

**Declaration Owner**

Vicostone Joint Stock Company

Hoalac Hi-tech Park, Thachthat, Hanoi, Vietnam

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Products

VICOSTONE® Quartz Surfaces

(UNSPSC 30162200 – Countertops)

Functional Unit

The functional unit is one square meter of countertop provided and maintained for a period of 10 years in residential use.

EPD Number and Period of Validity

SCS-EPD-08610

EPD Valid January 20, 2023 through January 23, 2028

Product Category Rule

Product Category Rule for Environmental Product Declarations:

PCR for Residential Countertops. NSF International. Valid through March 31, 2023.

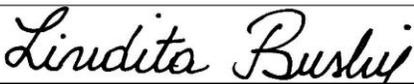
Program Operator

SCS Global Services

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Declaration Owner:	Vicostone Joint Stock Company
Address:	Hoalac Hi-tech Park, Thachthat, Hanoi, Vietnam
Declaration Number:	SCS-EPD-08610
Declaration Validity Period:	EPD Valid January 20, 2023 through January 23, 2028
Program Operator:	SCS Global Services
Declaration URL Link:	https://www.scsglobalservices.com/certified-green-products-guide
LCA Practitioner:	Gerard Mansell
LCA Software:	OpenLCA v1.11
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:	 Lindita Bushi, Ph.D., Athena Sustainable Materials Institute.
Product Category Rule:	Product Category Rule for Environmental Product Declarations: PCR for Residential Countertops. NSF International. Valid through March 31, 2023
PCR Review conducted by:	Evan Griffing, PhD, Environmental Clarity LLC, egriffing@environmentalclarity.com
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:	 Lindita Bushi, Ph.D., Athena Sustainable Materials Institute.
Declaration Contents:	Product Scope.....cover About VICOSTONE.....2 Product Description.....2 Product Characteristics and Performance.....2 Material Composition.....4 Life Cycle Assessment Stages.....4 Product Life Cycle Flow Diagram.....5 Life Cycle Inventory.....6 Life Cycle Impact Assessment.....7 Supporting Technical Information.....10 References.....14

Disclaimers: This EPD conforms to ISO 14025, 14040, 14044 and 21930

Scope of Results Reported: The PCR requirements limit the scope of the LCA metrics such that the results exclude environmental and social performance benchmarks and thresholds, and exclude impacts from the depletion of natural resources, land use ecological impacts, ocean impacts related to greenhouse gas emissions, risks from hazardous wastes and impacts linked to hazardous chemical emissions.

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.

ABOUT VICOSTONE

VICOSTONE® is a pioneer in manufacturing quartz-based engineered stone in Asia. With a global distribution network, VICOSTONE® Quartz Surfaces are now available in all continents and recommended by interior designers and architects. With five production lines of compound stones utilizing technology transferred from Breton S.p.A (Italy), and using the most advanced techniques with latest technology, VICOSTONE can provide millions of square meters per year and is one of the leading engineered stone manufacturers in the world.

PRODUCT DESCRIPTION

VICOSTONE® quartz based engineered stones are produced from about 90% pure natural quartz aggregates that are adhered with polymer resin with color powder and have a hardness and flexural strength that is much higher than natural and other engineered stones. With a special and luxurious beauty, VICOSTONE® compound stones are widely used in interior applications such as kitchen countertops, bathroom vanities, wall paneling, flooring, etc. In this LCA study, VICOSTONE® Quartz Surfaces are fabricated for use as a residential countertop. The manufacturer warrants the product for a period of 15 years from the date of purchase.

PRODUCT CHARACTERISTICS AND PERFORMANCE

Table 1. Product characteristics for VICOSTONE® Quartz Surfaces.

Characteristic	Nominal Value	Unit
Slab thickness	20.0 (0.787)	mm (inch)
Slab length	305 (120)	cm (inch)
Slab width	144 (56)	cm (inch)
Slab weight	46.0 (9.42)	kg/m ² (lb/ft ²)
Underlayment included	N	Y/N
VOC Emissions Test Method	GREENGUARD Gold	-



Table 2. Product performance test results for VICOSTONE® Quartz Surfaces.

Specifications	Test Method	Results
Water Absorption	ASTM C97 / C97M-18	≤ 0.02 %
	BS EN 14617-1:2013	≤ 0.02 %
Apparent Density	ASTM C97 / C97M-18	2.1 – 2.3 g/cm ³
	BS EN 14617-1:2013	2.1 – 2.3 g/cm ³
Flexural Strength	ASTM C880/C880M-18	Fine and medium grain: ≥ 55 MPa Coarse grain: ≥ 41 MPa
	BS EN 14617-2:2016	Fine and medium grain: > 60 MPa Coarse grain: > 40 MPa
Compressive Strength	ASTM C170/C170M-17	Dry: ≥ 200 MPa
	BS EN 14617-15:2005	Dry: ≥ 185 MPa
Chemical Resistance	ASTM C650-04:2014	Unaffected
	BS EN 14617-10:2012	Class C4
Dimension Stability	EN 14617-12:2012	Class A
Impact Resistance	ASTM C1870-18	36-inch ball drop: ≤ 0.25 in 48-inch ball drop: ≤ 0.27 in
	BS EN 14617-9:2005	> 4 J
Abrasion Resistance	ASTM C501-84:2015	Abrasive Wear index: I _w ≥ 179
	BS EN 14617-4:2012	Volume of chord: V ≤ 165 mm ³ Chord length: l ≤ 27 mm
Thermal Shock Resistance	ASTM C484-99:2014	No visible damage after 10 cycles
	EN 14617-6:2012	No visible defects after 20 cycles Change in mass: ≤ 0.05%
		Change in flexural strength: - 8.4% ÷ 5.4%
Freeze-thaw Resistance	ASTM C1026-13:2018	No visible damage after 300 cycles
		Wt. Loss: ≤ 0.09%
	EN 14617-5:2012	No obvious damage after 20 cycles KM _{f25} = 93 ÷ 105%
Mohs's Scratch Hardness	EN 101: 1991	≥ 6
Slip Resistance	DIN 51130:2014	R9 at Honed 400
	ASTM C1028-06	Static coefficient of friction - Dry: 0.7 ÷ 0.8 (Polished/Honed finish) - Wet: 0.5 ÷ 0.7 (Polished/Honed finish)
Microbial Resistance	ASTM D6329-98	Ranking 3: Resistant to Mold Growth
Stain Resistance	ASTM C 1378-04:2019	Class A (Polished finish)
Surface Burning	ASTM E84:21a	Class A

MATERIAL COMPOSITION

Table 3. Material composition of VICOSTONE® Quartz Surfaces in kilograms per functional unit and in percentage of total weight.

Material	Amount in Final Product (kg/m ²)	Percent of Total (%)	Material Resources Type
Quartz	39.9	86.6%	Virgin non-renewable
Polyester resin	3.74	8.1%	Virgin non-renewable
Styrene	1.97	4%	Virgin non-renewable
Color pigments	0.24	0.5%	Virgin non-renewable
Additives	0.20	0.4%	Virgin non-renewable
Total	46.0	100%	-

In conformance with the PCR, product materials were reviewed for the presence of any toxic or hazardous chemicals with respect to US regulations.¹ Based on a review of the product components provided by the manufacturer, no regulated chemicals were identified in the product or product components.

LIFE CYCLE ASSESSMENT STAGES

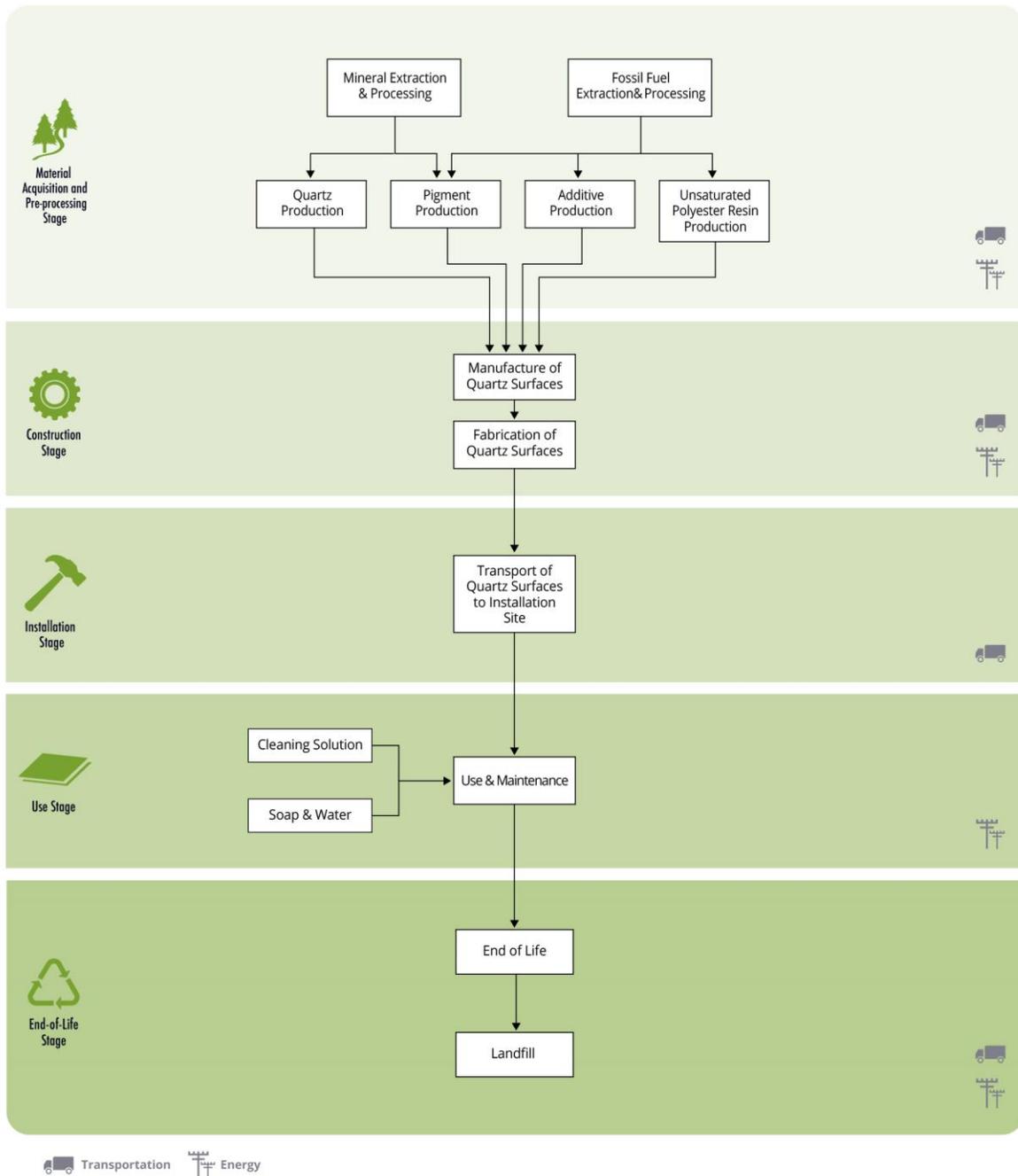
A cradle-to-grave life cycle assessment (LCA) was completed for this product in accordance with ISO 14040, ISO 14044, and the Product Category Rule for Environmental Product Declarations: *PCR for Residential Countertops*. The diagram below illustrates the life cycle stages included in this EPD.



¹ Resource Conservation and Recovery Act (RCRA), Subtitle 3. <https://www.epa.gov/rcra/resource-conservation-and-recovery-act-rcra-overview>

PRODUCT LIFE CYCLE FLOW DIAGRAM

The diagram below is a representation of the most significant contributions to the life cycle of VICOSTONE® Quartz Surfaces. This includes material acquisition and pre-processing, construction (manufacture and fabrication), installation, use, and end-of-life.



LIFE CYCLE INVENTORY

The life cycle inventory (LCI) flows for the EPD are shown in Table 4 through Table 6 in accordance with the requirements of the PCR and ISO 21930. Water usage from electricity generation is included.

Table 4. Air and water emissions for 1 m² VICOSTONE® Quartz Surfaces provided and maintained for a period of 10 years.

Parameter	Unit	Raw Materials	Manufacturing	Installation	Use & Maintenance	Disposal	Total
Air Emissions							
Carbon dioxide	kg	42.0	12.5	26.1	3.51	2.26	86.3
	%	49%	14%	30%	4.1%	2.6%	100%
Carbon monoxide	kg	9.72x10 ⁻²	7.63x10 ⁻³	4.66x10 ⁻²	3.01x10 ⁻³	6.64x10 ⁻³	0.161
	%	60%	4.7%	29%	1.9%	4.1%	100%
Methane	kg	0.185	1.11x10 ⁻²	1.85x10 ⁻²	4.29x10 ⁻³	1.71x10 ⁻³	0.221
	%	84%	5%	8.4%	1.9%	0.77%	100%
Nitrogen oxides	kg	0.125	4.20x10 ⁻²	0.223	5.97x10 ⁻³	1.58x10 ⁻²	0.411
	%	30%	10%	54%	1.5%	3.8%	100%
Nitrous oxide	kg	2.69x10 ⁻²	3.36x10 ⁻⁴	7.52x10 ⁻⁴	1.07x10 ⁻³	9.94x10 ⁻⁵	2.91x10 ⁻²
	%	92%	1.2%	2.6%	3.7%	0.34%	100%
Sulfur oxides	kg	0.121	5.37x10 ⁻²	0.112	4.99x10 ⁻³	3.19x10 ⁻³	0.296
	%	41%	18%	38%	1.7%	1.1%	100%
Water Emissions							
Dioxin	kg	1.63x10 ⁻¹⁵	3.81x10 ⁻¹⁸	1.44x10 ⁻¹⁷	6.45x10 ⁻¹⁸	2.89x10 ⁻¹⁸	1.65x10 ⁻¹⁵
	%	98%	0.23%	0.87%	0.39%	0.18%	100%
Heavy metals	kg	9.58x10 ⁻⁴	1.15x10 ⁻³	2.34x10 ⁻⁴	9.86x10 ⁻⁵	1.55x10 ⁻³	3.99x10 ⁻³
	%	24%	29%	5.9%	2.5%	39%	100%
Nitrates	kg	1.02x10 ⁻²	4.73x10 ⁻³	1.81x10 ⁻³	8.05x10 ⁻²	1.05x10 ⁻⁴	9.73x10 ⁻²
	%	10%	4.9%	1.9%	83%	0.11%	100%
Phosphates	kg	2.90x10 ⁻²	1.52x10 ⁻²	5.32x10 ⁻³	1.74x10 ⁻³	5.26x10 ⁻⁴	5.18x10 ⁻²
	%	56%	29%	10%	3.4%	1%	100%



Table 5. Resource use and waste flows for 1 m² VICOSTONE® Quartz Surfaces provided and maintained for a period of 10 years.

Parameter	Unit	Raw Materials	Manufacturing	Installation	Use & Maintenance	Disposal	Total
Resources							
Primary Energy Demand	MJ	1,030	185	392	112	37.3	1,750
	%	59%	11%	22%	6.4%	2.1%	100%
Non-renewable, fossil	MJ	963	151	384	19.5	36.6	1,550
	%	62%	9.7%	25%	1.3%	2.4%	100%
Non-renewable, nuclear	MJ	37.8	6.33	4.16	1.31	0.348	50.0
	%	76%	13%	8.3%	2.6%	0.7%	100%
Renewable, wind, solar, geothermal	MJ	3.26	0.880	0.577	0.198	4.43x10 ⁻²	4.96
	%	66%	18%	12%	4%	0.89%	100%
Renewable, water	MJ	11.6	25.4	2.28	0.625	0.171	40.1
	%	29%	63%	5.7%	1.6%	0.43%	100%
Renewable, biomass	MJ	12.5	1.22	1.22	87.0	7.71x10 ⁻²	102
	%	12%	1.2%	1.2%	85%	0.076%	100%
Water use	m ³	2.75	0.640	0.241	0.578	1.98x10 ⁻²	4.23
	%	65%	15%	5.7%	14%	0.47%	100%
Wastes							
Hazardous waste	kg	7.25x10 ⁻⁴	1.08x10 ⁻⁴	8.84x10 ⁻⁴	4.44x10 ⁻⁵	8.70x10 ⁻⁵	1.85x10 ⁻³
	%	39%	5.9%	48%	2.4%	4.7%	100%
Non-hazardous waste (landfill)	kg	9.99	25.1	15.7	0.608	46.2	97.6
	%	10%	26%	16%	0.62%	47%	100%
Recycling	kg	0.00	0.00	0.00	0.00	0.00	0.00
	%	0%	0%	0%	0%	0%	0%
Incineration	kg	0.00	0.00	0.00	0.00	0.00	0.00
	%	0%	0%	0%	0%	0%	0%



Table 6. Additional parameters per ISO 21930: Resource use and waste flows for 1 m² VICOSTONE® Quartz Surfaces provided and maintained for a period of 10 years.

Parameter	Unit	Raw Materials	Manufacturing	Installation	Use & Maintenance	Disposal	Total
Resources							
RPR _E	MJ	27.4	27.5	4.08	87.8	0.292	147
	%	19%	19%	2.8%	60%	0.2%	100%
RPR _M	MJ	0.00	0.00	0.00	0.00	0.00	0.00
	%	0%	0%	0%	0%	0%	0%
NRPR _E	MJ	829	158	388	20.8	37.0	1,430
	%	58%	11%	27%	1.5%	2.6%	100%
NRPR _M	MJ	172	0.00	0.00	0.00	0.00	172
	%	100%	0%	0%	0%	0%	100%
SM	kg	0.00	0.00	0.00	0.00	0.00	0.00
RSF	MJ	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
RE	MJ	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
FW	m ³	2.75	0.640	0.241	0.578	1.98x10 ⁻²	4.23
	%	65%	15%	5.7%	14%	0.47%	100%
Wastes							
HWD	kg	7.25x10 ⁻⁴	1.08x10 ⁻⁴	8.84x10 ⁻⁴	4.44x10 ⁻⁵	8.70x10 ⁻⁵	1.85x10 ⁻³
	%	39%	5.9%	48%	2.4%	4.7%	100%
NHWD	kg	9.99	25.1	15.7	0.608	46.2	97.6
	%	10%	26%	16%	0.62%	47%	100%
HLRW	kg	9.49x10 ⁻⁵	2.07x10 ⁻⁵	1.75x10 ⁻⁵	5.26x10 ⁻⁶	1.33x10 ⁻⁶	1.40x10 ⁻⁴
	%	68%	15%	13%	3.8%	0.96%	100%
ILLRW	kg	1.64x10 ⁻³	2.59x10 ⁻⁴	2.55x10 ⁻³	4.22x10 ⁻⁵	2.47x10 ⁻⁴	4.74x10 ⁻³
	%	35%	5.5%	54%	0.89%	5.2%	100%
CRU	kg	0.00	0.00	0.00	0.00	0.00	0.00
MR	kg	0.00	0.00	0.00	0.00	0.00	0.00
MER	kg	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
EE	MJ	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.

LIFE CYCLE IMPACT ASSESSMENT

The life cycle impact assessment (LCIA) for the EPD is conducted in accordance with requirements of the PCR. Impact category indicators are estimated using the TRACI 2.1 and CML characterization methods. The LCIA results are calculated using OpenLCA v1.11 software.

Table 7. LCIA results for 1 m² VICOSTONE® Quartz Surfaces provided and maintained for a period of 10 years.

Impact Category	Unit	Raw Materials	Manufacturing	Installation	Use & Maintenance	Disposal	Total
TRACI							
Global warming	kg CO ₂ eq	54.5	12.9	26.8	3.90	2.34	100
	%	54%	13%	27%	3.9%	2.3%	100%
Acidification	kg SO ₂ eq	0.211	8.57x10 ⁻²	0.248	1.53x10 ⁻²	1.18x10 ⁻²	0.572
	%	37%	15%	43%	2.7%	2.1%	100%
Eutrophication	kg N eq	6.37x10 ⁻²	2.31x10 ⁻²	3.71x10 ⁻²	1.37x10 ⁻²	2.86x10 ⁻³	0.140
	%	45%	16%	26%	9.7%	2%	100%
Smog formation	kg O ₃ eq	1.45x10 ⁻²	3.06x10 ⁻³	7.04x10 ⁻³	2.14x10 ⁻³	4.13x10 ⁻⁴	2.72x10 ⁻²
	%	53%	11%	26%	7.9%	1.5%	100%
Ozone depletion	kg CFC-11 eq	5.51x10 ⁻⁶	5.18x10 ⁻⁷	4.56x10 ⁻⁶	2.24x10 ⁻⁷	4.39x10 ⁻⁷	1.13x10 ⁻⁵
	%	49%	4.6%	41%	2%	3.9%	100%
Fossil fuel depletion	MJ surplus	962	151	384	19.5	36.6	1,550
	%	62%	9.7%	25%	1.3%	2.4%	100%
CML							
Global warming	kg CO ₂ eq	54.8	12.9	26.8	3.92	2.34	101
	%	54%	13%	27%	3.9%	2.3%	100%
Acidification	kg SO ₂ eq	0.218	8.59x10 ⁻²	0.271	1.69x10 ⁻²	1.44x10 ⁻²	0.606
	%	36%	14%	45%	2.8%	2.4%	100%
Eutrophication	kg (PO ₄) ³⁻ eq	0.117	4.46x10 ⁻²	3.17x10 ⁻²	2.75x10 ⁻²	2.90x10 ⁻³	0.224
	%	52%	20%	14%	12%	1.3%	100%
Photochemical oxidation	kg C ₂ H ₄ eq	3.21	1.04	5.52	0.161	0.392	10.3
	%	31%	10%	53%	1.6%	3.8%	100%
Ozone layer depletion	kg CFC-11 eq	6.46x10 ⁻⁶	7.40x10 ⁻⁷	6.07x10 ⁻⁶	2.49x10 ⁻⁷	5.85x10 ⁻⁷	1.41x10 ⁻⁵
	%	46%	5.2%	43%	1.8%	4.1%	100%
Abiotic depletion, fossil fuels	MJ	128	12.0	55.3	2.08	5.41	203
	%	63%	5.9%	27%	1%	2.7%	100%
Abiotic depletion	kg Sb eq	54.5	12.9	26.8	3.90	2.34	100
	%	54%	13%	27%	3.9%	2.3%	100%

SUPPORTING TECHNICAL INFORMATION

Unit processes are developed using OpenLCA v1.11 software. The primary sources of secondary LCI data are from Ecoinvent.

Table 8. LCI datasets and associated databases used to model the VICOSTONE® Quartz Surfaces product system.

Flow	Dataset	Data Source	Publication Date
Product Materials			
Quartz	silica sand production silica sand Cutoff, S/RoW	Ecoinvent v3.8	2021
Polyester resin	polyester resin production, unsaturated polyester resin, unsaturated Cutoff, S/RoW	Ecoinvent v3.8	2021
Styrene	styrene production styrene Cutoff, S/RoW	Ecoinvent v3.8	2021
Pigment	market for titanium dioxide titanium dioxide Cutoff, S/RoW; carbon black production carbon black Cutoff, S/GLO	Ecoinvent v3.8	2021
Additives	chemical production, organic chemical, organic Cutoff, S/GLO	Ecoinvent v3.8	2021
Electricity/Heat/Resources for Manufacturing			
Electricity	market for electricity, medium voltage electricity, medium voltage Cutoff, S/VN	Ecoinvent v3.8	2021
Natural Gas	heat production, natural gas, at industrial furnace >100kW heat, district or industrial, natural gas Cutoff, S/RoW	Ecoinvent v3.8	2021
Diesel	diesel, burned in building machine diesel, burned in building machine Cutoff, S/GLO	Ecoinvent v3.8	2021
Fabrication			
Adhesive	methyl methacrylate production methyl methacrylate Cutoff, S/RoW	Ecoinvent v3.8	2021
Electricity	market group for electricity, medium voltage electricity, medium voltage Cutoff, S/US	Ecoinvent v3.8	2021
Transportation			
Road	transport, freight, lorry 16-32 metric ton, EURO4 transport, freight, lorry 16-32 metric ton, EURO4 Cutoff, S/RoW	Ecoinvent v3.8	2021
Ship	transport, freight, sea, container ship transport, freight, sea, container ship Cutoff, S/GLO	Ecoinvent v3.8	2021
Water	Tap water {RoW} market for Alloc Rec, U	Ecoinvent v3.8	2016

Data Quality

Data Quality Parameter	Data Quality Discussion
Time-Related Coverage: Age of data and the minimum length of time over which data is collected	The most recent available data are used, based on other considerations such as data quality and similarity to the actual operations. Typically, these data are less than 5 years old (typically 2016). All of the data used represented an average of at least one year's worth of data collection, and up to three years in some cases. Manufacturer-supplied data (primary data) are based on annualized production for 2021.
Geographical Coverage: Geographical area from which data for unit processes is collected to satisfy the goal of the study	The data used in the analysis provide the best possible representation available with current data. Electricity use for product manufacture is modeled using representative data for regional power mixes from the Ecoinvent database. Surrogate data used in the assessment are representative of global or North American operations. Data representative of global operations are considered sufficiently similar to actual processes. Data representing product disposal are based on US statistics.
Technology Coverage: Specific technology or technology mix	For the most part, data are representative of the actual technologies used for processing, transportation, and manufacturing operations. Representative datasets, specific to the type of material, are used to represent the actual processes, as appropriate.
Precision: Measure of the variability of the data values for each data expressed	Precision of results are not quantified due to a lack of data. Data collected for operations were typically averaged for one or more years and over multiple operations, which is expected to reduce the variability of results.
Completeness: Percentage of flow that is measured or estimated	The LCA model included all known mass and energy flows for production of the products. In some instances, surrogate data used to represent upstream and downstream operations may be missing some data which is propagated in the model. No known processes or activities contributing to more than 1% of the total environmental impact for each indicator are excluded.
Representativeness: Qualitative assessment of the degree to which the data set reflects the true population of interest	Data used in the assessment represent typical or average processes as currently reported from multiple data sources and are therefore generally representative of the range of actual processes and technologies for production of these materials. Considerable deviation may exist among actual processes on a site-specific basis; however, such a determination would require detailed data collection throughout the supply chain back to resource extraction.
Consistency: Qualitative assessment of whether the study methodology is applied uniformly to the various components of the analysis	The consistency of the assessment is considered to be high. Data sources of similar quality and age are used; with a bias towards Ecoinvent v3.8 data where available. Different portions of the product life cycle are equally considered.
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	Based on the description of data and assumptions used, this assessment would be reproducible by other practitioners. All assumptions, models, and data sources are documented.
Sources of the Data: Description of all primary and secondary data sources	For the manufacturing of VICOSTONE Quartz Surfaces, primary data were provided by Vicostone. Similarly, the upstream transport of materials used for manufacturing is based on data provided by Vicostone. The fabrication process is derived from a fabrication manual provided by Vicostone and commercial sources for equipment used to derive key parameters for calculations. For the distribution of product from manufacturing facility to distribution center, a weighted average was calculated based on distribution center locations and the percent of annual shipments each received, provided by Vicostone, while modes and distances for this leg of transportation were estimated using the online calculator provided by SeaRates. The transport of VICOSTONE Quartz Surfaces from distribution center to fabrication facility and from fabrication facility to installation are based on the RITA transport survey. For secondary LCI data, Ecoinvent v3.8 LCI data are used.
Uncertainty of the Information: Uncertainty related to data, models, and assumptions	Uncertainty related to materials in the products and packaging is low. Actual supplier data for all upstream operations were not available and the study relied upon the use of existing representative datasets. These datasets contained relatively recent data (<10 years) but lacked geographical representativeness. Uncertainty related to the impact assessment methods used in the study are high. The impact assessment method required by the PCR includes impact potentials, which lack characterization of providing and receiving environments or tipping points.

Allocation

Resource use at the Vicostone facility in Hoalac Hi-tech Park, Thachthat, Hanoi, Vietnam was allocated to the product based on the product weight as a fraction of the total facility production. Impacts from transportation were allocated based on the mass of material and distance transported.

System boundaries

The system boundary of the life cycle assessment for the countertop was cradle-to-grave.

Elements excluded from the system boundary include the following:

- Construction activities, capital equipment, and infrastructure;
- Maintenance and operation of equipment;
- Personnel travel and resource use;
- Forklifts, storage frames, clamps, templating materials, and other reusable tools for fabrication;
- A-frames and strapping for shipping from manufacturing facility to distribution center;
- Ancillary and labeling materials used in manufacturing; and
- Repair of the countertops.

The deletion of these processes and inputs is permitted since it is not expected to significantly change the overall conclusions of the study and complies with the cut-off criteria requirements specified by the PCR.

A description of the system boundaries for this EPD are as follows:

- **Material acquisition and pre-processing stage** – The material acquisition, pre-processing, and intermediate processing stage starts when the material is extracted from nature, processed and refined, and ends when the material reaches the gate of the manufacturing facility (construction stage). Transportation within and between all processing is included. Waste and scrap created during this stage are included.
- **Construction stage** – The construction stage starts with the product material components entering the manufacturing facility and ends with the final countertop leaving the fabrication shop. Processes include manufacturing of quartz surface slab and fabrication into countertop in preparation for installation. Transportation of Quartz Surfaces slab between facilities is included (e.g., from the Vicostone manufacturing facility to distribution center, and from distribution center to fabrication shop). Waste and scrap generation are included. Countertops are generally delivered by truck using reusable cart equipment and padding to protect the faces (i.e., blankets, carpet); therefore, packaging of the final product is not included.
- **Installation stage** – The installation stage includes the delivery of the countertop to the point of installation, and energy and ancillary materials used during installation. Waste generated during countertop installation is negligible. Sinks, plumbing fixtures, and cook tops are excluded.
- **Use stage** – The use stage includes the cleaning of the countertop during its lifetime, as well as extraction, manufacturing and transport of all sundry material for cleaning. In accordance with the PCR, maintenance and repair of the countertop is generally insignificant and is excluded from this stage. The reference service life for the countertop in this EPD is 10 years.
- **End of life stage** – The end-of-life stage begins when the used product is ready for disposal and ends when the product is landfilled. Transportation for disposal is included.

Cut-off criteria

According to the PCR, cumulative omitted mass or energy flows shall not exceed 5% and mass or energy flows that contribute more than 10% to an impact category shall be included. In the present study, except as noted, all known materials and processes were included in the life cycle inventory.



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