ENVIRONMENTAL PRODUCT DECLARATION

Vapor-Lock – PU Adhesives

Certified Environmental Product Declaration
www.nsf.org

Program Operator	NSF Certification LLC 789 N. Dixboro, Ann Arbor, MI 48105 www.nsf.org
Manufacturer Name and Address	Bostik, Inc. Conyers Georgia Plant, 150 Parker Road, Conyers, GA 30094
Declaration Number	EPD10970
Declared Product and Functional Unit	Vapor-Lock manufactured at Conyers, GA 1 kg of Dispersion adhesives and primers for floor coverings
Reference PCR and Version Number	Core PCR: ISO 21930: Sustainability in buildings and civil engineering works - Core rules for environmental product declarations of construction products and services (ISO, 2017) Note - In the absence of an applicable product category PCR, this EPD was informed by the expired PCR: Part B: Requirements on the EPD for Dispersion adhesives and primers for floor coverings (IBU V1.7, 2019)
Product's intended Application and Use	Flooring and Wall Applications
Product RSL	N/A
Markets of Applicability	North America
Date of Issue	07/05/2024
Period of Validity	5 years from date of issue
EPD Type	Product Specific
Range of Dataset Variability	N/A
EPD Scope	Cradle to Gate with Options (A1-A5, C1-C4)
Year of reported manufacturer primary data	2019
LCA Software and Version Number	LCA for Experts (formerly known as GaBi) 10.6.1.265
LCI Database and Version Number	LCA for Experts (formerly known as GaBi) Database V2022.1
LCIA Methodology and Version Number	TRACI 2.1 IPCC AR6
The sub-category PCR review was conducted by:	No subcategory PCR is available. ISO 21930 serves as the core PCR for this EPD.

This declaration was independently verified in accordance with ISO 14025: 2006 and ISO 21930:2017 which serves as the core PCR: **☐ Internal ☒ External**	Jack Geibig - EcoForm jgeibig@ecoform.com
This life cycle assessment was conducted in accordance with ISO 14044 and the reference PCR by:	WAP Sustainability Consulting
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:	Jack Geibig - EcoForm jgeibig@ecoform.com

Limitations:
Environmental declarations from different programs (ISO 14025) may not be comparable.
EPDs are comparable only if they comply with ISO 21930:2017, include all relevant information modules and are based on equivalent scenarios with respect to the context of construction works.

Description of Company

Bostik is a world-class leader in sealing and bonding technologies. We create smart adhesive solutions for both industries and consumers, covering a broad range of markets such as construction, packaging, automotive, high tech, hygiene products, etc. The adhesive division of the Arkema Group, a specialty materials leader, Bostik benefits from unique research & development capabilities to help build a world that is safer, more sustainable, and adaptive. With over 2 billion USD annual sales and over 6,000 people, Bostik is present in more than 50 countries.

Product Definition and Characteristics

Bostik's Vapor-Lock™ is a high-performance adhesive, moisture control, and sound reduction membrane all in one. Its superior properties provide a tough, flexible, tenacious bond to a variety of surfaces, and it is not adversely affected by exposure to moisture, water, or alkalinity. Vapor-Lock™ exhibits exceptional green grab or high tack immediately after troweling, making installation easier and more secure. This adhesive contains 1% recycled rubber material, has 0 VOC's (as calculated per SCAQMD Rule 1168) and does NOT contain any water. Vapor-Lock™ contains Bostik's BLOCKADE™ antimicrobial protection, which inhibits the growth of bacteria, mold, or mildew on the surface of the cured adhesive. No substances required to be reported as hazardous are associated with the production of this product.

Product Classification and Description

Table 1: Technical Data

Vapor-Lock™	
Color	Brown with black specks
Odor	Mild
Density (lbs/gallon)	14.7
Shelf Life	12 months
Percentage of Water*	0%
Application Temperature	50˚F to 100˚F (10˚C to 38˚C)

***Per ASTM E203-01 Standard Test Method for water using Volumetric Karl Fischer Titration Method. Results rounded to the nearest tenth. Test Method has error range of +/_ 0.2%.**

Life Cycle Stages

Product Stage

Raw material manufacturing

Typical product composition provided by Bostik is summarized in Table 2.

Table 2: Product Composition

Ingredient Category	% of product by mass
Limestone	58.6%
Sulfonic acids, C10-18-alkane, phenyl esters	3.63%
Carbon black	0.62%
Polypropylene glycol	16.3%
Hydrocarbons, C9-unsaturated, polymerized	5.87%
1,2-Benzenedicarboxylic acid, di-C9-11-branched alkyl esters, C10-rich	3.63%
4,4'-Methylenediphenyl diisocyanate	5.47%
Propylene carbonate	2.41%
Other additives	3.46%

***This product contains no regulated substances.**

Transportation of raw materials to plants

The distances were modeled by materials and calculated using a supplier location and location of manufacturing. For materials where supplier data was not provided, a default distance of 250 miles was used per PCR default scenarios.

Adhesive manufacturing

The manufacturing process primarily consists of mixing and dispersing raw materials into a homogenous mixture. After that the product is packaged in pails and transported to the customer. A 5% manufacturing waste is assumed, however, all process waste generated is recycled back into the manufacturing process.

Transportation

In this stage, the product is transported from the manufacturing site to the distributor, and finally to the application site. The product is delivered to the customer via truck. Since granular sales records were not available, a default distance of 500 km for transport from factory gate to job site was used in the study.

Production Installation

Adhesive products featured in this study are ready-to-use products. Once the surface is clean and prepped product is poured directly on the surface and distributed using hand tools such as rollers, brooms, and finishing trowels. Optimal performance can be achieved when the product is installed in accordance with manufacturer guidelines provided on https://www.bostik.com/us/en_US/. Packaging and installation waste disposal (5%) have been modeled as per appropriate US EPA disposal pathways.

Use

No use phase has been declared for the adhesive and sealant products since the anticipated reference service life depends on the specific installation situation and exposure associated with the products. It can be influenced by weather factors as well as by mechanical or chemical loads.

Disposal

Adhesives are applied and cured. They cannot be separated into their constituent components to be recycling/ reused. Therefore, they are disposed to landfill (100%) with what it is attached to, based on US average construction waste disposal scenarios. Distance to end-of-life facilities is assumed to be 100 km.

Life Cycle Assessment Methodology

This EPD was developed to meet the requirements of ISO 21930 (2017) which was used as the core PCR. Given the absence of a specific product category PCR for sealants, elements of this study were informed by the expired PCR Part B: Requirements on the EPD for Dispersion adhesives and primers for floor coverings (IBU V1.7, 2019). Specifically, the declared unit, system boundaries, and other elements were chosen in alignment with these requirements.

Declared Unit

The declared unit according to the PCR is 1 kg of adhesive. This product requires no accessories to meet the requirements of the functional unit.

Table 3: Mass per declared unit

	Vapor-Lock
Mass per declared unit [kg]	1
Productiveness [kg/m^2]	0.87-1.99

System Boundary

This LCA is a Cradle-to-Gate with Options (A1-A5, C1-C4) study. An overview of the system boundary is shown in **Error! Reference source not found.**.

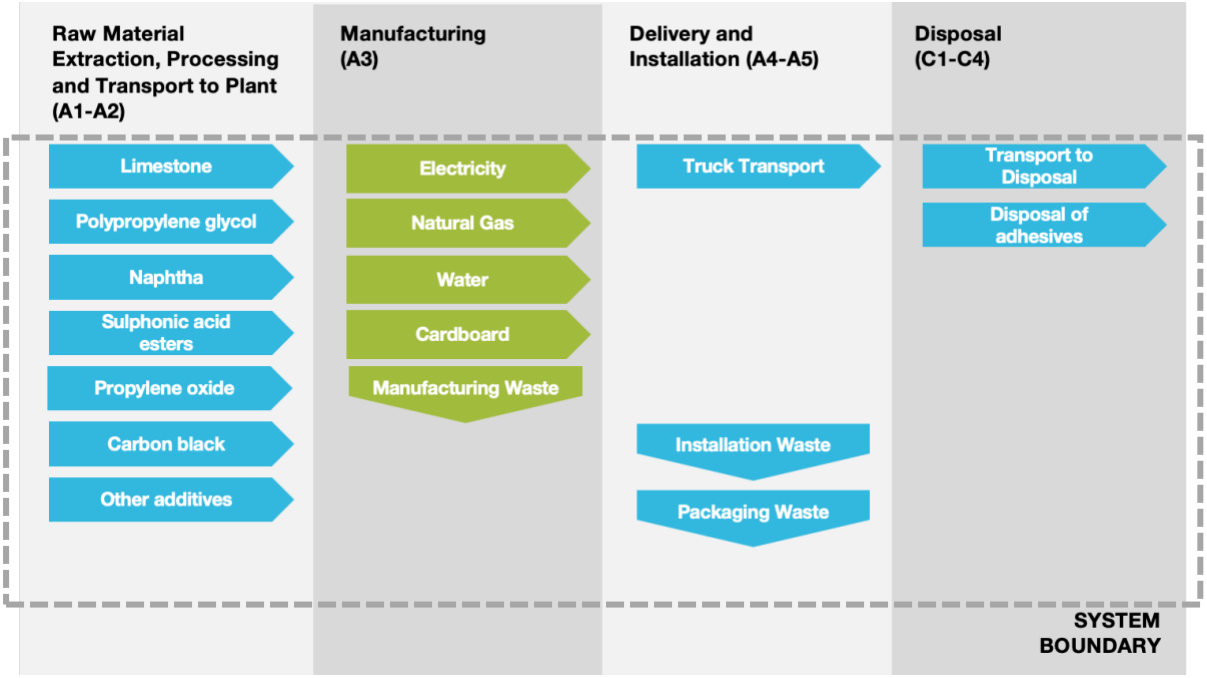

Figure 1: System Boundary

Estimates and Assumptions

All estimates and assumptions are within the requirements of ISO 14040/44. The majority of the estimations are within the primary data. The primary data was collected as annual totals including all utility usage and production information. For the LCA, the usage information was divided by the production volume to create an energy use per declared unit. Other assumptions are listed below:

- Availability of geographically more accurate datasets would have improved the accuracy of the study.
- Only known and quantifiable environmental impacts are considered.
- Due to the assumptions and value choices listed above, these do not reflect real-life scenarios and hence they cannot assess actual and exact impacts, but only potential environmental impacts.

Cut-off Criteria

Material inputs greater than 1% (based on total mass of the final product) were included within the scope of analysis. In cases of insufficient input data or data gaps for a unit process, the cut-off criteria is 1% of energy usage, 1% of total mass input of the unit process and 1% of environmental impacts as stated in ISO 21930. Cumulative excluded material inputs and environmental impacts are less than 5% based on total weight of the declared unit.

The list of excluded materials and energy inputs include:

- Some minor additives have been excluded (2.8%). The exclusion of these materials has no major impacts on the overall results. However, to account for this difference, the inputs were scaled up to fill in the missing additives to total the composition to 100%.
- As the tools used during the installation of the product are multi-use tools and can be reused after each installation, the per-declared unit impacts are considered negligible and therefore are not included.
- Some material inputs may have been excluded within the LCA for Experts (formerly known as GaBi) datasets used for this project. All LCA for Experts (formerly known as GaBi) datasets have been critically reviewed and conform to the exclusion requirement of ISO 21930.

There are no substances with hazardous and toxic properties that can be of concern for human health and/ or the environment in the products included in this study.

Data Sources

Primary data was collected by facility personnel and from utility bills and was used for all manufacturing processes. Whenever available, supplier data was used for raw materials used in the production processes. When primary data did not exist, secondary data for raw material production was utilized from LCA for Experts (formerly known as GaBi) Version 10.6.1.35, Database V2021.2.

Data Quality Assessment

The overall data quality is considered very good.

Geographical Coverage

The geographical scope of the manufacturing portion of the life cycle is Conyers, GA. All primary data were collected from the manufacturer. The geographic coverage of primary data is considered excellent.

The geographical scope of the raw material acquisition is the United States. Customer distribution, site installation, and use portions of the life cycle is mostly the United States.

In selecting secondary data (i.e. LCA for Experts (formerly known as GaBi) Datasets), priority was given to the accuracy and representativeness of the data. When available and deemed of significant quality, country-specific data were used. However, priority was given to technological relevance and accuracy in selecting secondary data. This often led to the substitution of regional and/or global data for country-specific data. Overall geographic data quality is considered good.

Time Coverage

Primary data were provided by the manufacturer and represent all information for calendar year 2019. The project commenced in 2021. Due to deviation from business-as-usual manufacturing in 2020, attributed to the COVID-19 pandemic, utility data from 2019 were used. Using these data meets the PCR requirements. Time coverage of these primary data is considered good.

Data necessary to model cradle-to-gate unit processes were sourced from Sphera LCA for Experts (formerly known as GaBi) LCI datasets. Time coverage of the LCA for Experts (formerly known as GaBi) datasets varies from approximately 2010 to present. All datasets rely on at least one 1-year average data. Overall time coverage of the datasets is considered good and meets the requirement of the PCR that all data be updated within a 10- year period.

Technological Coverage

Primary data provided by the manufacturer is specific to the technology the company uses in manufacturing their product. It is site-specific and considered of good quality. It is worth noting that the energy used in manufacturing the product includes overhead energy such as lighting, heating, and sanitary use of water. Sub-metering was not available to extract process-only energy use from the total energy use. Sub-metering would improve the technological coverage of data quality.

Data necessary to model cradle-to-gate unit processes was sourced from LCA for Experts (formerly known as GaBi) LCI datasets. Technological coverage of the datasets is considered good relative to the actual supply chain of the manufacturer. While improved life cycle data from suppliers would improve technological coverage, the use of lower-quality generic datasets does meet the goal of this LCA.

Completeness

The data included is considered complete. No known flows above 1% were excluded and the sum of all excluded flows totals less than 5%.

Period under Review

The period under review is calendar year 2019.

Allocation

General principles of allocation were based on ISO 14040/44. There are no products other than the product under study that are produced as part of the manufacturing processes. Since there are no co-products, no allocation based on co-products is required. To derive per-unit values for manufacturing inputs, allocation based on total production by mass was adopted.

Comparability

This study was not completed with the intent that comparative assertion with external objects or public disclosures (i.e., comparative marketing claims) would be made.

Life Cycle Assessment Scenarios

Table 4: Transport to the building site (A4)

Name	Value	Unit
Fuel Type	Diesel	-
Fuel Efficiency	44.7	L/100km
Vehicle Type	US: Truck-Heavy Heavy-duty Diesel Truck / 53,333 lb payload	-
Transportation Distance	500	km
Capacity utilization	67	%
Weight of products transported	1.05	kg
Capacity utilization volume factor	1	1

Table 5: Installation into the building (A5)

Name	Value	Unit
Product wastage [%]	5	%
Waste materials at the construction site before waste processing, generated by product installation [kg]	0.16	kg
Pulp waste to incineration [kg]	0.0013	kg
Pulp waste to landfill [kg]	0.005	kg
Pulp waste to recycling [kg]	0.020	kg
Metal waste to incineration [kg]	0.01	kg
Metal waste to landfill [kg]	0.02	kg
Metal waste to recycling [kg]	0.04	kg
Biogenic Carbon in cardboard packaging [kg CO2e]	-	kg CO_2e
Biogenic Carbon in paper packaging [kg CO2e]	0.0022	kg CO_2e
Biogenic Carbon in wooden pallet [kg CO2e]	0.0406	kg CO_2e

Table 6: End of life (C1-C4)

Name		Value	Unit
Assumptions for scenario development		-	-
Collection process (specified by type)	Collected separately	-	kg
	Collected with mixed construction waste	1	kg
Recovery (specified by type)	Reuse	-	kg
	Recycling	-	kg
	Landfill	1	kg
	Incineration	-	kg
	Incineration with energy recovery	-	kg
	Energy conversation efficiency rate	-	-
Disposal (specified by type)	Product of material for final deposition	1	kg
Removals of biogenic carbon (excluding packaging)		-	kg CO_2

Life Cycle Assessment Results

Table 7: Description of the system boundary modules

	PRODUCT STAGE			CONSTRUCT-ION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				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 supply	Transport	Manufacturing	Transport from gate to site	Assembly/Install	Use	Maintenance	Repair	Replacement	Refurbishment	Building Operational Energy Use During	Building Operational Water Use During	Deconstruction	Transport	Waste processing	Disposal	Reuse, Recovery, Recycling Potential
Cradle to Gate with Options	X	X	X	X	X	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	ND

Note: Comparisons cannot be made between product-specific or industry average EPDs at the design stage of a project, before a building has been specified. Comparisons may be made between product-specific or industry average EPDs at the time of product purchase when product performance and specifications have been established and serve as a functional unit for comparison. Environmental impact results shall be converted to a functional unit basis before any comparison is attempted. Any comparison of EPDs shall be subject to the requirements of ISO 21930. EPDs are not comparative assertions and are either not comparable or have limited comparability when they have different system boundaries, are based on different product category rules or are missing relevant environmental impacts. Such comparison can be inaccurate and could lead to erroneous selection of materials or products which are higher impact, at least in some impact categories

Life Cycle Impact Assessment Results

Table 8: North American Impact Assessment Results

Impact Category	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
TRACI LCIA Impacts (North America), CML and IPCC AR6									
AP [kg SO_2 eq]	3.67E-03	2.04E-04	2.35E-04	ND	0.00E+00	2.26E-05	0.00E+00	3.67E-04	ND
EP [kg N eq]	3.02E-04	1.82E-05	3.36E-05	ND	0.00E+00	2.38E-06	0.00E+00	2.76E-04	ND
GWP [kg CO_2 eq]	1.59E+00	4.41E-02	9.47E-02	ND	0.00E+00	8.04E-03	0.00E+00	8.52E-02	ND
ODP [kg CFC 11 eq]	7.06E-14	8.30E-17	3.74E-15	ND	0.00E+00	1.52E-17	0.00E+00	2.70E-15	ND
ADP-fossil fuel [MJ] (CML)	2.28E+01	5.15E-01	1.24E+00	ND	0.00E+00	9.40E-02	0.00E+00	9.84E-01	ND
SFP [kg O_3 eq]	5.82E-02	4.71E-03	3.70E-03	ND	0.00E+00	5.16E-04	0.00E+00	6.45E-03	ND
IPCC AR5 GWP [kg CO_2 eq]	3.67E-03	2.04E-04	2.35E-04	ND	0.00E+00	2.26E-05	0.00E+00	3.67E-04	ND
Carbon Emissions and Uptake									
BCRP [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND
BCEP [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND
BCRK [kg CO_2]	4.74E-02	0.00E+00	2.37E-03	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND
BCEK [kg CO_2]	0.00E+00	0.00E+00	4.98E-02	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND
BCEW [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND
CCE [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND
CCR [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND
CWNR [kg CO_2]	0.00E+00	0.00E+00	0.00E+00	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND

Life Cycle Inventory Results

Table 9: Resource use, waste, and output flow results

Impact Category	A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Resource Use Indicators									
RPR_E [MJ]	2.45E+00	2.40E-02	1.33E-01	ND	0.00E+00	4.39E-03	0.00E+00	1.20E-01	ND
RPR_M [MJ]	5.00E-01	0.00E+00	2.50E-02	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND
RPR_T [MJ]	2.94E+00	2.40E-02	1.58E-01	ND	0.00E+00	4.39E-03	0.00E+00	1.20E-01	ND
$NRPR_E$ [MJ]	3.02E+01	6.18E-01	1.65E+00	ND	0.00E+00	1.13E-01	0.00E+00	1.28E+00	ND
$NRPR_M$ [MJ]	5.67E+00	0.00E+00	2.84E-01	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND
$NRPR_T$ [MJ]	3.59E+01	6.18E-01	1.93E+00	ND	0.00E+00	1.13E-01	0.00E+00	1.28E+00	ND
SM [kg]	5.00E-02	0.00E+00	2.50E-03	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND
RSF [MJ]	0.00E+00	0.00E+00	0.00E+00	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND
NRSF [MJ]	0.00E+00	0.00E+00	0.00E+00	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND
RE [MJ]	0.00E+00	0.00E+00	0.00E+00	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND
FW [m^3]	9.30E-03	8.64E-05	4.99E-04	ND	0.00E+00	1.58E-05	0.00E+00	1.84E-04	ND
Output Flows and Waste Categories									
HWD [kg]	2.35E-09	2.57E-12	1.21E-10	ND	0.00E+00	4.69E-13	0.00E+00	4.82E-11	ND
NHWD [kg]	6.15E-02	5.31E-05	1.32E-01	ND	0.00E+00	9.70E-06	0.00E+00	2.00E+00	ND
HLRW [kg]	6.87E-07	2.03E-09	3.60E-08	ND	0.00E+00	3.71E-10	0.00E+00	1.28E-08	ND
ILLRW [kg]	5.82E-04	1.71E-06	3.05E-05	ND	0.00E+00	3.12E-07	0.00E+00	1.13E-05	ND
CRU [kg]	0.00E+00	0.00E+00	0.00E+00	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND
MR [kg]	6.00E-04	0.00E+00	5.90E-02	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND
MER [kg]	0.00E+00	0.00E+00	1.26E-03	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND
EEE [MJ]	0.00E+00	0.00E+00	0.00E+00	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND
EET [MJ]	0.00E+00	0.00E+00	0.00E+00	ND	0.00E+00	0.00E+00	0.00E+00	0.00E+00	ND

LCA Interpretation

Overall, the dominance analysis shows that the vast majority of the impacts for all products are in the aggregated A1-A3 phase. A1-A3 includes raw material sourcing, transportation, and manufacturing. Following the A1-A3 phase in magnitude is the C1-C4 phase which includes final transport and disposal of the product.
For VaporLock, in the sourcing and extraction stage, the largest contributors to the impacts in terms of raw materials are polymers (71%) and plasticizer (17%). Within manufacturing, packaging contributes to 16%, electricity contributes to 0.7% of overall GWP impacts while thermal energy from natural gas contributes to 0.7%.
Shipping to customer contributes around 2.3% of total GWP impacts, while installation contributes around 0.5% of GWP impacts. Finally, disposal of the product to landfill contributes 14.6% to total GWP impacts.

Additional Environmental Information

Vapor-Lock has a Health Product Declaration (HPD) which can be found at https://www.hpd-collaborative.org/hpd-public-repository/.

Vapor-Lock has VOC Emission compliance testing for the following standards and codes:

- USGBC LEED Version 4/4.1, BD&C, ID&C, Residential BD&C Multifamily
- The WELL Building Standard, WELL v2, Feature X06
- ANSI/GBI 01-2019 Green Globes Assessment Protocol

These products also have FloorScore certificates that can be found here: https://www.scsglobalservices.com/certified-green-products-guide?q=bostik&program=301.

More information on Bostik's products can be found on their website.

Supporting Documentation

The full text of the acronyms are found in Table 10.

Table 10: Acronym Key

Acronym	Text	Acronym	Text
		LCA Indicators	
ADP-elements	Abiotic depletion potential for non-fossil resources	**GWP**	Global warming potential
ADP-fossil	Abiotic depletion potential for fossil resources	**OPD**	Depletion of stratospheric ozone layer
AP	Acidification potential of soil and water	**POCP**	Photochemical ozone creation potential
EP	Eutrophication potential	**Resources**	Depletion of non-renewable fossil fuels
		LCI Indicators	
RPR_E	Use of renewable primary energy excluding renewable primary energy resources used as raw materials	**RPR_M**	Use of renewable primary energy resources used as raw materials
$NRPR_E$	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	**$NRPR_M$**	Use of non-renewable primary energy resources used as raw materials
SM	Use of secondary materials	**FW**	Net use of fresh water
RSF	Use of renewable secondary fuels	**NRSF**	Use of non-renewable secondary fuels
HWD	Disposed-of-hazardous waste	**MR**	Materials for recycling
NHWD	Disposed-of non-hazardous waste	**MER**	Materials for energy recovery
HLRW	High-level radioactive waste, conditioned, to final repository	**ILLRW**	Intermediate- and low-level radioactive waste, conditioned, to final repository
CRU	Components for reuse	**EE**	Exported energy
RE	Recovered Energy		
		Biogenic Carbon Indicators	
BCRP	Biogenic Carbon Removal from Product	**BCEW**	Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes
BCEP	Biogenic Carbon Emission from Product	**CCE**	Calcination Carbon Emissions
BCRK	Biogenic Carbon Removal from Packaging	**CCR**	Carbonation Carbon Removals
BCEK	Biogenic Carbon Emission from Packaging	**CWNR**	Carbon Emissions from Combustion of Waste from Non- Renewable Sources used in Production Processes

References

ISO. (2006). ISO 14040/Amd 1:2020: Environmental management - Life cycle assessment - Principles and framework. Geneva: International Organization for Standardization.

ISO. (2006). ISO 14044/Amd 1:2017/Amd 2:2020: Environmental Management - Life cycle assessment - Requirements and Guidelines. Geneva: International Organization for Standardization.

IBU. (2019). Part B: Requirements on the EPD for Dispersion adhesives and primers for floor coverings. IBU.

IPCC. (2013). Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press.

IPCC. (2021). Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press. In Press.

ISO. (2006). ISO 14044/Amd 1:2017/Amd 2:2020: Environmental Management - Life cycle assessment - Requirements and Guidelines. Geneva: International Organization for Standardization.

ISO. (2017). ISO 21930: Sustainability in buildings and civil engineering works - Core rules for environmental product declarations of construction products and services. Geneva: International Organization for Standardization.