

**Declaration Owner**

Natural Polymers, LLC
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Products

Open Cell Spray Polyurethane Foam Insulation:

Natural-Therm® 0.5
Ultra-Pure® Open Cell
Natural-Therm® Light
Natural-Therm® Open Cell

Functional Unit

1 m² of installed insulation material with a thickness that gives an average thermal resistance of 1 m²·K/W (5.68 h·ft²·°F/Btu) with a building service life of 75 years (packaging included)

EPD Number and Period of Validity

SCS-EPD-10457
EPD Valid July 16, 2025 through July 15, 2030

Product Category Rule

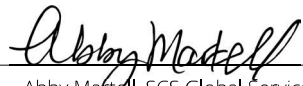
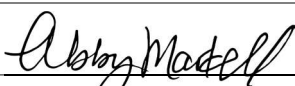
PCR Guidance for Building-Related Products and Services Part A: Life Cycle Assessment Calculation Rules and Report Requirements. Version 4.0. March 2022

PCR Guidance for Building-Related Products and Services Part B: Building Envelope Thermal Insulation EPD Requirements. Version 3.0. February 2024

Program Operator

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Address:	14438 E. North Ave., Cortland, IL, 60112, USA
Declaration Number:	SCS-EPD-10457
Declaration Validity Period:	July 16, 2025 through July 15, 2030
Version:	July 16, 2025
Product:	Natural Polymers Open Cell Spray Polyurethane Foam Insulation: Natural-Therm® 0.5 Ultra-Pure® Open Cell Natural-Therm® Light Natural-Therm® Open Cell
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EPD Scope:	Cradle-to-Grave
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Program Operator:	SCS Global Services
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LCA Software & LCI Database:	SimaPro Developer 9.6; ecoinvent 3.10
Independent critical review of the LCA and data, according to ISO 14044 and ISO 14071	<input type="checkbox"/> internal <input checked="" type="checkbox"/> external
LCA Reviewer:	 Abby Martell, SCS Global Services
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PCR Review conducted by:	Lindita Bushi, PhD (Chair); Hugues Imbeault-Tétreault, ing., M.Sc.A.; Jack Geibig
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Part B PCR Review conducted by:	Thomas Gloria (chair), Industrial Ecology Consultants; Christoph Koffler, thinkstep; Andre Desjarlais, Oak Ridge National Laboratory
Independent verification of the declaration and data, according to ISO 14025, ISO 21930, and the PCR	<input type="checkbox"/> internal <input checked="" type="checkbox"/> external
EPD Verifier:	 Abby Martell, SCS Global Services
Declaration Contents:	1. About Owens Corning3 2. Product3 3. LCA: Calculation Rules9 4. LCA: Scenarios and Additional Technical Information 13 5. LCA: Results 14 6. LCA: Interpretation 16 7. Additional Environmental Information 16 8. References 18
<p>Disclaimers: An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication.</p> <p>Conformity: This EPD conforms to ISO 14025:2006, and ISO 21930:2017.</p> <p>Ownership: The EPD owner has the sole ownership, liability, and responsibility of the EPD.</p> <p>Accuracy of Results: Due to PCR constraints, this EPD provides estimations of potential impacts that are inherently limited in terms of accuracy.</p> <p>Comparability: The PCR this EPD was based on was not written to support comparative assertions. EPDs based on different PCRs, or different calculation models, may not be comparable. When attempting to compare EPDs or life cycle impacts of products from different companies, the user should be aware of the</p>	

uncertainty in the final results, due to and not limited to, the practitioner's assumptions, the source of the data used in the study, and the specifics of the product modeled.

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

The owner of the declaration shall be liable for the underlying information and evidence; SCS shall not be liable with respect to manufacturer information, life cycle assessment data, and evidence supplied or made available to SCS.

1. About Owens Corning

Natural Polymers, LLC is proudly owned by Owens Corning. Owens Corning is a residential and commercial building products leader committed to building a sustainable future through material innovation. Their products provide durable, sustainable, energy-efficient solutions that leverage their unique capabilities and market-leading positions to help their customers win and grow. They are global in scope, human in scale with more than 25,000 employees in 31 countries dedicated to generating value for their customers and shareholders and making a difference in the communities where they work and live. Founded in 1938 and based in Toledo, Ohio, USA, Owens Corning posted 2024 sales of \$11.0 billion.

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

Cortland Plant
Cortland, IL, USA

2. Product

2.1 Product Description and Application

Natural Polymers spray polyurethane foam (SPF) insulation products are engineered to provide a wide range of performance characteristics, including thermal comfort and sound control. SPF insulation is a chemical product produced from the reaction of MDI (A-side) and a polyol resin mixture (B-side). SPF expands its original liquid volume when applied by spraying onto a substrate. As the foam expands, it adheres and contours to the surface, filling in cracks and crevices that can cause air infiltration.

Open cell spray polyurethane foam insulation products provide energy efficiency and air infiltration control as a high-performance building envelope insulation system. These products offer a self-adhering, seamless insulation that can be used in many areas of the building envelope, including open wall cavities, crawl spaces, perimeter rim joists, cathedral ceilings, and garage ceilings.

The following product names reflect differences in final product density and application. All spray polyurethane foam insulation products included in this study are made using consistent raw material inputs and manufacturing processes, making it appropriate to group them within a single EPD.

Table 1. Open Cell SPF Products

Spray Polyurethane Foam Insulation Products	Natural-Therm® 0.5
	Ultra-Pure® Open Cell
	Natural-Therm® Light
	Natural-Therm® Open Cell

The results of this declaration represent a production weighted average performance for the listed products. The product average results were calculated as a production weighted average based on 2024 production totals of the Natural-Therm® 0.5, Natural-Therm® Light/Natural-Therm® Open Cell, and Ultra Pure® open-cell SPF products.

- **Natural-Therm® 0.5** is an open cell water-blown, two-component, semi-rigid spray polyurethane foam insulation with a nominal 0.5 PCF in-place density. This product provides energy efficiency and air infiltration control as a high-performance building envelope insulation system. Natural-Therm® 0.5 Open Cell offers a self-adhering, seamless insulation that can be used in many areas of the building envelope, including open wall cavities, crawl spaces, perimeter rim joists, cathedral ceilings, and garage ceilings.
- **Natural-Therm® Light / Natural-Therm® Open Cell** are open cell water-blown, two-component, semi-rigid spray polyurethane foam insulation products with a nominal 0.40 PCF in-place density. These products provide energy efficiency and air infiltration control as a high-performance building envelope insulation system offering a self-adhering, seamless insulation that can be used in many areas of the building envelope, including open wall cavities, crawl spaces, perimeter rim joists, cathedral ceilings, and garage ceilings. Natural-Therm® Light and Natural-Therm® Open Cell are similar products with minor variations in minor side-B input materials.
- **Ultra-Pure® Open Cell** is a water-blown, open cell, two-component, semi-rigid spray polyurethane foam insulation with a nominal 0.50 PCF in-place density. This product provides energy efficiency and air infiltration control as a high-performance building envelope insulation system. Ultra-Pure® offers a self-adhering, seamless insulation that can be used in many areas of the building envelope, including open wall cavities, crawl spaces, perimeter rim joists, cathedral ceilings, and garage ceilings.

These products are covered by Construction Specification Institute (CSI) Masterformat code 07 21 29 - Sprayed Insulation and UNSPSC code 301415 for Insulation.

2.2 Methodological Framework

This declaration is a product-specific EPD and is cradle-to-grave. The underlying LCA upon which this EPD is based included the following life cycle modules: *Raw Material supply (A1); Inbound Transportation (A2); Manufacturing (A3); Distribution (A4); Installation (A5); Use (B1); End-of-life Transport (C2); and End-of-life Disposal (C4)*. No known flows have been deliberately excluded. The product is expected to perform as claimed for the 75-year reference service life (RSL) if it remains clean and dry in its installed state.

2.3 Technical Data

Standards, Code Compliance

- Natural-Therm® 0.5
 - Meets ICC-ES AC377 Type V-B
 - Code Evaluation Report IAPMO ER-336
 - UL GREENGUARD GOLD
- Ultra-Pure® Open Cell
 - Meets ICC-ES AC377 Type V-B
 - Code Evaluation Report IAPMO ER-801
 - UL GREENGUARD GOLD
- Natural-Therm® Light
 - Meets ICC-ES AC377 Type V-B
 - Code Evaluation Report IAPMO ER-589
 - UL GREENGUARD GOLD
- Natural-Therm® Open Cell
 - Meets ICC-ES AC377 Type V-B
 - Code Evaluation Report IAPMO number pending
 - UL GREENGUARD GOLD

2.4 Properties of Declared Product as Delivered

The two chemical formulations required to produce SPF (side-A and side-B) are delivered as a set to the job site in separate containers. On the job site, these formulations are mixed in equal volume proportions to create SPF. Table 2 provides thickness, R-value, and other specifications for open cell products. Additional performance specifications and standard requirements are provided in Table 3. More detailed information can be found at <https://www.owenscorning.com/en-us/insulation/residential/spray-foam>.

Table 2 Open Cell SPF Product Specifications

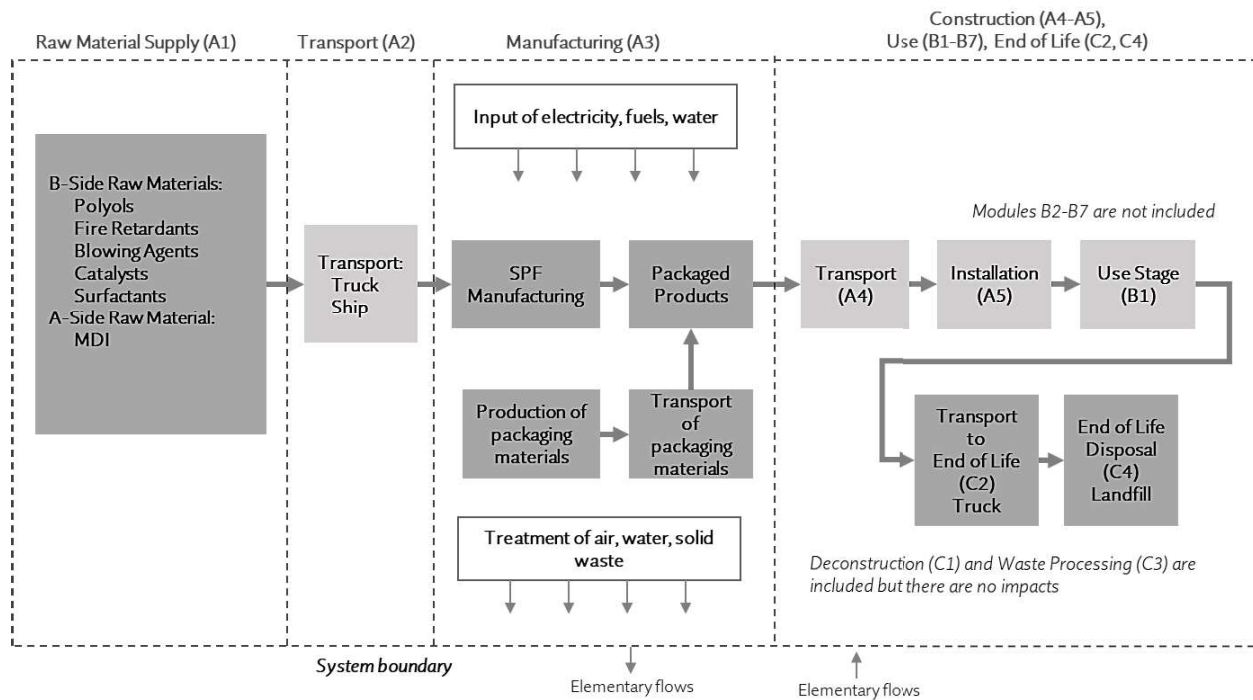
Product	Thickness (mm)	R Value [ft ² ·°F·h/Btu]	Nominal Density [kg/m ³]	Reference Flow [kg/m ²]
Natural-Therm® 0.5	25.4	3.7	8.0	0.312
Ultra-Pure® Open Cell	25.4	3.8	8.0	0.312
Natural-Therm® Open Cell / Natural-Therm® Light	25.4	3.7	6.4	0.250

Table 3. Summary of material performance requirements

Performance	Standard	Closed Cell SPF
Thermal Performance (R-value)	ASTM C518	3.7 – 3.8/inch
Surface Burning Characteristics	ASTM E84	Flame spread index < 25; Smoke developed < 450
Core Density	ASTM D1622	Nominal 0.40 – 0.50 pcf
Tensile Strength	ASTM D1623	6.12 psi (42.2 kPa)
Dimensional Stability	ASTM D2126	4.82% (185°F, 100% RH, 168 h)
Air Permeance	ASTM E283 or D2178	< 0.02 L/s/m ²

2.5 Flow Diagram

The diagram below represents the manufacturing process for spray polyurethane foam insulation products.



2.6 Material Composition

The side-A of SPF is methylene diphenyl diisocyanate (MDI). The side-B is a mixture of polyester and polyether polyols, flame retardants, blowing agents, catalysts, and other additives that, when mixed with side-A, creates foam that can be applied for insulation. The material composition of the side-B formulation is shown in Table 4.

While some of the ingredients may be classified as hazardous¹, per the Resource Conservation and Recovery Act (RCRA), Subtitle C, the product as installed and ultimately disposed of is not classified as a hazardous substance, as hazardous ingredients are rendered chemically inert after installation.

Table 4. B Side Composition

Component		Composition % (by Mass)
Polyols	Polyether	28-32%
	Compatibilizer	15-18%
Fire Retardants	TCPP*	18-22%
	Brominated	<1%
Blowing Agent	Reactive (H ₂ O)	18-22%
Catalysts	Amine*	8-11%
Surfactant	Silicone*	<2%
Additives	VOC Scavengers*	<2%

*chemical ingredients included in product safety data sheet¹

2.7 Manufacture

Natural Polymers spray polyurethane foam insulation products are produced at the Natural Polymers facility located at 14438 East North Avenue, Cortland, IL 60112.

The side-A material is sourced from suppliers and delivered to the manufacturing facility. The side-B raw materials delivered to the manufacturing facility are added to mix tanks for blending and subsequently packaged into drums. This study assumes 0.25% of the blowing agent is released to the atmosphere during product manufacturing.

2.8 Packaging

High-pressure SPF chemicals are packaged in unpressurized 55-gallon (208 L) steel or 25-gallon LDPE plastic drums. Finished packaged products are loaded onto pallets for distribution to the customer. Disposal of packaging materials is modeled in accordance with the assumptions outlined in Part A of the PCR (UL Environment, 2022). Plastic based packaging is disposed in landfill (68%), incineration (17%), and recycled (15%) as shown in Table 5. Metal based packaging is disposed in landfill (34%), incineration (9%), and recycled (57%). Paper based packaging is disposed in landfill (20%), incineration (5%), and recycled (75%).

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

Table 5. Waste Treatment of Packaging

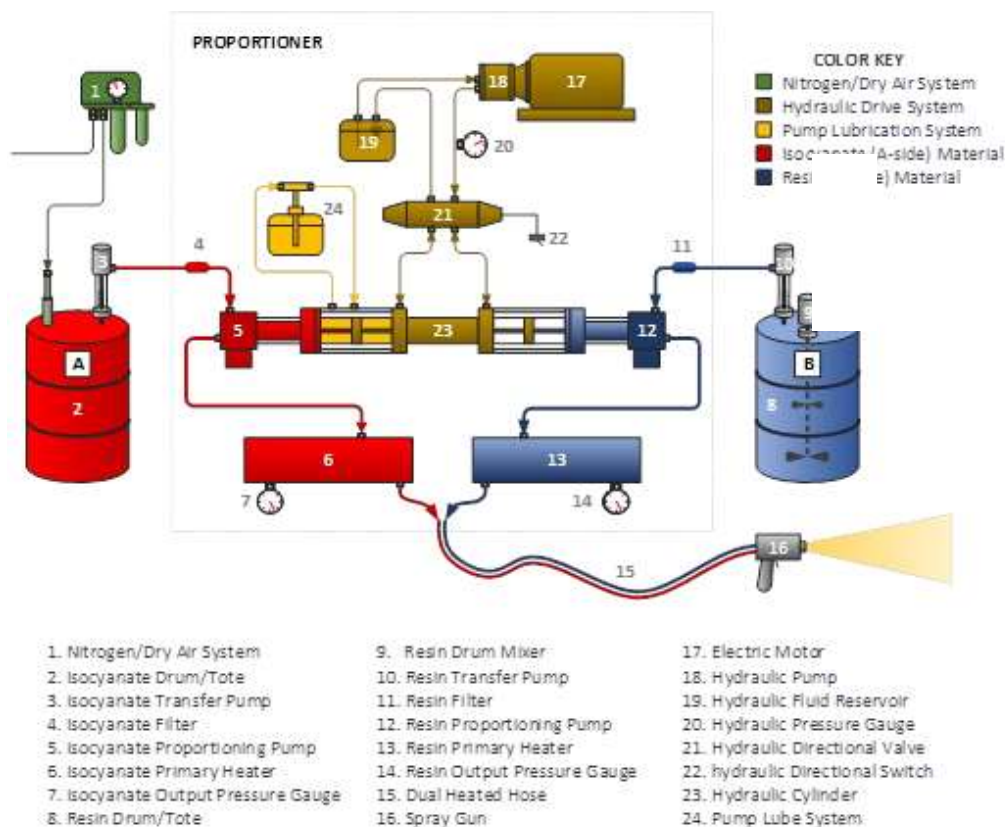
Country/Region	Material Type	Recycling Rate	Landfill Rate	Incineration Rate
United States	Plastics	15%	68%	17%
	Metal	57%	34%	9%
	Pulp (cardboard, paper)	75%	20%	5%

¹ See Safety Data Sheets for more information regarding hazardous ingredients:
[https://www.owenscorning.com/en-us/sds/results?q=OCNP&oc\[document_type\]\[\]=safety_data_sheet](https://www.owenscorning.com/en-us/sds/results?q=OCNP&oc[document_type][]=safety_data_sheet)

2.9 Transportation

The outbound transportation or distribution includes the transportation of the finished product to customers primarily by diesel semi-truck. The weighted average outbound transportation distance from the specified location to the building site is 1336 km.

2.10 Product Installation



Installation includes insulation of wall cavities, vented and unvented attics, ceilings, vented and unvented crawl spaces, rim joists, and floors. The side-A and side-B chemicals are delivered to the jobsite in unpressurized containers and heated to approximately 120-130 °F (49-54 °C) and pressurized to about 1000 psi (6,895 kPa) by specialized equipment. The chemicals are transferred by a heated hose and aerosolized by a spray gun and combined by impingement mixing at the point of application. Personal protective equipment such as goggles, protective suits, and respirator cartridges is required to protect applicators from chemical exposure during installation. Also needed are disposable materials such as masking tape and drop cloths. The schematic above shows the typical equipment components used to produce high-pressure SPF foam, including unpressurized side-A and side-B liquid drums with transfer pumps, which are connected to the proportioner system for heating and pressurizing the chemicals, and then through a heated hose connected to a spray gun for application. Schematic is credited to the Spray Polyurethane Foam Alliance's 2024 SPF Insulation industry-wide EPD².

After the foam cures and expands, any excess that may prevent installation of the interior cladding is cut off and discarded. For SPF with physical blowing agents, this study assumes 10% of the installed blowing agent is released to surrounding air during the installation phase. Discarded foam from installation also experiences blowing agent release while in landfill.

² https://pcr-epd.s3.us-east-2.amazonaws.com/1298.EPD_809_Spray_Polyurethane_Foam_Insulation_Open_Cell_OCSPF.pdf

Data for installation materials, energy, and wastes were derived from the SPFA 2024 industry-wide LCA study³. Disposal of packaging materials is modeled in accordance to the assumptions outlined in Part A of the PCR (UL Environment, 2022). All ancillary installation materials are assumed to be sent to landfill.

2.11 Use

Open cell SPF uses reactive blowing agent (water) and while it is released at the same rate during manufacturing, use, and end-of-life phases as other SPF blowing agents, there is no associated environmental impact.

2.12 Reference Service Life and Estimated Building Service Life

As prescribed in the PCR, Part A: Life Cycle Assessment Calculation Rules and Report Requirements, the Reference Service Life (RSL) of the insulation product is 75 years, which aligns with an assumed building Estimated Service Life (ESL) of 75 years, for the purposes of this study.

2.13 Re-use Phase

SPF is typically not reused or recycled following its removal from a building. Thus, reuse, recycling, and energy recovery are not applicable for this product.

2.14 Disposal

When the building is decommissioned, it is assumed that only manual labor is involved to remove the foam. Waste is assumed to be transported 100 miles (161 km) to the disposal site. The spray foam is assumed to be landfilled at end-of-life, as is typical for construction and demolition waste in the US.

³ <https://spraypolyurethanefoamalliance.growthzoneapp.com/ap/CloudFile/Download/LwkeO8zL>

3. LCA: Calculation Rules

3.1 Functional Unit

The product's function is to provide thermal insulation to buildings. Accordingly, the functional unit for the study is 1 m² of installed insulation material with a thickness that gives an average thermal resistance of RSI=1 m²·K/W (R = 5.68 h·ft²·°F/Btu) with a building service life of 75 years (packaging included) (Table 6).

Product Average

The results of this declaration represent a production weighted average performance for the listed products. The product average results were calculated as a production weighted average based on 2024 production totals of the Natural-Therm® 0.5, Ultra-Pure® Open Cell, and Natural-Therm® Open Cell / Natural-Therm® Light open-cell SPF products. When comparing the production weighted average LCIA results to the majority open cell product manufactured at the facility, the differences were <10% for all impact categories.

Table 6. Functional unit and reference flows.

Functional Unit	Thickness to Achieve FU (mm)	Reference flow (kg/m ²)
1 m ² of insulation with a thickness required for an average thermal resistance RSI = 1 m ² K/W	2.54E+01	2.72E-01*

*Production-weighted average of the reference flows shown in Table 2

3.2 System Boundary

The study uses a cradle-to-grave system boundary. As such, it includes upstream processing and production of raw materials (A1); raw materials transport to the production facility (A2); energy and water resources needed for production of SPF, wastes (including waste transport) & air emissions generated during the production of SPF, and materials and inbound transport of packaging materials (A3); transport of the components to the installation site (A4); installation of SPF insulation (A5); use phase (B1), transportation to end-of-life (C2), and end-of-life-disposal (C4) (Table 7). Building energy savings from the use of insulation are excluded from this analysis. Module D has been excluded from this analysis.

Table 7. System boundary

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

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

3.3 Estimates and Assumptions

This study assumes 100% of blowing agent consumed in the production of the formulation is eventually emitted, with 0.25% released during manufacturing, 10% released during installation, 24% released during lifetime in building, and 65.75% released during end-of-life. However, open cell SPF uses reactive blowing agent (water) and while it is released at the same rate during manufacturing, use, and end-of-life phases as other SPF blowing agents, there is no associated environmental impact.

3.4 Cut-off criteria

The underlying LCA study is in compliance with the cutoff criteria specified in the PCR. Due to the long lifetime of equipment, capital goods and infrastructure flows were excluded as having a negligible impact on the conclusions of the LCA. No known flows are deliberately excluded from this EPD.

The cut-off criteria for including or excluding materials, energy and emissions data of the study are as follows:

- Mass – According to ISO guidelines, if a flow is less than 1% of the cumulative mass of the model it may be excluded, providing its environmental relevance is not a concern.
- Energy – According to ISO guidelines, if a flow is less than 1% of the cumulative energy of the model it may be excluded, providing its environmental relevance is not a concern.
- Environmental relevance – If a flow meets the above criteria for exclusion, yet is thought to potentially have a significant environmental impact, it was included. Material flows which leave the system (emissions) and whose environmental impact is greater than 1% of the whole impact of an impact category that has been considered in the assessment must be covered. This judgment was made based on experience and documented as necessary.

3.5 Background Data

Primary manufacturing data were collected from the Natural Polymers manufacturing facility. The LCA model was created using SimaPro Developer 9.6. Background life cycle inventory data for raw materials and processes were obtained from the ecoinvent 3.10 database.

3.6 Data Quality

Primary data were based on measured and calculated data from the North American Natural Polymers plant which produced the product in calendar year 2024, and meets requirements for completeness along with temporal, geographical and technological representativeness. Background data were taken from the ecoinvent 3.10 database, which is on the approved database list in the PCR.

Table 8. *Data quality assessment*

Data Quality Parameter	Data Quality Discussion
Time-related Coverage: Age of data and the minimum length of time over which data is collected	Primary data were based on Natural Polymers's annual operations during calendar year 2024, consistent with the goal and scope of this analysis. The time coverage of secondary data used from the LCI databases have reference years between 2011 and 2023. Time related coverage is considered very good quality data.
Geographical Coverage: Geographical area from which data for unit processes is collected to satisfy the goal of the study	The geographical coverage for this study is North America. Primary data were sourced directly from the manufacturing facility in the USA. The regional electricity grids selected for the production phase were specific to the manufacturing facility in the US. The ecoinvent 3.10 database typically bases its research and measurement on specific producers, usually in Europe, and adjusts for global energy and transport considerations. Many of the common materials were modeled as global or "rest of world" datasets for consistency and in alignment with internal Owens Corning LCA conventions. Geographical coverage is considered very good quality.
Technology Coverage: Specific technology or technology mix	Technological representativeness was based on primary manufacturing data from the Natural Polymers facility.
Precision: Measure of the variability of the data values for each data expressed	Primary data were based on measured and calculated data from the plant which manufactures products covered by this study. The facility data were collected for the reference year 2024, and several sources were used to compare collected values and ensure precision. The data precision is therefore deemed to be of high quality for all measured and calculated data.
Completeness: Percentage of flow that is measured or estimated	All relevant process steps within the system boundary were considered. The primary data provided for SPF insulation manufacturing were benchmarked with data collected for the 2024 industry-wide EPD which has undergone third party review.
Representativeness: Qualitative assessment of the degree to which the data set reflects the true population of interest	Data sets used in the underlying LCA study were selected based on the most appropriate temporal, geographical, and technological representation of the actual processes and technology. These data sets reflect average processes from multiple sources, and thus generally represent the actual technology utilized to produce the materials. Still, it is often unknown the extent to which secondary data sets deviate from the specific system being studied
Consistency: Qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis	To ensure consistency, only primary data of the same level of detail and equivalent time interval (i.e., one calendar year) were used, and allocation was conducted similarly for all data categories and life cycle stages. All background data were sourced from the ecoinvent 3.10 database selecting the most appropriate geography.
Reproducibility: Qualitative assessment of the extent to which information about the methodology and data values would allow an independent practitioner to reproduce the results reported in the study	The reproducibility of the study results is merited by the scope of information provided in the underlying LCA report. Due to confidentiality of the data values, however, certain details were omitted from this public facing EPD, which may limit reproducibility by the public.
Sources of the Data: Description of all primary and secondary data sources	Primary data for raw material consumption, inbound transportation, annual production, energy consumption, water consumption, emissions to air, waste generation, packaging usage, distribution of finished goods, waste generation during installation, and installation practices were used in this study. Secondary data sets were selected from the ecoinvent 3.10 database.
Uncertainty of the Information: Uncertainty related to data, models, and assumptions	Because the quality of secondary data is not as good as primary data, the use of secondary data becomes an inherent limitation of the study. Secondary data may cover a broad range of technologies, time periods, and geographical locations. Because hundreds of data sets are linked together and because it is often unknown how much the secondary data used deviates from the specific system being studied, quantifying data uncertainty for the complete system becomes very challenging. As a result, it is not possible to provide a reliable quantified assessment of overall data uncertainty for this study.

3.7 Period under review

Primary data collected represent production during the 2024 calendar year. This analysis is intended to represent SPF insulation product production in 2024.

3.8 Allocation

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

The cut-off allocation approach is adopted in the case of any post-consumer and post-industrial recycled content, which is assumed to enter the system burden-free. Only environmental impacts from the point of recovery and forward (e.g., inbound transport, processing, etc.) are considered.

3.9 Comparability

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

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

4. LCA: Scenarios and Additional Technical Information

4.1 Transport to the Building Site (A4)

Table 9. Product distribution parameters, per functional unit, for open cell SPF insulation products

Name	Unit	Value
Vehicle type	-	EURO5, lorry >32 metric ton
Fuel type	-	Low-sulfur diesel
Liters of fuel	l/100km	6.14E-04
Transport distance	km	1.34E+03
Capacity utilization	%	63
Gross density of products transported	kg/m ³	8.00E+00
Capacity utilization volume factor	-	≥1

4.2 Installation into the Building (A5)

Table 10. Installation summary, per functional unit, for open cell SPF insulation products

Name	Unit	Value	Comment
Ancillary materials (per m ²)	kg/m ²	3.75E-03	Installation materials (lubricants, gloves, tapes, chemical suits)
Water consumption specified by water source and fate	m ³	0.00E+00	No freshwater needed to install
Other resources	kg/m ²	0.00E+00	No additional resources needed to install
Electricity consumption	BTU/m ²	1.63E-02	
Other energy carriers	gal/m ²	7.92E-03	Diesel
Product loss per functional unit	kg/m ²	2.21E-02	
Waste materials at the construction site before waste processing, generated by product installation	kg/m ²	2.81E-03	Installation waste to landfill
Output materials resulting from on-site waste processing	kg/m ²	0.00E+00	No on-site waste processing is expected
Mass of packaging waste	kg/m ²	4.86E-02	
Recycle (US)	kg/m ²	2.89E-02	
Landfill (US)	kg/m ²	1.57E-02	
Incineration (US)	kg/m ²	4.01E-03	
Biogenic carbon contained in packaging	kg CO ₂	1.53E-03	
Direct CO ₂ Emissions	kg/m ²	2.94E-01	
VOC content	µg/m ³	None detected	

4.3 Reference Service Life

Table 11. Reference Service Life, per functional unit, for open cell SPF insulation products

Name	Unit	SPF Insulation
RSL	years	75
Declared product properties (at the gate) and finishes, etc.	m ²	1
	R _{SI}	1

4.4 Use Stage (B1)

Table 12. Use Stage Emissions to Air, per functional unit, for open cell SPF insulation products

Name	Unit	Amount
Direct emissions to ambient air, soil and water	kg	0.00E+00

4.4 End-of-Life (C1-C4)

Table 13. End-of-Life summary, per functional unit, for open cell SPF insulation products

End-of-life		Unit	Unfaced Fiberglass Insulation
Assumptions for scenario development	It is assumed that all product is sent to landfill at end of life.		
Collection process	Collected separately	kg	0.00E+00
	Collected with mixed construction waste	kg	2.72E-01
Disposition	Landfill	kg	2.72E-01
Transport to disposal		km	1.61E+02
Blowing Agent Emissions to Air (65.75%)		kg	0.00E+00
Removals of biogenic carbon (excluding packaging)		kg CO ₂	5.94E-03

5. LCA: Results

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

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

Abbreviation	Impact Category	Unit	Characterization Method
GWP 100	Global Warming Potential, IPCC 2013	kg CO ₂ eq	IPCC 2013 (AR5)
ODP	Ozone Depletion Potential	kg CFC-11 eq	TRACI 2.1
AP	Acidification Potential	kg SO ₂ eq	TRACI 2.1
EP	Eutrophication Potential	Kg N eq	TRACI 2.1
SFP	Smog Formation Potential	kg O ₃ eq	TRACI 2.1
ADP _{fossil}	Abiotic Resource Depletion Potential of Non-renewable (fossil) energy resources (ADP _{fossil})	MJ, LHV	CML-baseline v4.7
GWP 100a	Global Warming Potential, IPCC 2021	kg CO ₂ eq	IPCC 2021 (AR6)

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

Table 15. Additional transparency indicators used.

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

Table 16. Carbon Emissions and Removals

Parameter	Unit
BCRP: Biogenic Carbon Removal from Product	[kg CO ₂]
BCEP: Biogenic Carbon Emission from Product	[kg CO ₂]
BCRK: Biogenic Carbon Removal from Packaging	[kg CO ₂]
BCEK: Biogenic Carbon Emission from Packaging	[kg CO ₂]
BCEW: Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes	[kg CO ₂]
CCE: Calcination Carbon Emissions	[kg CO ₂]
CCR: Carbonation Carbon Removals	[kg CO ₂]
CWNR: Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes	[kg CO ₂]

Table 17. North American Life Cycle Impact Assessment (LCIA) results for 1 m² open cell SPF insulation

Impact Category	Unit	A1 – A3	A4	A5	B1	C2	C4
GWP 100 ¹	[kg CO ₂ eq]	8.18E-01	2.88E-02	1.88E-01	0.00E+00	3.47E-03	7.29E-04
ODP	[kg CFC-11 eq]	2.95E-05	4.08E-10	2.18E-09	0.00E+00	4.91E-11	1.16E-11
AP	[kg SO ₂ eq]	3.07E-03	6.87E-05	9.85E-04	0.00E+00	8.27E-06	6.19E-06
EP	[kg N eq]	2.18E-03	4.68E-06	6.77E-05	0.00E+00	5.63E-07	3.92E-07
SFP	[kg O ₃ eq]	4.49E-02	1.75E-03	3.11E-02	0.00E+00	2.11E-04	1.94E-04
ADP _{fossil}	[MJ, LHV]	1.34E+01	3.83E-01	1.70E+00	0.00E+00	4.61E-02	9.46E-03
IPCC GWP 100a (2021) ²	[kg CO ₂ eq]	8.35E-01	2.91E-02	1.90E-01	0.00E+00	3.51E-03	7.39E-04

¹The GWP 100 impacts from TRACI v2.1 (July 2012) are based on 100-year time horizon GWP factors provided by the IPCC 2007 Fourth Assessment Report (AR4).

²100-year time horizon GWP factors as provided by the Fifth Assessment Report (AR5) shall be used for conformance with ISO 21930, Section 7.3.

Table 18. Resource Use Indicator Results for 1 m² open cell SPF insulation

Resource Use	Unit	A1 – A3	A4	A5	B1	C2	C4
RPR _E	[MJ, LHV]	1.74E+00	6.15E-04	1.40E-02	0.00E+00	7.42E-05	4.18E-05
RPR _M	[MJ, LHV]	4.25E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRPR _E	[MJ, LHV]	8.66E+01	3.83E-01	1.72E+00	0.00E+00	4.62E-02	9.49E-03
NRPR _M	[MJ, LHV]	3.53E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SM	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	[MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	[MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE	[MJ, LHV]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW	[m ³]	2.24E-02	1.29E-05	2.12E-04	0.00E+00	1.55E-06	3.29E-07

Table 19. Waste and Output Flow Indicator Results for 1 m² open cell SPF insulation

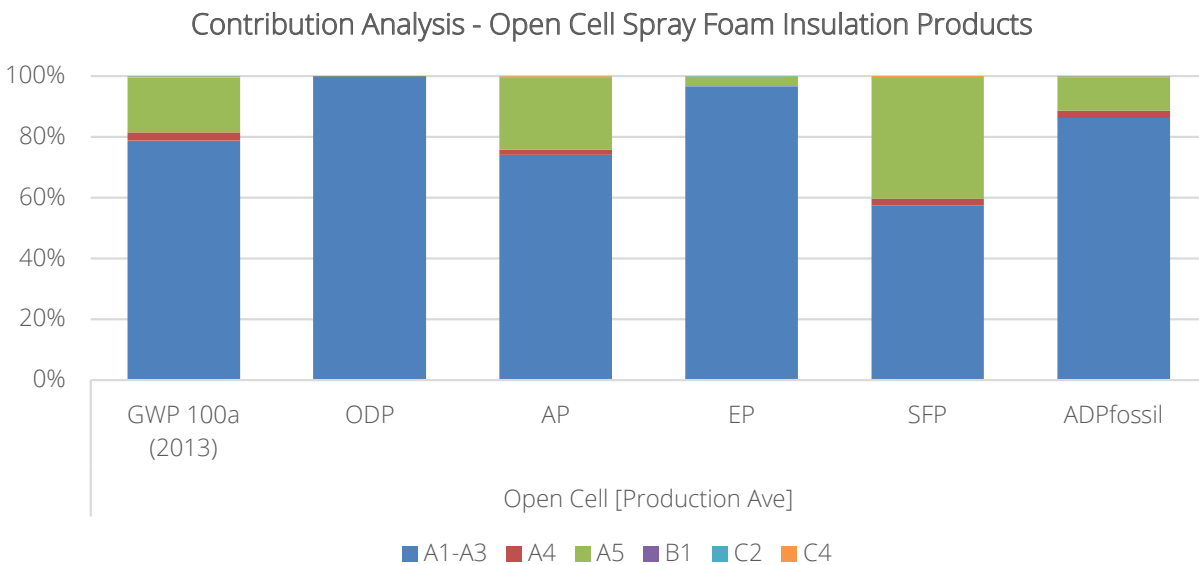
Resource Use	Unit	A1 – A3	A4	A5	B1	C2	C4
HWD	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NHWD	[kg]	5.79E-04	0.00E+00	4.44E-02	0.00E+00	0.00E+00	2.72E-01
HLRW	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ILLRW	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU	[kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR	[kg]	0.00E+00	0.00E+00	2.89E-02	0.00E+00	0.00E+00	0.00E+00
MER	[kg]	0.00E+00	0.00E+00	4.01E-03	0.00E+00	0.00E+00	0.00E+00
EE	[MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 20. Carbon Emissions and Removals Indicator Results for 1 m² open cell SPF insulation

Resource Use	Unit	A1 – A3	A4	A5	B1	C2	C4
BCRP	[kg CO ₂]	5.94E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEP	[kg CO ₂]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCRK	[kg CO ₂]	1.53E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEK	[kg CO ₂]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
BCEW	[kg CO ₂]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCE	[kg CO ₂]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CCR	[kg CO ₂]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CWNR	[kg CO ₂]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

6. LCA: Interpretation

The Product Stage (A1-A3) drives the majority of environmental impacts across all impact categories, followed by the Installation Stage. A1 raw materials - specifically Side B polyols and fire retardants and Side A MDI - are the largest contributors to potential environmental impacts.



This EPD is based on a cradle-to-gate LCA of closed cell spray polyurethane foam insulation. The study assumes that 100% of the blowing agent used in the formulation is ultimately emitted to the atmosphere to reflect a conservative, full-release scenario. Emission timing is distributed as follows: 0.25% during manufacturing, 10% during installation, 24% over the product's service life, and 65.75% at end-of-life. The formulation utilizes a reactive water-based blowing agent, which do not contribute significantly to GWP impacts which reflect upstream impacts from raw material production, rather than direct emissions from the foam itself.

Due to the absence of several formulation-specific chemicals in the ecoinvent v3.10 database, custom datasets were developed. These were constructed using stoichiometric reaction pathways and literature-based synthesis data, combined with proxy datasets from ecoinvent. While this approach enhances chemical specificity and accuracy, it may limit reproducibility or comparability with other EPDs that rely on generic or less tailored proxies.

Additionally, this EPD represents the product average results of SPF Open Cell products calculated as a production weighted average based on 2024 production totals. There is no significant variation in methods or materials for

manufacturing the two open cell products, and the LCIA results for the majority product are within 10% of the results for the production-weighted average results in all impact categories.

Comparative assertions should only be made when EPDs are based on the same PCR, system boundaries, and background datasets. Variations in LCA software, impact assessment methods, and assumptions—particularly regarding blowing agent emissions and chemical modeling—may significantly affect results.

7. Additional Environmental Information

7.1 Environment and Health during Manufacture

Manufacturing of SPF formulations and upstream chemicals are performed in industrial manufacturing facilities. Like many manufacturing processes, hazardous chemicals and manufacturing procedures may be employed. These manufacturers follow all local, state and federal regulations regarding safe use and disposal of all chemicals (US EPA, 2024a) (US EPA, 2024b), as well as safety requirements required of the general manufacturing operation of equipment and processes (Occupational Safety and Health Standards, n.d.) (Safety and Health Regulations for Construction, n.d.) (US Department of Labor, 2024a) (US Department of Labor, 2024b) and safe transport of all materials (US DOT) Environment and Health During Installation (US Code of Federal Regulations, 2024).

7.2 Energy Savings During Use

Insulation is a passive device that requires no extra utilities to operate over its useful life. Insulation of a building is responsible for reducing the energy burden associated with heating and cooling of a building.

7.3 Environment and Health during Installation

Installation of SPF involves potential exposure to certain hazardous chemicals that require risk mitigation through the use of personal protective equipment and on-site actions including ventilation and restricted access. Of greatest concern is the potential exposure to airborne and liquid isocyanates during and immediately after installation of SPF. Isocyanates are known chemical sensitizers and exposure can occur through contact with the skin, eyes and respiratory system. Ventilation of the work zone, coupled with use of proper personal protective equipment is required during and immediately after installation SPF. For more information on health and safety during and immediately after SPF installation, please visit www.spraypolyurethane.org.

7.4 Extraordinary Effects

Fire. Spray polyurethane foam, like all foam plastics and many construction materials – including wood - is a combustible material and will emit toxic gases including carbon monoxide during a fire. When used in buildings and other construction applications, foam plastics employ flame retardants to control ignition and spread of fire and development of smoke. In addition, foam plastics may need to be protected with fire-resistant coverings or coatings when used in certain construction applications, as dictated by the building codes. All foam plastic materials and assemblies should meet the fire test requirements of the applicable building codes.

Mechanical Destruction. Should the assembly the SPF is installed in, i.e. the wall or roof, have to be replaced then the SPF will have to be replaced as well.

7.5 Delayed Emissions

No delayed emissions are expected from this product.

7.6 Environmental Activities and Certifications

The Natural Polymers SPF insulation products included in this study have been certified to various standards. These standards include:

- **UL Environment GREENGUARD® Gold Certification** – The GREENGUARD® Certification Program specifies strict certification criteria for VOC's and indoor air quality. This voluntary program helps consumers identify products that have low chemical emissions for improved indoor air quality.
- **USDA Bio preferred** – Several of Natural Polymers SPF insulation products contain biorenewable content. Managed by the U.S. Department of Agriculture (USDA), the goal of the BioPreferred Program is to increase the purchase and use of biobased products. The BioPreferred Program was created by the 2002 Farm Bill and reauthorized and expanded as part of the Agriculture Improvement Act of 2018 (2018 Farm Bill). The Program's purpose is to spur economic development, create new jobs and provide new markets for farm commodities. The increased development, purchase, and use of biobased products reduces our nation's reliance on petroleum, increases the use of renewable agricultural resources, and contributes to reducing adverse environmental and health impacts.⁴

7.7 Further Information

Further information on the product can be found on the manufacturers' website at <https://www.owenscorning.com/en-us/insulation/residential/spray-foam>.

⁴ <https://www.biopreferred.gov/BioPreferred/>

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