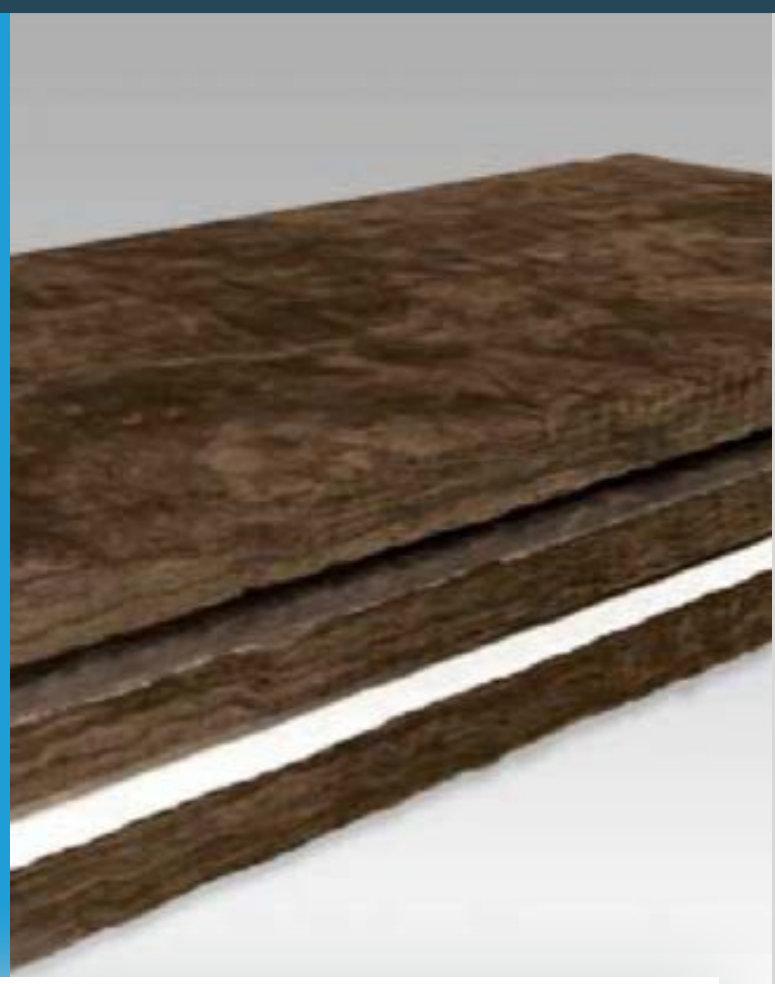
MANSON INSULATION

AK Board™

Unfaced, ASJ+, FSK

Manson Insulation AK 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 bio-based Technology and is available plain or with a factory appliefoil-scrim-kraft (FSK) facing or allservice jacket (ASJ+), and is the only formaldehyde-free glass mineral wool board product available today.





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 Manson for more product information

Environment & materials

Improved by:
Utilization of recycled glass
Manson's original plant-based bio-based binder technology

Certification & rating systems:
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)

CSI MasterFormat 07 21 13
Thermal Insulation Guide Specification

For spec help, contact us or call 317 421 8727

Download all documents

See LCA, interpretation & rating systems

SM Transparency Report (EPD)™

VERIFICATION	LCA
3rd party reviewed	NSF
Transparency Report (EPD)	
3rd party verified	NSF

Validity: 2018/12/03 - 2023/12/03
MAN - 20181203 -001

This declaration was independently verified by NSF to ISO 21930:2017, EN 15804, the UL Environment PCR, and ISO 14025:2006.

NSF International
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SUMMARY

Reference PCR
UL Building Envelope Thermal Insulation, 04/18 – 02/23

Regions; system boundaries
North America; Cradle to grave

Functional unit / reference service life:
1 m^2 of installed insulation w/packaging; thickness that gives an avg thermal resistance of RSI = 1 m^2·K/W over 75 years.

LCIA methodology: TRACI 2.1

LCA software; LCI database
GaBi 7; GaBi 2017

LCA conducted by: Sustainable Minds

Public LCA: Knauf and Manson Products

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317 398 4434

Contact us

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LCA results & interpretation

AK Board™

Life cycle assessment

Scope and summary

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

Application
Versatile product for thermal and acoustical applications in North America such as: heating and 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. Insulation is delivered to the installation site as one packaged bag containing varying amounts of product.

Functional unit
Reference service life: 75 years. One square meter of installed insulation material, packaging included, with a thickness that gives an average thermal resistance of RSI=1m2·K/W over a period of 75 years.
Reference flow: 3.08 kg of product with an unfaced option, a 0.220 kg ASJ+ facing option, or a 0.144 kg FSK facing option, at a thickness of 0.320 m to achieve the functional unit. (ASTM C518)

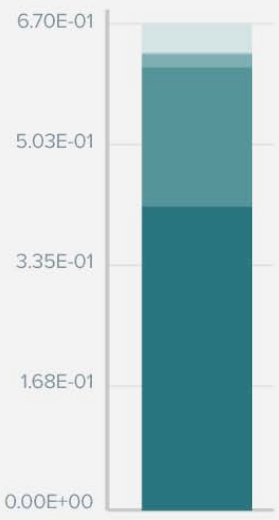
Manufacturing data
Reporting period: October 2015 – September 2016
Location: Shelbyville, IN

Default installation, packaging, and disposal scenarios
At the installation site, insulation products are unpackaged and installed. Staples may be used to board products. No material is lost or wasted because scraps are typically used to fill corners or crevices. Packaging waste, made up of paper and plastic, is disposed (plastic: 15% to recycling, 68% to landfill, and 17% to incineration; paper: 75% to recycling, 20% to landfill, and 5% to incineration), and no maintenance or replacement is required to achieve the product's life span. After removal, the insulation is assumed to be landfilled.

Material composition greater than 1% by weight

PART	MATERIAL	AVG % WT.
Batch	Post-consumer cullet	58.0%
Batch	Internal cullet	11.0%
Batch	Sand	8.0%
Batch	Borax	6.9%
Batch	Soda ash	3.1%
Batch	Sugars	2.4%
Batch	Limestone	2.2%
Facing	Facing (average)	2.1%
Facing	Facing adhesive	1.5%
Packaging	Plastic film	1.4%
Batch	Dolomite	1.2%
Batch	Nepheline syenite	1.2%
	Other	1.7%

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



LIFE CYCLE STAGE	MPTS/FUNC UNIT
Raw material acquisition	4.16E-01
Manufacturing	1.90E-01
Transportation	1.81E-02
Installation and maintenance	1.64E-03
Disposal/reuse/recycling	3.91E-02

Total impacts = 6.65E-01 mPts
per 75 years installed

A variation of 10 to 20% | A variation greater than 20%

What's causing the greatest impacts

All life cycle stages
For unfaced product, the manufacturing stage dominates the results for all impact categories except for eutrophication, respiratory effects, and non-carcinogenics. The raw materials acquisition stage dominates the results for eutrophication and respiratory effects, and the disposal stage dominates the results for non-carcinogenics. The impact of the raw material acquisition stage is mostly due to the borax, manganese dioxide, and soda ash in the batch and the dextrose in the binder. Since sand and borax are melted in the oven, they are not released into the air as fine particulates and therefore likely actually contribute less than what is calculated in the results tables below. The manufacturing stage shows major contributions to all impact categories. The contributions to outbound transportation are caused by the use of trucks and rail transport. The landfilling of the discarded product contributes to the disposal stage. The only impacts associated with installation and maintenance are due to the disposal of packaging waste, which is the smallest contributor to the results.

For faced products, the raw material acquisition stage is higher compared to the unfaced products because it includes potential impacts from the facing. Potential impacts for transportation and disposal are also higher due to the added mass from the addition of facing.

Manufacturing stage
The energy required to melt the glass and produce the glass fibers is the largest contributor to the manufacturing stage for all impact categories.

Characterized vs. single score results
Due to normalization and weighting, different stages can dominate the characterized and single score results. The batch ingredients sand and borax contribute significantly to the respiratory effects category, causing the raw materials acquisition stage to dominate the mPt results, but not the characterized results. However, they are not released into the air as fine particulates and therefore likely actually contribute less than what is calculated in the raw material acquisition stage. What this means is that the manufacturing stage may have a larger share of the impact than what is displayed in the total impacts by life cycle stage.

Sensitivity analysis
The three different facing options impact the type and amount of raw materials extracted during the raw material acquisition stage. The addition of facing contributes to higher impacts.

Multi-product weighted average
Results represent the weighted average using production volumes for the products covered. Variations of specific products for differences of 10–20% against the average are indicated in purple; differences greater than 20% are indicated in red. A difference greater than 10% is considered significant.

How we're making it greener

Knauf and Manson are committed to providing products that conserve energy and preserve natural resources.

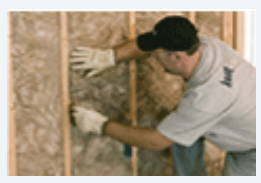
- These products use ECOSE® Technology, which is a plant-based binder adhesive instead of a fossil fuel based binder. ECOSE Technology represents a fossil fuel avoidance equivalent of 100,000 barrels of oil a year for Manson and Knauf Insulation products combined.
- Our product contains a high degree of recycled content, which translates to 20% less glass melting energy and a 25% reduction in embodied carbon.
  Our utilization of recycled content reduces mining impacts by 60%. In fact, Knauf and Manson products combined use 10 railcars of recycled glass a day.
- All glass fiber made by Manson and Knauf 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	TRANSPORATION	INSTALLATION AND MAINTENANCE	DISPOSAL / REUSE / RECYCLING
Information modules: Included | Excluded* *In the installation and maintenance phase, packaging waste in module A5 is the only contributor to the potential impacts.	A1 Raw Materials	A3 Manufacturing	A4 Transportion/ Delivery	A5 Construction/ Installation	C1 Deconstruction/ Demolition
	A2 Transportation			B1 Use	C2 Transporation
				B2 Maintenance	C3 Waste Processing
				B3 Repair	C4 Disposal
				B4 Replacement	
				B5 Refurbishment	
				B6 Operational energy use	
				B7 Operational water use	




SM 2013 Learn about SM Single Score results

Impacts per 75 years of service	4.16E-01 mPts	1.90E-01 mPts	1.81E-02 mPts	1.64E-03 mPts	3.91E-02 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.

Unfaced: TRACI v2.1 results per functional unit

A variation of 10 to 20% \| A variation greater than 20%

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

Ecological damage

Impact category	Unit					
Acidification	kg SO_2 eq	6.25E-03	1.95E-02	4.62E-03	3.43E-05	1.16E-03
Eutrophication	kg N eq	1.14E-03	9.64E-04	3.69E-04	8.53E-06	6.86E-05
Global warming (Embodied carbon)	kg CO_2 eq	9.76E-01	8.14E+00	8.63E-01	5.78E-02	2.53E-01
Ozone depletion	kg CFC-11 eq	4.59E-10	3.09E-09	5.95E-12	3.85E-11	3.36E-12

Human health damage

Impact category	Unit					
Carcinogenics	CTU_h	3.93E-10	1.34E-09	4.57E-10	1.62E-11	8.44E-10
Non-carcinogenics	CTU_h	2.72E-08	7.98E-08	3.40E-08	2.04E-09	9.47E-08
Respiratory	kg $PM_{2.5}$ eq	7.03E-03	2.83E-03	2.41E-04	2.51E-05	6.38E-04
Smog	kg O_3 eq	1.02E-01	2.02E-01	1.55E-01	7.20E-04	2.68E-02

Additional environmental information

Impact category	Unit					
Ecotoxicity	CTU_e	9.67E-02	1.99E-01	1.08E-01	6.89E-04	2.48E-02
Fossil fuel depletion	MJ, LHV	1.57E+00	8.30E+00	1.64E+00	1.23E-02	5.01E-01

FSK-faced: TRACI v2.1 results per functional unit

A variation of 10 to 20% | A variation greater than 20%

LIFE CYCLE STAGE		RAW MATERIAL ACQUISITION	MANUFACTURING	TRANSPORTATION	INSTALLATION AND MAINTENANCE	DISPOSAL / REUSE / RECYCLING
Ecological damage						
Impact category	Unit					
Acidification	kg SO_2 eq	7.69E-03	1.95E-02	4.83E-03	3.43E-05	1.21E-03
Eutrophication	kg N eq	1.27E-03	9.64E-04	3.86E-04	8.53E-06	7.18E-05
Global warming	kg CO_2 eq	1.36E+00	8.14E+00	9.03E-01	5.78E-02	2.65E-01
Ozone depletion	kg CFC-11 eq	3.59E-09	3.09E-09	6.22E-12	3.85E-11	3.52E-12
Human health damage						
Impact category	Unit					
Carcinogenics	CTU_h	8.08E-10	1.34E-09	4.78E-10	1.62E-11	8.82E-10
Non-carcinogenics	CTU_h	6.71E-08	7.98E-08	3.55E-08	2.04E-09	9.90E-08
Respiratory effects	kg $PM_{2.5}$ eq	7.25E-03	2.83E-03	2.52E-04	2.51E-05	6.67E-04
Smog	kg O_3 eq	1.23E-01	2.02E-01	1.62E-01	7.20E-04	2.81E-02
Additional environmental information						
Impact category	Unit					
Ecotoxicity	CTU_e	1.24E-01	1.99E-01	1.13E-01	6.89E-04	2.59E-02
Fossil fuel depletion	MJ, LHV	2.60E+00	8.30E+00	1.71E+00	1.23E-02	5.24E-01

ASJ+ faced: TRACI v2.1 results per functional unit

A variation of 10 to 20% | A variation greater than 20%

LIFE CYCLE STAGE		RAW MATERIAL ACQUISITION	MANUFACTURING	TRANSPORTATION	INSTALLATION AND MAINTENANCE	DISPOSAL / REUSE / RECYCLING
Ecological damage						
Impact category	Unit					
Acidification	kg SO_2 eq	8.12E-03	1.95E-02	4.94E-03	3.43E-05	1.24E-03
Eutrophication	kg N eq	1.30E-03	9.64E-04	3.95E-04	8.53E-06	7.34E-05
Global warming	kg CO_2 eq	1.55E+00	8.14E+00	9.24E-01	5.78E-02	2.71E-01
Ozone depletion	kg CFC-11 eq	4.06E-09	3.09E-09	6.37E-12	3.85E-11	3.60E-12
Human health damage						
Impact category	Unit					
Carcinogenics	CTU_h	1.05E-09	1.34E-09	4.89E-10	1.62E-11	9.03E-10
Non-carcinogenics	CTU_h	9.06E-08	7.98E-08	3.63E-08	2.04E-09	1.01E-07
Respiratory effects	kg $PM_{2.5}$ eq	7.31E-03	2.83E-03	2.58E-04	2.51E-05	6.82E-04
Smog	kg O_3 eq	1.30E-01	2.02E-01	1.66E-01	7.20E-04	2.87E-02
Additional environmental information						
Impact category	Unit					
Ecotoxicity	CTU_e	1.43E-01	1.99E-01	1.15E-01	6.89E-04	2.65E-02
Fossil fuel depletion	MJ, LHV	3.31E+00	8.30E+00	1.75E+00	1.23E-02	5.36E-01

References

LCA Backround Report

Knauf Insulation and Manson Insulation Products LCA Background Report (public version), Knauf 2018. GaBi 7, GaBi 2017 database.

PCRs
ISO 21930:2017 serves as the core PCR along with EN 15804 and UL Part A.

ULE PCR Part A: Life Cycle Assessment Calculation Rules and Report Requirements v3.1

May 2, 2018. Technical Advisory Panel members reviewed and provided feedback on content written by UL Environment and USGBC. Past and present members of the Technical Advisory Panel are listed in the PCR.

ULE PCR Part B: Building Envelope Thermal Insulation

Version 2.0, April 2018. PCR review conducted by Thomas Gloria, PhD (chair, t.gloria@industrial-ecology.com); Andre Desjarlais; and Christoph Koffler, PhD.

ULE General Program Instructions v2.1, April 2017

ISO 14025, “Sustainability in buildings and civil engineering works -- Core rules for environmental product declarations of construction products and services”, ISO21930:2017

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	1/2 product
✓ Product-specific Type III EPD	1 product

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	
✓ C 3.5.2.2 and SI 4.1.2 Path B: Prescriptive Path for Interior Fit-outs	

Collaborative for High Performance Schools National Criteria

MW 7.1 – Environmental Product Declarations

✓ Third-party certified type III EPD	2 points

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. They are designed to present information transparently to make the limitations of comparability more understandable. TRs/EPDs of products that conform to the same PCR and include the same life cycle stages, but are made by different manufacturers, may not sufficiently align to support direct comparisons. They therefore, cannot be used as comparative assertions unless the conditions defined in ISO 14025 Section 6.7.2. ‘Requirements for Comparability’ are satisfied. Comparison of the environmental performance of building envelope thermal insulation 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 the 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, when they comply with all referenced standards, use the same sub-category PCR, and use equivalent scenarios with respect to construction works. However, variations and deviations are possible. Example of variations: Different LCA software and background LCI data sets may lead to different results upstream or downstream of the life cycle stages declared.

SM Transparency Report (EPD)™

VERIFICATION	LCA
3rd party reviewed	✓ NSF
	Transparency Report (EPD)
3rd party verified	✓ NSF

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How we make it greener

AK Board™

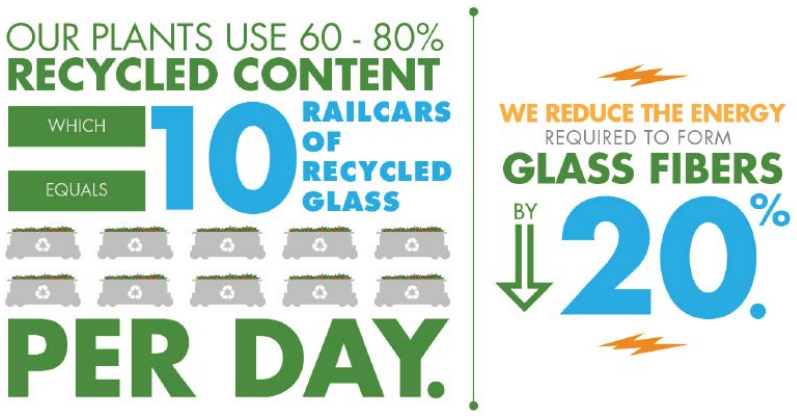
See LCA results by life cycle stage

RAW MATERIAL ACQUISITION



Utilize recycled content

Our plants use 60 – 80% recycled content – which translates to about 10 railcars of recycled glass cullet a day. By leveraging so much recycled content, we reduce the energy required to form glass fibers by 20%. If we use even 60% recycled content, then mining impacts are reduced proportionately.



Pursue sequestration potential

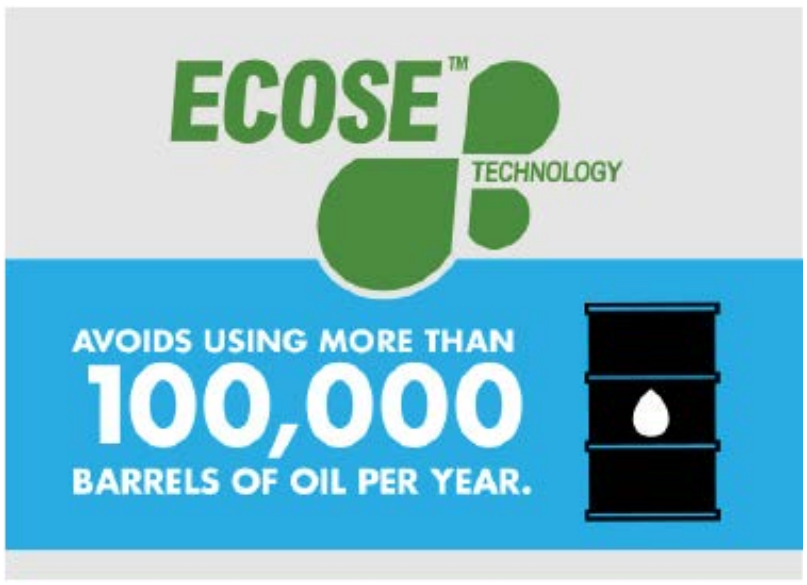
Manson and Knauf's bio-based ECOSE Technology is derived from corn. On average, the Knauf Family Farm produces one half the amount of corn we use to make our products on an annual basis, which is equal to 5,000 acres. While we don't grow the corn used in our products, the use of corn has a significant carbon sequestration impact on our processes. For instance, the use of corn actually offsets the carbon impact of some of the ancillary facers used on our products.

MANUFACTURING

Develop bio-based formaldehyde-free binder

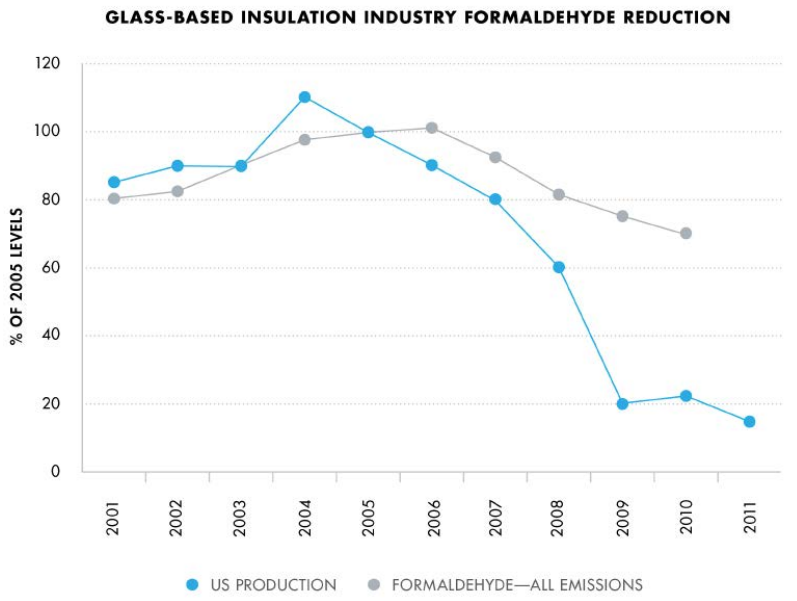
In 2008, Knauf Insulation launched perhaps the nation's largest formaldehyde-free green chemistry initiative called ECOSE Technology. Offering this into the building materials marketplace quickly transformed the entire glass mineral fiber industry toward bio-based chemistries. Today phenol-formaldehyde (PF) based resins are largely a thing of the past with regard to large volume mineral fiber based insulation products. Knauf has also launched a new business venture to assist other industries in accessing ECOSE Technology for their processes.

In a given year, using corn-based ECOSE Technology instead of phenol & formaldehyde avoids the equivalent of more than 100,000 barrels of oil in North America alone.



Lead green chemistry efforts

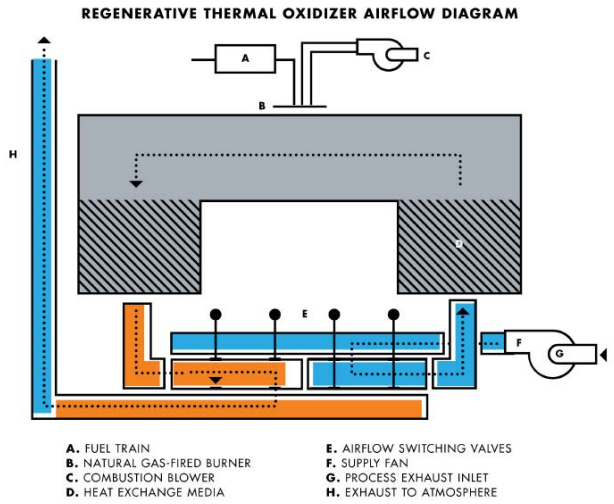
Following the launch of our ECOSE Technology in 2009, we had transformed all of our products and processes to this new technology. Using our bio-based ECOSE Technology has removed phenol and formaldehyde from our stack emissions. By 2012, the entire industry had followed our lead. This initiative not only established Knauf Insulation in a leadership position, but it had a transformative impact on our industry in general.

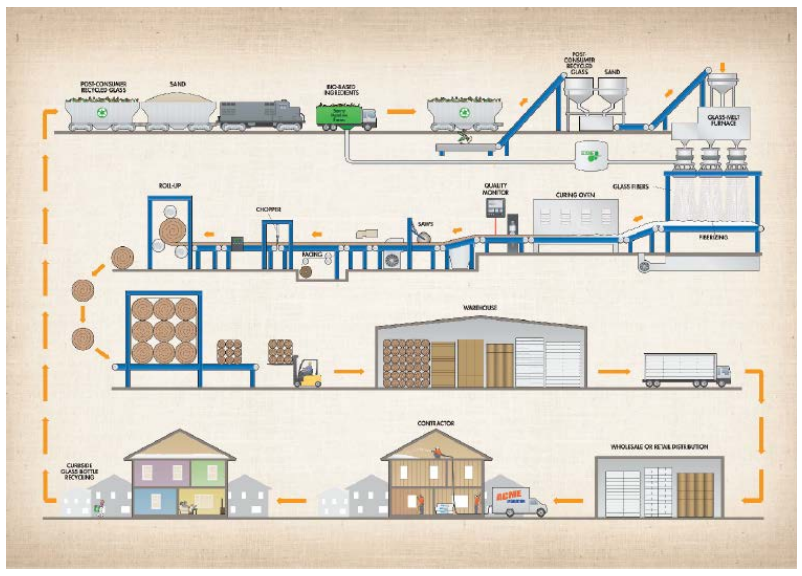


Green manufacturing Processes

1. Regenerative thermal oxidizers Knauf Insulation uses regenerative thermal oxidizers (RTO) to capture and recycle much of the energy we used 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.

2. Recycling As you can see below, everything we do starts with recycling. Our plant uses as much as 80% recycled content. While our only option is to landfill our products at end of life, that doesn't stop us from encouraging consumers to recycle other products, particularly glass bottles.





Continuous Improvement

Continuous improvement is key to our sustainable development. Globally, we maintain the following Bureau Veritas certifications: ISO 9000, 14000, and 50001. These certifications relate to quality management systems, energy management and environmental management efforts. For more information on our current continuous improvement efforts, please review our global sustainability report.

TRANSPORTATION

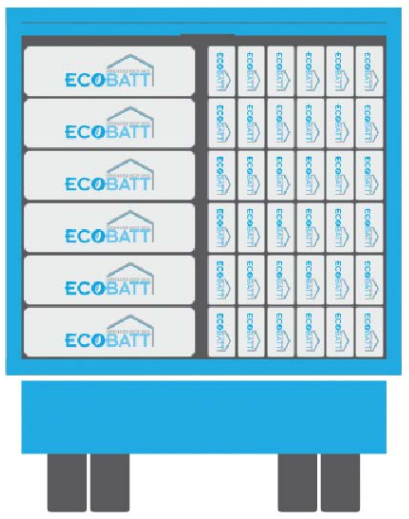


Leverage compression packaging

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. This compression means:

- More material can fit on one truck when compared to other insulation materials
- Fewer packages on a job
- Fewer deliveries needed





INSTALLATION AND MAINTENANCE



Be confident in glass mineral wool'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, glass mineral wool has been exonerated entirely. Glass mineral wool 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 glass mineral wool 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 was 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.

Red List Free Since 2012, Knauf Insulation North America used the Living Building Challenge (LBC) Red List as its developmental benchmark. The Red List is a list of chemicals that are avoided in material imperative for the construction of LBC buildings. Formaldehyde is just one of about 800 chemicals on the Red List. Manson Insulation has chosen the Health Product Declaration® (HPD) Collaborative as its standard for reporting building product content and associated health information.

EUCEB tested Glass fiber is perhaps the most widely studied building material available today. 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 35 years of research behind its safety, perhaps no other building material has been as thoroughly evaluated as fiberglass products. We believe a safe product is one that has been thoroughly evaluated.

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 **to see all the credits you can earn using Manson and Knauf Insulation products.**



DISPOSAL



Promote Recycling
Manson and Knauf are recycling advocates. We take every opportunity to advocate for recycling and financially support the Glass Recycling Coalition (GRC). We feel that a comprehensive understanding of the benefits of recycling will lead to greater recycling adoption and more promotion by state and local governments. While our only option is to landfill our products at end of life, that doesn't stop us from encouraging consumers to recycle other products, particularly glass bottles.

GLASS RECYCLING COALITION
MEMBER
glassrecycles.org

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North America; Cradle to grave

Functional unit / reference service life:
1 m^2 of installed insulation w/packaging; thickness that gives an avg thermal resistance of RSI = 1 m^2·K/W over 75 years.

LCIA methodology: TRACI 2.1

LCA software; LCI database
GaBi 7; GaBi 2017

LCA conducted by: Sustainable Minds

Public LCA: Knauf and Manson Products

Manson Insutation
One Knauf Drive
Shelbyville, IN 46176
www.imanson.com
317 398 4434

Contact us

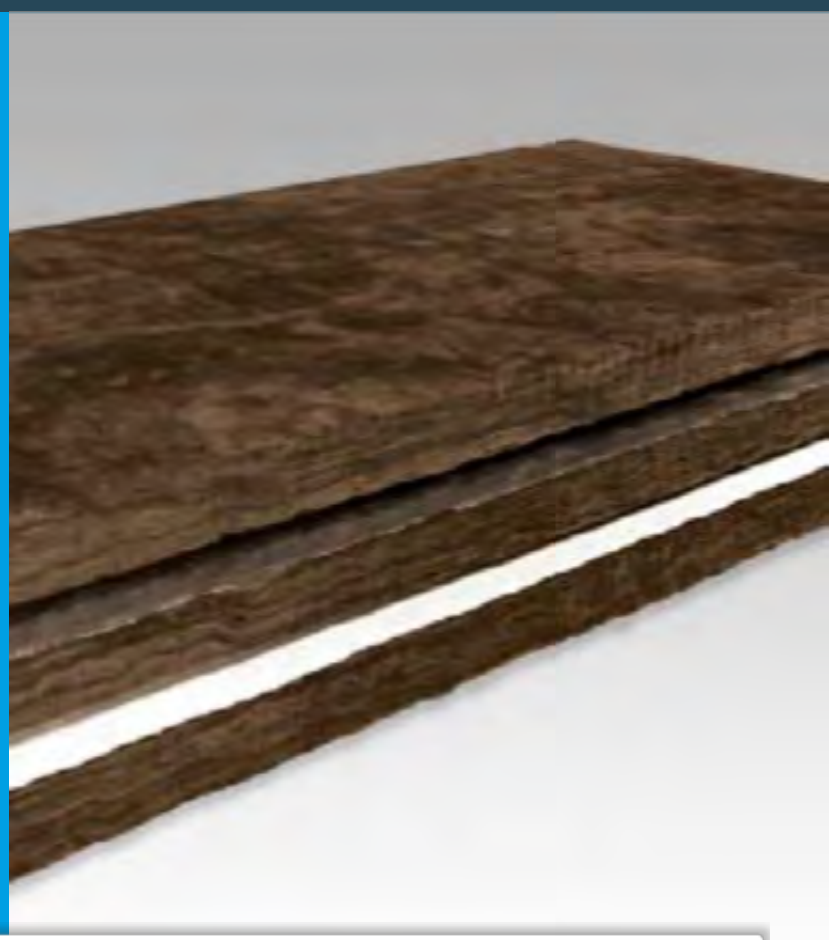
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MANSON INSULATION

AK Board™

Unfaced, ASJ+, FSK

Manson Insulation AK 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 bio-based Technology and is available plain or with a factory applied foil-scrim-kraft (FSK) facing or allservice jacket (ASJ+), and is the only formaldehyde-free glass mineral wool board product available today.





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 Manson for more product specifications

Environment & materials

Improved by:
Utilization of recycled glass

Manson's original plant-based bio-based binder technology

Certification & rating systems:
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)

CSI MasterFormat® 07 21 13

Thermal Insulation Guide Specification

For spec help, contact us or call 317 421 8727

See LCA, interpretation & rating systems

SM Transparency Report™

VERIFICATION	LCA
3rd party reviewed	
Transparency Report	
3rd party reviewed	

Validity: 12/03/18 – 12/03/23
MAN – 12032018 – 001

This declaration was independently verified by NSF to ISO 21930:2017, EN 15804, the UL Environment PCR, and ISO 14025:2006.

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LCA results & interpretation

AK Board™

Life cycle assessment

Scope and summary

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

Application
Versatile product for thermal and acoustical applications in North America such as: heating and 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. Insulation is delivered to the installation site as one packaged bag containing varying amounts of product.

Functional unit
Reference service life: 75 years. 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 over a period of 75 years.
Reference flow: 3.08 kg of product with an unfaced option, a 0.220 kg ASJ+ facing option, or a 0.144 kg FSK facing option, at a thickness of 0.320 m to achieve the functional unit. (ASTM C518)

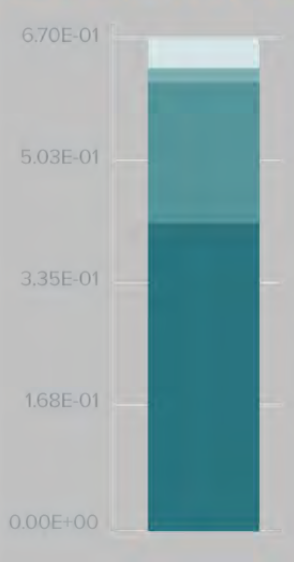
Manufacturing data
Reporting period: October 2015 – September 2016
Location: Shelbyville, IN

Default installation, packaging, and disposal scenarios
At the installation site, insulation products are unpackaged and installed. Staples may be used to board products. No material is lost or wasted because scraps are typically used to fill corners or crevices. Packaging waste, made up of paper and plastic, is disposed (plastic: 15% to recycling, 68% to landfill, and 17% to incineration; paper: 75% to recycling, 20% to landfill, and 5% to incineration), and no maintenance or replacement is required to achieve the product's life span. After removal, the insulation is assumed to be landfilled.

Material composition greater than 1% by weight

PART	MATERIAL	AVG % WT.
Batch	Post-consumer cullet	58.0%
Batch	Internal cullet	11.0%
Batch	Sand	8.0%
Batch	Borax	6.9%
Batch	Soda ash	3.1%
Batch	Sugars	2.4%
Batch	Limestone	2.2%
Facing	Facing (average)	2.1%
Facing	Facing adhesive	1.5%
Packaging	Plastic film	1.4%
Batch	Dolomite	1.2%
Batch	Nepheline syenite	1.2%
	Other	1.7%

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



LIFE CYCLE STAGE	MPTS/FUNC UNIT
Raw material acquisition	4.16E-01
Manufacturing	1.90E-01
Transportation	1.81E-02
Installation and maintenance	1.64E-03
Disposal/reuse/recycling	3.91E-02

Total impacts = 6.65E-01 mPts
per 75 years installed

A variation of 10 to 20% | A variation greater than 20%

What's causing the greatest impacts

All life cycle stages
For unfaced product, the manufacturing stage dominates the results for all impact categories except for eutrophication, respiratory effects, and non-carcinogenics. The raw materials acquisition stage dominates the results for eutrophication and respiratory effects, and the disposal stage dominates the results for non-carcinogenics. The impact of the raw material acquisition stage is mostly due to the borax, manganese dioxide, and soda ash in the batch and the dextrose in the binder. Since sand and borax are melted in the oven, they are not released into the air as fine particulates and therefore likely actually contribute less than what is calculated in the results tables below. The manufacturing stage shows major contributions to all impact categories. The contributions to outbound transportation are caused by the use of trucks and rail transport. The landfilling of the discarded product contributes to the disposal stage. The only impacts associated with installation and maintenance are due to the disposal of packaging waste, which is the smallest contributor to the results.
For faced products, the raw material acquisition stage is higher compared to the unfaced products because it includes potential impacts from the facing. Potential impacts for transportation and disposal are also higher due to the added mass from the addition of facing.

Manufacturing stage
The energy required to melt the glass and produce the glass fibers is the largest contributor to the manufacturing stage for all impact categories.

Characterized vs. single score results
Due to normalization and weighting, different stages can dominate the characterized and single score results. The batch ingredients sand and borax contribute significantly to the respiratory effects category, causing the raw materials acquisition stage to dominate the mPt results, but not the characterized results. However, they are not released into the air as fine particulates and therefore likely actually contribute less than what is calculated in the raw material acquisition stage. What this means is that the manufacturing stage may have a larger share of the impact than what is displayed in the total impacts by life cycle stage.

Sensitivity analysis
The three different facing options impact the type and amount of raw materials extracted during the raw material acquisition stage. The addition of facing contributes to higher impacts.

Multi-product weighted average
Results represent the weighted average using production volumes for the products covered. Variations of specific products for differences of 10–20% against the average are indicated in purple; differences greater than 20% are indicated in red. A difference greater than 10% is considered significant.

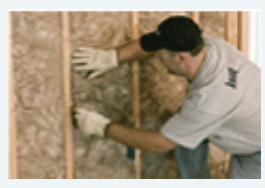
How we're making it greener

Knauf and Manson are committed to providing products that conserve energy and preserve natural resources.

- These products use ECOSE® Technology, which is a plant-based binder adhesive instead of a fossil fuel based binder. ECOSE Technology represents a fossil fuel avoidance equivalent of 100,000 barrels of oil a year for Manson and Knauf Insulation products combined.
- Our product contains a high degree of recycled content, which translates to 20% less glass melting energy and a 25% reduction in embodied carbon.
- Our utilization of recycled content reduces mining impacts by 60%. In fact, Knauf and Manson products combined use 10 railcars of recycled glass a day.
- All glass fiber made by Manson and Knauf 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	TRANSPORATION	INSTALLATION AND MAINTENANCE	DISPOSAL/REUSE/ RECYCLING
Information modules: Included | Excluded* *In the installation and maintenance phase, packaging waste in module A5 is the only contributor to the potential impacts.	**A1 Raw Materials**	**A3 Manufacturing**	**A4 Transporation/ Delivery**	**A5 Construction/ Installation**	**C1 Deconstruction/ Demolition**
	A2 Transportation			**B1 Use**	**C2 Transporation**
				B2 Maintenance	**C3 Waste Processing**
				B3 Repair	**C4 Disposal**
				B4 Replacement	
				B5 Refurbishment	
				B6 Operational energy use	
				B7 Operational water use	
					

SM 2013 Learn about SM Single Score results

Impacts per 75 years of service	4.16E-01 mPts	1.90E-01 mPts	1.81E-02 mPts	1.64E-03 mPts	3.91E-02 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.

Unfaced: TRACI v2.1 results per functional unit

A variation of 10 to 20% | A variation greater than 20%

Ecological damage

Impact category	Unit	RAW MATERIAL ACQUISITION	MANUFACTURING	TRANSPORTATION	INSTALLATION AND MAINTENANCE	DISPOSAL/REUSE/ RECYCLING
Acidification	**kg SO_2 eq**	6.25E-03	1.95E-02	4.62E-03	3.43E-05	1.16E-03
Eutrophication	**kg N eq**	1.14E-03	9.64E-04	3.69E-04	8.53E-06	6.86E-05
Global warming	**kg CO_2 eq**	9.76E-01	8.14E+00	8.63E-01	5.78E-02	2.53E-01
Ozone depletion	**kg CFC-11 eq**	4.59E-10	3.09E-09	5.95E-12	3.85E-11	3.36E-12

Human health damage

Impact category	Unit	RAW MATERIAL ACQUISITION	MANUFACTURING	TRANSPORTATION	INSTALLATION AND MAINTENANCE	DISPOSAL/REUSE/ RECYCLING
Carcinogenics	**CTU_h**	3.93E-10	1.34E-09	4.57E-10	1.62E-11	8.44E-10
Non-carcinogenics	**CTU_h**	2.72E-08	7.98E-08	3.40E-08	2.04E-09	9.47E-08
Respiratory effects	**kg $PM_{2.5}$ eq**	7.03E-03	2.83E-03	2.41E-04	2.51E-05	6.38E-04
Smog	**kg O_3 eq**	1.02E-01	2.02E-01	1.55E-01	7.20E-04	2.68E-02

Additional environmental information

Impact category	Unit	RAW MATERIAL ACQUISITION	MANUFACTURING	TRANSPORTATION	INSTALLATION AND MAINTENANCE	DISPOSAL/REUSE/ RECYCLING
Ecotoxicity	**CTU_e**	9.67E-02	1.99E-01	1.08E-01	6.89E-04	2.48E-02
Fossil fuel depletion	**MJ, LHV**	1.57E+00	8.30E+00	1.64E+00	1.23E-02	5.01E-01

FSK-faced: TRACI v2.1 results per functional unit

A variation of 10 to 20% | A variation greater than 20%

Ecological damage

Impact category	Unit	RAW MATERIAL ACQUISITION	MANUFACTURING	TRANSPORTATION	INSTALLATION AND MAINTENANCE	DISPOSAL/REUSE/ RECYCLING
Acidification	**kg SO_2 eq**	7.69E-03	1.95E-02	4.83E-03	3.43E-05	1.21E-03
Eutrophication	**kg N eq**	1.27E-03	9.64E-04	3.86E-04	8.53E-06	7.18E-05
Global warming	**kg CO_2 eq**	1.36E+00	8.14E+00	9.03E-01	5.78E-02	2.65E-01
Ozone depletion	**kg CFC-11 eq**	3.59E-09	3.09E-09	6.22E-12	3.85E-11	3.52E-12

Human health damage

Impact category	Unit	RAW MATERIAL ACQUISITION	MANUFACTURING	TRANSPORTATION	INSTALLATION AND MAINTENANCE	DISPOSAL/REUSE/ RECYCLING
Carcinogenics	**CTU_h**	8.08E-10	1.34E-09	4.78E-10	1.62E-11	8.82E-10
Non-carcinogenics	**CTU_h**	6.71E-08	7.98E-08	3.55E-08	2.04E-09	9.90E-08
Respiratory effects	**kg $PM_{2.5}$ eq**	7.25E-03	2.83E-03	2.52E-04	2.51E-05	6.67E-04
Smog	**kg O_3 eq**	1.23E-01	2.02E-01	1.62E-01	7.20E-04	2.81E-02

Additional environmental information

Impact category	Unit	RAW MATERIAL ACQUISITION	MANUFACTURING	TRANSPORTATION	INSTALLATION AND MAINTENANCE	DISPOSAL/REUSE/ RECYCLING
Ecotoxicity	**CTU_e**	1.24E-01	1.99E-01	1.13E-01	6.89E-04	2.59E-02
Fossil fuel depletion	**MJ, LHV**	2.60E+00	8.30E+00	1.71E+00	1.23E-02	5.24E-01

ASJ+ faced: TRACI v2.1 results per functional unit

A variation of 10 to 20% | A variation greater than 20%

Ecological damage

Impact category	Unit	RAW MATERIAL ACQUISITION	MANUFACTURING	TRANSPORTATION	INSTALLATION AND MAINTENANCE	DISPOSAL/REUSE/ RECYCLING
Acidification	**kg SO_2 eq**	8.12E-03	1.95E-02	4.94E-03	3.43E-05	1.24E-03
Eutrophication	**kg N eq**	1.30E-03	9.64E-04	3.95E-04	8.53E-06	7.34E-05
Global warming	**kg CO_2 eq**	1.55E+00	8.14E+00	9.24E-01	5.78E-02	2.71E-01
Ozone depletion	**kg CFC-11 eq**	4.06E-09	3.09E-09	6.37E-12	3.85E-11	3.60E-12

Human health damage

Impact category	Unit	RAW MATERIAL ACQUISITION	MANUFACTURING	TRANSPORTATION	INSTALLATION AND MAINTENANCE	DISPOSAL/REUSE/ RECYCLING
Carcinogenics	**CTU_h**	1.05E-09	1.34E-09	4.89E-10	1.62E-11	9.03E-10
Non-carcinogenics	**CTU_h**	9.06E-08	7.98E-08	3.63E-08	2.04E-09	1.01E-07
Respiratory effects	**kg $PM_{2.5}$ eq**	7.31E-03	2.83E-03	2.58E-04	2.51E-05	6.82E-04
Smog	**kg O_3 eq**	1.30E-01	2.02E-01	1.66E-01	7.20E-04	2.87E-02

Additional environmental information

Impact category	Unit	RAW MATERIAL ACQUISITION	MANUFACTURING	TRANSPORTATION	INSTALLATION AND MAINTENANCE	DISPOSAL/REUSE/ RECYCLING
Ecotoxicity	**CTU_e**	1.43E-01	1.99E-01	1.15E-01	6.89E-04	2.65E-02
Fossil fuel depletion	**MJ, LHV**	3.31E+00	8.30E+00	1.75E+00	1.23E-02	5.36E-01

See the additional EPD content required by the UL Environment PCR on page 4 of the Transparency Report PDF.

References

LCA Background Report
Knauf Insulation and Manson Insulation Products LCA Background Report (public version), Knauf 2018. GaBi 7, GaBi 2017 database.

PCRs
ISO 21930:2017 serves as the core PCR along with EN 15804 and UL Part A.

ULE PCR Part A: Life Cycle Assessment Calculation Rules and Report Requirements v3.1
May 2, 2018. Technical Advisory Panel members reviewed and provided feedback on content written by UL Environment and USGBC. Past and present members of the Technical Advisory Panel are listed in the PCR.

ULE PCR Part B: Building Envelope Thermal Insulation
Version 2.0, April 2018. PCR review conducted by Thomas Gloria, PhD (chair, t.gloria@industrial-ecology.com); Andre Desjarlais; and Christoph Koffler, PhD.

ULE General Program Instructions v2.1, April 2017

ISO 14025, "Sustainability in buildings and civil engineering works -- Core rules for environmental product declarations of construction products and services", ISO21930:2017

Download PDF SM Transparency Report/Material Health Overview, which includes the additional EPD content required by the UL Environment PCR.

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. They are designed to present information transparently to make the limitations of comparability more understandable. TRs/EPDs of products that conform to the same PCR and include the same life cycle stages, but are made by different manufacturers, may not sufficiently align to support direct comparisons. They therefore, cannot be used as comparative assertions unless the conditions defined in ISO 14025 Section 6.7.2. 'Requirements for Comparability' are satisfied. Comparison of the environmental performance of building envelope thermal insulation 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 the 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, when they comply with all referenced standards, use the same sub-category PCR, and use equivalent scenarios with respect to construction works. However, variations and deviations are possible. Example of variations: Different LCA software and background LCI data sets may lead to different results 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	½ product
✓ Product-specific Type III EPD	1 product

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
- ✓ C 3.5.2.2 and SI 4.1.2 Path B: Prescriptive Path for Interior Fit-outs

Collaborative for High Performance Schools National Criteria
MW 7.1 – Environmental Product Declarations

✓ Third-party certified type III EPD	2 points

SM Transparency Report™

VERIFICATION	LCA
3rd party reviewed	✓ NSF
	Transparency Report
3rd party reviewed	✓ NSF

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How we make it greener

AK Board™

Collapse all

See LCA results by life cycle stage

RAW MATERIAL ACQUISITION



Utilize recycled content

Our plants use 60 – 80% recycled content – which translates to about 10 railcars of recycled glass cullet a day. By leveraging so much recycled content, we reduce the energy required to form glass fibers by 20%. If we use even 60% recycled content, then mining impacts are reduced proportionately.



Pursue sequestration potential

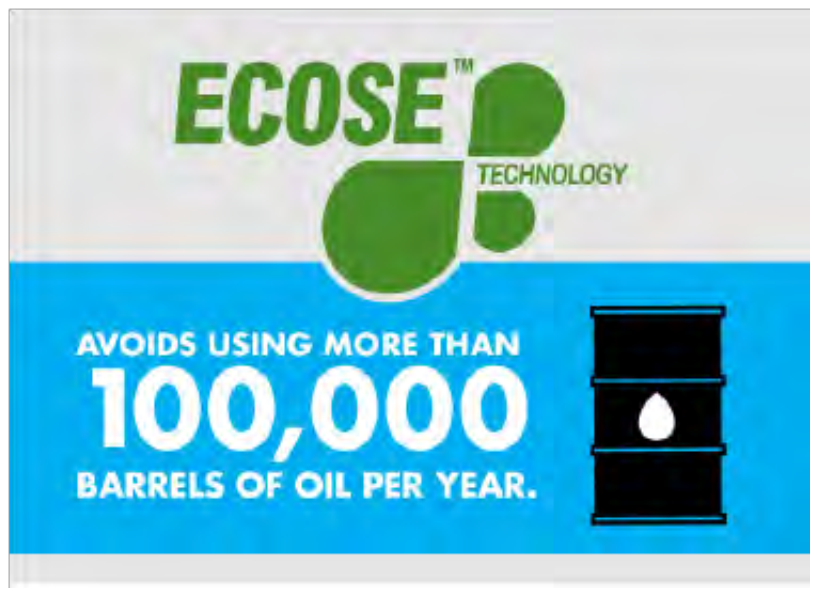
Manson and Knauf's bio-based ECOSE Technology is derived from corn. On average, the Knauf Family Farm produces one half the amount of corn we use to make our products on an annual basis, which is equal to 5,000 acres. While we don't grow the corn used in our products, the use of corn has a significant carbon sequestration impact on our processes. For instance, the use of corn actually offsets the carbon impact of some of the ancillary facers used on our products.

MANUFACTURING

Develop bio-based formaldehyde-free binder

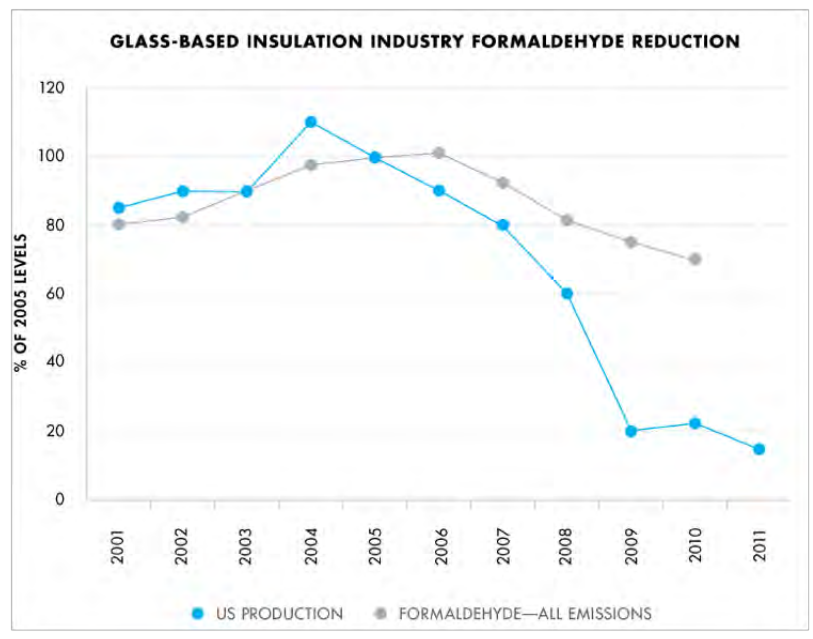
In 2008, Knauf Insulation launched perhaps the nation's largest formaldehyde-free green chemistry initiative called ECOSE Technology. Offering this into the building materials marketplace quickly transformed the entire glass mineral fiber industry toward bio-based chemistries. Today phenol-formaldehyde (PF) based resins are largely a thing of the past with regard to large volume mineral fiber based insulation products. Knauf has also launched a new business venture to assist other industries in accessing ECOSE Technology for their processes.

In a given year, using corn-based ECOSE Technology instead of phenol & formaldehyde avoids the equivalent of more than 100,000 barrels of oil in North America alone.



Lead green chemistry efforts

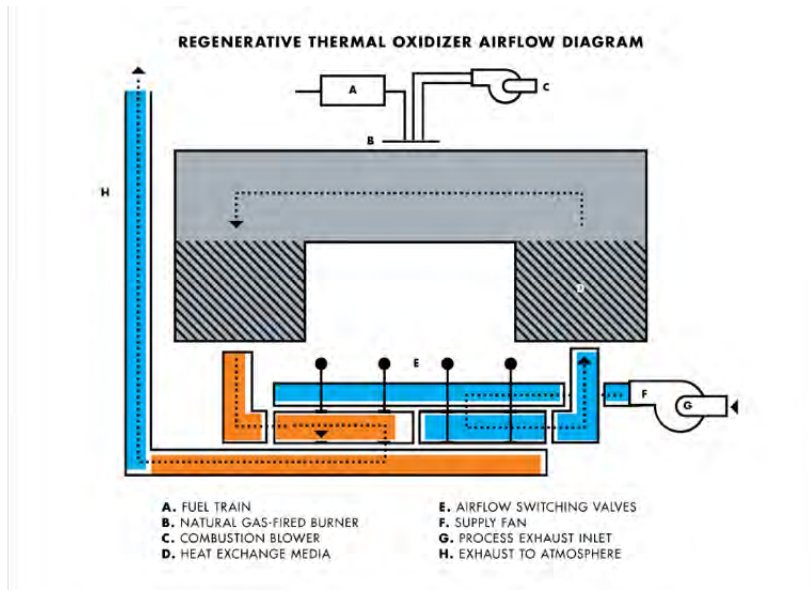
Following the launch of our ECOSE Technology in 2009, we had transformed all of our products and processes to this new technology. Using our bio-based ECOSE Technology has removed phenol and formaldehyde from our stack emissions. By 2012, the entire industry had followed our lead. This initiative not only established Knauf Insulation in a leadership position, but it had a transformative impact on our industry in general.

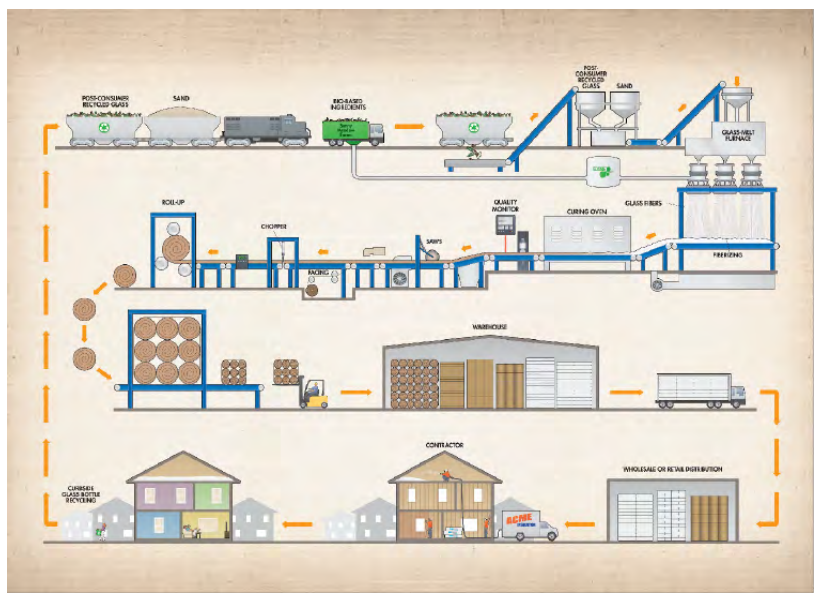


Green manufacturing Processes

1. Regenerative thermal oxidizers Knauf Insulation uses regenerative thermal oxidizers (RTO) to capture and recycle much of the energy we used 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.

2. Recycling As you can see below, everything we do starts with recycling. Our plant uses as much as 80% recycled content. While our only option is to landfill our products at end of life, that doesn't stop us from encouraging consumers to recycle other products, particularly glass bottles.





Continuous Improvement

Continuous improvement is key to our sustainable development. Globally, we maintain the following Bureau Veritas certifications: ISO 9000, 14000, and 50001. These certifications relate to quality management systems, energy management and environmental management efforts. For more information on our current continuous improvement efforts, please review our global sustainability report.

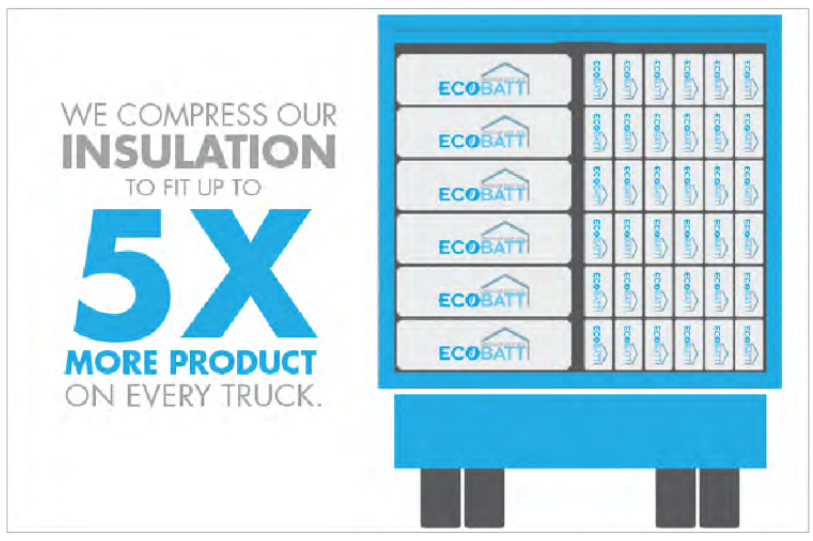
TRANSPORTATION



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. This compression means:

- More material can fit on one truck when compared to other insulation materials
- Fewer packages on a job
- Fewer deliveries needed



INSTALLATION AND MAINTENANCE



Be confident in glass mineral wool'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, glass mineral wool has been exonerated entirely. Glass mineral wool 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 glass mineral wool 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 was 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.

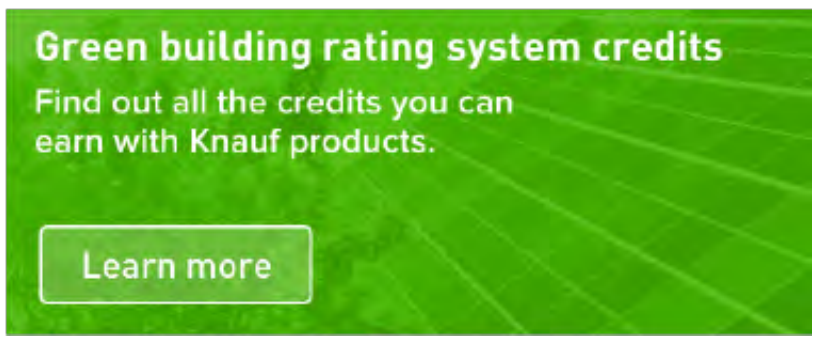
Red List Free Since 2012, Knauf Insulation North America used the Living Building Challenge (LBC) Red List as its developmental benchmark. The Red List is a list of chemicals that are avoided in material imperative for the construction of LBC buildings. Formaldehyde is just one of about 800 chemicals on the Red List. Manson Insulation has chosen the Health Product Declaration® (HPD) Collaborative as its standard for reporting building product content and associated health information.

EUCEB tested Glass fiber is perhaps the most widely studied building material available today. 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 35 years of research behind its safety, perhaps no other building material has been as thoroughly evaluated as fiberglass products. We believe a safe product is one that has been thoroughly evaluated.

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

Manson and Knauf are recycling advocates. We take every opportunity to advocate for recycling and financially support the Glass Recycling Coalition (GRC). We feel that a comprehensive understanding of the benefits of recycling will lead to greater recycling adoption and more promotion by state and local governments. While our only option is to landfill our products at end of life, that doesn't stop us from encouraging consumers to recycle other products, particularly glass bottles.



SM Transparency Report™

VERIFICATION	LCA
3rd party reviewed	NSF
	Transparency Report
3rd party verified	NSF

Validity: 12/03/18 – 12/03/23
MAN – 12032018 – 001

This declaration was independently verified by NSF to ISO 21930:2017, EN 15804, the UL Environment PCR, and ISO 14025:2006.

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Additional EPD content required by: ULE PCR Parts A and B for Building Envelope Thermal Insulation

AK BOARD™

Data

Background This company-specific product/product group specific declaration was created by collecting product data over the course of a year for each line at each location the product was manufactured. For products with multiple manufacturing locations, data are a weighted average by production volume at each location. For average products, which are products that have more than one facing option, data are a weighted average of the mass of each functional unit. The reference service life applies for the reference in-use conditions only.

Allocation Since only facility-level data were available, allocation among a facility's co-products was used to determine the input and output flows associated with each product. Allocation of materials and energy was done on a mass basis for all products except for the facing, which was allocated based on product area. Allocation of transportation was based on either weight or volume, depending on which was found to greater restrict the amount of cargo. Glass cullet is assumed to enter the system burden-free in that burden associated with the production of virgin glass is not allocated to the fiberglass life cycle. Likewise, the system boundary was drawn to include landfilling of fiberglass at end-of-life (following the polluter pays principle), but exclude any credits from recovery.

Cut-off criteria For the inclusion of mass and energy flows are 1% of renewable primary resource (energy), 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 exception to these criteria is 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.

Scenarios and additional technical information

PARAMETER	VALUE	UNIT
Transport to the building site [A4]		
Vehicle type	Truck	
Average distance from Shelbyville to installation site	680	mi
Capacity utilization by mass	27	%
Installation into the building [A5]		
Distance from installation site to disposal	100	mi
Mass of paper packaging waste to disposal	0.0225	kg
Mass of plastic packaging waste to disposal	0.0519	kg
Biogenic carbon contained in paper packaging	9.88E-03	kg CO_2
GWP based in biogenic carbon content of paper packaging	2.72E-02	kg CO_2e
GWP based in biogenic carbon content of plastic packaging	0	kg CO_2e
Disposal/reuse/recycling [C1-C4]		
Distance from installation site to disposal	100	mi
Mass of product waste to disposal	3.08-3.30	kg
Removals of biogenic carbon (excluding packaging)	8.72E-03-9.33E-03	kg CO_2

Resource use, output and waste flows, and carbon emissions and removals for unfaced AK BOARD™ per functional unit

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	Total
Resource use indicators																
Renewable primary energy used as energy carrier (fuel)	MJ, LHV	7.57E+00	2.97E-01	5.01E-03	0	0	0	0	0	0	0	0	2.33E-02	0	2.04E-01	**8.10E+00**
Renewable primary resources with energy content used as material	MJ, LHV	2.19E-03	0	6.21E-07	0	0	0	0	0	0	0	0	0	0	0	**2.19E-03**
Total use of renewable primary resources with energy content	MJ, LHV	7.57E+00	2.97E-01	5.01E-03	0	0	0	0	0	0	0	0	2.33E-02	0	2.04E-01	**8.10E+00**
Non-renewable primary resources used as an energy carrier (fuel)	MJ, LHV	1.46E+02	1.22E+01	9.90E-02	0	0	0	0	0	0	0	0	9.59E-01	0	2.97E+00	**1.62E+02**
Non-renewable primary resources with energy content used as material	MJ, LHV	1.16E-07	0	6.17E-11	0	0	0	0	0	0	0	0	0	0	0	**1.16E-07**
Total use of non-renewable primary resources with energy content	MJ, LHV	1.46E+02	1.22E+01	9.90E-02	0	0	0	0	0	0	0	0	9.59E-01	0	2.97E+00	**1.62E+02**
Secondary materials	kg	1.87E+00	0	0	0	0	0	0	0	0	0	0	0	0	0	**1.87E+00**
Renewable secondary fuels	MJ, LHV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Non-renewable secondary fuels	MJ, LHV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Recovered energy	MJ, LHV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Use of net fresh water resources	m3	1.22E+03	3.33E+01	2.83E+00	0	0	0	0	0	0	0	0	2.62E+00	0	9.53E+01	**1.36E+03**
Output flows and waste category indicators																
Hazardous waste disposed	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Non-hazardous waste disposed	kg	0	0	7.44E-02	0	0	0	0	0	0	0	0	0	0	3.08E+00	**3.15E+00**
High-level radioactive waste, conditioned, to final repository	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Intermediate- and low-level radioactive waste, conditioned, to final repository	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Components for re-use	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Materials for recycling	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Materials for energy recovery	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Exported energy	MJ, LHV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Carbon emissions and removals

Biogenic Carbon Removal from Product	kg CO_2	1.10E-01	0	0	0	0	0	0	0	0	0	0	0	0	**1.10E-01**
Biogenic Carbon Emission from Product	kg CO_2	1.26E-01	0	0	0	0	0	0	0	0	0	0	0	8.72E-03	**1.34E-01**
Biogenic Carbon Removal from Packaging	kg CO_2	5.89E-03	0	0	0	0	0	0	0	0	0	0	0	0	**5.89E-03**
Biogenic Carbon Emission from Packaging	kg CO_2	0	0	9.88E-03	0	0	0	0	0	0	0	0	0	0	**9.88E-03**
Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes	kg CO_2	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Calcination Carbon Emissions	kg CO_2	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Carbonation Carbon Removals	kg CO_2	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes	kg CO_2	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**

TRACI v2.1 disaggregated results for unfaced AK BOARD™ per functional unit

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks. These six impact categories required by the PCR 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. Impact categories which were not required by the PCR are included in part to allow for the calculation of millipoints using the SM2013 Methodology, but it should be noted that there are known limitations related to these impact categories due to their high degree of uncertainty. LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

Impact category	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
Acidification	kg SO_2 eq	2.57E-02	4.62E-03	3.43E-05	0	0	0	0	0	0	0	0	2.95E-04	0	8.66E-04
Eutrophication	kg N eq	2.11E-03	3.69E-04	8.53E-06	0	0	0	0	0	0	0	0	2.47E-05	0	4.39E-05
Global warming	kg SO_2 eq	9.11E+00	8.63E-01	5.78E-02	0	0	0	0	0	0	0	0	6.78E-02	0	1.85E-01
Ozone depletion	kg CFC-11 eq	3.55E-09	5.95E-12	3.85E-11	0	0	0	0	0	0	0	0	4.68E-13	0	2.89E-12
Smog	kg O_3 eq	3.04E-01	1.55E-01	7.20E-04	0	0	0	0	0	0	0	0	9.76E-03	0	1.71E-02
Fossil fuel depletion	MJ, LHV	9.87E+00	1.64E+00	1.23E-02	0	0	0	0	0	0	0	0	1.29E-01	0	3.72E-01

Additional environmental information for unfaced AK BOARD™ per functional unit

Impact category	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
Ecotoxicity	CTUe	2.95E-01	1.08E-01	6.89E-04	0	0	0	0	0	0	0	0	8.46E-03	0	1.63E-02
Carcinogenics	CTUh	1.74E-09	4.57E-10	1.62E-11	0	0	0	0	0	0	0	0	3.59E-11	0	8.08E-10
Non-carcinogenics	CTUh	1.07E-07	3.40E-08	2.04E-09	0	0	0	0	0	0	0	0	2.67E-09	0	9.20E-08
Respiratory effects	kg PM2.5 eq	9.85E-03	2.41E-04	2.51E-05	0	0	0	0	0	0	0	0	1.56E-05	0	6.22E-04

The product does not contain substances that are identified as hazardous according to standards or regulations of the Resource Conservation and Recovery Act (RCRA), Subtitle C, nor does it (or its associated processes) release dangerous, regulated substances that affect health and environment, including indoor air emissions, gamma or ionizing radiation emissions, or chemicals released to the air or leached to water and soil.

Resource use, output and waste flows, and carbon emissions and removals for FSK-faced AK BOARD™ per functional unit

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	Total
Resource use indicators																
Renewable primary energy used as energy carrier (fuel)	MJ, LHV	9.70E+00	3.10E-01	5.01E-03	0	0	0	0	0	0	0	0	2.44E-02	0	2.13E-01	**1.02E+01**
Renewable primary resources with energy content used as material	MJ, LHV	2.22E-03	0	6.21E-07	0	0	0	0	0	0	0	0	0	0	0	**2.22E-03**
Total use of renewable primary resources with energy content	MJ, LHV	9.70E+00	3.10E-01	5.01E-03	0	0	0	0	0	0	0	0	2.44E-02	0	2.13E-01	**1.03E+01**
Non-renewable primary resources used as an energy carrier (fuel)	MJ, LHV	1.54E+02	1.28E+01	9.90E-02	0	0	0	0	0	0	0	0	1.00E+00	0	3.11E+00	**1.71E+02**
Non-renewable primary resources with energy content used as material	MJ, LHV	1.16E-07	0	6.17E-11	0	0	0	0	0	0	0	0	0	0	0	**1.16E-07**
Total use of non-renewable primary resources with energy content	MJ, LHV	1.54E+02	1.28E+01	9.90E-02	0	0	0	0	0	0	0	0	1.00E+00	0	3.11E+00	**1.71E+02**
Secondary materials	kg	1.87E+00	0	0	0	0	0	0	0	0	0	0	0	0	0	**1.87E+00**
Renewable secondary fuels	MJ, LHV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Non-renewable secondary fuels	MJ, LHV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Recovered energy	MJ, LHV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Use of net fresh water resources	m3	3.06E+03	3.49E+01	2.83E+00	0	0	0	0	0	0	0	0	2.74E+00	0	9.97E+01	**3.20E+03**

Output flows and waste category indicators

Hazardous waste disposed	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Non-hazardous waste disposed	kg	0	0	7.44E-02	0	0	0	0	0	0	0	0	0	3.22E+00	**3.29E+00**
High-level radioactive waste, conditioned, to final repository	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Intermediate- and low-level radioactive waste, conditioned, to final repository	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Components for re-use	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Materials for recycling	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Materials for energy recovery	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Exported energy	MJ, LHV	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Carbon emissions and removals

Biogenic Carbon Removal from Product	kg CO_2	1.21E-01	0	0	0	0	0	0	0	0	0	0	0	0	**1.21E-01**
Biogenic Carbon Emission from Product	kg CO_2	1.26E-01	0	0	0	0	0	0	0	0	0	0	0	9.12E-03	**1.35E-01**
Biogenic Carbon Removal from Packaging	kg CO_2	5.89E-03	0	0	0	0	0	0	0	0	0	0	0	0	**5.89E-03**
Biogenic Carbon Emission from Packaging	kg CO_2	0	0	9.88E-03	0	0	0	0	0	0	0	0	0	0	**9.88E-03**
Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes	kg CO_2	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Calcination Carbon Emissions	kg CO_2	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Carbonation Carbon Removals	kg CO_2	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes	kg CO_2	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**

TRACI v2.1 disaggregated results for FSK-faced AK BOARD™ per functional unit

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks. These six impact categories required by the PCR 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. Impact categories which were not required by the PCR are included in part to allow for the calculation of millipoints using the SM2013 Methodology, but it should be noted that there are known limitations related to these impact categories due to their high degree of uncertainty. LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

Impact category	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
Acidification	kg SO_2 eq	2.72E-02	4.83E-03	3.43E-05	0	0	0	0	0	0	0	0	3.09E-04	0	9.05E-04
Eutrophication	kg N eq	2.23E-03	3.86E-04	8.53E-06	0	0	0	0	0	0	0	0	2.58E-05	0	4.60E-05
Global warming	kg SO_2 eq	9.49E+00	9.03E-01	5.78E-02	0	0	0	0	0	0	0	0	7.09E-02	0	1.94E-01
Ozone depletion	kg CFC-11 eq	6.68E-09	6.22E-12	3.85E-11	0	0	0	0	0	0	0	0	4.89E-13	0	3.03E-12
Smog	kg O_3 eq	3.24E-01	1.62E-01	7.20E-04	0	0	0	0	0	0	0	0	1.02E-02	0	1.79E-02
Fossil fuel depletion	MJ, LHV	1.09E+01	1.71E+00	1.23E-02	0	0	0	0	0	0	0	0	1.35E-01	0	3.89E-01

Additional environmental information for FSK-faced AK BOARD™ per functional unit

Impact category	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
Ecotoxicity	CTUe	3.23E-01	1.13E-01	6.89E-04	0	0	0	0	0	0	0	0	8.85E-03	0	1.71E-02
Carcinogenics	CTUh	2.15E-09	4.78E-10	1.62E-11	0	0	0	0	0	0	0	0	3.75E-11	0	8.45E-10
Non-carcinogenics	CTUh	1.47E-07	3.55E-08	2.04E-09	0	0	0	0	0	0	0	0	2.79E-09	0	9.62E-08
Respiratory effects	kg PM2.5 eq	1.01E-02	2.52E-04	2.51E-05	0	0	0	0	0	0	0	0	1.63E-05	0	6.51E-04

The product does not contain substances that are identified as hazardous according to standards or regulations of the Resource Conservation and Recovery Act (RCRA), Subtitle C, nor does it (or its associated processes) release dangerous, regulated substances that affect health and environment, including indoor air emissions, gamma or ionizing radiation emissions, or chemicals released to the air or leached to water and soil.

Resource use, output and waste flows, and carbon emissions and removals for ASJ+-faced AK BOARD™ per functional unit

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	Total
Resource use indicators																
Renewable primary energy used as energy carrier (fuel)	MJ, LHV	9.95E+00	3.18E-01	5.01E-03	0	0	0	0	0	0	0	0	2.50E-02	0	2.18E-01	**1.05E+01**
Renewable primary resources with energy content used as material	MJ, LHV	2.22E-03	0	6.21E-07	0	0	0	0	0	0	0	0	0	0	0	**2.22E-03**
Total use of renewable primary resources with energy content	MJ, LHV	9.95E+00	3.18E-01	5.01E-03	0	0	0	0	0	0	0	0	2.50E-02	0	2.18E-01	**1.05E+01**
Non-renewable primary resources used as an energy carrier (fuel)	MJ, LHV	1.60E+02	1.30E+01	9.90E-02	0	0	0	0	0	0	0	0	1.03E+00	0	3.18E+00	**1.77E+02**
Non-renewable primary resources with energy content used as material	MJ, LHV	1.16E-07	0	6.17E-11	0	0	0	0	0	0	0	0	0	0	0	**1.16E-07**
Total use of non-renewable primary resources with energy content	MJ, LHV	1.60E+02	1.30E+01	9.90E-02	0	0	0	0	0	0	0	0	1.03E+00	0	3.18E+00	**1.77E+02**
Secondary materials	kg	1.87E+00	0	0	0	0	0	0	0	0	0	0	0	0	0	**1.87E+00**
Renewable secondary fuels	MJ, LHV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Non-renewable secondary fuels	MJ, LHV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Recovered energy	MJ, LHV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Use of net fresh water resources	m3	3.03E+03	3.57E+01	2.83E+00	0	0	0	0	0	0	0	0	2.80E+00	0	1.02E+02	**3.17E+03**
Output flows and waste category indicators																
Hazardous waste disposed	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Non-hazardous waste disposed	kg	0	0	7.44E-02	0	0	0	0	0	0	0	0	0	0	3.29E+00	**3.37E+00**
High-level radioactive waste, conditioned, to final repository	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Intermediate- and low-level radioactive waste, conditioned, to final repository	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Components for re-use	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Materials for recycling	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Materials for energy recovery	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Exported energy	MJ, LHV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Carbon emissions and removals																
Biogenic Carbon Removal from Product	kg CO_2	1.26E-01	0	0	0	0	0	0	0	0	0	0	0	0	0	**1.26E-01**
Biogenic Carbon Emission from Product	kg CO_2	1.26E-01	0	0	0	0	0	0	0	0	0	0	0	0	9.33E-03	**1.35E-01**
Biogenic Carbon Removal from Packaging	kg CO_2	5.89E-03	0	0	0	0	0	0	0	0	0	0	0	0	0	**5.89E-03**
Biogenic Carbon Emission from Packaging	kg CO_2	0	0	9.88E-03	0	0	0	0	0	0	0	0	0	0	0	**9.88E-03**
Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes	kg CO_2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Calcination Carbon Emissions	kg CO_2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Carbonation Carbon Removals	kg CO_2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes	kg CO_2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**

TRACI v2.1 disaggregated results for ASJ+-faced AK BOARD™ per functional unit

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks. These six impact categories required by the PCR 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. Impact categories which were not required by the PCR are included in part to allow for the calculation of millipoints using the SM2013 Methodology, but it should be noted that there are known limitations related to these impact categories due to their high degree of uncertainty. LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks.

Impact category	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
Acidification	kg SO_2 eq	2.76E-02	4.94E-03	3.43E-05	0	0	0	0	0	0	0	0	3.16E-04	0	9.26E-04
Eutrophication	kg N eq	2.27E-03	3.95E-04	8.53E-06	0	0	0	0	0	0	0	0	2.64E-05	0	4.70E-05
Global warming	kg SO_2 eq	9.69E+00	9.24E-01	5.78E-02	0	0	0	0	0	0	0	0	7.26E-02	0	1.98E-01
Ozone depletion	kg CFC-11 eq	7.14E-09	6.37E-12	3.85E-11	0	0	0	0	0	0	0	0	5.01E-13	0	3.10E-12
Smog	kg O_3 eq	3.32E-01	1.66E-01	7.20E-04	0	0	0	0	0	0	0	0	1.04E-02	0	1.83E-02
Fossil fuel depletion	MJ, LHV	1.16E+01	1.75E+00	1.23E-02	0	0	0	0	0	0	0	0	1.38E-01	0	3.98E-01

Additional environmental information for ASJ+-faced AK BOARD™ per functional unit

Impact category	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
Ecotoxicity	CTUe	3.42E-01	1.15E-01	6.89E-04	0	0	0	0	0	0	0	0	9.05E-03	0	1.74E-02
Carcinogenics	CTUh	2.39E-09	4.89E-10	1.62E-11	0	0	0	0	0	0	0	0	3.84E-11	0	8.64E-10
Non-carcinogenics	CTUh	1.70E-07	3.63E-08	2.04E-09	0	0	0	0	0	0	0	0	2.86E-09	0	9.85E-08
Respiratory effects	kg PM2.5 eq	1.01E-02	2.58E-04	2.51E-05	0	0	0	0	0	0	0	0	1.67E-05	0	6.66E-04

The product does not contain substances that are identified as hazardous according to standards or regulations of the Resource Conservation and Recovery Act (RCRA), Subtitle C, nor does it (or its associated processes) release dangerous, regulated substances that affect health and environment, including indoor air emissions, gamma or ionizing radiation emissions, or chemicals released to the air or leached to water and soil.

SM Transparency Report (EPD)™

VERIFICATION LCA

3rd party reviewed — Transparency Report (EPD)

3rd party verified

Validity: 2018/12/03 - 2023/12/03
MAN - 20181203 -001

This declaration was independently verified by NSF to ISO 21930:2017, EN 15804, the UL Environment PCR, and ISO 14025:2006.

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SUMMARY
Reference PCR
UL Building Envelope Thermal Insulation, 04/18 – 02/23

Regions; system boundaries
North America; Cradle to grave

Functional unit / reference service life:
1 m^2 of installed insulation w/packaging; thickness that gives an avg thermal resistance of RSI = 1 m^2·K/W over 75 years.

LCIA methodology: TRACI 2.1

LCA software; LCI database
GaBi 7; GaBi 2017

LCA conducted by: Sustainable Minds

Public LCA: Knauf and Manson Products

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