K/W with a building service life of 75 years.

Reference service life: 75 years when installed per manufacturer's instructions
Reference flow: 0.176 kg of product, at a thickness of 0.0664 m to achieve the functional unit. (ASTM C518)

Manufacturing data
Reporting period: January 2022 – December 2022
Location: Lanett, AL

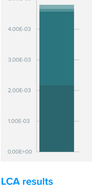
Default installation, packaging, and disposal scenarios
At the installation site, insulation products are unpackaged and installed. For loose fill products, an insulation blower or sprayer is typically used to install the product. The potential impact of the blower/sprayer is assumed to be negligible since its use is spread out over hundreds of bags of product; therefore, it was 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.

Material composition greater than 1% by weight

PART	MATERIAL	%WT.
Batch	Cullet	35-40%
Batch	Sand	20-25%
Batch	Borates	10-15%
Batch	Soda ash	10-15%
Batch	Feldspar	5-8%
Batch	Limestone	8-10%
Additives	Oils	1-2%
Additives	Others	<1%
Packaging	Plastic	1-2%

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



LIFE CYCLE STAGE	MPTS/FUNC. UNIT
Raw material acquisition	2.19E-03
Manufacturing	2.38E-03
Transportation	9.57E-05
Installation and maintenance	6.86E-06
Disposal/reuse/recycling	1.32E-04

Total impacts = 4.80E-03 mPts
per 75 years installed

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 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. 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 loose fill insulation manufactured in Albion, MI is 4.08E-01 kg CO_2-eq per functional unit.

How we're making it greener

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

- 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)				(X) B4 Replacement	
				(X) B5 Refurbishment	
				(X) B6 Operational energy use	
				(X) B7 Operational water use	





*Module D is also excluded from this system boundary (MND).

SM Single Score

Learn about SM Single Score results

Impacts per 1 square meter of insulation material	2.19E-03 mPts	2.38E-03 mPts	9.57E-05 mPts	6.86E-06 mPts	1.32E-04 mPts
Materials or processes contributing >20% to total impacts in each life cycle stage	Batch 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 (Jet Stream® - Lanett, AL)

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	9.18E-02	3.16E-01	5.17E-03	1.34E-03	6.40E-03
Ozone depletion kg CFC-11 eq	1.05E-15	3.80E-14	1.15E-17	1.33E-17	1.84E-16
Acidification kg SO_2 eq	4.12E-04	4.61E-04	2.65E-05	7.94E-07	2.68E-05
Eutrophication kg N eq	4.55E-05	1.26E-04	2.27E-06	3.69E-07	1.65E-06
Human health damage					
Impact category / Unit					
Smog kg O_3 eq	4.09E-03	1.01E-02	9.09E-04	1.04E-05	5.24E-04
Respiratory effects kg $PM_{2.5}$ eq	3.25E-05	2.11E-05	1.30E-06	3.93E-08	1.81E-06
Additional environmental information					
Impact category / Unit					
Carcinogenics CTU_h	5.1%	91.9%	0.2%	0.0%	2.7%
Non-carcinogenics CTU_h	12.5%	80.6%	0.4%	0.1%	6.4%
Ecotoxicity CTU_e	7.8%	90.3%	0.9%	0.1%	0.9%
Fossil fuel depletion MJ surplus	1.21E-01	5.50E-01	9.69E-03	3.23E-04	1.25E-02

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 (Groupe 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).

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

Download PDF SM Transparency Report / EPD

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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

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

Environmental product declarations

○ Industry-wide (generic) EPD	1 product
● Product-specific Type III EPD	1.5 product

Collaborative for High Performance Schools National Criteria
MW CS.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

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

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

Validity: 12/12/21 – 12/12/28
KNA – 12122023 – 003

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.

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SUMMARY
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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

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LCA results & interpretation

Jet Stream® Ultra Blowing Wool Insulation

Albion, MI | Lanett, AL | Shasta Lake, CA | Shelbyville, IN | EPD additional content | Material health

Scope and summary

○ Cradle to gate ○ Cradle to gate with options ✓ Cradle to grave

Application
At the installation site, loose fill is installed using a blowing wool machine and blown into open attics or closed cavities. It can be used to dense-pack sidewalls using the drill and fill technique common in retrofitting homes or in home weatherization activities.

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·K/W with a building service life of 75 years.

Reference service life: 75 years when installed per manufacturer's instructions
Reference flow: 0.176 kg of product, at a thickness of 0.0664 m to achieve the functional unit. (ASTM C518)

Manufacturing data
Reporting period: January 2022 – December 2022
Location: Shasta Lake, CA

Default installation, packaging, and disposal scenarios
At the installation site, insulation products are unpackaged and installed. For loose fill products, an insulation blower or sprayer is typically used to install the product. The potential impact of the blower/sprayer is assumed to be negligible since its use is spread out over hundreds of bags of product; therefore, it was 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.

Material composition greater than 1% by weight

PART	MATERIAL	%WT.
Batch	Cullet	60-70%
Batch	Sand	10-15%
Batch	Borates	10-15%
Batch	Soda ash	5-8%
Batch	Limestone	2-5%
Additives	Oils	1-2%
Additives	Others	<1%
Packaging	Plastic	1-2%

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

LIFE CYCLE STAGE	MPTS/FUNC. UNIT
Raw material acquisition	1.87E-03
Manufacturing	1.80E-03
Transportation	9.57E-05
Installation and maintenance	6.86E-06
Disposal/reuse/recycling	1.32E-04

Total impacts = 3.90E-03 mPts
per 75 years installed

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 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 energy used 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. 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 loose fill insulation manufactured in Albion, MI is 3.62E-01 kg CO_2-eq per functional unit.

How we're making it greener

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

- 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**
				(X) B4 Replacement	
Information modules: (X) | Excluded (MND)*				**(X) B5 Refurbishment**	
				(X) B6 Operational energy use	
				(X) B7 Operational water use	

*Module D is also excluded from this system boundary (MND).





SM Single Score

Learn about SM Single Score results

Impacts per 1 square meter of insulation material	1.87E-03 mPts	1.80E-03 mPts	9.57E-05 mPts	6.86E-06 mPts	1.32E-04 mPts
Materials or processes contributing >20% to total impacts in each life cycle stage	Batch 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 (Jet Stream® - Shasta Lake, CA)

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	1.53E-01	2.09E-01	5.17E-03	1.34E-03	6.40E-03
Ozone depletion kg CFC-11 eq	2.23E-13	8.02E-14	1.15E-17	1.33E-17	1.84E-16
Acidification kg SO_2 eq	3.18E-04	4.76E-04	2.65E-05	7.94E-07	2.68E-05
Eutrophication kg N eq	3.45E-05	1.14E-04	2.27E-06	3.69E-07	1.65E-06
Human health damage					
Impact category / Unit					
Smog kg O_3 eq	4.44E-03	6.73E-03	9.09E-04	1.04E-05	5.24E-04
Respiratory effects kg $PM_{2.5}$ eq	2.25E-05	1.77E-05	1.30E-06	3.93E-08	1.81E-06
Additional environmental information					
Impact category / Unit					
Carcinogenics CTU_h	26.2%	71.2%	0.2%	0.0%	2.3%
Non-carcinogenics CTU_h	46.8%	48.4%	0.3%	0.1%	4.4%
Ecotoxicity CTU_e	29.0%	69.4%	0.8%	0.0%	0.8%
Fossil fuel depletion MJ surplus	4.53E-01	3.56E-01	9.69E-03	3.23E-04	1.25E-02

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).

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

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

Environmental product declarations

○ Industry-wide (generic) EPD	1 product
✓ Product-specific Type III EPD	1.5 product

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

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 – 003

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.

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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:
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LCA results & interpretation

Jet Stream® Ultra Blowing Wool Insulation

Albion, MI | Lanett, AL | Shasta Lake, CA | **Shelbyville, IN** | EPD additional content | Material health

Scope and summary

○ Cradle to gate ○ Cradle to gate with options ● Cradle to grave

Application
At the installation site, loose fill is installed using a blowing wool machine and blown into open attics or closed cavities. It can be used to dense-pack sidewalls using the drill and fill technique common in retrofitting homes or in home weatherization activities.

Functional unit
One square meter of installed insulation material, packaging included, with a thickness that gives an average thermal resistance of R_{si} = 1m².K/W with a building service life of 75 years.

Reference service life: 75 years when installed per manufacturer's instructions
Reference flow: 0.176 kg of product, at a thickness of 0.0664 m to achieve the functional unit. (ASTM C518)

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

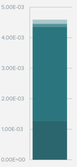
Default installation, packaging, and disposal scenarios
At the installation site, insulation products are unpackaged and installed. For loose fill products, an insulation blower or sprayer is typically used to install the product. The potential impact of the blower/sprayer is assumed to be negligible since its use is spread out over hundreds of bags of product; therefore, it was 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.

Material composition greater than 1% by weight

PART	MATERIAL	%WT.
Batch	Cullet	60-70%
Batch	Sand	10-15%
Batch	Borates	5-8%
Batch	Soda ash	5-8%
Batch	Feldspar	2-5%
Batch	Limestone	2-5%
Batch	Oxides	<1%
Additives	Oils	1-2%
Packaging	Others	<1%
Packaging	Plastic	1-2%

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



LIFE CYCLE STAGE	MPTS/FUNC. UNIT
Raw material acquisition	1.31E-03
Manufacturing	3.03E-03
Transportation	9.57E-05
Installation and maintenance	6.86E-06
Disposal/reuse/recycling	1.32E-04

Total impacts = 4.57E-03 mPts
per 75 years installed

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 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. 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 loose fill insulation manufactured in Albion, MI is 4.09E-01 kg CO_2-eq per functional unit.

How we're making it greener

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

- 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**	
				(X) B5 Refurbishment	
				(X) B6 Operational energy use	
				(X) B7 Operational water use	

*Module D is also excluded from this system boundary (MND).





SM Single Score

Learn about SM Single Score results

Impacts per 1 square meter of insulation material	1.31E-03 mPts	3.03E-03 mPts	9.57E-05 mPts	6.86E-06 mPts	1.32E-04 mPts
Materials or processes contributing >20% to total impacts in each life cycle stage	Batch 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 (Jet Stream® - 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	5.84E-02	3.51E-01	5.17E-03	1.34E-03	6.40E-03
Ozone depletion kg CFC-11 eq	3.62E-13	3.81E-14	1.15E-17	1.33E-17	1.84E-16
Acidification kg SO_2 eq	2.40E-04	5.64E-04	2.65E-05	7.94E-07	2.68E-05
Eutrophication kg N eq	2.60E-05	1.43E-04	2.27E-06	3.69E-07	1.65E-06
Human health damage					
Impact category / Unit					
Smog kg O_3 eq	2.51E-03	1.07E-02	9.09E-04	1.04E-05	5.24E-04
Respiratory effects kg $PM_{2.5}$ eq	1.91E-05	3.05E-05	1.30E-06	3.93E-08	1.81E-06
Additional environmental information					
Impact category / Unit					
Carcinogenics CTU_h	3.9%	93.3%	0.2%	0.0%	2.5%
Non-carcinogenics CTU_h	9.5%	83.7%	0.4%	0.1%	6.2%
Ecotoxicity CTU_e	5.5%	92.7%	0.9%	0.0%	0.9%
Fossil fuel depletion MJ surplus	8.95E-02	4.90E-01	9.69E-03	3.23E-04	1.25E-02

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).

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

Download PDF SM Transparency Report / EPD

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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

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

Environmental product declarations

○ Industry-wide (generic) EPD	1 product
● Product-specific Type III EPD	1.5 product

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

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 – 003	
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.
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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 m² installed insulation material, packaging included, with thickness that gives average thermal resistance of R_{si} = 1m².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

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EPD additional content

Jet Stream® Ultra Blowing Wool Insulation

Albion, MI | Lanett, AL | Shasta Lake, CA | Shelbyville, IN | EPD additional content | Material health

Data

Background This product-specific plant-specific declaration was created by collecting production data from the Albion, MI; Lanett, AL; Shasta Lake, CA; and Shelbyville, IN production locations. Secondary data sources include those available in LCA for Experts 2023 databases.

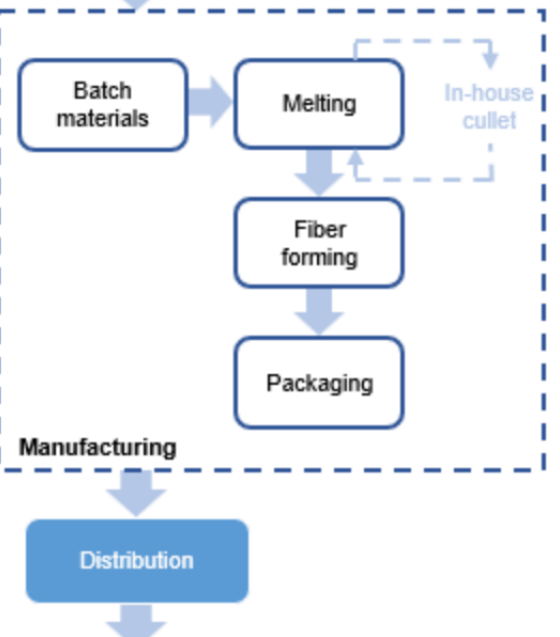
Allocation The PCR prescribes where and how allocation occurs. Since only facility-level data were available, allocation among the facilities' other co-products was necessary to determine the input and output flows associated with the product. Allocation of batch materials and energy was done on a product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

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

Quality Temporal and technological representativeness are considered to be high. Geographical representativeness is considered to be high. All relevant process steps for the product system were considered and modeled. The process chain is considered sufficiently complete with regards to the goal and scope of this study. The product system was checked for mass balance and completeness of the inventory. Capital goods were excluded since they are assumed not to significantly affect the conclusions of the LCA. Otherwise, no data were knowingly omitted. For more information on data quality, see the LCA background report.

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

Flow diagram



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	28.8	kg/m^3
Capacity utilization volume factor	1	-
Installation into the building [A5]		
Mass of plastic packaging waste	0.00271	kg
Biogenic carbon content of packaging	0	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	0.173 kg
Disposal	Product for final deposition in landfill	0.173 kg

Technical properties	
Dimensions/quantities delivered to installation site	Jet Stream® is sold in bags. One master bag contains 42 plastic bags, and each bag weighs 32 pounds.
ASTM or ANSI product specification	ASTM C764; Type I
Corrosion	ASTM C764; Pass
Combustibility	ASTM E136; Non-combustible
Water vapor sorption (by weight)	ASTM C1104; Less than 5%
Critical radiant flux	ASTM E970; Greater than 0.12 W/cm^2
Mold growth	ASTM C1338; Pass
Surface burning characteristics (flame spread/smoke developed)	ASTM E84, CAN 4-S102.2; 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.

Jet Stream® Ultra Blowing Wool Insulation produced in Albion, MI: 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	3.28E-01	5.17E-03	1.34E-03	0	0	2.78E-03	0	3.62E-03	**3.41E-01**
Ozone depletion	kg CFC-11 eq	1.21E-11	1.15E-17	1.33E-17	0	0	6.21E-18	0	1.78E-16	**1.21E-11**
Acidification	kg SO2 eq	6.60E-04	2.65E-05	7.94E-07	0	0	7.61E-06	0	1.92E-05	**7.14E-04**
Eutrophication	kg N eq	1.37E-04	2.27E-06	3.69E-07	0	0	8.06E-07	0	8.43E-07	**1.42E-04**
Smog	kg O_3 eq	9.67E-03	9.09E-04	1.04E-05	0	0	1.74E-04	0	3.50E-04	**1.11E-02**
Respiratory effects	kg PM2.5 eq	4.31E-05	1.30E-06	3.93E-08	0	0	3.26E-07	0	1.48E-06	**4.63E-05**
Additional environmental information										
Carcinogenics	CTUh	96.4%	0.3%	0.1%	0%	0%	0.2%	0%	3.1%	**100%**
Non-carcinogenics	CTUh	91.3%	0.5%	0.2%	0%	0%	0.3%	0%	7.7%	**100%**
Ecotoxicity	CTUe	97.7%	1.1%	0.1%	0%	0%	0.6%	0%	0.6%	**100%**
Fossil fuel depletion	MJ surplus	4.86E-01	9.69E-03	3.23E-04	0	0	5.21E-03	0	7.30E-03	**5.08E-01**
Resource use indicators										
Renewable primary energy used as energy carrier (fuel)	MJ, LHV	1.05E+00	2.85E-03	5.36E-04	0	0	1.53E-03	0	6.79E-03	**1.06E+00**
Renewable primary resources with energy content used as material	MJ, LHV	8.68E-09	-2.36E-13	1.26E-13	0	0	-1.27E-13	0	1.35E-12	**8.68E-09**
Non-renewable primary resources used as an energy carrier (fuel)	MJ, LHV	5.20E+00	7.32E-02	3.51E-03	0	0	3.94E-02	0	5.80E-02	**5.38E+00**
Non-renewable primary resources with energy content used as material	MJ, LHV	1.27E-08	2.92E-10	8.61E-12	0	0	1.57E-10	0	1.45E-10	**1.33E-08**
Secondary materials	kg	1.11E-01	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**1.11E-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	9.43E-02	9.90E-06	2.95E-06	0	0	5.33E-06	0	7.19E-06	**9.44E-02**
Abiotic depletion potential, fossil	MJ, LHV	4.54E+00	7.27E-02	2.98E-03	0	0	3.91E-02	0	5.62E-02	**4.71E+00**
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	1.52E-03	0.00E+00	1.84E-03	0	0	0.00E+00	0	1.73E-01	**1.77E-01**
High-level radioactive waste	kg	2.29E-07	2.13E-10	2.22E-10	0	0	1.15E-10	0	7.17E-10	**2.30E-07**
Intermediate- and low-level radioactive waste, conditioned, to final repository	kg	2.36E-04	1.80E-07	1.87E-07	0	0	9.66E-08	0	6.41E-07	**2.37E-04**
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	4.06E-04	0	0	0.00E+00	0	0.00E+00	**4.06E-04**
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	2.62E-02	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**2.62E-02**
Biogenic carbon emission from product	kg CO_2	2.83E-02	0.00E+00	0.00E+00	0	0	0.00E+00	0	2.98E-04	**2.86E-02**
Biogenic carbon removal from packaging	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Biogenic carbon emission from packaging	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Biogenic carbon emission from combustion of waste	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
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 renewable sources used in production processes + Carbon emissions from combustion of waste from non 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**

Jet Stream® Ultra Blowing Wool Insulation produced in Lanett, AL: 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	4.08E-01	5.17E-03	1.34E-03	0	0	2.78E-03	0	3.62E-03	**4.21E-01**
Ozone depletion	kg CFC-11 eq	3.91E-14	1.15E-17	1.33E-17	0	0	6.21E-18	0	1.78E-16	**3.93E-14**
Acidification	kg SO2 eq	8.73E-04	2.65E-05	7.94E-07	0	0	7.61E-06	0	1.92E-05	**9.28E-04**
Eutrophication	kg N eq	1.72E-04	2.27E-06	3.69E-07	0	0	8.06E-07	0	8.43E-07	**1.76E-04**
Smog	kg O_3 eq	1.42E-02	9.09E-04	1.04E-05	0	0	1.74E-04	0	3.50E-04	**1.56E-02**
Respiratory effects	kg PM2.5 eq	5.37E-05	1.30E-06	3.93E-08	0	0	3.26E-07	0	1.48E-06	**5.68E-05**
Additional environmental information										
Carcinogenics	CTUh	97.0%	0.2%	0.0%	0%	0%	0.1%	0%	2.6%	**100%**
Non-carcinogenics	CTUh	93.0%	0.4%	0.1%	0%	0%	0.2%	0%	6.2%	**100%**
Ecotoxicity	CTUe	98.1%	0.9%	0.1%	0%	0%	0.5%	0%	0.5%	**100%**
Fossil fuel depletion	MJ surplus	6.71E-01	9.69E-03	3.23E-04	0	0	5.21E-03	0	7.30E-03	**6.93E-01**
Resource use indicators										
Renewable primary energy used as energy carrier (fuel)	MJ, LHV	1.11E+00	2.85E-03	5.36E-04	0	0	1.53E-03	0	6.79E-03	**1.12E+00**
Renewable primary resources with energy content used as material	MJ, LHV	2.95E-10	-2.36E-13	1.26E-13	0	0	-1.27E-13	0	1.35E-12	**2.97E-10**
Non-renewable primary resources used as an energy carrier (fuel)	MJ, LHV	6.45E+00	7.32E-02	3.51E-03	0	0	3.94E-02	0	5.80E-02	**6.63E+00**
Non-renewable primary resources with energy content used as material	MJ, LHV	1.70E-08	2.92E-10	8.61E-12	0	0	1.57E-10	0	1.45E-10	**1.76E-08**
Secondary materials	kg	5.89E-02	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**5.89E-02**
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	1.13E-01	9.90E-06	2.95E-06	0	0	5.33E-06	0	7.19E-06	**1.13E-01**
Abiotic depletion potential, fossil	MJ, LHV	5.65E+00	7.27E-02	2.98E-03	0	0	3.91E-02	0	5.62E-02	**5.82E+00**
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	2.70E-02	0.00E+00	1.84E-03	0	0	0.00E+00	0	1.73E-01	**2.02E-01**
High-level radioactive waste	kg	2.77E-07	2.13E-10	2.22E-10	0	0	1.15E-10	0	7.17E-10	**2.78E-07**
Intermediate- and low-level radioactive waste, conditioned, to final repository	kg	2.85E-04	1.80E-07	1.87E-07	0	0	9.66E-08	0	6.41E-07	**2.86E-04**
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	4.06E-04	0	0	0.00E+00	0	0.00E+00	**4.06E-04**
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	3.02E-02	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**3.02E-02**
Biogenic carbon emission from product	kg CO_2	3.27E-02	0.00E+00	0.00E+00	0	0	0.00E+00	0	2.98E-04	**3.30E-02**
Biogenic carbon removal from packaging	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Biogenic carbon emission from packaging	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Biogenic carbon emission from combustion of waste	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
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 renewable sources used in production processes + Carbon emissions from combustion of waste from non 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**

Jet Stream® Ultra Blowing Wool Insulation produced in Shasta Lake, CA: 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	3.62E-01	5.17E-03	1.34E-03	0	0	2.78E-03	0	3.62E-03	**3.75E-01**
Ozone depletion	kg CFC-11 eq	3.03E-13	1.15E-17	1.33E-17	0	0	6.21E-18	0	1.78E-16	**3.03E-13**
Acidification	kg SO2 eq	7.94E-04	2.65E-05	7.94E-07	0	0	7.61E-06	0	1.92E-05	**8.48E-04**
Eutrophication	kg N eq	1.49E-04	2.27E-06	3.69E-07	0	0	8.06E-07	0	8.43E-07	**1.53E-04**
Smog	kg O_3 eq	1.12E-02	9.09E-04	1.04E-05	0	0	1.74E-04	0	3.50E-04	**1.26E-02**
Respiratory effects	kg PM2.5 eq	4.02E-05	1.30E-06	3.93E-08	0	0	3.26E-07	0	1.48E-06	**4.34E-05**
Additional environmental information										
Carcinogenics	CTUh	97.5%	0.2%	0.0%	0%	0%	0.1%	0%	2.2%	**100%**
Non-carcinogenics	CTUh	95.2%	0.3%	0.1%	0%	0%	0.2%	0%	4.3%	**100%**
Ecotoxicity	CTUe	98.4%	0.8%	0.0%	0%	0%	0.4%	0%	0.4%	**100%**
Fossil fuel depletion	MJ surplus	8.09E-01	9.69E-03	3.23E-04	0	0	5.21E-03	0	7.30E-03	**8.32E-01**
Resource use indicators										
Renewable primary energy used as energy carrier (fuel)	MJ, LHV	1.98E+00	2.85E-03	5.36E-04	0	0	1.53E-03	0	6.79E-03	**1.99E+00**
Renewable primary resources with energy content used as material	MJ, LHV	1.06E-08	-2.36E-13	1.26E-13	0	0	-1.27E-13	0	1.35E-12	**1.06E-08**
Non-renewable primary resources used as an energy carrier (fuel)	MJ, LHV	7.25E+00	7.32E-02	3.51E-03	0	0	3.94E-02	0	5.80E-02	**7.43E+00**
Non-renewable primary resources with energy content used as material	MJ, LHV	2.58E-08	2.92E-10	8.61E-12	0	0	1.57E-10	0	1.45E-10	**2.64E-08**
Secondary materials	kg	9.97E-02	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**9.97E-02**
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	1.06E-01	9.90E-06	2.95E-06	0	0	5.33E-06	0	7.19E-06	**1.06E-01**
Abiotic depletion potential, fossil	MJ, LHV	6.50E+00	7.27E-02	2.98E-03	0	0	3.91E-02	0	5.62E-02	**6.67E+00**
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	4.80E-03	0.00E+00	1.84E-03	0	0	0.00E+00	0	1.73E-01	**1.80E-01**
High-level radioactive waste	kg	2.58E-07	2.13E-10	2.22E-10	0	0	1.15E-10	0	7.17E-10	**2.59E-07**
Intermediate- and low-level radioactive waste, conditioned, to final repository	kg	2.66E-04	1.80E-07	1.87E-07	0	0	9.66E-08	0	6.41E-07	**2.67E-04**
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	4.06E-04	0	0	0.00E+00	0	0.00E+00	**4.06E-04**
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	3.08E-02	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**3.08E-02**
Biogenic carbon emission from product	kg CO_2	3.31E-02	0.00E+00	0.00E+00	0	0	0.00E+00	0	2.98E-04	**3.34E-02**
Biogenic carbon removal from packaging	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Biogenic carbon emission from packaging	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Biogenic carbon emission from combustion of waste	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
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 renewable sources used in production processes + Carbon emissions from combustion of waste from non 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**

Jet Stream® Ultra Blowing Wool Insulation 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	4.09E-01	5.17E-03	1.34E-03	0	0	2.78E-03	0	3.62E-03	**4.22E-01**
Ozone depletion	kg CFC-11 eq	4.00E-13	1.15E-17	1.33E-17	0	0	6.21E-18	0	1.78E-16	**4.00E-13**
Acidification	kg SO2 eq	8.05E-04	2.65E-05	7.94E-07	0	0	7.61E-06	0	1.92E-05	**8.59E-04**
Eutrophication	kg N eq	1.69E-04	2.27E-06	3.69E-07	0	0	8.06E-07	0	8.43E-07	**1.74E-04**
Smog	kg O_3 eq	1.32E-02	9.09E-04	1.04E-05	0	0	1.74E-04	0	3.50E-04	**1.47E-02**
Respiratory effects	kg PM2.5 eq	4.96E-05	1.30E-06	3.93E-08	0	0	3.26E-07	0	1.48E-06	**5.28E-05**
Additional environmental information										
Carcinogenics	CTUh	97.2%	0.2%	0.0%	0%	0%	0.1%	0%	2.4%	**100%**
Non-carcinogenics	CTUh	93.3%	0.4%	0.1%	0%	0%	0.2%	0%	6.0%	**100%**
Ecotoxicity	CTUe	98.2%	0.9%	0.0%	0%	0%	0.5%	0%	0.4%	**100%**
Fossil fuel depletion	MJ surplus	5.80E-01	9.69E-03	3.23E-04	0	0	5.21E-03	0	7.30E-03	**6.02E-01**
Resource use indicators										
Renewable primary energy used as energy carrier (fuel)	MJ, LHV	1.26E+00	2.85E-03	5.36E-04	0	0	1.53E-03	0	6.79E-03	**1.27E+00**
Renewable primary resources with energy content used as material	MJ, LHV	1.71E-08	-2.36E-13	1.26E-13	0	0	-1.27E-13	0	1.35E-12	**1.71E-08**
Non-renewable primary resources used as an energy carrier (fuel)	MJ, LHV	7.01E+00	7.32E-02	3.51E-03	0	0	3.94E-02	0	5.80E-02	**7.19E+00**
Non-renewable primary resources with energy content used as material	MJ, LHV	1.49E-08	2.92E-10	8.61E-12	0	0	1.57E-10	0	1.45E-10	**1.55E-08**
Secondary materials	kg	1.04E-01	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**1.04E-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	1.23E-01	9.90E-06	2.95E-06	0	0	5.33E-06	0	7.19E-06	**1.23E-01**
Abiotic depletion potential, fossil	MJ, LHV	5.56E+00	7.27E-02	2.98E-03	0	0	3.91E-02	0	5.62E-02	**5.73E+00**
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	2.72E-02	0.00E+00	1.84E-03	0	0	0.00E+00	0	1.73E-01	**2.02E-01**
High-level radioactive waste	kg	5.48E-07	2.13E-10	2.22E-10	0	0	1.15E-10	0	7.17E-10	**5.49E-07**
Intermediate- and low-level radioactive waste, conditioned, to final repository	kg	5.15E-04	1.80E-07	1.87E-07	0	0	9.66E-08	0	6.41E-07	**5.17E-04**
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	4.06E-04	0	0	0.00E+00	0	0.00E+00	**4.06E-04**
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	2.95E-02	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**2.95E-02**
Biogenic carbon emission from product	kg CO_2	3.23E-02	0.00E+00	0.00E+00	0	0	0.00E+00	0	2.98E-04	**3.26E-02**
Biogenic carbon removal from packaging	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Biogenic carbon emission from packaging	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
Biogenic carbon emission from combustion of waste	kg CO_2	0.00E+00	0.00E+00	0.00E+00	0	0	0.00E+00	0	0.00E+00	**0.00E+00**
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 renewable sources used in production processes + Carbon emissions from combustion of waste from non 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**

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 – 003

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.

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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

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LCA & material health results & interpretation

Jet Stream® Ultra Blowing Wool Insulation

Albion, MI | Lanett, AL | Shasta Lake, CA | Shelbyville, IN | EPD additional content | Material health

Evaluation programs

Declare

Declare labels are issued to products disclosing ingredient inventory, sourcing and end of life options. Declare labels are based on the Manufacturers Guide to Declare, administered by the International Living Future Institute.

How it works

Material ingredients are inventoried and screened against the Living Building Challenge (LBC) Red List which represents the 'worst in class' materials, chemicals, and elements known to pose serious risks to human health and the greater ecosystem.

Assessment scope and results

Declare™

Inventory threshold: 100 ppm

Declare level:
The Declare product database and label are used to select products that meet the LBC's stringent materials requirements, streamlining the materials specification and certification process.

- LBC Red List Free
- LBC Red List Approved
- Declared

Click the label to see the full declaration.

Jet Stream® Ultra loosefill insulation


Declare.
Jet Stream Ultra Loosefill Insulation
Knauf Insulation
Final Assembly: Multiple Locations in USA
Life Expectancy: Life of Structure Year(s)
End of Life Options: Landfill (100%)
EU CoC Screened: Contains
Ingredients:
Glass, oxide, chemicals; Manufacturing Oil †, Silicone
†SIN List present > 100ppm
Living Building Challenge Criteria: Compliant
I-13 Red List:
■ LBC Red List Free
□ LBC Red List Approved
□ Declared
% Disclosed: 100% at 100ppm
VOC Content: Not Applicable
I-10 Interior Performance: Not Applicable
I-14 Responsible Sourcing: Not Applicable
KNF-0007
EXP: 01 APR 2024
SCREENED: 09 MAR 2023
Original Issue Date: 2013
MANUFACTURER RESPONSIBLE FOR LABEL ACCURACY
INTERNATIONAL LIVING FUTURE INSTITUTE™ living-future.org/declare

What's in this product and why

Declare level

Jet Stream® Ultra contains no Red List chemicals. The Red List is a list of chemicals that are not allowed in Living Building Challenge buildings. Being Red List free is our design benchmark at Knauf.

Jet Stream Ultra is designed to be blown into walls and attics. This product works well in interiors, as it is virgin glass with a small amount of lubricant. The product meets GreenGuard Gold criteria and is validated to be formaldehyde-free.

The fiber comprising Jet Stream Ultra is 98 – 99% inert virgin glass, with a small amount of lubricant added. The ingredients in this product avoid the 800+ chemicals of the Living Building Challenge Red List. The product is designated Red List Free and formaldehyde-free.

What's in the product and why

Because Jet Stream Ultra is designed to be blown into walls and attics, it contains a small amount of fossil based lubricant (1 – 2%) to facilitate blowing. The remainder of the product is inert virgin glass fiber. The ingredients of Jet Stream Ultra avoid the 800+ chemicals of the Living Building Challenge Red List.

This product has a high degree of recycled content, and environmental mining impacts are reduced approximately 60% by using recycled glass rather than virgin materials. The glass formulations used in Knauf products are audited for health & safety using the European Certification Board for Mineral Wool Products (EUCEB) exoneration process.

Where it goes at the end of its life

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

How we're making it healthier

Knauf Insulation North America (KINA) engages very closely with its vendors to eliminate and avoid chemicals of concern.

- We lead the fiberglass industry in the most Red List Free products.
- Our products are certified for indoor air quality and meet the most stringent emission requirements from UL Environment through the Greenguard certification program.
- Our products are Certified Formaldehyde Free by UL Environment.

See how we make it greener

References

Declare

Jet Stream® Ultra Blowing Wool Insulation

Manufacturer's Guide to Declare
A comprehensive guide providing information about the program, the assessment methodology, how to submit material data to obtain a Declare label and how they are used to meet the Health & Happiness and Materials Petals of the Living Building Challenge.

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

○ **X08** Materials Optimization

Collaborative for High Performance Schools National Criteria
EQ C7.1 Material Health Disclosures

☑ Performance Approach	2 points
☑ Prescriptive Approach	2 points

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EPD	LCA
3rd-party verified	☑
	Transparency Report (EPD)
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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.

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SUMMARY

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UL Part B: Building Envelope Thermal Insulation v2.0

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North America; Cradle-to-grave

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LCA for Experts v10.7; LCA for Experts 2023

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How we make it greener

Jet Stream® Ultra Blowing Wool Insulation

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.

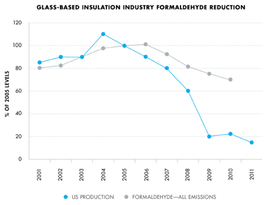
MANUFACTURING

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.

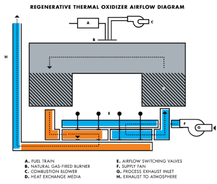
Knauf Insulation, comprised of Knauf Insulation North America (KINA) and Knauf Insulation Europe, Middle East, Asia, Asia Pacific (KI EMEA & APAC), share an overall global certification for ISO 45001 Health & Safety, ISO 14001 Environmental, ISO 50001 Energy, and ISO 9001 Quality through a third-party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

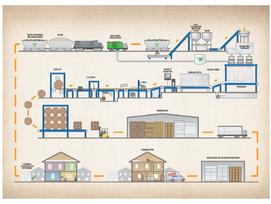
Our Continuous Improvement Program, with all its tools and systems associated with it, provide a formal process where we are constantly monitoring our manufacturing and sustainability Key Performance Indicators (KPIs) with an eye towards improvement. This Continuous Improvement centric management system 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.

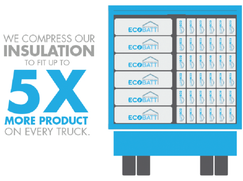




TRANSPORTATION

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 validated by UL Environment.

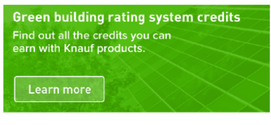
3rd Party UL Environmental Claim Validation states that Knauf Insulation products manufactured in North America contain an average of 61% recycled content, consisting of 20% post-consumer and 41% pre-consumer recycled glass.

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



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.

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	Transparency Report (EPD)
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