Declaration Owner
Natural Polymers, LLC
14438 E. North Ave., Cortland, IL, 60112, USA
1-800-GET-PINK (1-800-438-7465)
www.owenscorning.com

Products
Closed Cell Spray Polyurethane Foam Insulation:
Natural-Therm® 2.0 HFO Summer-Winter
Ultra-Pure® Closed 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-10458
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
SCS Global Services
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Address:	14438 E. North Ave., Cortland, IL, 60112, USA
Declaration Number:	SCS-EPD-10458
Declaration Validity Period:	July 16, 2025 through July 15, 2030
Version:	July 16, 2025
Product:	Natural Polymers Closed Cell Spray Polyurethane Foam Insulation: Natural-Therm® 2.0 HFO Summer-Winter Ultra-Pure® Closed Cell
EPD Type:	Manufacturer Specific
EPD Scope;	Cradle-to-Grave
Markets of Applicability:	North America
Program Operator:	SCS Global Services
Declaration URL Link:	https://www.scsglobalservices.com/certified-green-products-guide
LCA Practitioners:	Bill Flanagan, LCACP (Aspire Sustainability) Angela Fisher, LCACP (Aspire Sustainability)
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	☐ internal X external
LCA Reviewer:	Abby Martell, SCS Global Services
Part A Product Category Rule:	PCR Guidance for Building-Related Products and Services Part A: Life Cycle Assessment Calculation Rules and Report Requirements. Version 4.0. UL Environment. Mar. 2022
PCR Review conducted by:	Lindita Bushi, PhD (Chair); Hugues Imbeault-Tétreault, ing., M.Sc.A.; Jack Geibig
Part B Product Category Rule:	PCR Guidance for Building-Related Products and Services Part B: Building Envelope Thermal Insulation EPD Requirements. Version 3.0. February 2024
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	☐ internal X external
EPD Verifier:	Abby Martell, SCS Global Services
Declaration Contents:	

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.*

Conformity: *This EPD conforms to ISO 14025:2006, and ISO 21930:2017.*

Ownership: *The EPD owner has the sole ownership, liability, and responsibility of the EPD.*

Accuracy of Results: *Due to PCR constraints, this EPD provides estimations of potential impacts that are inherently limited in terms of accuracy.*

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 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.

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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.

Closed 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. *Closed Cell SPF Products*

Spray Polyurethane Foam Insulation Products	Natural-Therm® 2.0 HFO Summer-Winter
	Ultra-Pure® Closed Cell

The results of this declaration represent a production weighted average performance for the listed products. The product average results were calculated based on 2024 production totals of the Natural-Therm® and Ultra Pure® closed-cell SPF products.

- Natural-Therm® 2.0 HFO is summer and winter versions of a closed cell, two-component, semi-rigid spray polyurethane foam insulation with a zero ozone depleting potential and low GWP blowing agent and a nominal 2.0 PCF in-place density.
- Ultra-Pure® Closed Cell is a zero-ODP, low-GWP blowing agent, two-component, semi-rigid spray polyurethane foam insulation with a nominal 2.0 PCF in-place density.

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

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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® 2.0 HFO Summer-Winter
- Meets ICC-ES AC377 Type I-IV and V-B
- Code Evaluation Report IAPMO ER-714
- UL GREENGUARD GOLD
- Compliant with State HFC Regulations
- Tested for Radon Resistance (NRC A1-023490)
- Ultra-Pure® Closed Cell
- Meets ICC-ES AC377 Type I-IV and V-B
- Code Evaluation Report IAPMO ER-800
- UL GREENGUARD GOLD
- Compliant with State HFC Regulations

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 two closed 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. *Closed Cell SPF Product Specifications*

Product	Thickness (mm)	R Value [ft²·°F·h/Btu]	Nominal Density [kg/m3]	Reference Flow [kg/m2]
Natural-Therm® 2.0 HFO	20	7.2	32	0.640
Ultra-Pure® Closed Cell	20	7.2	32	0.640

Table 3. *Summary of material performance requirements*

Performance	Standard	Closed Cell SPF
Thermal Performance (R-value)	ASTM C518	7.2/inch
Surface Burning Characteristics	ASTM E84	Flame spread index < 25 Smoke developed < 450
Core Density	ASTM D1622	Nominal 2.0 pcf
Closed-Cell Content	ASTM D6226	> 90%
Tensile Strength	ASTM D1623	16.05 psi (110.7 kPa)
Compressive Strength	ASTM D1621	37.98 psi (261.9 kPa)
Dimensional Stability	ASTM D2126	2.22% (158°F 100% RH 168 h)
Vapor Permeance (> 1.1 inch)	ASTM E96	< 1.0 perms (Class II)
Air Permeance (> 1 inch)	ASTM E2178	Meets criteria

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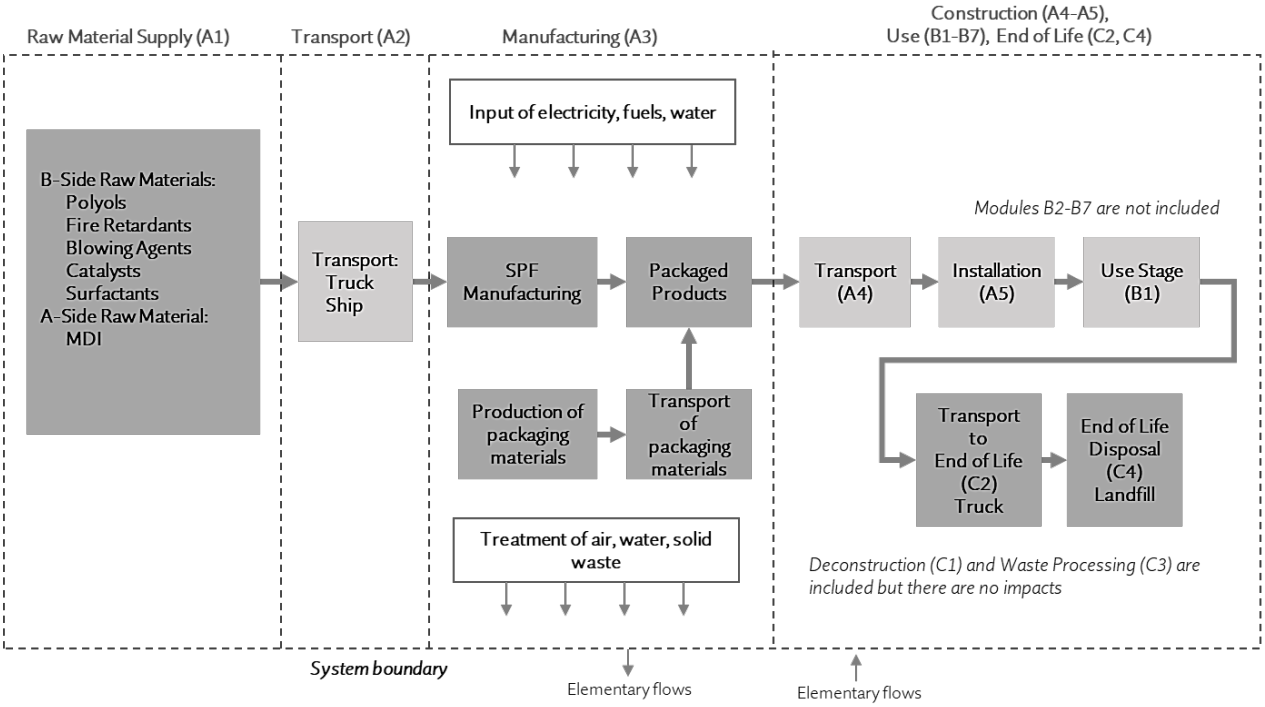
2.5 Flow Diagram

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 hazardous[1], 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	Polyester	52-56%
	Polyether	15-17%
	Mannich	<1%
	Compatibilizer	<1%
Fire Retardants	TCPP*	5-7%
	TEP	<1%
	Brominated	2-4%
Blowing Agents	HFO-1336mzz or HCFO-1233zd	10-14%
	Reactive (H2O)	<2%
Catalysts	Amine*, metal	4-7%
Surfactant	Silicone*	<2%

**chemical ingredients included in product safety data sheet*[1]

[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

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2.7 Manufacture

Natural Polymers, LLC, an Owens Corning company, 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 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). Metal based packaging is disposed in landfill (34%), incineration (9%), and recycled (57%) as shown in Table 5. Paper based packaging is disposed via landfill (20%), incineration (5%), and recycled (75%) .

Table 5. *Waste Treatment of Packaging*

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

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.

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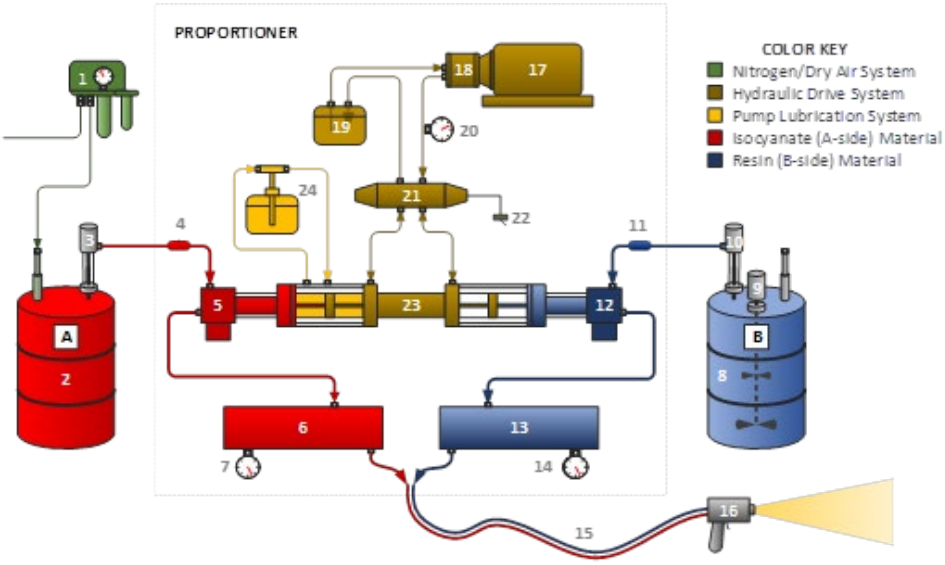
2.10 Product Installation



1. Nitrogen/Dry Air System
2. Isocyanate Drum/Tote
3. Isocyanate Transfer Pump
4. Isocyanate Filter
5. Isocyanate Proportioning Pump
6. Isocyanate Primary Heater
7. Isocyanate Output Pressure Gauge
8. Resin Drum/Tote
9. Resin Drum Mixer
10. Resin Transfer Pump
11. Resin Filter
12. Resin Proportioning Pump
13. Resin Primary Heater
14. Resin Output Pressure Gauge
15. Dual Heated Hose
16. Spray Gun
17. Electric Motor
18. Hydraulic Pump
19. Hydraulic Fluid Reservoir
20. Hydraulic Pressure Gauge
21. Hydraulic Directional Valve
22. hydraulic Directional Switch
23. Hydraulic Cylinder
24. Pump Lube System

Installation includes insulation of wall cavities, vented and unvented attics, ceilings, vented and unvented crawl spaces, rim joists, and floors, as well as under slab and foundation wall insulation. 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 EPD[2].

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. Data for installation materials, energy, and wastes were derived from the SPFA 2024 industry-wide LCA study[3]. 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] https://pcr-epd.s3.us-east-
[2].amazonaws.com/1299.EPD_808_Spray_Polyurethane_Foam_Insulation_Closed_Cell_Using_Hydrofluoroolefins_CCSPF_HFO.pdf
[3] https://spraypolyurethanefoamalliance.growthzoneapp.com/ap/CloudFile/Download/LwkeO8zL

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2.11 Use

As this study only looks at the life cycle of spray foam insulation, and not the building, the use phase only contains the emissions of any chemicals off-gassed from the foam. This study assumes 24% of the original chemical blowing agent is off-gassed over a 75-year lifetime.

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. This study assumes that 100% of the blowing agent is emitted across its life cycle (no blowing agent remains in the product in the landfill); therefore, 65.75% of the blowing agent is emitted at this stage in the life cycle.

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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=1m2·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® 2.0 HFO Summer-Winter and Ultra-Pure® Closed Cell SPF products. When comparing the production weighted average LCIA results to the majority closed 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/m2)
1 m² of insulation with a thickness required for an average thermal resistance RSI = 1 m²K/W	2.00E+01	6.40E-01

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

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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.

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.

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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' 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 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.

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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.

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4. LCA: Scenarios and Additional Technical Information

4.1 Transport to the Building Site (A4)

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

Name	Unit	Value
Vehicle type	-	EURO5, lorry >32 metric ton
Fuel type	-	Low-sulfur diesel
Liters of fuel	l/100km	1.44E-03
Transport distance	km	1.34E+03
Capacity utilization	%	63
Gross density of products transported	kg/m^3	3.20E+01
Capacity utilization volume factor	-	≥1

4.2 Installation into the Building (A5)

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

Name	Unit	Value	Comment
Ancillary materials (per m^2)	kg/m2	8.83E-03	Installation materials (lubricants, gloves, tapes, chemical suits)
Water consumption specified by water source and fate	m3	0.00E+00	No freshwater needed to install
Other resources	kg/m2	0.00E+00	No additional resources needed to install
Electricity consumption	BTU/m2	3.82E-02	
Other energy carriers	gal/m2	1.86E-02	Diesel
Product loss per functional unit	kg/m2	5.19E-02	
Waste materials at the construction site before waste processing, generated by product installation	kg/m2	6.60E-03	Installation waste to landfill
Output materials resulting from on-site waste processing	kg/m2	0.00E+00	No on-site waste processing is expected
Mass of packaging waste	kg/m2	8.76E-02	
Recycle (US)	kg/m2	*5.24E-02*	
Landfill (US)	kg/m2	*2.79E-02*	
Incineration (US)	kg/m2	*7.34E-03*	
Biogenic carbon contained in packaging	kg CO2	6.54E-03	
Direct HFO/HFCO Emissions (10%)	kg/m2	3.61E-03	
VOC content	$\mu g/m^3$	None detected	

4.3 Reference Service Life

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

Name	Unit	SPF Insulation
RSL	years	75
Declared product properties (at the gate) and finishes, etc.	m2	1
	R_{SI}	1

4.4 Use Stage (B1)

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

Name	Unit	Amount
Direct emissions to ambient air, soil and water	kg	8.66E-03

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4.5 End-of-Life (C1-C4)

Table 13. *End-of-Life summary, per functional unit, for closed 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	6.40E-01
Disposition	Landfill	kg	6.40E-01
Transport to disposal	EURO5, lorry >32 metric ton	km	1.61E+02
Blowing Agent Emissions to Air (65.75%)		kg	2.45E-02
Removals of biogenic carbon (excluding packaging)		kg CO_2	9.18E-02

5. LCA: Results

Results of the Life Cycle Assessment are presented below. The results represent a production weighted average of the closed cell SPF products. 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 SO2 eq	TRACI 2.1
EP	Eutrophication Potential	Kg N eq	TRACI 2.1
SFP	Smog Formation Potential	kg O3 eq	TRACI 2.1
ADP_{fossil}	Abiotic Resource Depletion Potential of Non-renewable (fossil) energy resources (ADPfossil)	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.

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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 CO2]
BCEP: Biogenic Carbon Emission from Product	[kg CO2]
BCRK: Biogenic Carbon Removal from Packaging	[kg CO2]
BCEK: Biogenic Carbon Emission from Packaging	[kg CO2]
BCEW: Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes	[kg CO2]
CCE: Calcination Carbon Emissions	[kg CO2]
CCR: Carbonation Carbon Removals	[kg CO2]
CWNR: Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes	[kg CO2]

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Table 17. *North American Life Cycle Impact Assessment (LCIA) results for 1 m^2 closed cell SPF insulation*

Impact Category	Unit	A1 -A3	A4	A5	B1	C2	C4
GWP 100[1]	[kg CO_2 eq]	2.56E+00	6.77E-02	2.96E-01	3.47E-02	8.16E-03	9.67E-02
ODP	[kg CFC-11 eq]	6.95E-05	9.59E-10	5.13E-09	0.00E+00	1.16E-10	2.73E-11
AP	[kg SO_2 eq]	9.57E-03	1.62E-04	2.31E-03	0.00E+00	1.95E-05	1.46E-05
EP	[kg N eq]	8.26E-03	1.10E-05	1.59E-04	0.00E+00	1.33E-06	9.22E-07
SFP	[kg O_3 eq]	1.30E-01	4.11E-03	7.31E-02	0.00E+00	4.95E-04	4.57E-04
ADP_{fossil}	[MJ, LHV]	4.29E+01	9.00E-01	4.00E+00	0.00E+00	1.08E-01	2.22E-02
IPCC GWP 100a (2021)[2]	[kg CO_2 eq]	2.62E+00	6.85E-02	3.00E-01	3.47E-02	8.25E-03	9.67E-02

[1]The 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).
[2]100-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 m^2 closed cell SPF insulation*

Resource Use	Unit	A1 -A3	A4	A5	B1	C2	C4
RPR_E	[MJ, LHV]	3.44E+00	1.45E-03	3.28E-02	0.00E+00	1.74E-04	9.83E-05
RPR_M	[MJ, LHV]	6.72E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
$NRPR_E$	[MJ, LHV]	4.54E+01	9.02E-01	4.03E+00	0.00E+00	1.09E-01	2.23E-02
$NRPR_M$	[MJ, LHV]	8.46E-05	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]	2.32E-02	3.03E-05	4.93E-04	0.00E+00	3.65E-06	7.73E-07

Table 19. *Waste and Output Flow Indicator Results for 1 m^2 closed 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]	2.36E-03	0.00E+00	9.52E-02	0.00E+00	0.00E+00	6.40E-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	5.24E-02	0.00E+00	0.00E+00	0.00E+00
MER	[kg]	0.00E+00	0.00E+00	7.34E-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 m^2 closed cell SPF insulation*

Resource Use	Unit	A1 -A3	A4	A5	B1	C2	C4
BCRP	[kg CO_2]	9.18E-02	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]	6.54E-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

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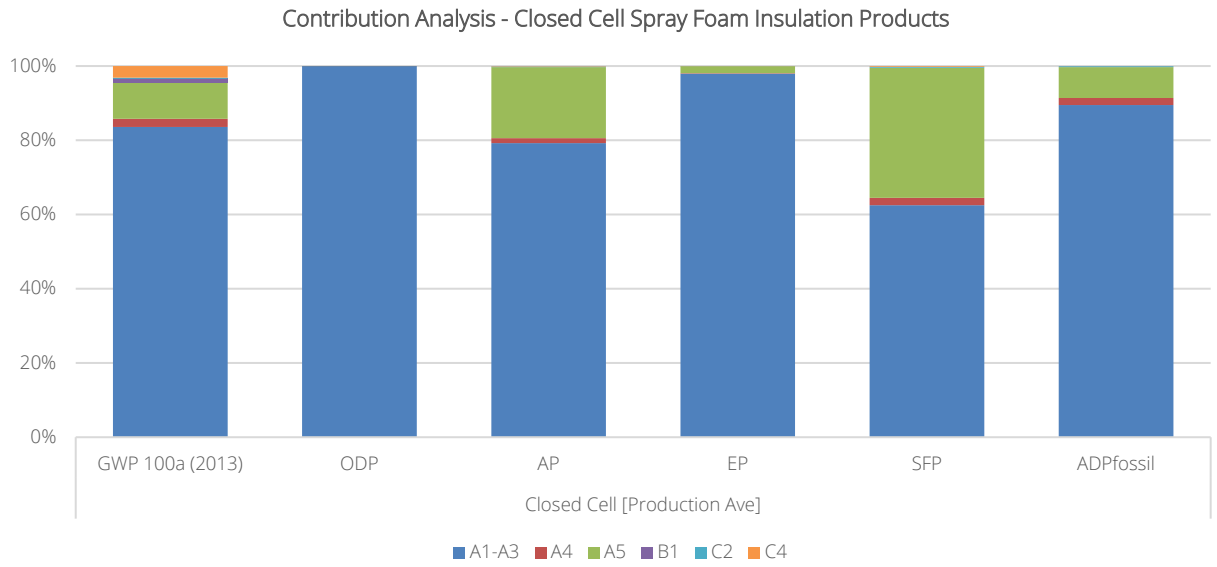
6. LCA: Interpretation

The Product Stage (A1-A3) drives the majority of environmental impacts across all impact categories, followed by the Installation Stage. A1 raw materials - specifically polyols, blowing agents, and fire retardants - 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. These assumptions did not significantly influence the overall impacts which primarily 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 Closed 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 closed 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.

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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 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.

7.3 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.

Water. Closed-cell SPF products meet the FEMA Class 5 requirements for flood-damage resistant insulation materials for floors and walls.

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.

7.4 Delayed Emissions

No delayed emissions are expected from this product.

7.5 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.

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- **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]
- **Radon barrier** – Natural-Therm® 2.0 HFO Closed Cell has been tested by third-party laboratories and shown to play an efficient role as a radon gas diffusion barrier than traditional polyethylene sheet, providing reduced radon levels entering the home with excellent insulation properties.[5] Less radon entering the home, coupled with greater control of temperature and humidity with Natural-Therm® 2.0 HFO, may enable reduced air exchanges and HVAC requirements.

7.6 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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