



## ENVIRONMENTAL **PRODUCT DECLARATION**

# PERM-A-BARRIER®

## (PAB) AIR BARRIER SYSTEM

- PERM-A-BARRIER® (PAB) Wall Membrane
- PERM-A-BARRIER® (PAB) Wall Membrane LT
- PERM-A-BARRIER® (PAB) AI Wall Membrane
- PERM-A-BARRIER® (PAB) AI Wall Membrane LT

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**

EPD10787

**Declared Product and Functional Unit**

PERM-A-BARRIER® Wall Membrane, PERM-A-BARRIER® Wall Membrane  
LT, PERM-A-BARRIER® AL Wall Membrane  
Functional Unit: 1 m<sup>2</sup> of product

**Reference PCR and Version Number**

ASTM International Water-Resistive and Air Barriers, v. 09/17

**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  ExternalTony Favilla  
afavilla@nsf.org**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.

### PERM-A-BARRIER® Wall Membranes & PERM-A-BARRIER® Wall Membranes LT

PERM-A-BARRIER® 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® Wall Membranes:

- Prevent premature deterioration of the building envelope
- Enhance thermal performance of the structure and save energy costs
- Improve comfort for the building occupants

LT indicates products designed for lower surface and ambient temperatures.

### PERM-A-BARRIER® Aluminum Wall Membranes & PERM-A-BARRIER® Aluminum Wall Membranes LT

PERM-A-BARRIER® Aluminum 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® Wall Membranes:

- Prevent premature deterioration of the building envelope
- Enhance thermal performance of the structure and save energy costs
- Improve comfort for the building occupants

LT indicates products designed for lower surface and ambient temperatures.



### 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 Data by Product**

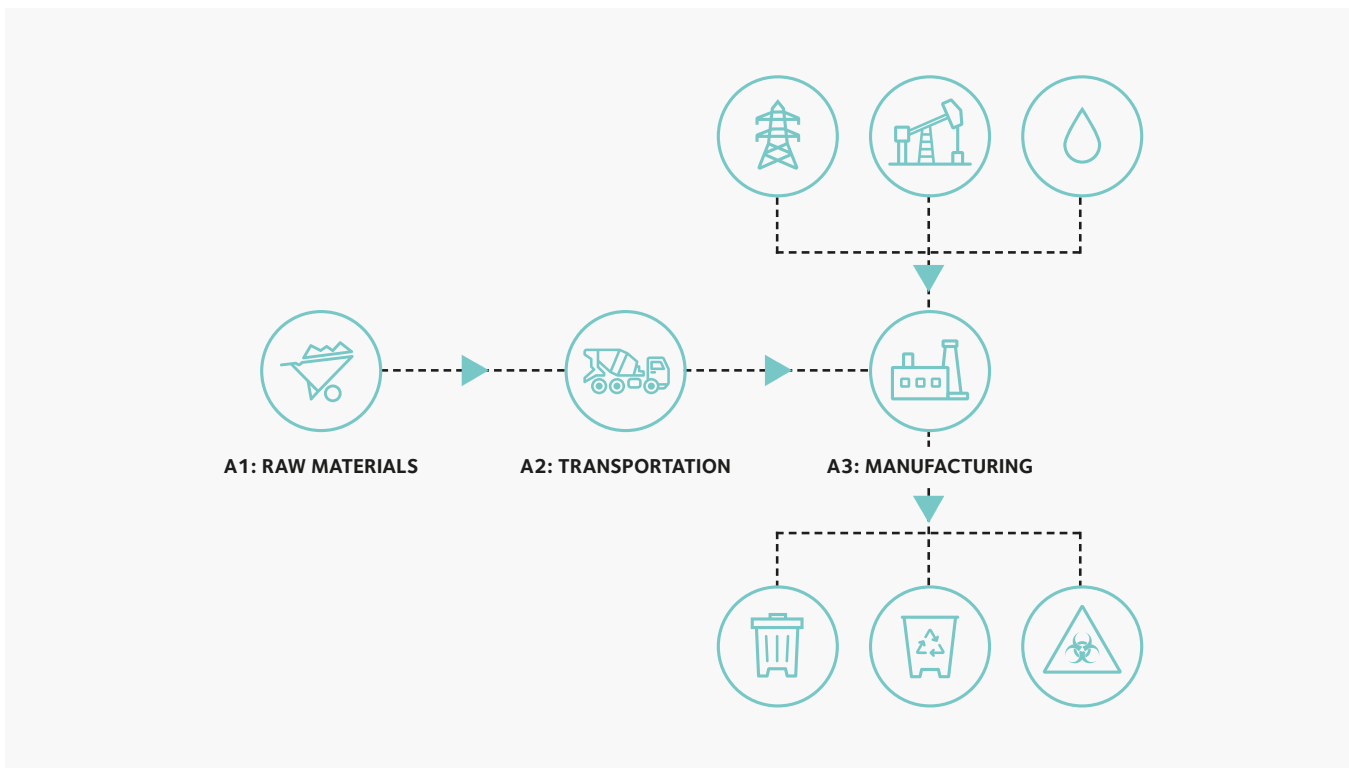
Property	Typical Value PERM-A-BARRIER® Wall Membrane	Typical Value PERM-A-BARRIER® Wall Membrane LT	Typical Value PERM-A-BARRIER® Aluminum Wall Membrane	Typical Value PERM-A-BARRIER® Aluminum Wall Membrane LT	Test Method
<b>Color</b>	Dark grey	Dark grey	Dark grey	Dark grey	
<b>Thickness</b>	3/64 in. (1 mm)	3/64 in. (1 mm)	3/64 in. (1 mm)	3/64 in. (1 mm)	ASTM D3767 method A
<b>Minimum Tensile Strength, Membranes</b>	400 psi (2.8 MPa)	400 psi (2.8 MPa)	400 psi (2.8 MPa)	400 psi (2.8 MPa)	ASTM D412 die C modified
<b>Minimum Tensile Strength, Film</b>	5000 psi (34.5 MPa)	5000 psi (34.5 MPa)	5000 psi (34.5 MPa)	5000 psi (34.5 MPa)	ASTM D412 die C modified
<b>Minimum Elongation, to Failure of Rubberized Asphalt</b>	200%	200%	200%	200%	ASTM D412 die C modified
<b>Pliability, at 180° Bend Over 1 in. (25 mm) Mandrel</b>	Pass at -25 °F (-32 °C)	Pass at -45 °F (-43 °C)	Pass at -45 °F (-43 °C)	Pass at -45 °F (-43 °C)	ASTM D1970
<b>Nail Sealability</b>	Pass	Pass	Pass	Pass	ASTM D1970
<b>Crack Cycling, 1/8 in. (3.2 mm) at -25 °F (-32 °C)</b>	Unaffected	Unaffected	Unaffected	Unaffected	ASTM C836
<b>Minimum Puncture Resistance, Membrane</b>	40 lbs (178 N)	40 lbs (178 N)	70 lbs (311 N)	70 lbs (311 N)	ASTM E154
<b>Lap Peel Adhesion at Minimum Application Temperature</b>	4 lbs/in. width (700 N/m)	5 lbs/in. width (875 N/m)	5 lbs/in. width (875 N/m)	5 lbs/in. width (875 N/m)	ASTM D1876

<b>Maximum Permeance to Water Vapor Transmission</b>	0.05 perms/ (Pa.s.m <sup>2</sup> ) (2.9 ng)	0.05 perms/ (Pa.s.m <sup>2</sup> ) (2.9 ng)	0.05 perms/ (Pa.s.m <sup>2</sup> ) (2.9 ng)	0.05 perms/ (Pa.s.m <sup>2</sup> ) (2.9 ng)	ASTM E96 method
<b>Air Permeance of In-place Membrane</b>	0.0002 cfm/ft <sup>2</sup> (<0.001 L/s/m <sup>2</sup> )	0.0002 cfm/ft <sup>2</sup> (<0.001 L/s/m <sup>2</sup> )	0.0002 cfm/ft <sup>2</sup> (<0.001 L/s/m <sup>2</sup> )	0.0002 cfm/ft <sup>2</sup> (<0.001 L/s/m <sup>2</sup> )	ASTM E2178
<b>Assembly Air Permeance at 1.57 psf (75 Pa) Pressure Difference</b>	<0.0008 cfm/ft <sup>2</sup> (<0.004 L/s/m <sup>2</sup> )	<0.0008 cfm/ft <sup>2</sup> (<0.004 L/s/m <sup>2</sup> )	<0.0008 cfm/ft <sup>2</sup> (<0.004 L/s/m <sup>2</sup> )	<0.0008 cfm/ft <sup>2</sup> (<0.004 L/s/m <sup>2</sup> )	ASTM E2357
<b>Water Absorption (Weight Gain at 24 Hours)</b>	0.1%	0.1%	0.1%	0.1%	ASTM D570

### 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 facility at Mt. Pleasant, TN by a combination of truck and train transportation.

## 1.8 MATERIAL COMPOSITION

**Table 2: Material Composition per functional unit of 1 m<sup>2</sup> of product for installation**

Materials	PAB Wall Membrane	PAB Wall Membrane LT	PAB AL Wall Membrane	PAB AL Wall Membrane LT
Asphalt	35%	35%	36%	35%
Aromatic Oil	23%	25%	23%	25%
SBS Rubber	15%	14%	16%	14%
Other Materials	27%	27%	25%	25%

This product contains no regulated substances.

## 1.9 PACKAGING

**Table 3: Packaging requirements per functional unit of 1 m<sup>2</sup> of product for installation**

	PAB Wall Membrane	PAB Wall Membrane LT	PAB AL Wall Membrane	PAB AL Wall Membrane LT	UNIT
Pallet	0.0384	0.0384	0.0384	0.0384	kg/m <sup>2</sup>
Carton	0.0145	0.0145	0.0145	0.0145	kg/m <sup>2</sup>
Plastic	0.000897	0.000897	0.000897	0.000897	kg/m <sup>2</sup>

# 2

## Life Cycle Assessment Background Information

### 2.1 DECLARED UNIT

The declared unit according to the PCR is 1 m<sup>2</sup> of product for installation.

**Table 4: Declared Unit**

	PAB Wall Membrane	PAB Wall Membrane LT	PAB AL Wall Membrane	PAB AL Wall Membrane LT
<b>Declared Unit</b>	1 m <sup>2</sup>	1 m <sup>2</sup>	1 m <sup>2</sup>	1 m <sup>2</sup>
<b>Weight (kg)</b>	1.35	1.35	1.25	1.25

### 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 5: Summary of Included Life-Cycle Modules**

Module	Description
<b>A1</b>	Product Stage: Raw Material Supply
<b>A2</b>	Product Stage: Transport
<b>A3</b>	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 first allocated between liquid and membrane products by engineering estimates, then divided by the annual input of all materials and 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. All primary data were collected from the manufacturer. The geographic coverage of primary data is considered excellent. Primary data were provided by the manufacturer and represent all information for calendar year 2020. Secondary data meets the requirement of the PCR that all data be updated within a 10- year period. 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. The manufacturing input data was first allocated between liquid and membrane products by engineering estimates and then a mass-based allocation method was adopted for this study. 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 1m<sup>2</sup> 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 6: 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 7: LCIA Indicators**

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

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

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

**Table 8: Resource Use, Waste, and Output Flow Indicators**

Abbreviation	Parameter	Unit
<b>Resource Use Parameters</b>		
<b>RPR<sub>E</sub></b>	Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ, net calorific value (LHV)
<b>RPR<sub>M</sub></b>	Use of renewable primary energy resources used as raw materials	MJ, net calorific value
<b>NRPR<sub>E</sub></b>	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ, net calorific value
<b>NRPR<sub>M</sub></b>	Use of non-renewable primary energy resources used as raw materials	MJ, net calorific value
<b>SM</b>	Use of secondary materials	kg
<b>RSF</b>	Use of renewable secondary fuels	MJ, net calorific value
<b>NRSF</b>	Use of non-renewable secondary fuels	MJ, net calorific value
<b>RE</b>	Recovered energy	MJ, net calorific value
<b>FW</b>	Net use of fresh water	m <sup>3</sup>

<b>Waste Parameters and Output Flows</b>		
<b>HWD</b>	Disposed-of-hazardous waste	kg
<b>NHWD</b>	Disposed-of non-hazardous waste	kg
<b>HLRW</b>	High-level radioactive waste, conditioned, to final repository	kg
<b>ILLRW</b>	Intermediate- and low-level radioactive waste, conditioned, to final repository	kg
<b>CRU</b>	Components for reuse	kg
<b>MR</b>	Materials for recycling	kg
<b>MER</b>	Materials for energy recovery	kg
<b>EEE</b>	Exported electrical energy	MJ
<b>EET</b>	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 9: Additional indicator results (ISO 21930:2007)**

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

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**Material Resources Consumption**

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<b>Nonrenewable Material Resources</b>	kg
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<b>Renewable Material Resources</b>	kg
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### 3.1 RESULTS (ISO 21930:2017)

Table 10: LCIA results for PERM-A-BARRIER® Wall Membrane products, per 1 m<sup>2</sup>

Impact Category	PAB Wall Membrane	PAB Wall Membrane	PAB Wall Membrane	PAB Wall Membrane	PAB Wall Membrane LT	PAB Wall Membrane LT	PAB Wall Membrane LT	PAB Wall Membrane LT
	A1	A2	A3	A1-A3	A1	A2	A3	A1-A3
<b>IPCC AR5</b>								
<b>GWP [kg CO2 eq]</b>	1.81E+00	7.90E-02	4.51E-02	<b>1.94E+00</b>	1.78E+00	7.58E-02	4.51E-02	<b>1.90E+00</b>
<b>TRACI</b>								
<b>AP [kg SO2 eq]</b>	2.79E-03	1.55E-04	1.33E-04	<b>3.08E-03</b>	2.75E-03	1.54E-04	1.33E-04	<b>3.04E-03</b>
<b>EP [kg N eq]</b>	3.37E-04	1.90E-05	3.23E-05	<b>3.88E-04</b>	3.33E-04	1.86E-05	3.23E-05	<b>3.84E-04</b>
<b>GWP [kg CO2 eq]</b>	1.73E+00	7.80E-02	4.38E-02	<b>1.85E+00</b>	1.69E+00	7.48E-02	4.38E-02	<b>1.81E+00</b>
<b>ODP [kg CFC 11 eq]</b>	2.86E-12	1.48E-16	1.35E-14	<b>2.88E-12</b>	2.86E-12	1.42E-16	1.35E-14	<b>2.88E-12</b>
<b>SFP [kg O3 eq]</b>	6.67E-02	4.04E-03	1.96E-03	<b>7.27E-02</b>	6.54E-02	4.06E-03	1.96E-03	<b>7.14E-02</b>
<b>Resource Use Indicators</b>								
<b>RPRE [MJ]</b>	2.25E+00	4.29E-02	4.87E-01	<b>2.78E+00</b>	2.23E+00	4.11E-02	4.87E-01	<b>2.76E+00</b>
<b>RPRM [MJ]</b>	5.44E+00	0.00E+00	6.47E-01	<b>6.09E+00</b>	5.44E+00	0.00E+00	6.47E-01	<b>6.09E+00</b>
<b>NRPRE [MJ]</b>	3.19E+01	1.10E+00	6.39E-01	<b>3.36E+01</b>	3.14E+01	1.06E+00	6.39E-01	<b>3.31E+01</b>
<b>NRPRM [MJ]</b>	3.90E+01	0.00E+00	3.96E-02	<b>3.91E+01</b>	3.89E+01	0.00E+00	3.96E-02	<b>3.89E+01</b>
<b>SM [kg]</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
<b>RSF [MJ]</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
<b>NRSF [MJ]</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
<b>RE [MJ]</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
<b>FW [m3]</b>	8.47E-03	1.54E-04	2.75E-04	<b>8.90E-03</b>	8.26E-03	1.48E-04	2.75E-04	<b>8.68E-03</b>
<b>Output Flows and Waste Categories</b>								
<b>HWD [kg]</b>	4.72E-08	4.58E-12	4.49E-10	<b>4.76E-08</b>	4.71E-08	4.40E-12	4.49E-10	<b>4.75E-08</b>
<b>NHWD [kg]</b>	2.19E-02	9.47E-05	3.69E-03	<b>2.57E-02</b>	2.10E-02	9.09E-05	3.69E-03	<b>2.48E-02</b>
<b>HLRW [kg]</b>	6.70E-07	3.62E-09	2.17E-08	<b>6.96E-07</b>	6.66E-07	3.47E-09	2.17E-08	<b>6.91E-07</b>
<b>ILLRW [kg]</b>	5.82E-04	3.05E-06	1.91E-05	<b>6.04E-04</b>	5.79E-04	2.93E-06	1.91E-05	<b>6.01E-04</b>
<b>CRU [kg]</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
<b>MR [kg]</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
<b>MER [kg]</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
<b>EEE [MJ]</b>	0.00E+00	0.00E+00	1.34E-07	<b>1.34E-07</b>	0.00E+00	0.00E+00	1.34E-07	<b>1.34E-07</b>
<b>EET [MJ]</b>	0.00E+00	0.00E+00	6.31E-08	<b>6.31E-08</b>	0.00E+00	0.00E+00	6.30E-08	<b>6.30E-08</b>

**Table 11: LCIA results for PERM-A-BARRIER® Aluminum Wall Membrane products, per 1 m<sup>2</sup>**

Impact Category	PAB AL Wall Membrane	PAB AL Wall Membrane	PAB AL Wall Membrane	PAB Wall Membrane	PAB AL Wall Membrane LT	PAB AL Wall Membrane LT	PAB AL Wall Membrane LT	PAB AL Wall Membrane LT
	A1	A2	A3	A1-A3	A1	A2	A3	A1-A3
<b>IPCC AR5</b>								
<b>GWP [kg CO2 eq]</b>	1.51E+00	7.11E-02	4.50E-02	<b>1.62E+00</b>	1.48E+00	6.85E-02	4.50E-02	<b>1.60E+00</b>
<b>TRACI</b>								
<b>AP [kg SO2 eq]</b>	2.51E-03	1.41E-04	1.33E-04	<b>2.79E-03</b>	2.48E-03	1.40E-04	1.33E-04	<b>2.75E-03</b>
<b>EP [kg N eq]</b>	3.10E-04	1.72E-05	3.23E-05	<b>3.60E-04</b>	3.08E-04	1.69E-05	3.23E-05	<b>3.57E-04</b>
<b>GWP [kg CO2 eq]</b>	1.43E+00	7.02E-02	4.37E-02	<b>1.54E+00</b>	1.40E+00	6.75E-02	4.37E-02	<b>1.52E+00</b>
<b>ODP [kg CFC 11 eq]</b>	2.85E-12	1.33E-16	1.35E-14	<b>2.87E-12</b>	2.85E-12	1.28E-16	1.35E-14	<b>2.87E-12</b>
<b>SFP [kg O3 eq]</b>	6.15E-02	3.69E-03	1.96E-03	<b>6.71E-02</b>	6.04E-02	3.72E-03	1.96E-03	<b>6.61E-02</b>
<b>Resource Use Indicators</b>								
<b>RPRE [MJ]</b>	1.91E+00	3.86E-02	4.87E-01	<b>2.44E+00</b>	1.90E+00	3.71E-02	4.87E-01	<b>2.42E+00</b>
<b>RPRM [MJ]</b>	5.44E+00	0.00E+00	6.47E-01	<b>6.09E+00</b>	5.44E+00	0.00E+00	6.47E-01	<b>6.09E+00</b>
<b>NRPRE [MJ]</b>	2.70E+01	9.92E-01	6.38E-01	<b>2.87E+01</b>	2.67E+01	9.55E-01	6.38E-01	<b>2.83E+01</b>
<b>NRPRM [MJ]</b>	3.66E+01	0.00E+00	3.96E-02	<b>3.66E+01</b>	3.65E+01	0.00E+00	3.96E-02	<b>3.66E+01</b>
<b>SM [kg]</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
<b>RSF [MJ]</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
<b>NRSF [MJ]</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
<b>RE [MJ]</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
<b>FW [m3]</b>	5.64E-03	1.39E-04	2.75E-04	<b>6.06E-03</b>	5.47E-03	1.33E-04	2.75E-04	<b>5.88E-03</b>
<b>Output Flows and Waste Categories</b>								
<b>HWD [kg]</b>	4.71E-08	4.12E-12	4.49E-10	<b>4.75E-08</b>	4.70E-08	3.97E-12	4.49E-10	<b>4.75E-08</b>
<b>NHWD [kg]</b>	1.97E-02	8.52E-05	3.69E-03	<b>2.34E-02</b>	1.90E-02	8.20E-05	3.69E-03	<b>2.27E-02</b>
<b>HLRW [kg]</b>	4.97E-07	3.26E-09	2.17E-08	<b>5.22E-07</b>	4.94E-07	3.14E-09	2.17E-08	<b>5.19E-07</b>
<b>ILLRW [kg]</b>	4.37E-04	2.75E-06	1.91E-05	<b>4.59E-04</b>	4.35E-04	2.64E-06	1.91E-05	<b>4.57E-04</b>
<b>CRU [kg]</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
<b>MR [kg]</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
<b>MER [kg]</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>	0.00E+00	0.00E+00	0.00E+00	<b>0.00E+00</b>
<b>EEE [MJ]</b>	0.00E+00	0.00E+00	1.23E-07	<b>1.23E-07</b>	0.00E+00	0.00E+00	1.23E-07	<b>1.23E-07</b>
<b>EET [MJ]</b>	0.00E+00	0.00E+00	5.80E-08	<b>5.80E-08</b>	0.00E+00	0.00E+00	5.81E-08	<b>5.81E-08</b>

### 3.2 ADDITIONAL RESULTS (ISO 21930:2007)

**Table 12: Additional indicator results for PERM-A-BARRIER® Wall Membrane products, per 1 m<sup>2</sup>**

	PAB Wall Membrane	PAB Wall Membrane	PAB Wall Membrane	PAB Wall Membrane	PAB Wall Membrane LT	PAB Wall Membrane LT	PAB Wall Membrane LT	PAB Wall Membrane LT
	A1	A2	A3	A1-A3	A1	A2	A3	A1-A3
<b>Total Primary Energy Consumption [MJ (HHV)]</b>								
<b>Nonrenewable Fossil</b>	7.52E+01	1.18E+00	6.90E-01	<b>7.71E+01</b>	7.45E+01	1.13E+00	6.90E-01	<b>7.63E+01</b>
<b>Nonrenewable Nuclear</b>	1.49E+00	7.78E-03	4.85E-02	<b>1.54E+00</b>	1.48E+00	7.47E-03	4.85E-02	<b>1.53E+00</b>
<b>Renewable (Solar, Wind, Hydro, Geo)</b>	7.69E+00	4.29E-02	1.13E+00	<b>8.86E+00</b>	7.67E+00	4.11E-02	1.13E+00	<b>8.85E+00</b>
<b>Renewable (Biomass)</b>	-	-	-	-	-	-	-	-
<b>Material Resources Consumption (kg)</b>								
<b>Nonrenewable Material Resources</b>	1.93E+00	8.49E-03	1.04E-01	<b>2.04E+00</b>	1.86E+00	8.14E-03	1.04E-01	<b>1.97E+00</b>
<b>Renewable Material Resources</b>	6.18E-01	1.21E-02	6.24E-02	<b>6.92E-01</b>	6.17E-01	1.20E-02	6.24E-02	<b>6.92E-01</b>

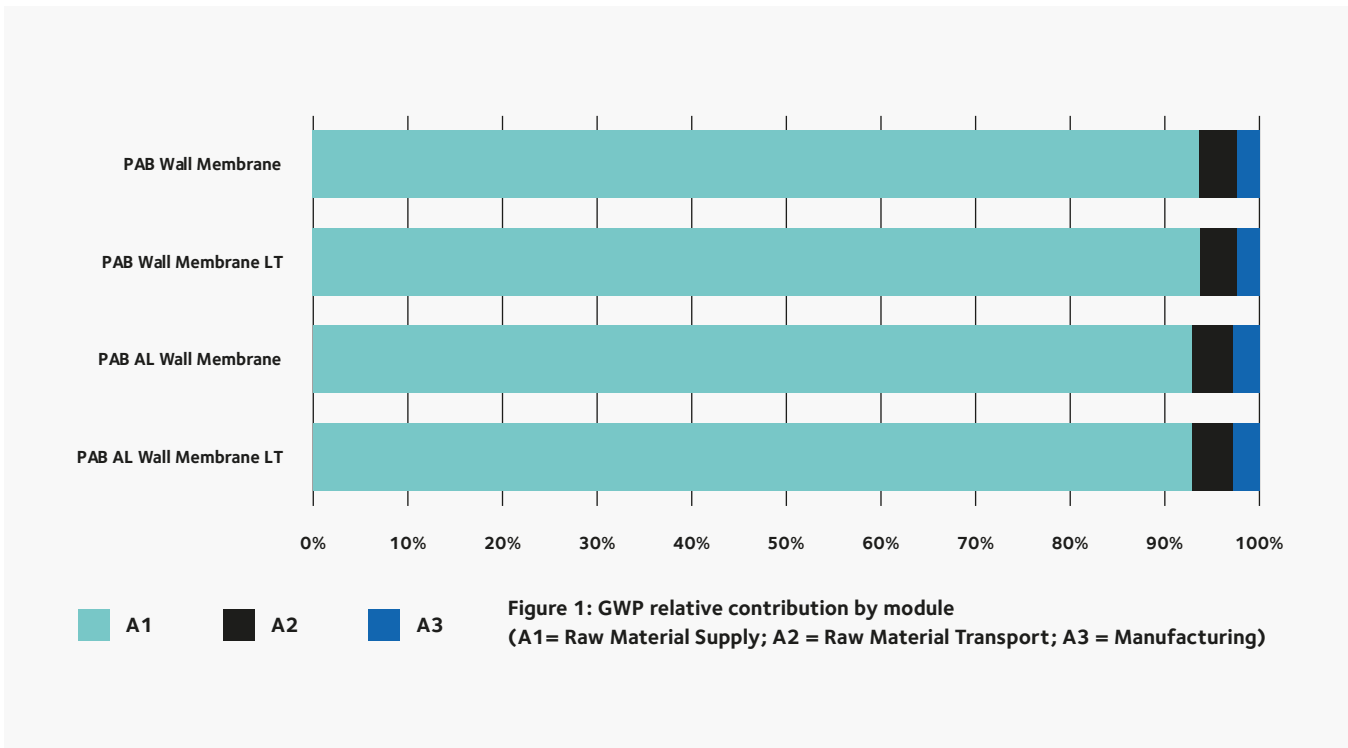
**Table 13: Additional indicator results for PERM-A-BARRIER® Aluminum Wall Membrane products, per 1 m<sup>2</sup>**

	PAB AL Wall Membrane	PAB AL Wall Membrane	PAB AL Wall Membrane	PAB AL Wall Membrane	PAB AL Wall Membrane LT	PAB AL Wall Membrane LT	PAB AL Wall Membrane LT	PAB AL Wall Membrane LT
	A1	A2	A3	A1-A3	A1	A2	A3	A1-A3
<b>Total Primary Energy Consumption [MJ (HHV)]</b>								
<b>Nonrenewable Fossil</b>	6.78E+01	1.06E+00	6.89E-01	<b>6.96E+01</b>	6.74E+01	1.02E+00	6.89E-01	<b>6.91E+01</b>
<b>Nonrenewable Nuclear</b>	1.12E+00	7.00E-03	4.84E-02	<b>1.17E+00</b>	1.11E+00	6.74E-03	4.84E-02	<b>1.17E+00</b>
<b>Renewable (Solar, Wind, Hydro, Geo)</b>	7.35E+00	3.86E-02	1.13E+00	<b>8.52E+00</b>	7.34E+00	3.71E-02	1.13E+00	<b>8.51E+00</b>
<b>Renewable (Biomass)</b>	-	-	-	-	-	-	-	-
<b>Material Resources Consumption (kg)</b>								
<b>Nonrenewable Material Resources</b>	1.75E+00	7.64E-03	1.04E-01	<b>1.86E+00</b>	1.70E+00	7.35E-03	1.04E-01	<b>1.81E+00</b>
<b>Renewable Material Resources</b>	6.13E-01	1.11E-02	6.24E-02	<b>6.86E-01</b>	6.13E-01	1.10E-02	6.24E-02	<b>6.86E-01</b>



# 4 Life Cycle Assessment Interpretation

For the selected PERM-A-BARRIER® air barriers, the primary contributors to the GWP impacts are the raw materials found in module A1. The primary contributors are asphalt, SBR, and aromatic oil. Transport (A2) and manufacturing (A3) contribute less than 10% of impacts.



## 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)