ENVIRONMENTAL PRODUCT DECLARATION

KERALITE® PRODUCT FAMILY

KERALITE FILMED, KERALITE SELECT FILMED, KERALITE LAMINATED, KERALITE SELECT LAMINATED, KERALITE ULTRA

FIRE RATED SAFETY GLASS CERAMIC

Keralite is a fully code-compliant fire-protective glass ceramic able to withstand high temperature and thermal shock. Listed for 20-90 and 180 minutes by UL, all Keralite products pass the required hose-stream test and provide light transmission values of 82% or higher.

Keralite is an asset to sustainable design and can help achieve LEED credits with accompanying EPDs and HPDs. It comes polished or unpolished, with laminated and filmed options that meet impact safety standards, ensuring maximum comfort for building occupants while keeping them protected in case of fire.

vetrotech SAINT-GOBAIN

Vetrotech's glass solutions meet internationally recognized environmental standards at every stage of their life cycles. Our products support you in gaining points for sustainable building labels such as LEED, BREAM, WELL, DGNB, HQE and others.

We strive to deliver innovative solutions that enable our customers to build and renovate safe, sustainable and comfortable buildings. Installing our glass in an office can contribute to ensuring the right amount of daylight, increasing productivity by 18% while at the same time protecting against attacks or fire.

Vetrotech belongs to the Saint-Gobain group, the world's largest building materials company. Saint-Gobain has been creating and delivering innovative and high performance solutions to enhance habitat and daily life for over 350 years.

Saint-Gobain is committed to providing sustainable products and to limiting our impacts on the environment while doing so. (See our CSR at https://www.saint-gobain.com/en/corporate-responsibility.)

For more information, visit: www.vetrotech.com/sustainability.

UL CERTIFIED ENVIRONMENTAL PRODUCT DECLARATION ULCOM/EPD

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Keralite® Product Family

According to ISO 14025, ISO 21930:2017 and EN 15804

This declaration is an environmental product declaration (EPD) in accordance with ISO 14025. EPDs rely on Life Cycle Assessment (LCA) to provide information on a number of environmental impacts of products over their life cycle. Exclusions: EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, environmental impact assessments, etc. Accuracy of Results: EPDs regularly rely on estimations of impacts, and the level of accuracy in estimation of effect differs for any particular product line and reported impact. Comparability: EPDs are not comparative assertions and are either not comparable or have limited comparability when they cover different life cycle stages, are based on different product category rules or are missing relevant environmental impacts. EPDs from different programs may not be comparable.

PROGRAM OPERATOR	UL Environment
DECLARATION HOLDER	Vetrotech Saint-Gobain
DECLARATION NUMBER	4789836129.101.1
DECLARED PRODUCT	Vetrotech Keralite Family Products: Fire Rated Safety Glass Ceramic
REFERENCE PCR	UL Environment PCR Part B – Processed Glass EPD Requirements. Version 1.0 2016.
REFERENCE PCR STANDARD	☒ EN 15804 (2012) ☐ ISO 21930 (2007) ☒ ISO 21930 (2017)
DATE OF ISSUE	April 1, 2021
PERIOD OF VALIDITY	5 Years
CONTENTS OF THE DECLARATION	Product definition and information about building physics Information about basic material and the material's origin Description of the product's manufacture Indication of product processing Information about the in-use conditions Life cycle assessment results Testing results and verifications

The PCR review was conducted by:	UL Environment Thomas P. Gloria, Ph.D, Chair epd@ulenvironment.com
This declaration was independently verified in accordance with ISO 14025 by Underwriters Laboratories ☐ INTERNAL ☒ EXTERNAL	Grant R. Martin Grant R. Martin, UL Environment
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Thomas Gloria Tom Gloria, Industrial Ecology Consultants

This EPD conforms with ISO 21930:2017 & EN 15804

ENVIRONMENTAL PRODUCT DECLARATION

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Keralite® Product Family

According to ISO 14025, ISO 21930:2017 and EN 15804

Product Documentation

Product Description

Keralite is a fire-protective-rated glass ceramic used in standard fire-protective-rated frames to contain smoke and flames. Filmed and laminated versions of the product meet impact safety rating criteria.

Keralite is offered in different configurations based on customer preference. Keralite Filmed is a non-polished glass with a film applied. Keralite Laminated is a non-polished glass with a lamination applied. Keralite Select Filmed and Keralite Select Laminated are polished versions of the filmed and laminated products respectively.

Keralite Select products have a lower haze and allow for clearer views through the glass in applications where that is important for the customer, but otherwise are the same as their non-polished versions.

Keralite installation at Slocum High School

Keralite Ultra is also laminated with intumescent layers. It has a higher impact resistance due to its increased thickness.

Application

Classified as fire-protective and referred to in the IBC as a “protective opening,” Vetrotech Keralite products can be applied where protective openings are required. All Keralite products are used in fire-rated openings to contain smoke and flames. Keralite fulfills maximum human impact safety requirements.

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Keralite® Product Family

According to ISO 14025, ISO 21930:2017 and EN 15804

Technical Data

Keralite Product Details							
CSI Code	*08800*						
UNSPSC Code	*301717*						
Keralite Technical Data							
	Fire Rating, minutes	**Visible light transmission, %**	**U-factor, btu/°F.hr.ft²**	**STC Rating, dB**	**Impact Safety Rating**	**US Testing**	**Canadian Testing**
Keralite Filmed	20-90, 180 minutes	88%	0.93 Summer; 1.03 Winter	31/27	CPSC 16CFR 1201; CAN/CGSB 12.1-2017; ANSI Z97.1	UL 9, 10B, 10C; NFPA 80, 252, 257	CAN/ULC – S104, S106
Keralite Laminated	20-90, 180 minutes	85.6%	0.87 Summer; 0.99 Winter	34/31	CPSC 16CFR 1201; CAN/CGSB 12.1-2017; ANSI Z97.1	UL 9, 10B, 10C; NFPA 80, 252, 257	CAN/ULC – S104, S106
Keralite Ultra	20-180 minutes	79%	0.79	38	CPSC 16CFR 1201; CAN/CGSB 12.1-2017; ANSI Z97.1	UL 9, 10B, 10C; NFPA 80, 252, 257	CAN/ULC – S104, S106

Table 1: Keralite Product Technical Details

Placing on the Market

The Keralite family of products is certified by Underwriter Laboratories (UL) under the following Standards: UL 9, Standard for Fire Tests of Window Assemblies; UL 10b, Standard for Fire Tests of Door Assemblies; and UL 10c, Standard for Positive Pressure Fire Tests of Door Assemblies.

They are certified with the National Fire Protection Association (NFPA) standards 80 (Standard for Fire Doors and Other Opening Protectives), 252 (Standard Methods of Fire Tests of Door Assemblies) and 257 (Standard on Fire Test for Window and Glass Block Assemblies).

In Canada, Keralite products are certified under S104 (Standard Method for Fire Tests of Door Assemblies) and S106 (Standard Method for Fire Tests of Window and Glass Block Assemblies).

Keralite products meet Impact Safety Ratings with the Consumer Product Safety Commission (CPSC) 16 CFR 1201 Cat. I & II standard, Safety Standard for Architectural Glazing Materials. Products also meet the Canadian General Standards Board (CGSB) CAN/CGSB-12.1-M impact safety standards for Tempered or Laminated Safety Glass and the American National Standards Institute (ANSI) Z97.1 Safety Glazing Materials Used in Buildings impact safety standard.

Delivery Status

Keralite products are available in custom sizes according to customer specification ranging up to 2.9 m^2.

The packaging consists of a wood crate with foam padding for support.

Base Materials/Ancillary Materials

Keralite Filmed		Keralite Laminated	
Material	**Average Product Composition**	**Material**	**Average Product Composition**
Ceramic Glass	98.4%	Ceramic Glass	96.2%
Finishing Materials	1.6%	Finishing Materials	3.8%
Polyester Film	*Finishing Material Components Proprietary*	*Polyvinyl Butyral*	*Finishing Material Components Proprietary*
Adhesive		*Triethylene Glycol*	
Hard Coat		*Calcium Carbonate*	
Total kg/m^2:	**12.5**	**Total kg/m^2:**	**20.8**

Table 2: Keralite Material Content

Manufacturing Location

The manufacturing facilities involved in the production of the Keralite product line are:

Ceramic Glass Production	Finishing Application	Finishing Sizing
Bagneaux, France	Condren, France	Auburn, Washington

Manufacturing

The ceramic glass is produced at the Bagneaux, France facility. Raw materials are mixed into a batch and then melted into glass sheets of specified thicknesses. The glass sheets are then conveyed through a cooling tunnel. Upon cooling, the glass is cleaned and sent through a ceramicizing tunnel. The glass is then packaged for finishing at the Condren, France facility.

At the Condren facility the product is trimmed on the edges and washed. For lamination products (Keralite Laminated), two glass sheets are laminated together. For filming products (Keralite Filmed), a film is applied to a side of the glass sheet. The product is packaged and shipped to the Auburn, WA facility where the product is cut per custom orders and distributed to customers.

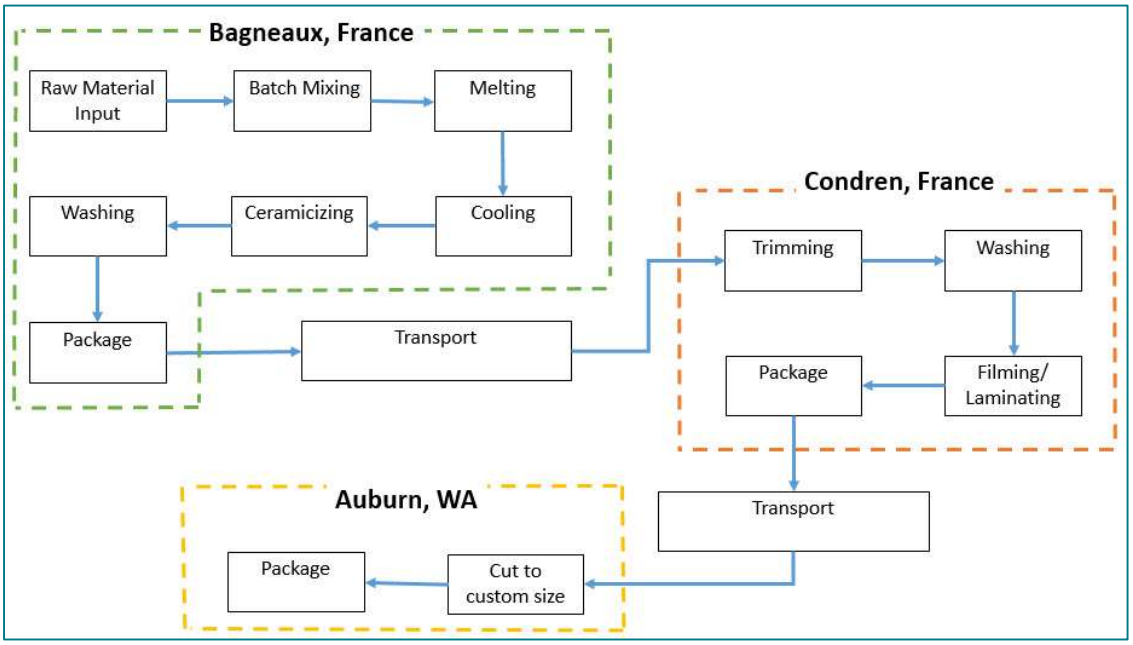

Figure 1: Keralite Process Flow

Environment and Health During Manufacturing

Saint-Gobain has well-established Environmental, Health, and Safety (EHS) and product stewardship programs, which help to enforce proper evaluation and monitoring of chemicals and raw materials chosen to manufacture products. These programs ensure that all environmental and OSHA requirements are met or exceeded to ensure the health and safety of all employees and contractors.

The Bagneaux, Condren, and Auburn manufacturing facilities operate integrated Environmental, Health, and Safety Management Systems that align with the ISO 14001 and ISO 45001 standards.

Product Processing/Installation

Keralite glass ceramic fire rated glazing material is for use in fire rated windows, transoms, and borrowed lite assemblies.

Keralite should be installed only into listed fire-rated assemblies using fire rated setting blocks and/or one of the following: Ceramic Glazing Tape or Closed Cell PVC Tape. In addition, both tapes can be used in conjucntion with cosmetic silicone sealant.

Additional installation guidelines are available on the Vetrotech website: www.vetrotech.com

Packaging

Packaging of the final product after production is included in the life cycle assessment. Packaging material includes wood crates with styrofoam padding for support.

Condition of Use

Vetrotech Keralite should be handled with care during transportation, storage, inspection, and installation. In addition, it should be stored in a dry place.

Environment and Health During Use

Keralite products have no known emissions during use that could affect the environment or human health.

No additional maintenance is required during the use of Keralite products. Cleaning can be done with a typical glass cleaning solution as needed, in the same way as for conventional glass.

Extraordinary Effects

Fire, Water, and Mechanical Destruction

Keralite products have no known extraordinary effects concerning fire, water, or mechanical destruction.

Re-Use/Recycling

Vetrotech and Saint-Gobain actively monitor and engage in on-going studies regarding processed glass recycling and disposal. At this time there are no end-of-life recycling programs formally established across the industry for fire rated glass..

Disposal

Keralite is usually removed and loaded onto a truck or dumpster at the decommissioning of a building. The product's end-of-life is assumed to be inert in a landfill. Disposal in a municipal landfill or in commercial incineration facilities is permissible and should be done in accordance with local, provincial, and federal regulations.

Further Information

www.vetrotech.com

LCA Calculation Rules

Declared Unit

Declared Unit						
Name	**Unit**	Keralite Filmed	Keralite Select Filmed	Keralite Laminated	Keralite Select Laminated	Keralite Ultra
Declared unit	m^2	1	1	1	1	1
Mass	kg/m^2	12.5	12.5	20.8	20.8	36.5
Conversion to 1 kg	-	0.08	0.08	0.048	0.048	0.027
Thickness	mm	5	5	8	8	17
Interlayer	%	n/a	n/a	n/a	n/a	n/a

Table 3: Declared Unit Information

System Boundary

The life cycle analysis performed for this EPD is classified as a “cradle-to-gate” study. The system boundary includes raw material supply, raw material transport, and manufacture. Additional life cycle stages of transport from the manufacture to customer, installation, use, and end-of-life are excluded from this study as required by the PCR.

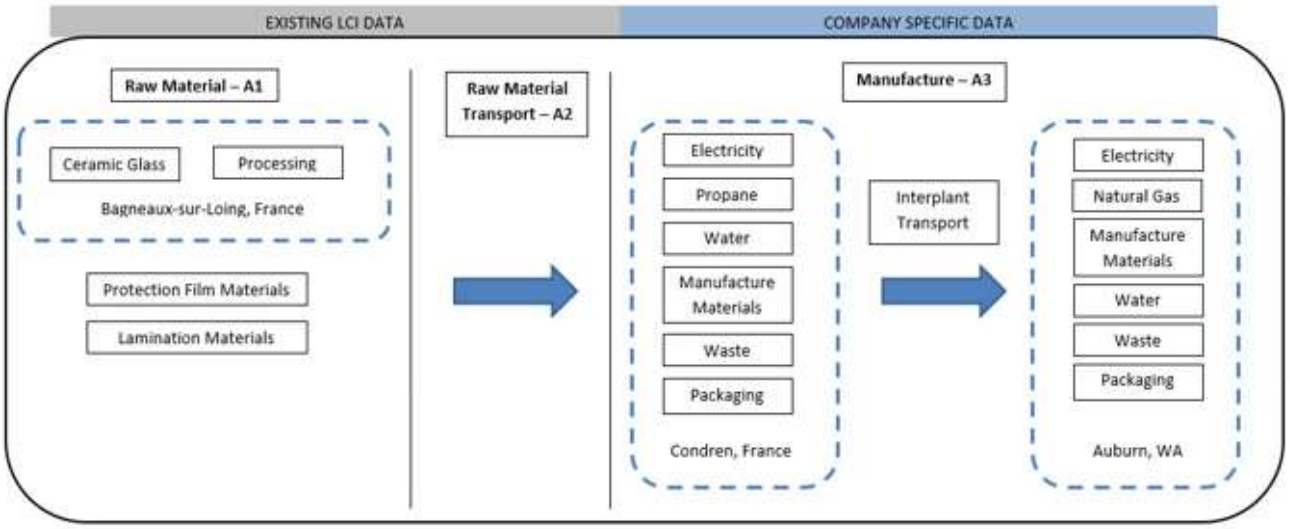

Figure 2: System Boundary Flow Diagram

Description of the System Boundary (X=included in LCA: MND=module not declared)																
Product Stage			Construction Process Stage		Use Stage							End of Life Stage				Benefits & Loads Beyond System Boundaries
Raw Material Supply	Transport	Manufacturing	Transport from the gate to the site	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	De-construction demolition	Transport	Waste Processing	Disposal	Reuse-Recover-Recycling Potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

Table 4: System Boundary

Estimates and Assumptions

Estimates and assumptions are required in life cycle analysis to constrain the project boundary or model when little or not data is available. In this study of Keralite products, estimates or assumptions were made regarding the background dataset for some of the raw material inputs as specific datasets were not available in the software. Estimates were also used for transportation distances when actual distances were not available. All estmates and assumptions are appropriately noted in the report.

Cut-Off Criteria

The cut-off criteria established for the study include materials, energy, and emissions data. For the purposes of this study, the crtieria are as follows:

- Mass – Chemicals with a combined weight less than 1% of the mass of the modeled product may be excluded, providing its environmental relevance is not a concern.
- Human activity factors were not included in the scope of this study.
- Capital equipment factors were not includd in the scope of this study.

Background Data

GaBi version 10.0 software system was used for modeling the life cycle of the Keralite products. Each background dataset was taken from the GaBi Thinkstep US Ecoinvent, USLCI databases, or Ecoinvent v3.

Data Quality

Wherever secondary data is used, the study adopts critically reviewed data for consistency, precision, and reproducibility to limit uncertainty. The data sources used are complete and representative of North America and Europe (depending on the material source) in terms of the geographic and technological coverage and are less than 10 years old. Any deviations from these initial data quality requirements for secondary data are documented in the report. Overall, the primary data from the manufacturing location is of very high quality, being directly tracked and measured by facility personel. Secondary data sets are of fair-to-good quality.

Period Under Review

Data for this LCA was collected for the 2019 calendar year.

Allocation

The Condren, France facility is the only facility that processes the ceramic glass with the finishing materials for the Keralite product line for Saint-Gobain Vetrotech. However, the Keralite glass is not the only product manufactured at this location. Allocation to the Keralite products versus other products manufacture at the Condren facility was based on production data provided by manufacturing personnel

Auburn is the only facility for Saint-Gobain Vetrotech that completes the final cutting of the Keralite product; although the Keralite product is not the only product manufactured at Auburn. Allocation to the Keralite product line at Auburn was based on production data provided by the manufacturing personnel. Keralite is produced with various finishes, such as Filmed and Laminated, polished and not polished. In order to accurately allocate inputs and outputs, a full list of all Keralite orders produced in 2019 was evaluated. Production was allocated among the Keralite products based on the square meters produced as a percentage of the overall Keralite production.

Comparability

Comparison of the environmental performance of processed glass 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. Full conformance with the PCR for North American Processed Glass allows EPD comparability only when all stages of the processed glass life cycle have been considered, which is not permitted under this PCR. However, variation and deviations are possible.

LCA Results

The results shown here are representative of the embodied environmental impacts for 1 square meter of the weighted average Keralite product. The tables and charts below present the environmental impact potentials for the system boundary modules A1-A3, raw material supply, raw material transport, and manufacturing as specified by the PCR. The results for each of the individual products represented in this EPD are shown in the Appendix.

Environmental Impacts – North America

TRACI Impact Assessment Method (North America)					
Impact Indicator	**Unit**	**Raw Materials (A1)**	**Raw Material Transport (A2)**	**Manufacture (A3)**	**Total (A1-A3)**
Global Warming Potential	*kg CO_2 eq*	3.20E+01	2.81E+00	1.18E+00	3.59E+01
Ozone Depletion Potential	*kg CFC 11 eq*	1.93E-06	3.80E-16	1.79E-07	2.11E-06
Acidification Potential	*kg SO_2 eq*	1.94E-01	7.12E-02	2.89E-02	2.94E-01
Eutrophication Potential	*kg N eq*	8.23E-02	2.62E-03	9.34E-03	9.43E-02
Photochemical Ozone Creation Potential	*kg O_3 eq*	1.78E+00	1.41E+00	2.14E-01	3.40E+00
Abiotic Resource Depletion Potential (elements)	*kg Fe eq*	1.76E+00	1.13E-03	1.05E-01	1.86E+00
Abiotic Resource Depletion Potential (fossil fuels)	*MJ*	9.00E+01	5.00E+00	5.44E+00	1.00E+02

Table 5: Keralite Weighted Average Results for North America, TRACI 2.1 Environmental Impacts

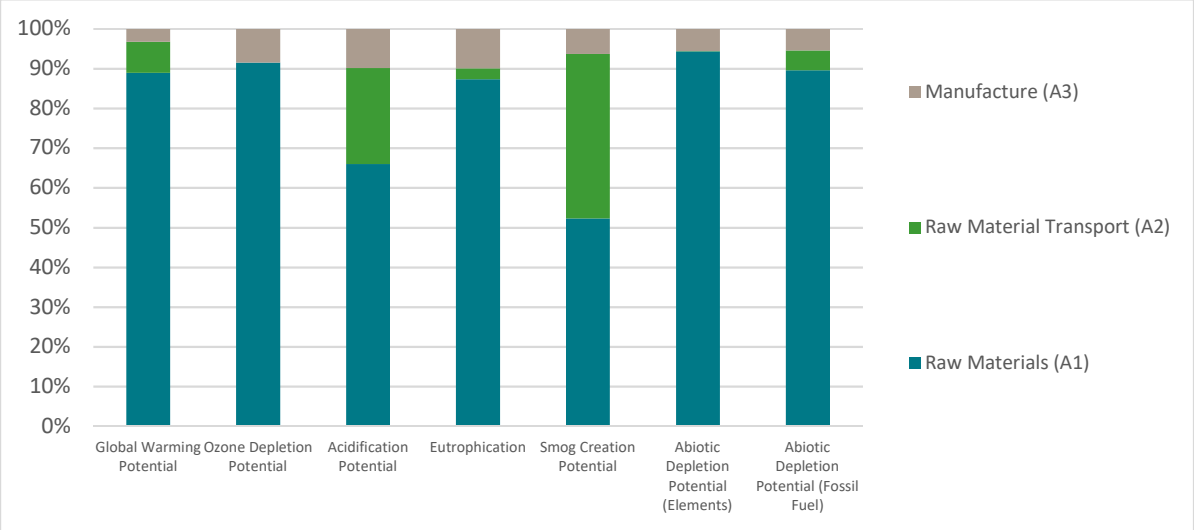

Figure 3: Keralite Weighted Average Results for North America, TRACI 2.1 Environmental Impacts

Environmental Impacts – Europe

CML Impact Assessment Method (Europe)					
Impact Indicator	**Unit**	**Raw Materials (A1)**	**Raw Material Transport (A2)**	**Manufacture (A3)**	**Total (A1-A3)**
Global Warming Potential	*kg CO_2 eq*	3.22E+01	2.81E+00	1.24E+00	3.62E+01
Ozone Depletion Potential	*kg CFC 11 eq*	1.66E-06	3.80E-16	1.51E-07	1.81E-06
Acidification Potential	*kg SO_2 eq*	1.98E-01	6.59E-02	2.59E-02	2.90E-01
Eutrophication Potential	*kg (PO4)3 eq*	4.80E-02	7.56E-03	7.58E-03	6.31E-02
Photochemical Ozone Creation Potential	*kg ethane eq*	1.22E-02	2.95E-03	1.03E-03	1.62E-02
Abiotic Resource Depletion Potential (elements)	*kg Sb eq*	1.16E-03	1.12E-07	9.34E-06	1.17E-03
Abiotic Resource Depletion Potential (fossil fuels)	*MJ*	7.20E+02	3.48E+01	5.81E+01	8.13E+02

Table 6: Keralite Weighted Average Results for Europe, CML Environmental Impacts

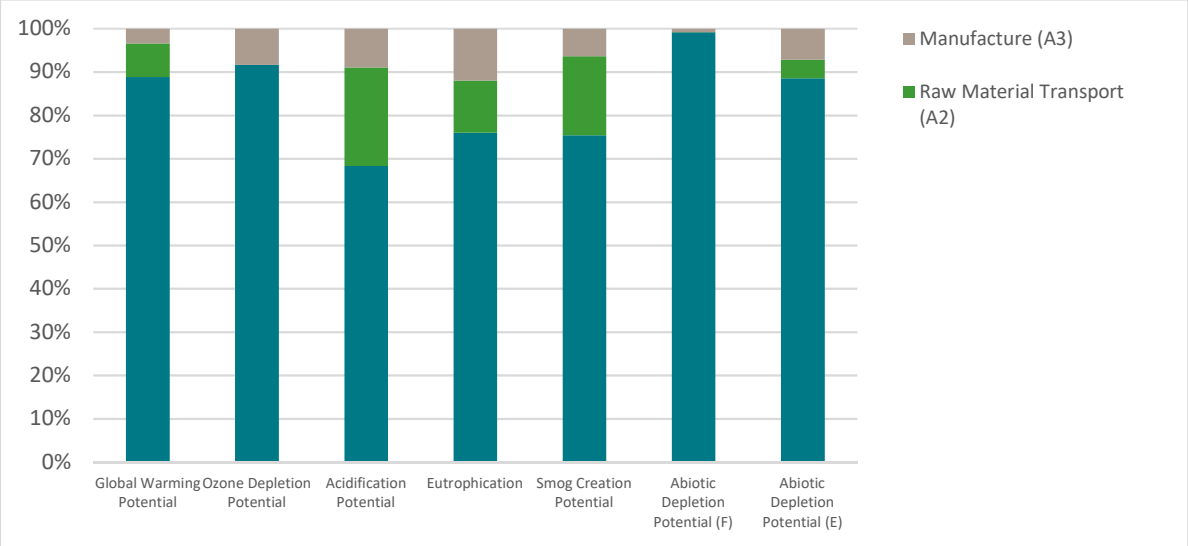

Figure 4: Keralite Weighted Average Results for Europe, CML Environmental Impacts

Resource Use

Primary Resource Use					
		Raw Materials (A1)	**Raw Materials Transport (A2)**	**Manufacture (A3)**	**Total (A1-A3)**
PERE: Renewable primary energy as energy carrier	MJ	8.52E+01	5.77E-01	6.02E+01	1.46E+02
PERM: Renewable primary energy resources as material utilization	MJ	2.43E-06	-7.87E-10	1.14E+01	1.14E+01
PERT: Total use of renewable primary energy resources	MJ	8.52E+01	5.77E-01	7.17E+01	1.57E+02
PENRE: Non-renewable primary energy as energy carrier	MJ	8.76E+02	3.49E+01	1.19E+02	1.03E+03
PENRM: Non-renewable primary energy as material utilization	MJ	2.73E-06	7.94E-08	8.43E-08	2.89E-06
PENRT: Total use of non-renewable primary energy resources	MJ	8.76E+02	3.49E+01	1.19E+02	1.03E+03

Table 7: Keralite Weighted Average Use of Primary Resources

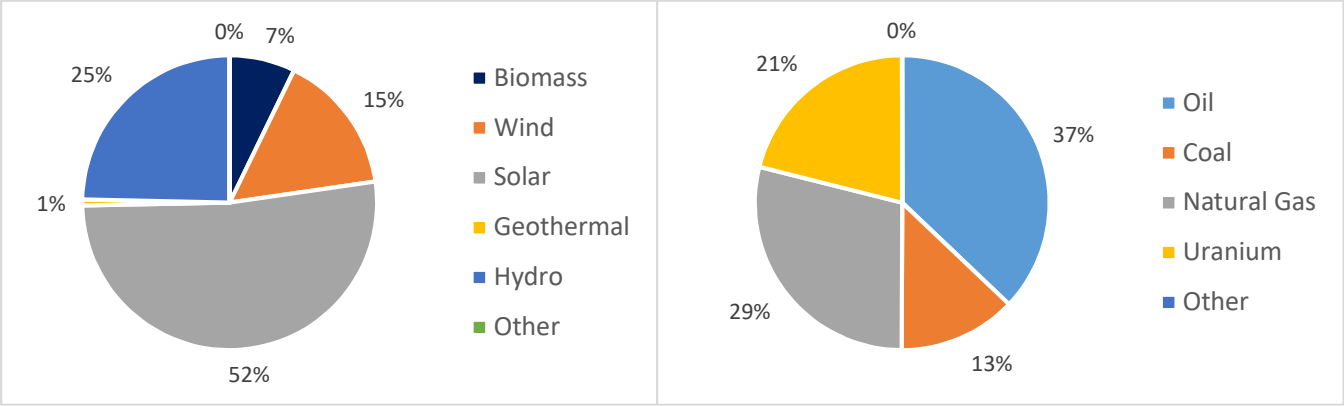

Figure 4: Keralite Weighted Average Renewable and Non-Renewable Energy by Source

Secondary Resource Use					
		Raw Materials (A1)	**Raw Materials Transport (A2)**	**Manufacture (A3)**	**Total (A1-A3)**
SM: Use of Secondary materials	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF: Use of Renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF: Non-renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE: Recovered energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW: Use of net fresh water resources	m^3	3.91E-01	7.25E-04	1.34E-01	5.26E-01

Table 8: Keralite Weighted Average, use of Secondary Resources

Output Flows and Waste Categories

Waste Categories					
		Raw Materials (A1)	**Raw Materials Transport (A2)**	**Manufacture (A3)**	**Total (A1-A3)**
HWD: Hazardous waste disposed	kg	3.73E-05	4.09E-07	1.15E-07	3.79E-05
NHWD: Non-hazardous waste disposed	kg	9.62E+00	4.02E-03	3.00E+00	1.26E+01
RWD: Radioactive waste disposed	kg	5.66E-02	4.02E-05	2.37E-02	8.04E-02
RWD_{High}: High level radioactive waste, conditioned, to final repository	kg	2.39E-05	3.64E-08	1.01E-05	3.40E-05
RWD_{Low}: Intermediate and low level radioactive waste, conditioned, to final repository	kg	1.49E-03	1.09E-06	6.30E-04	2.12E-03

Table 9: Keralite Weighted Average, Waste Categories

Output Flows					
		Raw Materials (A1)	Raw Materials Transport (A2)	Manufacture (A3)	Total (A1-A3)
CRU: Components for reuse	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR: Materials for recycling	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER: Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE: Recovered energy exported	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 10: Keralite Weighted Average Output Flows

Biogenic Carbon

Biogenic Carbon					
	Raw Materials (A1)	Raw Materials Transport (A2)	Manufacture (A3)	Packaging (A3)	Cradle-to-Gate (A1-A3)
Biogenic Carbon (kg CO2 eq)	-3.49E+00	-3.89E-02	-6.39E-01	-4.15E+00	-8.32E+00

Table 11: Keralite Weighted Average Biogenic Carbon

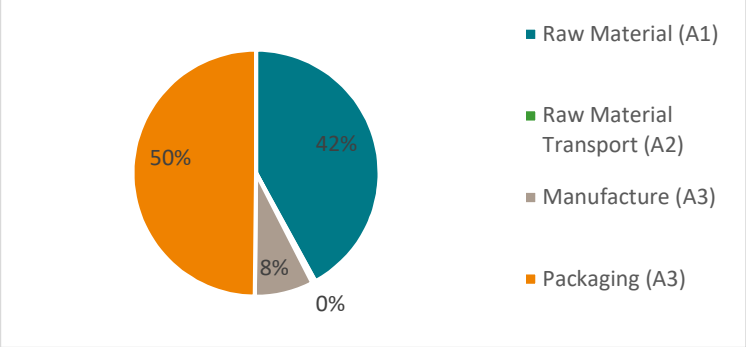

Figure 5: Keralite Weighted Average Biogenic Carbon

LCA Interpretation

Based on the results from the life cycle assessment, the life cycle impacts are strongly driven by the raw materials, particularly the glass which accounts for as much as 97% of the raw material impacts and 85% of the cradle-to-gate impact potentials. The impacts for the raw material transportation stage (A2) also contribute by as much as 5-40% of the overall environmental impact potentials.

LCA Development

This EPD and the corresponding LCA were prepared by Saint-Gobain Corporation North America in Malvern, Pennslyvania.

References

- Product Category Rules for Building-Related Product and Services: Part A – Life Cycle Assessment Calculation Rules and Report Requirements, Version 3.2 2018. UL Environment
- UL General Program Rules, Version 2.5, March 2020. UL Environment
- Product Category Rule Guidance for Building-Related Products and Services: Part B – Processed Glass EPD Requirements. Version 1.0 2016. UL Environment
- ISO 14040: 2006 Series – Environmental Management-Life Cycle Assessment
- ISO 14025 – Environmental labels and declarations – Type III environmental declarations – Principles and procedures
- ISO 14044 – Environmental management – Life cycle assessment – Requirements and guidelines; Amendment 2: 2020
- EN 15804: 2012+A1: 2013 – Sustainability of construction works – Environmental Product Declarations – Core rules for the product category of construction products
- ISO 21930: 2017 – Sustainability in building construction – Environmental declaration of building products
- Vetrotech Saint-Gobain Keralite Life Cycle Assessment Report, March 2021. Saint-Gobain North America EHS&S Department
- Vetrotech Website: www.vetrotech.com

Appendix: Individual Product Results for Keralite Products

Vetrotech Keralite Filmed and Keralite Select Filmed					
Cradle-to-Gate		Raw Materials (A1)	Raw Materials Transport (A2)	Manufacture (A3)	Total (A1-A3)
TRACI 2.1 Impact Categories					
Global Warming Potential	kg CO^2 eq	2.19E+01	2.10E+00	1.16E+00	2.52E+01
Ozone Depletion Potential	kg CFC-11 eq	1.46E-06	2.84E-16	1.79E-07	1.63E-06
Acidification Potential	kg SO_2 eq	1.61E-01	5.33E-02	2.87E-02	2.43E-01
Eutrophication Potential	kg N eq	6.11E-02	1.96E-03	9.33E-03	7.23E-02
Smog Creation Potential	kg O3 eq	1.25E+00	1.06E+00	2.11E-01	2.52E+00
Abiotic Depletion Potential (elements)	kg Fe eq	1.84E+00	8.43E-04	1.04E-01	1.94E+00
Abiotic Depletion Potential (fossil)	MJ	5.48E+01	3.74E+00	5.39E+00	6.39E+01
CML Impact Categories					
Global Warming Potential	kg CO^2 eq	2.21E+01	2.10E+00	1.22E+00	2.54E+01
Ozone Depletion Potential	kg R-11 eq	1.25E-06	2.84E-16	1.51E-07	1.40E-06
Acidification Potential	kg SO_2 eq	1.68E-01	4.93E-02	2.58E-02	2.43E-01
Eutrophication Potential	kg phosphate eq	3.51E-02	5.66E-03	7.56E-03	4.83E-02
Smog Creation Potential	kg ethane eq	9.57E-03	2.21E-03	1.06E-03	1.28E-02
Abiotic Depletion Potential (elements)	kg Sb eq	1.34E-03	8.35E-08	9.33E-06	1.35E-03
Abiotic Depletion Potential (fossil)	MJ	4.54E+02	2.60E+01	5.77E+01	5.38E+02
Use of Primary Resources					
Renewable primary energy as energy carrier	MJ	5.54E+01	4.29E-01	6.02E+01	1.16E+02
Renewable primary energy resources as material utilization	MJ	1.84E-06	-5.85E-10	1.14E+01	1.14E+01
Total use of renewable primary energy resources	MJ	5.54E+01	4.29E-01	7.16E+01	1.27E+02
Non-renewable primary energy as energy carrier	MJ	5.47E+02	2.61E+01	1.19E+02	6.92E+02
Non-renewable primary energy as material utilization	MJ	1.59E-06	5.90E-08	8.41E-08	1.73E-06
Total use of non-renewable primary energy resources	MJ	5.47E+02	2.61E+01	1.19E+02	6.92E+02
Use of Secondary Resources					
Use of Secondary materials	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of Renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Recovered energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of net fresh water resources	m^3	2.67E-01	5.40E-04	1.34E-01	4.01E-01
Waste Flows					
Hazardous waste disposed	kg	3.73E-05	4.09E-07	1.15E-07	3.79E-05
Non-hazardous waste disposed	kg	9.62E+00	4.02E-03	3.00E+00	1.26E+01
Radioactive waste disposed	kg	5.66E-02	4.02E-05	2.37E-02	8.04E-02
High level radioactive waste to final repository	kg	2.39E-05	3.64E-08	1.01E-05	3.40E-05
Intermediate and low level radioactive waste	kg	1.49E-03	1.09E-06	6.30E-04	2.12E-03
Output Material Flows					
Components for reuse	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Recovered energy exported	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Biogenic Carbon					
Biogenic Carbon	kg CO2 eq	-2.24E+00	-2.89E-02	-6.37E-01	-4.15E+00

Table 12: Keralite Filmed and Keralite Select Filmed Individual Results

Vetrotech Keralite Laminated and Keralite Select Laminated					
Cradle-to-Gate		Raw Materials (A1)	Raw Materials Transport (A2)	Manufacture (A3)	Total (A1-A3)
TRACI 2.1 Impact Categories					
Global Warming Potential	kg CO^2 eq	4.30E+01	3.51E+00	1.21E+00	4.77E+01
Ozone Depletion Potential	kg CFC-11 eq	2.37E-06	4.75E-16	1.79E-07	2.55E-06
Acidification Potential	kg SO_2 eq	2.21E-01	8.88E-02	2.91E-02	3.39E-01
Eutrophication Potential	kg N eq	1.03E-01	3.26E-03	9.36E-03	1.16E-01
Smog Creation Potential	kg O3 eq	2.33E+00	1.76E+00	2.18E-01	4.31E+00
Abiotic Depletion Potential (elements)	kg Fe eq	1.48E+00	1.41E-03	1.06E-01	1.59E+00
Abiotic Depletion Potential (fossil)	MJ	1.32E+02	6.25E+00	5.49E+00	1.44E+02
CML Impact Categories					
Global Warming Potential	kg CO^2 eq	4.33E+01	3.52E+00	1.27E+00	4.81E+01
Ozone Depletion Potential	kg R-11 eq	2.04E-06	4.75E-16	1.51E-07	2.19E-06
Acidification Potential	kg SO_2 eq	2.20E-01	8.21E-02	2.61E-02	3.28E-01
Eutrophication Potential	kg phosphate eq	6.07E-02	9.42E-03	7.61E-03	7.78E-02
Smog Creation Potential	kg ethane eq	1.47E-02	3.66E-03	1.01E-03	1.94E-02
Abiotic Depletion Potential (elements)	kg Sb eq	7.98E-04	1.41E-07	9.35E-06	8.07E-04
Abiotic Depletion Potential (fossil)	MJ	1.03E+03	4.35E+01	5.85E+01	1.13E+03
Use of Primary Resources					
Renewable primary energy as energy carrier	MJ	1.19E+02	7.29E-01	6.03E+01	1.80E+02
Renewable primary energy resources as material utilization	MJ	3.00E-06	-9.92E-10	1.14E+01	1.14E+01
Total use of renewable primary energy resources	MJ	1.19E+02	7.29E-01	7.17E+01	1.91E+02
Non-renewable primary energy as energy carrier	MJ	1.26E+03	4.36E+01	1.19E+02	1.42E+03
Non-renewable primary energy as material utilization	MJ	4.07E-06	1.00E-07	8.44E-08	4.25E-06
Total use of non-renewable primary energy resources	MJ	1.26E+03	4.36E+01	1.19E+02	1.42E+03
Use of Secondary Resources					
Use of Secondary materials	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of Renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Recovered energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of net fresh water resources	m^3	5.27E-01	9.15E-04	1.34E-01	6.62E-01
Waste Flows					
Hazardous waste disposed	kg	5.64E-05	5.18E-07	1.18E-07	5.70E-05
Non-hazardous waste disposed	kg	1.40E+01	5.03E-03	3.53E+00	1.75E+01
Radioactive waste disposed	kg	8.46E-02	5.03E-05	2.37E-02	1.08E-01
High level radioactive waste to final repository	kg	3.51E-05	4.56E-08	1.01E-05	4.52E-05
Intermediate and low level radioactive waste	kg	2.22E-03	1.36E-06	6.30E-04	2.86E-03
Output Material Flows					
Components for reuse	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Recovered energy exported	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Biogenic Carbon					
Biogenic Carbon	kg CO2 eq	-4.91E+00	-4.91E-02	-6.42E-01	-4.15E+00

Table 13: Keralite Laminated and Keralite Select Laminated Individual Results

Vetrotech Keralite Ultra					
Cradle-to-Gate		Raw Materials (A1)	Raw Materials Transport (A2)	Manufacture (A3)	Total (A1-A3)
TRACI 2.1 Impact Categories					
Global Warming Potential	kg CO^2 eq	1.03E+02	6.15E+00	1.30E+00	1.11E+02
Ozone Depletion Potential	kg CFC-11 eq	4.25E-06	8.31E-16	1.79E-07	4.43E-06
Acidification Potential	kg SO_2 eq	4.52E-01	1.56E-01	2.97E-02	6.37E-01
Eutrophication Potential	kg N eq	1.95E-01	5.72E-03	9.39E-03	2.10E-01
Smog Creation Potential	kg O3 eq	5.14E+00	3.09E+00	2.30E-01	8.45E+00
Abiotic Depletion Potential (elements)	kg Fe eq	2.90E+00	2.47E-03	1.09E-01	3.01E+00
Abiotic Depletion Potential (fossil)	MJ	3.72E+02	1.10E+01	5.69E+00	3.88E+02
CML Impact Categories					
Global Warming Potential	kg CO^2 eq	1.04E+02	6.16E+00	1.36E+00	1.12E+02
Ozone Depletion Potential	kg R-11 eq	3.66E-06	8.31E-16	1.51E-07	3.81E-06
Acidification Potential	kg SO_2 eq	4.45E-01	1.44E-01	2.66E-02	6.15E-01
Eutrophication Potential	kg phosphate eq	1.19E-01	1.65E-02	7.70E-03	1.44E-01
Smog Creation Potential	kg ethane eq	3.22E-02	6.44E-03	9.18E-04	3.96E-02
Abiotic Depletion Potential (elements)	kg Sb eq	1.49E-03	2.46E-07	9.38E-06	1.50E-03
Abiotic Depletion Potential (fossil)	MJ	2.79E+03	7.61E+01	6.00E+01	2.92E+03
Use of Primary Resources					
Renewable primary energy as energy carrier	MJ	3.23E+02	1.27E+00	6.04E+01	3.85E+02
Renewable primary energy resources as material utilization	MJ	5.18E-06	-1.73E-09	1.14E+01	1.14E+01
Total use of renewable primary energy resources	MJ	3.23E+02	1.27E+00	7.18E+01	3.97E+02
Non-renewable primary energy as energy carrier	MJ	3.48E+03	7.64E+01	1.21E+02	3.68E+03
Non-renewable primary energy as material utilization	MJ	1.27E-05	1.75E-07	8.51E-08	1.30E-05
Total use of non-renewable primary energy resources	MJ	3.48E+03	7.64E+01	1.21E+02	3.68E+03
Use of Secondary Resources					
Use of Secondary materials	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of Renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-renewable secondary fuels	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Recovered energy	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Use of net fresh water resources	m^3	1.22E+00	1.59E-03	1.35E-01	1.36E+00
Waste Flows					
Hazardous waste disposed	kg	1.79E-04	9.00E-07	1.30E-07	1.80E-04
Non-hazardous waste disposed	kg	4.37E+01	8.80E-03	5.54E+00	4.93E+01
Radioactive waste disposed	kg	2.64E-01	8.81E-05	2.37E-02	2.87E-01
High level radioactive waste to final repository	kg	1.05E-04	7.98E-08	1.01E-05	1.15E-04
Intermediate and low level radioactive waste	kg	6.90E-03	2.39E-06	6.31E-04	7.54E-03
Output Material Flows					
Components for reuse	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recovery	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Recovered energy exported	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Biogenic Carbon					
Biogenic Carbon	kg CO2 eq	-1.35E+01	-8.54E-02	-6.50E-01	-4.15E+00

Table 14: Keralite Ultra Individual Results