

A large, modern office building with a prominent glass facade and concrete accents, set against a blue sky with light clouds. The building is surrounded by greenery and a paved area.

ENVIRONMENTAL **PRODUCT DECLARATION**


PERM-A-BARRIER®

(PAB) AIR BARRIER SYSTEM

- PERM-A-BARRIER® (PAB) NPL 10
- PERM-A-BARRIER® (PAB) NPL 10LT
- PERM-A-BARRIER® (PAB) NPS
- PERM-A-BARRIER® (PAB) VPL
- PERM-A-BARRIER® (PAB) VPL 50RS UV Stable
- PERM-A-BARRIER® (PAB) VPL LT
- PERM-A-BARRIER® (PAB) VPS 30

GCP is a leading global provider of construction products that include high-performance specialty construction chemicals and building materials.



Program Operator	NSF Certification LLC 789 N. Dixboro, Ann Arbor, MI 48105 www.nsf.org	 
General Program Instructions	NSF Program Operator Rules, February 2015	
Manufacturer Name and Address	GCP Applied Technologies Inc. 2325 Lakeview Parkway Alpharetta GA 30009 USA	
Declaration Number	EPD10786	
Declared Product and Functional Unit	PERM-A-BARRIER® NPL 10, PERM-A-BARRIER® NPL 10LT, PERM-A-BARRIER® NPS, PERM-A-BARRIER® VPL, PERM-A-BARRIER® VPL 50RS UV Stable, PERM-A-BARRIER® VPL LT, PERM-A-BARRIER® VPS 30 Functional Unit: 1 m ² of product	
Reference PCR and Version Number	ASTM International Water-Resistive and Air Barriers	
Product's Intended Application and Use	Air Barrier Membranes	
Product RSL	Not Applicable	
Markets of Applicability	North America	
Date of Issue	September 26, 2022	
Period of Validity	5 years from date of issue	
EPD Type	Product Specific	
Intended Audience	Business-to-Business	
Range of Dataset Variability	N/A	
EPD Scope	Cradle to Gate	
Year of reported manufacturer primary data	2020	
LCA Software and Version Number	GaBi 10.6.1.35	

LCI Database and Version Number

GaBi Database 2022.1

LCIA Methodology and Version Number

TRACI 2.1

The PCR Review was Conducted By:Thomas Gloria, PhD (chair)
Graham Finch
Paul H. Shipp

This declaration was independently verified in accordance with ISO 14025:2006. ISO 21930:2017 serves as the core PCR along with EN 15804 (2012) and UL PCR Part A, v3.1 (2018), with additional considerations from the UL PCR Part B: Insulated Metal Panels Metal Composite Panels and Metal Cladding - Roof and Wall Panels.

 Internal ExternalJack Geibig
jgeibig@ecoform.com**This Reference Life Cycle Assessment was Conducted in Accordance with ISO 14044 and the Reference PCRs By:**

WAP Sustainability Consulting

This Life Cycle Assessment was Independently Verified in Accordance with ISO 14044 and the Reference PCR By:Jack Geibig
jgeibig@ecoform.com**Limitations:**

Environmental declarations from different programs (ISO 14025) may not be comparable. Comparison of the environmental performance of Products 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 as instructed under this PCR. Full conformance with the PCR for Products allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible". Example of variations: Different LCA software and background LCI datasets may lead to differences results for upstream or downstream of the life cycle stages declared. As this EPD is based on a declared unit, the results cannot be used to compare between products.

1

Product Definition and Information

1.1 DESCRIPTION OF COMPANY

GCP is a leading global provider of construction products that include high-performance specialty construction chemicals and building materials. GCP partners with producers, contractors, designers, and engineers to achieve performance and sustainability goals. The company has a legacy of first to market and award-winning solutions that have been used to build some of the world's most renowned structures. GCP is focused on continuous improvement for its customers, end-users, and the environment.

1.2 PRODUCT DESCRIPTION

The PERM-A-BARRIER® portfolio provides watertight, airtight air barrier systems and full field technical support for flexibility and high-performance compatibility with a project's building envelope design. GCP offer a broad product range for any wall design or design requirement. GCP air barrier membranes and accessories are designed to work together and are rigorously tested to meet building code requirements. The end result is a truly optimized wall design that's sustainable over time.

PERM-A-BARRIER® NPL 10/NPL 10LT

PERM-A-BARRIER® NPL 10/NPL 10 LT is a fluid applied, one component, latex-based membrane that cures to form a resilient, monolithic, fully-bonded elastomeric sheet when applied to construction surfaces. Designed to satisfy the requirements of fire-rated assemblies, PERM-A-BARRIER® NPL 10/NPL 10 LT can be included in a wide variety of NFPA 285 compliant wall designs.

PERM-A-BARRIER® NPL 10/NPL 10 LT membrane is vapor impermeable and provides superior protection against the damaging effects of air and liquid water ingress on building structures. The product creates a solid barrier against air infiltration and exfiltration which minimizes energy loss from the structure and associated moisture related issues. Also impermeable to liquid water, PERM-A-BARRIER® NPL 10/NPL 10 LT acts as a water drainage plane.

PERM-A-BARRIER® VPL

PERM-A-BARRIER® VPL is a fluid applied, one component, acrylic membrane that cures to form a resilient, monolithic, fully bonded elastomeric sheet when applied to construction surfaces. For application at temperatures between 20 °F (-7 °C) and rising to 60 °F (16 °C). PERM-A-BARRIER® VPL membrane provides superior protection against the damaging effects of air and liquid water ingress on building structures. The product creates a solid barrier against air



infiltration and exfiltration, which minimizes associated energy loss and condensation problems. PERM-A-BARRIER® VPL membrane is vapor permeable for wall assemblies requiring this “breathable” characteristic. As a vapor permeable membrane, it permits the transfusion of water vapor that may otherwise condense in the wall structure; but is impermeable to liquid water, which allows the material to act as a water drainage plain.

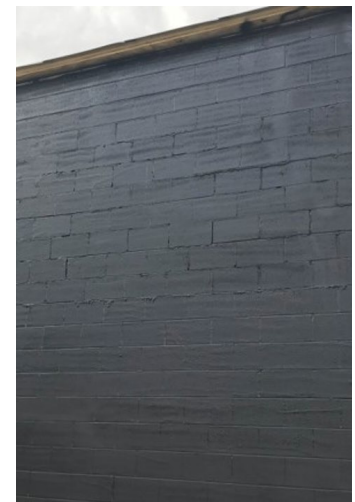
PERM-A-BARRIER® NPS

PERM-A-BARRIER® NPS (Non Permeable Sheet) Wall Membranes are ideal for protecting the building superstructure from the damaging effects of the elements. By minimizing air and water vapor flow through the building exterior, PERM-A-BARRIER® NPS Wall Membranes prevent premature deterioration of the building envelope, enhance thermal performance of the structure and save energy costs, and improve comfort for the building occupants.

PERM-A-BARRIER® VPL 50RS UV Stable

PERM-A-BARRIER® VPL 50RS UV Stable Membrane is a fluid applied, one component, STPE (Silyl Terminated Polyether) vapor permeable air and water barrier. When applied to approved construction surfaces, PERM-A-BARRIER® VPL 50RS UV Stable liquid is designed to cure and form a resilient, monolithic, fully bonded elastomeric sheet, and to create a continuous barrier against air infiltration and exfiltration, reducing associated energy loss and condensation problems.

PERM-A-BARRIER® VP 50RS UV Stable Membrane is specifically designed to provide superior protection against the damaging effects of air and liquid water ingress on the building envelope. Vapor permeability allows the wall to breathe and dry, minimizing the risk of water vapor from being trapped and condensing within the wall. While PERM-A-BARRIER® VPL 50RS UV Stable Membrane is vapor permeable, it is impermeable to liquid water, allowing the material to act as a water drainage plain within the wall.



PERM-A-BARRIER® VPL LT

PERM-A-BARRIER® VPL Low Temp (LT) is a two-component, fluid-applied, acrylic membrane that cures to form a resilient, monolithic, fully bonded elastomeric sheet when applied to construction surfaces at temperatures between 20 °F (-7°C) and rising to 60 °F (16°C). PAB VPL LT membrane provides superior protection against the damaging effects of air and liquid water ingress on building structures. The product creates a solid barrier against air infiltration and exfiltration, which minimizes associated energy loss and condensation problems. PAB VPL LT membrane is vapor permeable for wall assemblies requiring this “breathable” characteristic. As a vapor permeable membrane, this product permits the transfusion of water vapor that may otherwise condense in the wall structure; but is impermeable to liquid water, which allows the material to act as a water drainage plane.

PERM-A-BARRIER® VPS 30

PERM-A-BARRIER® VPS 30 is a primerless, vapor permeable air and water barrier membrane consisting of a proprietary breathable carrier film with a specially designed adhesive. This unique membrane provides protection against the damaging effects of air and water ingress on building structures. It creates an effective barrier against air infiltration and exfiltration, which reduces associated energy loss and condensation problems through the building envelope.

1.3 APPLICATION

Air barriers are systems of materials designed and constructed to control airflow between a conditioned space and an unconditioned space. The air barrier system is the primary air enclosure boundary that separates indoor (conditioned) air and outdoor (unconditioned) air. Air barrier systems also typically define the location of the pressure boundary of the building enclosure.

1.4 PRODUCT DESCRIPTION

Table 1: Technical details, NPL 10/10LT and VPL

Property	Typical Value	Typical Value	Test Method
	PERM-A-BARRIER® NPL 10/10LT	PERM-A-BARRIER® VPL	
Thickness	44Mils wet film 25Mils dry film	44Mils wet film 25Mils dry film	
Solids Content by Volume	53% (48%)	5% (approx.)	
Drying Time @ 50% R.H., 68°F1	4 hours - tack free 24 hours - fully dry	4 hours - tack free 24 hours - fully dry	
Air Permeance	<0.02 L/s·m ² @ 75 Pa (<0.004 cfm/ft ² @ 1.57 psf)	<0.0001 cfm/ft ² @ 75 Pa	ASTM E2178
Assembly Air Permeance	<0.02 L/s·m ² @ 75 Pa (<0.004 cfm/ft ² @ 1.57 psf)	Pass	ASTM E2357
Water Resistance of In-place Membrane	Pass	Pass	ASTM E331
Water Vapor Transmission	<1 Perms <1 Perms	n/a 20perms	ASTM E96 - Method A ASTME E96 - Method B
Pull Adhesion to Glass-mat Faced Gypsum Sheathing²	20 psi	30 psi	Unaffected
Pull Adhesion to Concrete	50 psi	100 psi	ASTM D4541
Elongation	550%	250%	ASTM D4541
Nail Sealability	Pass	Pass	ASTM D412 - Die C
Low Temperature Flexibility	Pass at -15°F (at -26°C)	Pass at -20°F (at -29°C)	ASTM D1970
UV Exposure Period	3 months	n/a	

Table 2: Technical details, NPS

Property	Typical Value PERM-A-BARRIER® NPS	Test Method
Thickness Includes HDPE Film	0.018 in. (0.46 mm)	ASTM D3767 method A
Minimum Tensile Strength, Membrane	400 psi (2.8 MPa)	ASTM D412
Minimum Tensile Strength, Film	5000 psi (34.5 MPa)	ASTM D412
Minimum Elongation, to Failure	200%	ASTM D412
Pliability, at 180° Bend Over 1 in. (25 mm) Mandrel	Pass at -20°F (-29°C)	ASTM D1970
Crack Cycling, 1/8 in. (3.2 mm) at -25°F (-32°C)	Pass	ASTM C1305
Nail Sealability	Pass	ASTM D1970
Minimum Puncture Resistance, Membrane	40 lbs (178 N)	ASTM E154
Lap Peel Adhesion at Minimum Application Temperature	3.5 lbs/in.	ASTM D1876
Maximum Permeance to Water Vapor Transmission	<0.01 perms / 0.02 perms	ASTM E96 Method A/ Method B
Water Resistance of In-place Membrane	Pass at >15 psf	ASTM E331
Air Permeance of In-place Membrane¹	< 0.02 L/s/m ² (0.004cfm/ft ²)	ASTM E2178
Assembly Air Permeance at 1.57 psf (75 Pa) Pressure Difference¹	< 0.02 L/s/m ² (0.004cfm/ft ²)	ASTM E2357
Water Absorption (Weight Gain at 48 hours)	0.1%	ASTM D570

Wall Assembly Fire Test	Pass as part of various wall assemblies with foam plastic insulation ²	NFPA 285
Peel Adhesion to Gypsum Board	>5 pli	ASTM D903
Peel Adhesion to Concrete	>5 pli	ASTM D903

Table 3: Technical details, VPL 50RS

Property	Typical Value PERM-A-BARRIER® VPL 50RS	Test Method
Color	Black	
Solids Content by Volume	98.2%	
Maximum In-Service Temperature	300° F (148°C)	
Maximum UV Exposure	UV stable behind open-joint rainscreen system; can be exposed up to 12 months during construction	
The Volatile Organic Compound	32 g/L	Calculated
Drying time @ 50% R.H., 68° F1	Complete cure in 24 hours, Skin over in 2 hours	
Water Resistance of In-place Membrane	Pass at >15 psf	ASTM E331
Air Permeance	<0.02 L/s·m ² @ 75 Pa (<0.004 cfm/ft ² @ 1.57 psf)	ASTM E2178
Assembly Air Permeance	<0.02 L/s·m ² @ 75 Pa (<0.004 cfm/ft ² @ 1.57 psf)	ASTM E2357
Water Vapor Transmission	13 perms @ 20 mils	ASTM E96 - Method B
Pull Adhesion to Glass-mat Faced Gypsum Sheathing²	>30 psi, facer failure	ASTM D4541
Pull Adhesion to CMU	>50 psi	ASTM D4541

Elongation	>250%	ASTM D412—Die C
Nail Sealability	Pass	ASTM D1970
Low Temperature Flexibility	Pass at -40 °F	ASTM D1970
Wall Assembly Fire Test	Pass as part of various wall assemblies with foam plastic insulation	NFPA 285
Crack Bridging	Pass	ASTM C1305 for 1/8 inch crack at -20°F (-28.9°C)
Mold, Mildew and Fungal Growth	Pass	ASTM D 5590-17

Table 4: Technical details, PAB VPS 30

Property	Typical Value PERM-A-BARRIER® VPS 30 WALL MEMBRANE	Test Method
Thickness		ASTM D3767 Method A
Color	White	
Water Resistance of In-place Membrane	Pass at >20 psf	ASTM E 331
Water Vapor Permeance	13.9 perms	ASTM E96 – Method B, wet cup
Water Resistance	Pass	ICC – AC38
Air Permeance at Test Pressure of 1.57 psf (75 Pa)	<0.02 L/s/m ² (0.004 cfm/ft ²)	ASTM E2178
Assembly Air Permeance at Test Pressure of 1.57 psf (75 Pa)	<0.2 L/s/m ² (0.04 cfm/ft ²)	ASTM E2357
Peel Strength @ Minimum Temperature (25 °F)	>1.5 lbf/in	ASTM D903 modified

Pull Adhesion	>15 psi Gypsum board >12 psi CMU	ASTM D4541
Breaking Force	>40 lb Machine Direction >35 lb Cross Direction	ASTM D5034
Low Temperature Flexibility	Pass	ICC – AC38
Surface burning characteristics	Flame Spread Index, Class A Smoke Developed Index, Class A	ASTM E84
Drainage Efficiency	90%	ASTM E2273
Wall assembly Fire Test	Pass as part of various wall assemblies with foam plastic insulation	NFPA 285

Table 5: Technical details, PAB VPL LT

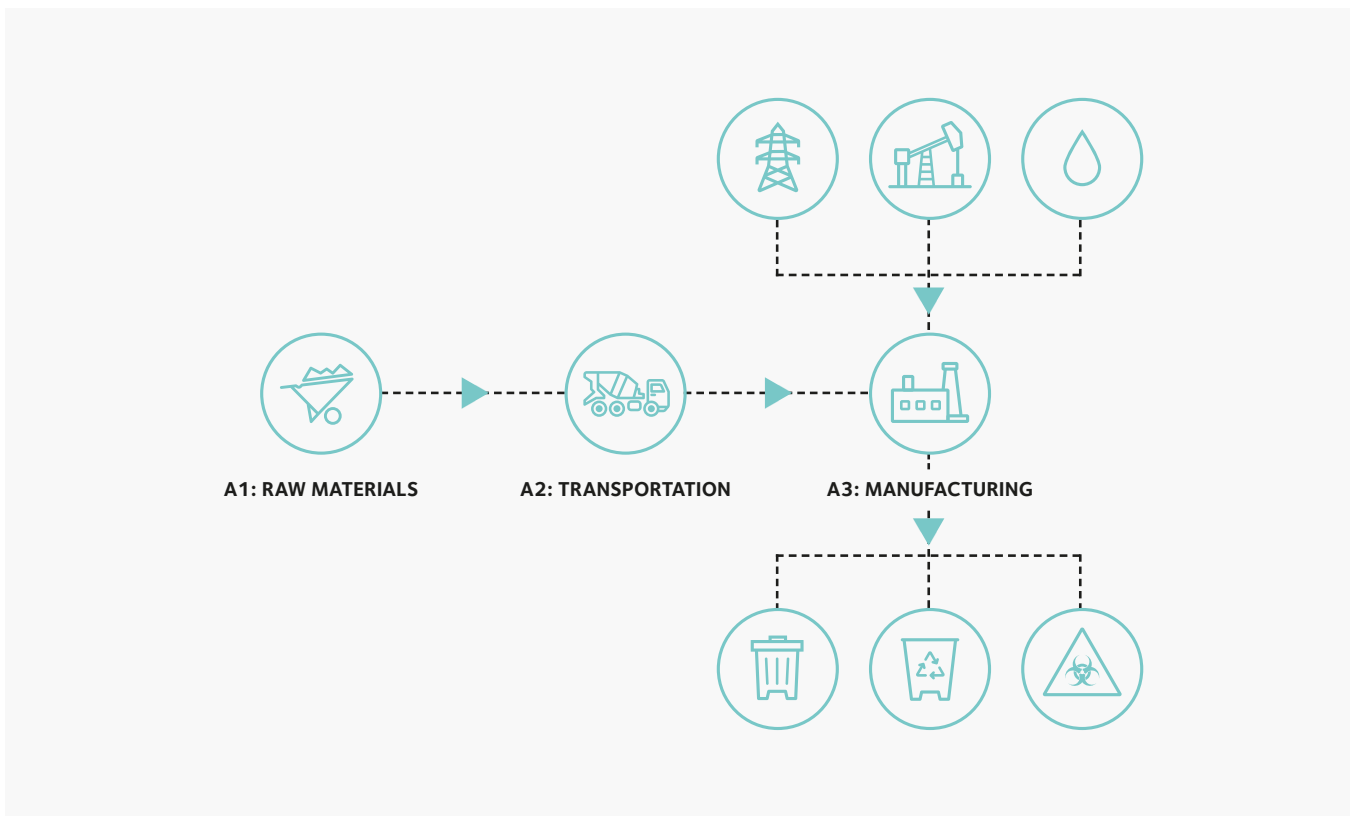
Property	Typical Value PERM-A-BARRIER® VPL LT MEMBRANE	Test Method
Thickness	44 mils wet (1 mm) 25 mils dry	ASTM D3767 method A
Color	Green	
Drying time @ 50% R.H., 68 °F	4 hours – tack free 24 hours – fully dry	
Water Resistance of In-place Membrane	Pass	ASTM E 331
Water Vapor Transmission	20 perms	ASTM E96 – Method B
Elongation	25%	ASTM D412 die C modified
Nail Sealability	Pass	ASTM D1970
Air Permeance of In-place Membrane	0.0001 cfm/ft ² (<0.001 L/s/m ²) @ 75 Pa	ASTM E2178

Assembly Air Permeance	Pass	ASTM E2357
Pull Adhesion to Glass-mat Faced Gypsum Sheathing	30 psi	ASTM D4541
Pull Adhesion to Concrete	100 psi	ASTM D4541
Low Temperature Flexibility	Pass at -20°F (-29°C)	ASTM D1970
Wall Assembly Fire Test	Pass as part of various wall assemblies with foam plastic insulation	NFPA 285

1.5 DECLARATION OF METHODOLOGICAL FRAMEWORK

This EPD is considered a Cradle-to-Gate study. A summary of the life cycle stages included in this EPD is presented in 2.2. No known flows are deliberately excluded from this EPD. Third party verified ISO 14040/44 secondary LCI data sets contribute more than 67% of total impacts in all impact categories required by the PCR: ASTM International Water-Resistive and Air Barriers.

1.6 PROCESS FLOW DIAGRAM



1.7 MANUFACTURING

Raw materials are sourced from the suppliers within North America and are transported to the manufacturing facilities by a combination of truck and train transportation. Manufacturing occurs at Mt. Pleasant, TN, Chicago, IL, and two toll manufacturers based in the southeast USA from which primary data were obtained. Manufacturing data were unavailable for a third party tolled manufactur product and therefore the Mt. Pleasant, TN manufacturing data were used as a proxy for similar product.

1.8 MATERIAL COMPOSITION

Table 6: Material Composition per functional unit of 1 m² of product for installation

Materials	PAB NPL 10	PAB NPL 10 LT	Materials	PAB VPL	PAB VPL LT
Butofan	76%	83%	Acrylic	37%	35%
Alumina Trihydrate	19%	9%	Alumina Trihydrate	36%	33%
Other Materials	5%	8%	Water	20%	18%
			Other Materials	7%	13%

Materials	PAB VPL 50 RS UV Stable	Materials	PAB NPS	Materials	PAB NPS 30
Silyl SAX 350	21%	Petroleum Hydrocarbon Resin	28%	Proprietary Adhesive	41%
TEG-EH	21%	Styrene/Isoprene	20%	PET Release Liner	23%
Kotamite	51%	Naphtha	12%	PP Non-woven Barrier	37%
Other Materials	7%	PET	20%		
		HDPE	19%		
		Other materials	1%		

This product contains no regulated substances.

1.9 PACKAGING

Table 7: Packaging requirements per functional unit of 1 m² of product for installation

	PAB NPL 10	PAB NPL 10 LT	PAB NPS	PAB VPL	PAB VPL 50RS UV Stable	PAB VPS 30	PAB VPL LT	UNIT
Pallet	0.0292	0.0292	0.0187	0.00974	0.0224	1.73E-02	3.72E-02	kg/m ²
Carton	-	-	0.0234	-	-	3.06E-02	-	kg/m ²
Plastic	0.0580	0.0580	6.23E-04	0.0612	-	5.76E-04	-	kg/m ²
Steel	0.0772	0.0772		0.0117	0.0378	-	6.55E-01	kg/m ²

2

Life Cycle Assessment Background Information

2.1 DECLARED UNIT

The declared unit according to the PCR is 1m² of product for installation. Note that environmental impact results for fluid applied products will be proportional to dry product thickness if applied for a specific application to a thickness other than the one specified below. Note that PAB VPS 30 is a membrane, not a fluid-applied product.

Table 8: Declared Unit

	PAB NPL 10	PAB NPL 10 LT	PAB NPS	PAB VPL	PAB VPL 50RS UV Stable	PAB VPS 30	PAB VPL LT
Declared Unit	1m ²	1m ²	1m ²	1m ²	1m ²	1m ²	1m ²
Weight (kg)	2.04	1.99	0.56	1.54	0.71	0.696	1.57
Density (g/cm³)	1.15	1.12	n/a	1.4	1.4	n/a	1.4
Dry product thickness (mm)	1.0	1.0	n/a	0.64	0.51	n/a	0.64
Solids content by volume (%)	53%	48%	n/a	59%	98.2%	n/a	59%

2.2 SYSTEM BOUNDARY

This EPD is considered a Cradle-to-Gate study. A summary of the life cycle modules included in this EPD is presented in Table 3. Modules A4-A5, B1-B4 and C1-C4 were not declared. Infrastructure flows have been excluded.

Table 9: Summary of Included Life-Cycle Modules

Module	Description
A1	Product Stage: Raw Material Supply
A2	Product Stage: Transport
A3	Product Stage: Manufacturing

2.3 ESTIMATES AND ASSUMPTIONS

All estimates and assumptions are within the requirements of ISO 14040/44. Most of the estimations are within the primary data. The primary data was collected as annual totals including all material inputs, utility usage and production information. For the LCA, the total utility usage information was divided by the annual input of all materials and then allocated to the product based on its material composition.

2.4 CUTOFF CRITERIA

Material inputs greater than 1% (based on total mass of the final product) were included within the scope of analysis. Material inputs less than 1% were included if sufficient data was available to warrant inclusion and/or the material input was thought to have significant environmental impact. Cumulative excluded material inputs and environmental impacts are less than 5% based on total weight of the functional unit. No known flows are deliberately excluded from this EPD.

2.5 DATA SOURCES

Primary data were collected by GCP associates for onsite energy, water, and waste during manufacturing. Whenever available, supplier data were used for raw materials used in the production process. When primary data did not exist, secondary data for raw material production were used from GaBi Database 2022.1. All calculation procedures adhere to ISO 14044.

2.6 DATA QUALITY

The geographical scope of the manufacturing portion of the life cycle is Mt Pleasant, TN and Chicago, IL, for all of the products except for PAB NPL 10LT, PAB VPL 50RS US Stable, and PAB VPS 30, which are manufactured by toll manufacturers in the southeastern US. All primary data were collected from the manufacturers, with the exception of PAB VPS 30 where the Mt Pleasant, TN manufacturing data were used as a proxy. The geographic coverage of primary data is considered excellent. Primary data were provided by the manufacturer and represent all information for calendar year 2020. Primary data provided by the manufacturer is specific to the technology that the company uses in manufacturing their product. It is site-specific and considered of good quality. Data used to allocate energy and water on a per unit of product produced includes overhead energy such as lighting, heating, and sanitary use of water. Sub-metering was not available to extract process only energy and water use from the total energy use. Sub-metering would improve the technological coverage of data quality.

2.7 PERIOD UNDER REVIEW

The period under review is calendar year 2020.

2.8 ALLOCATION

General principles of allocation were based on ISO 14040/44. The manufacturing processes at GCP studied in this LCA, produces different types of construction products that are similar in product specifications. A mass-based allocation method was adopted for this study. The manufacturing inputs and wastes were allocated on a mass basis to the product. As a default, secondary GaBi datasets use a physical mass basis for allocation. Throughout the study recycled materials were accounted for via the cut-off method.

3

Life Cycle Assessment Results

All results are given per functional unit, which is 1m² of applied waterproofing or air-barrier. Environmental impacts were calculated using the GaBi software platform. Impact results have been calculated using IPCC AR5 and TRACI 2.1 characterization factors. LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks. These six 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. Emerging LCA impact categories and inventory items are still under development and can have high levels of uncertainty that preclude international acceptance pending further development. Use caution when interpreting data in these categories

Table 10: Description of the System Boundary Modules

	PRODUCT STAGE			CONSTRUCTION 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 Product Use	Building Operational Water Use During Product Use	Deconstruction	Transport	Waste Processing	Disposal	Reuse, Recovery, Recycling Potential
CRADLE TO GRAVE	X			MND		MND							MND				MND

Table 11: LCIA Indicators

Abbreviation	Parameter	Unit
IPCC AR 5		
GWP	Global warming potential (100 years, excludes biogenic CO ₂)	kg CO ₂ eq
TRACI 2.1		
AP	Acidification potential of soil and water	kg SO ₂ eq

EP	Eutrophication potential	kg N eq
GWP	Global warming potential (100 years, excludes biogenic CO ₂)	kg CO ₂ eq
ODP	Depletion of stratospheric ozone layer	kg CFC 11 eq
SFP	Smog formation potential	kg O ₃ eq

In addition to the environmental parameters described in the previous section, the following resource use and waste categories are also disclosed.

Table 12: Resource Use, Waste, and Output Flow Indicators

Abbreviation	Parameter	Unit
Resource Use Parameters		
RPR_E	Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ, net calorific value (LHV)
RPR_M	Use of renewable primary energy resources used as raw materials	MJ, net calorific value
NRPR_E	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ, net calorific value
NRPR_M	Use of non-renewable primary energy resources used as raw materials	MJ, net calorific value
SM	Use of secondary materials	kg
RSF	Use of renewable secondary fuels	MJ, net calorific value
NRSF	Use of non-renewable secondary fuels	MJ, net calorific value
RE	Recovered energy	MJ, net calorific value
FW	Net use of fresh water	m ³

Waste Parameters and Output Flows		
HWD	Disposed-of-hazardous waste	kg
NHWD	Disposed-of non-hazardous waste	kg
HLRW	High-level radioactive waste, conditioned, to final repository	kg
ILLRW	Intermediate- and low-level radioactive waste, conditioned, to final repository	kg
CRU	Components for reuse	kg
MR	Materials for recycling	kg
MER	Materials for energy recovery	kg
EEE	Exported electrical energy	MJ
EET	Exported thermal energy	MJ

In order to align with the PCR, which references ISO 21930:2007, primary energy consumption results also need to be reported for the higher heating value (HHV) / gross calorific value, as well as material resource consumption.

Table 13: Additional indicator results (ISO 21930:2007)

Parameter	Unit
Total Primary Energy Consumption	
Nonrenewable Fossil	MJ, gross calorific value (HHV)
Nonrenewable Nuclear	MJ, gross calorific value (HHV)
Renewable (Solar, Wind, Hydro, Geo)	MJ, gross calorific value (HHV)
Renewable (Biomass)	MJ, gross calorific value (HHV)

Material Resources Consumption

Nonrenewable Material Resources	kg
--	----

Renewable Material Resources	kg
-------------------------------------	----

3.1 RESULTS (ISO 21930:2017)

Table 14: LCIA results for PERM-A-BARRIER® NPL10 and NPL10LT, per 1 m²

Impact Category	PAB NPL 10	PAB NPL 10	PAB NPL 10	PAB NPL 10	PAB NPL 10LT	PAB NPL 10LT	PAB NPL 10LT	PAB NPL 10LT
	A1	A2	A3	A1-A3	A1	A2	A3	A1-A3
IPCC AR5								
GWP [kg CO2 eq]	4.05E+00	1.50E-01	5.96E-01	4.80E+00	3.59E+00	1.58E-01	9.39E-01	4.69E+00
TRACI								
AP [kg SO2 eq]	9.18E-03	2.26E-04	1.38E-03	1.08E-02	5.35E-03	2.38E-04	1.56E-03	7.15E-03
EP [kg N eq]	3.59E-04	3.18E-05	1.75E-04	5.66E-04	3.49E-04	3.34E-05	2.52E-04	6.35E-04
GWP [kg CO2 eq]	3.90E+00	1.48E-01	5.61E-01	4.61E+00	3.44E+00	1.56E-01	8.77E-01	4.47E+00
ODP [kg CFC 11 eq]	1.45E-10	2.82E-16	1.11E-14	1.45E-10	1.46E-10	2.96E-16	1.91E-14	1.46E-10
SFP [kg O3 eq]	1.09E-01	5.08E-03	1.73E-02	1.31E-01	1.05E-01	5.33E-03	2.15E-02	1.32E-01
Resource Use Indicators								
RPRE [MJ]	1.77E+00	8.15E-02	6.48E-01	2.50E+00	1.42E+00	8.56E-02	1.20E+00	2.70E+00
RPRM [MJ]	0.00E+00	0.00E+00	1.63E-01	1.63E-01	0.00E+00	0.00E+00	3.04E-01	3.04E-01
NRPRE [MJ]	9.26E+01	2.10E+00	1.37E+01	1.08E+02	8.72E+01	2.20E+00	1.66E+01	1.06E+02
NRPRM [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.94E+00	0.00E+00	0.00E+00	2.94E+00
SM [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW [m3]	1.33E-02	2.93E-04	6.52E-02	7.88E-02	1.33E-02	3.08E-04	6.41E-02	7.77E-02
Output Flows and Waste Categories								
HWD [kg]	1.37E-06	8.71E-12	9.19E-04	9.20E-04	1.38E-06	9.15E-12	1.18E-03	1.18E-03
NHWD [kg]	5.42E-02	1.80E-04	6.42E-02	1.19E-01	4.56E-02	1.89E-04	1.53E-01	1.99E-01
HLRW [kg]	6.50E-07	6.89E-09	3.96E-07	1.05E-06	5.96E-07	7.23E-09	1.57E-06	2.17E-06
ILLRW [kg]	5.54E-04	5.80E-06	3.32E-04	8.92E-04	5.00E-04	6.09E-06	1.31E-03	1.82E-03
CRU [kg]	0.00E+00	0.00E+00	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE [MJ]	0.00E+00	0.00E+00	9.33E-03	9.33E-03	0.00E+00	0.00E+00	3.41E-02	3.41E-02
EET [MJ]	0.00E+00	0.00E+00	4.39E-03	4.39E-03	0.00E+00	0.00E+00	1.59E-02	1.59E-02

Table 15: LCIA results for PERM-A-BARRIER® NPS and VPL, per 1 m²

Impact Category	PAB NPS	PAB NPS	PAB NPS	PAB NPS	PAB VPL	PAB VPL	PAB VPL	PAB VPL
	A1	A2	A3	A1-A3	A1	A2	A3	A1-A3
IPCC AR5								
GWP [kg CO2 eq]	1.03E+00	4.29E-02	4.71E-02	1.12E+00	3.54E+00	6.12E-02	4.08E-01	4.01E+00
TRACI								
AP [kg SO2 eq]	1.51E-03	6.45E-05	1.78E-04	1.75E-03	8.23E-03	9.21E-05	9.87E-04	9.31E-03
EP [kg N eq]	1.10E-04	9.07E-06	6.31E-05	1.82E-04	4.97E-04	1.29E-05	1.27E-04	6.37E-04
GWP [kg CO2 eq]	9.77E-01	4.23E-02	4.60E-02	1.06E+00	3.41E+00	6.04E-02	3.85E-01	3.85E+00
ODP [kg CFC 11 eq]	2.01E-14	8.03E-17	4.51E-14	6.53E-14	1.67E-12	1.15E-16	6.47E-15	1.67E-12
SFP [kg O3 eq]	3.65E-02	1.45E-03	2.49E-03	4.04E-02	9.12E-02	2.07E-03	1.10E-02	1.04E-01
Resource Use Indicators								
RPRE [MJ]	9.35E-01	2.32E-02	4.27E-01	1.39E+00	2.22E+00	3.32E-02	4.04E-01	2.66E+00
RPRM [MJ]	0.00E+00	0.00E+00	5.85E-01	5.85E-01	0.00E+00	0.00E+00	1.02E-01	1.02E-01
NRPRE [MJ]	2.30E+01	5.98E-01	6.18E-01	2.42E+01	5.22E+01	8.53E-01	8.44E+00	6.15E+01
NRPRM [MJ]	1.42E+01	0.00E+00	2.75E-02	1.43E+01	2.35E+01	0.00E+00	0.00E+00	2.35E+01
SM [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW [m3]	5.90E-03	8.35E-05	3.74E-04	6.36E-03	2.89E-02	1.19E-04	4.92E-02	7.82E-02
Output Flows and Waste Categories								
HWD [kg]	1.06E-09	2.48E-12	8.79E-10	1.94E-09	4.03E-06	3.54E-12	6.97E-04	7.01E-04
NHWD [kg]	6.12E-03	5.14E-05	9.60E-03	1.58E-02	2.55E-02	7.33E-05	4.93E-02	7.49E-02
HLRW [kg]	4.84E-07	1.96E-09	2.41E-08	5.10E-07	9.85E-07	2.80E-09	2.67E-07	1.25E-06
ILLRW [kg]	4.04E-04	1.65E-06	2.17E-05	4.28E-04	8.24E-04	2.36E-06	2.23E-04	1.05E-03
CRU [kg]	0.00E+00	0.00E+00	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE [MJ]	0.00E+00	0.00E+00	5.49E-08	5.49E-08	0.00E+00	0.00E+00	7.08E-03	7.08E-03
EET [MJ]	0.00E+00	0.00E+00	2.58E-08	2.58E-08	0.00E+00	0.00E+00	3.33E-03	3.33E-03

Table 16: LCIA results for PERM-A-BARRIER® VPS 30 and VPL LT, per 1 m²

Impact Category	PAB NPS	PAB NPS	PAB NPS	PAB NPS	PAB VPL	PAB VPL	PAB VPL	PAB VPL
	A1	A2	A3	A1-A3	A1	A2	A3	A1-A3
IPCC AR5								
GWP [kg CO2 eq]	8.58E-01	5.81E-03	5.41E-02	9.18E-01	1.63E+00	7.42E-02	2.00E+00	3.71E+00
TRACI								
AP [kg SO2 eq]	1.37E-03	1.07E-04	2.29E-04	1.70E-03	3.67E-03	1.12E-04	4.55E-03	8.33E-03
EP [kg N eq]	3.45E-04	4.23E-06	7.02E-05	4.19E-04	2.23E-04	1.57E-05	2.56E-04	4.95E-04
GWP [kg CO2 eq]	8.21E-01	5.73E-03	5.24E-02	8.79E-01	1.57E+00	7.32E-02	1.95E+00	3.60E+00
ODP [kg CFC 11 eq]	1.05E-09	8.58E-18	3.60E-14	1.05E-09	7.20E-13	1.39E-16	2.96E-14	7.50E-13
SFP [kg O3 eq]	3.04E-02	2.14E-03	3.00E-03	3.55E-02	4.25E-02	2.50E-03	6.77E-02	1.13E-01
Resource Use Indicators								
RPRE [MJ]	6.09E-01	1.53E-03	4.72E-01	1.08E+00	9.85E-01	4.02E-02	1.17E+00	2.20E+00
RPRM [MJ]	0.00E+00	0.00E+00	6.97E-01	6.97E-01	0.00E+00	0.00E+00	3.88E-01	3.88E-01
NRPRE [MJ]	1.66E+01	7.49E-02	7.07E-01	1.74E+01	2.42E+01	1.03E+00	2.28E+01	4.80E+01
NRPRM [MJ]	8.34E+00	0.00E+00	2.54E-02	8.37E+00	1.12E+01	0.00E+00	0.00E+00	1.12E+01
SM [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RE [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW [m3]	5.26E-03	5.16E-06	4.16E-04	5.68E-03	1.28E-02	1.44E-04	3.83E-01	3.96E-01
Output Flows and Waste Categories								
HWD [kg]	5.05E-08	3.08E-13	9.60E-10	5.15E-08	1.74E-06	4.30E-12	2.05E-04	2.07E-04
NHWD [kg]	6.31E-03	6.76E-06	9.41E-03	1.57E-02	1.17E-02	8.88E-05	8.01E-02	9.19E-02
HLRW [kg]	2.96E-07	1.55E-10	2.65E-08	3.23E-07	4.37E-07	3.40E-09	8.70E-08	5.28E-07
ILLRW [kg]	2.98E-04	1.43E-07	2.33E-05	3.22E-04	3.66E-04	2.86E-06	8.77E-05	4.56E-04
CRU [kg]	0.00E+00	0.00E+00	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE [MJ]	0.00E+00	0.00E+00	2.10E-08	2.10E-08	0.00E+00	0.00E+00	2.08E-03	2.08E-03
EET [MJ]	0.00E+00	0.00E+00	9.86E-09	9.86E-09	0.00E+00	0.00E+00	9.80E-04	9.80E-04

Table 17: LCIA results for PERM-A-BARRIER® VPL 5ORS, per 1 m²

Impact Category	PAB VPL 5ORS	PAB VPL 5ORS	PAB VPL 5ORS	PAB VPL 5ORS	-	-	-	-
	A1	A2	A3	A1-A3	-	-	-	-
IPCC AR5								
GWP [kg CO2 eq]	1.19E+00	4.86E-02	2.96E-01	1.53E+00	-	-	-	-
TRACI								
AP [kg SO2 eq]	1.82E-03	5.28E-04	5.69E-04	2.92E-03	-	-	-	-
EP [kg N eq]	5.04E-04	2.40E-05	5.58E-05	5.84E-04	-	-	-	-
GWP [kg CO2 eq]	1.15E+00	4.80E-02	2.77E-01	1.48E+00	-	-	-	-
ODP [kg CFC 11 eq]	1.94E-13	8.76E-17	8.27E-15	2.03E-13	-	-	-	-
SFP [kg O3 eq]	3.40E-02	1.06E-02	6.29E-03	5.09E-02	-	-	-	-
Resource Use Indicators								
RPRE [MJ]	2.03E+00	1.92E-02	5.40E-01	2.59E+00	-	-	-	-
RPRM [MJ]	0.00E+00	0.00E+00	2.34E-01	2.34E-01	-	-	-	-
NRPRE [MJ]	1.90E+01	6.53E-01	3.84E+00	2.35E+01	-	-	-	-
NRPRM [MJ]	7.67E+00	0.00E+00	0.00E+00	7.67E+00	-	-	-	-
SM [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-	-	-	-
RSF [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-	-	-	-
NRSF [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-	-	-	-
RE [MJ]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-	-	-	-
FW [m3]	1.31E-02	6.44E-05	1.16E-03	1.44E-02	-	-	-	-
Output Flows and Waste Categories								
HWD [kg]	1.12E-09	2.59E-12	1.08E-04	1.08E-04	-	-	-	-
NHWD [kg]	4.28E-02	5.62E-05	4.54E-02	8.83E-02	-	-	-	-
HLRW [kg]	4.52E-07	1.65E-09	3.17E-07	7.71E-07	-	-	-	-
ILLRW [kg]	4.20E-04	1.44E-06	2.66E-04	6.87E-04	-	-	-	-
CRU [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-	-	-	-
MR [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-	-	-	-
MER [kg]	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-	-	-	-
EEE [MJ]	0.00E+00	0.00E+00	1.22E-02	1.22E-02	-	-	-	-
EET [MJ]	0.00E+00	0.00E+00	5.70E-03	5.70E-03	-	-	-	-

3.2 ADDITIONAL RESULTS (ISO 21930:2007)

Table 18: Additional indicator results for PERM-A-BARRIER® NPL10 and NPL10LT, per 1 m²

	PAB NPL 10	PAB NPL 10	PAB NPL 10	PAB NPL 10	PAB NPL 10LT	PAB NPL 10LT	PAB NPL 10LT	PAB NPL 10LT
	A1	A2	A3	A1-A3	A1	A2	A3	A1-A3
Total Primary Energy Consumption [MJ (HHV)]								
Nonrenewable Fossil	1.00E+02	2.24E+00	1.41E+01	1.16E+02	9.75E+01	2.35E+00	1.44E+01	1.14E+02
Nonrenewable Nuclear	1.42E+00	1.48E-02	8.49E-01	2.28E+00	1.28E+00	1.55E-02	3.35E+00	4.65E+00
Renewable (Solar, Wind, Hydro, Geo)	1.77E+00	8.15E-02	8.11E-01	2.67E+00	1.42E+00	8.56E-02	1.50E+00	3.01E+00
Renewable (Biomass)	-	-	-	-	-	-	-	-
Material Resources Consumption (kg)								
Nonrenewable Material Resources	6.13E+00	1.61E-02	9.03E-01	7.05E+00	5.04E+00	1.69E-02	1.46E+00	6.52E+00
Renewable Material Resources	5.75E-02	1.98E-02	1.45E-02	9.17E-02	3.69E-02	1.97E-02	3.81E-02	9.47E-02

Table 19: Additional indicator results for PERM-A-BARRIER® NPS and VPL, per 1 m²

	PAB NPS	PAB NPS	PAB NPS	PAB NPS	PAB VPL	PAB VPL	PAB VPL	PAB VPL
	A1	A2	A3	A1-A3	A1	A2	A3	A1-A3
Total Primary Energy Consumption [MJ (HHV)]								
Nonrenewable Fossil	3.93E+01	6.39E-01	6.44E-01	4.06E+01	8.10E+01	9.12E-01	8.62E+00	9.05E+01
Nonrenewable Nuclear	1.04E+00	4.22E-03	5.50E-02	1.09E+00	2.11E+00	6.02E-03	5.72E-01	2.69E+00
Renewable (Solar, Wind, Hydro, Geo)	9.35E-01	2.32E-02	1.01E+00	1.97E+00	2.22E+00	3.32E-02	5.05E-01	2.76E+00
Renewable (Biomass)	-	-	-	-	-	-	-	-
Material Resources Consumption (kg)								
Nonrenewable Material Resources	1.24E+00	4.60E-03	1.56E-01	1.40E+00	6.18E+00	6.57E-03	6.33E-01	6.82E+00
Renewable Material Resources	1.48E-02	5.37E-03	7.88E-02	9.89E-02	5.04E-02	1.31E-02	9.61E-03	7.31E-02

Table 20: Additional indicator results for PERM-A-BARRIER® NPL10 and NPL10LT, per 1 m²

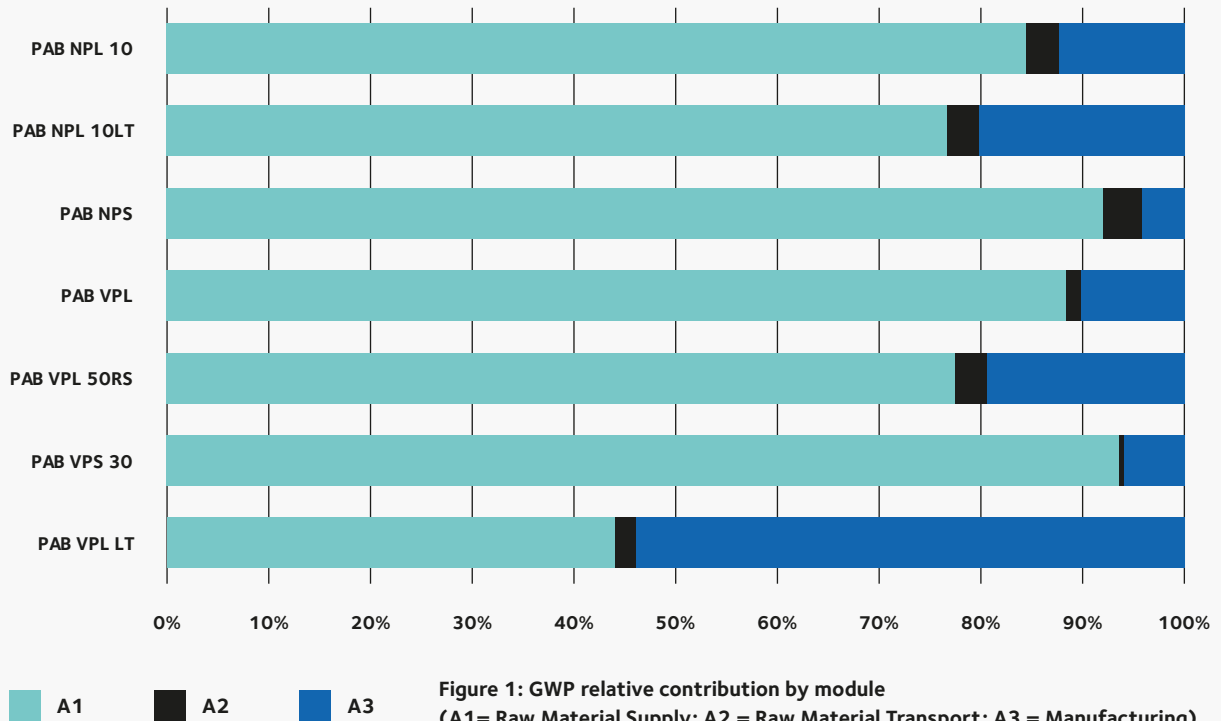
	PAB VPS 30	PAB VPS 30	PAB VPS 30	PAB VPS 30	PAB VPL LT	PAB VPL LT	PAB VPL LT	PAB VPL LT
	A1	A2	A3	A1-A3	A1	A2	A3	A1-A3
Total Primary Energy Consumption [MJ (HHV)]								
Nonrenewable Fossil	2.42E+01	7.46E-02	6.74E-01	2.49E+01	3.44E+01	1.03E+00	2.22E+01	5.77E+01
Nonrenewable Nuclear	7.97E-01	3.63E-04	5.90E-02	8.57E-01	9.37E-01	7.30E-03	6.38E-01	1.58E+00
Renewable (Solar, Wind, Hydro, Geo)	6.04E-01	1.53E-03	1.17E+00	1.77E+00	9.85E-01	4.02E-02	1.56E+00	2.59E+00
Renewable (Biomass)	4.37E-03	1.61E-11	1.03E-09	4.37E-03	4.44E-07	3.08E-10	6.47E-04	6.47E-04
Material Resources Consumption (kg)								
Nonrenewable Material Resources	8.15E-01	4.06E-04	1.32E-01	9.48E-01	2.82E+00	7.96E-03	9.21E+00	1.20E+01
Renewable Material Resources	1.14E-02	1.76E-03	1.07E-01	1.21E-01	2.23E-02	1.47E-02	5.24E-02	8.94E-02

Table 21: Additional indicator results for PERM-A-BARRIER® VPL 50RS, per 1 m²

	PAB VPL 50RS	PAB VPL 50RS	PAB VPL 50RS	PAB VPL 50RS	-	-	-	-
	A1	A2	A3	A1-A3	-	-	-	-
Total Primary Energy Consumption [MJ (HHV)]								
Nonrenewable Fossil	2.72E+01	6.98E-01	3.41E+00	3.13E+01	-	-	=	=
Nonrenewable Nuclear	1.62E+00	3.68E-03	6.80E-01	2.30E+00	-	-	-	-
Renewable (Solar, Wind, Hydro, Geo)	2.03E+00	1.92E-02	7.75E-01	2.82E+00	-	-	-	-
Renewable (Biomass)	-	-	-	-	-	-	-	-
Material Resources Consumption (kg)								
Nonrenewable Material Resources	2.08E+00	4.19E-03	5.04E-01	2.59E+00	-	-	-	-
Renewable Material Resources	1.09E-01	6.30E-03	2.12E-02	1.37E-01	-	-	-	-

4 Life Cycle Assessment Interpretation

For the selected PERM-A-BARRIER® air barrier products, the primary contributors to the GWP impacts are the raw materials found in module A1, with larger contributions coming from materials that make up a larger portion of the composition. Manufacturing (A3) is the second largest contributor to GWP, driven by electricity and packaging. The exception is VPL LT where the packaging is a more significant contributor.



5

Life Cycle Assessment Interpretation

1. 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.
2. ISO 14044: 2006 Environmental Management – Life cycle assessment – Requirements and Guidelines.
3. ISO 14044: 2006/ Amd 1:2017 Environmental Management – Life cycle assessment – Requirements and Guidelines – Amendment 1.
4. ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations – Principles and Procedures.
5. ISO 21930:2007 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services.
6. ISO 21930:2017 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services.
7. TRACI: The Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts. Version 2.1 – User Guide - <https://nepis.epa.gov/Adobe/PDF/P100HN53.pdf>.
8. ASTM International PCR: Water-Resistive and Air Barriers (UNCPC 54530 and/or CSI MasterFormat DESIGNATIONS 072500, 072600 and 072700)