

ENVIRONMENTAL PRODUCT DECLARATION

NON-REINFORCED EPDM MEMBRANE

SINGLE PLY ROOFING MEMBRANE
INSTALLATION: FULLY ADHERED



Single ply, non-reinforced EPDM membrane fully adhered and representative of 1.1 mm and 1.5 mm thicknesses



Holcim Solutions and Products EMEA BV is a leading manufacturer of high-performing synthetic single-ply roofing and lining systems for commercial, industrial and residential applications.

Elevate roofing systems are marketed under the brand names RubberGard™ EPDM, RubberCover™ EPDM and UltraPly™ TPO. Elevate lining systems are marketed under the brand names PondGard™ EPDM and GeoGard™ EPDM.

Holcim Solutions and Products EMEA BV entered the waterproofing industry in 1980. The company has since produced and installed over 1,500,000,000 m² of single-ply membranes worldwide. Contractors, building owners, architects and specifiers trust Holcim Solutions and Products as a leading, single source for superior roofing and lining systems.

Holcim Solutions and Products EMEA BV is part of the Holcim Group, a global leader in innovative and sustainable building solutions



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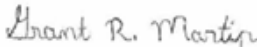
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REINFORCED EPDM MEMBRANE
SINGLE PLY ROOFING MEMBRANE
INSTALLATION: MECHANICALLY FASTENED

According to ISO 14025

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



PROGRAM OPERATOR	UL Environment	
DECLARATION HOLDER	Holcim Solutions and Products EMEA BV	
DECLARATION NUMBER	4787742079.101.1	
DECLARED PRODUCT	EPDM Non-Reinforced Single Ply Roofing Membrane (Fully Adhered)	
REFERENCE PCR	ASTM International Single Ply Roofing Membranes v.1 (2013) with UL Addendum v.1 (2019)	
DATE OF ISSUE	July 1, 2019	
PERIOD OF VALIDITY	5 Years	
CONTENTS OF THE DECLARATION	Product definition and information about building physics Information about basic material and the material's origin Description of the product's manufacture Indication of product processing Information about the in-use conditions Life cycle assessment results Testing results and verifications	
The PCR review was conducted by:	ASTM International	
	Panel Review	
	cert@astm.org	
This declaration was independently verified in accordance with ISO 14025 by Underwriters Laboratories ☐ INTERNAL ☒ EXTERNAL		
	Grant R. Martin, UL Environment	
This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:		
	Thomas Gloria, Industrial Ecology Consultants	

This EPD conforms with ISO 21930:2007 & EN 15804

Environment



Product Definition

Description of Product

The product system evaluated in this report is an installed single ply non-reinforced EPDM roofing membrane at the finished nominal thicknesses listed in Table 1.

Table 1: Membrane specification and standard

Roof System	Declared Thicknesses	Membrane Weight [kg/m ²]	Reference Flow [kg/1000 m ² installed over 60 years]	Standard
Non-reinforced ethylene propylene diene monomer (EPDM)	45 mils (1.1mm)	1.45	3,240	ASTM D4637 EN 13956
	60 mils (1.5mm)	1.95	4,005	

Application and Uses

Elevate non-reinforced EPDM membrane is an extremely durable synthetic rubber single-ply roofing membrane used worldwide in low-slope roofs for commercial, industrial and residential buildings. It is known to provide excellent long term weatherability, hail resistance, and repairability. It is classified as a thermoset material with the seams of the roofing system sealed with specially formulated Splice tape. It is sold in a variety of widths and thicknesses. Elevate Non-reinforced EPDM membranes do not have a reinforcement scrim and are designed for use in fully adhered, ballasted and mechanically fastened assemblies.

Product Life Cycle Description

Material Content

Table 2 shows the input material for non-reinforced EPDM roofing membranes and their material percentages.

Table 2: Average composition of non-reinforced EPDM roofing membrane

Material	%
Base Resin (EPDM)	27%
Filler	27%
Pigment	21%
Paraffinic oil	18%
EPDM scrap (internal)	6%
Activator	1%
Curative	< 1%
Naphthenic oil	< 1%

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Material	%
Processing aid	< 1%
Anti-oxidizing agent	< 1%

Manufacturing Process

The main material input into the manufacturing process is EPDM rubber in the form of pellets and (uncured) scrap. Additional materials include various additives, which aid in the manufacturing process (e.g., accelerators) and which enhance the membrane's performance (e.g., fire retardants and pigments). The manufacturing process begins with mixing the raw materials together in large batches to create uncured rubber that is slabbed off onto skids for quality control testing of the physical properties. Once the uncured rubber has passed the quality control test it is then calendared or extruded into 1.1 or 1.5 mm thick sheets. EPDM membranes can be produced with or without internal reinforcing scrim (see Elevate's EPD on reinforced EPDM membrane for details). The extruded sheets are sent through an inspection station and then dusted with mica to keep the material from sticking to itself though the vulcanization process where the sheeting is cured through heat and pressure. Once vulcanized, the sheeting goes through final inspection and then is packaged into 30.5 m long rolls. For sheets wider than 3.05 m, calendared sheets are sent through an inspection table and into an automated sheet building machine to create sheets up to 15.2 m wide. The large sheets also go through a dusting process prior to being sent through the vulcanization process. After vulcanization the sheets are cut to the desired width and packaged onto a cardboard core. Any uncured or cured trimmings are recycled back into the process to minimize waste and reduce cost.

Figure 1 shows the manufacturing process for EPDM.

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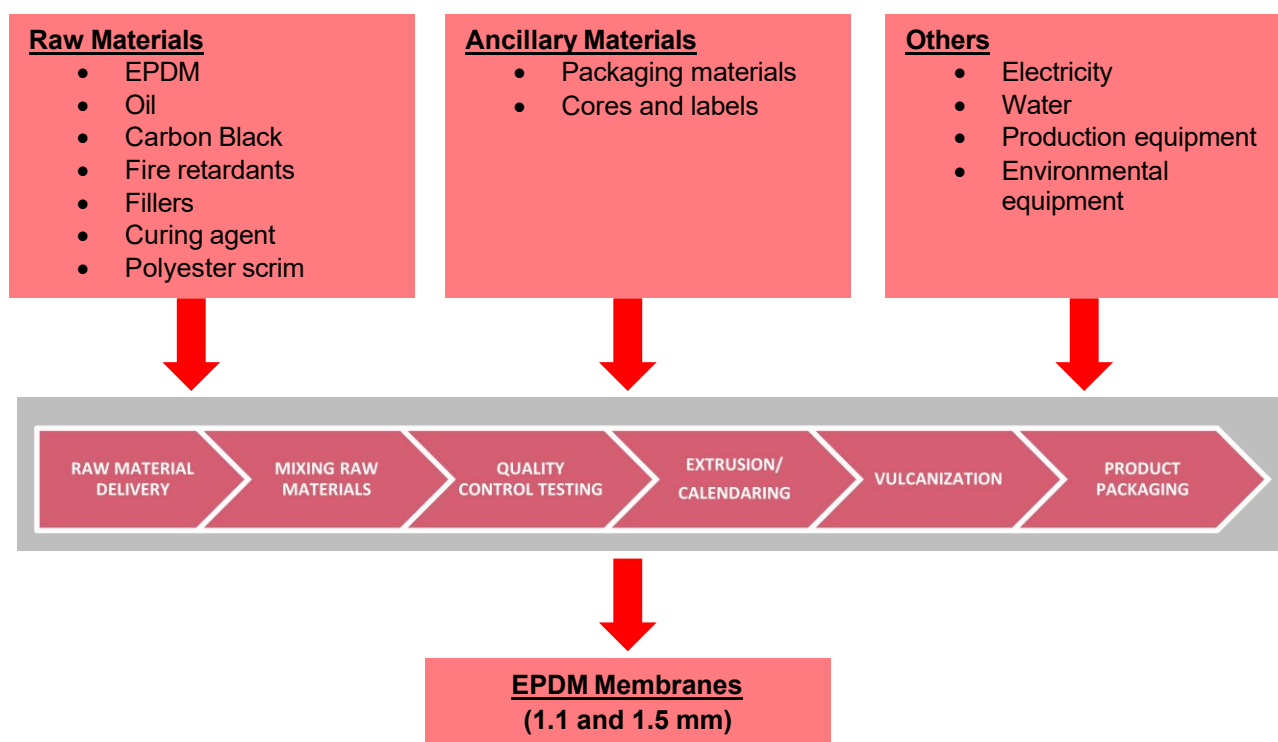


Figure 1: EPDM production process map

Installation

The installation process was modeled following common practice in which non-reinforced EPDM is fully adhered using appropriate adhesives.

Table 3 shows the material inputs, material outputs, and emissions associated with the installation of 1000 m² of non-reinforced EPDM membrane. This scenario is based on the industry average EPD and is intended to represent a typical installation (SPRI, 2017b). It is assumed to be representative for all thicknesses. Packaging materials are disposed of after the membrane is installed at the building site.

Table 3: Installation of non-reinforced EPDM, unit process (per 1,000 m²)

I/O	Material	Value	Unit
Inputs	Non-reinforced EPDM roofing membrane (packaged), incl. 2.5% overlap	1,025	m ²
	Low-VOC adhesive (SPRI, 2017a)	699	kg
Outputs	1 m ² of installed non-reinforced EPDM roofing membrane	1,000	m ²
	VOC (toluene) emissions to air	161	kg
	Packaging waste (from membrane and adhesive)	*	kg

* varies with membrane thickness

Use

The use stages have no burden, as any maintenance or replacement of the systems to meet the building service life requires only manual labor and no additional material, energy, or water. No energy or water are required to use the roof while installed. Burdens from complete roof system replacements necessary to fulfill the building service life are reflected in the aggregated results of the product, construction, and EoL stages, per the PCR.

A study conducted by SKZ (Süddeutsche Kunststoff Zentrum – South German Plastic Center), and commissioned by WDK (Wirtschaftsverband Deutsche Kautschukindustrie – German Rubber Industry) and the VESP (Vereniging EPDM Systeem Producenten Benelux – United EPDM System Manufacturers) assessed the life expectancy of EPDM roofing by testing membranes that had already been installed for 30 years and subjecting them to additional artificial aging. It concluded that the predicted life expectancy of EPDM membranes is over 50 years (SKZ, 2004). Therefore, a reference service life of 50 years is conservatively used for this study.

End-of-Life

At the end of the roofing membrane's useful life, it was assumed that the membrane material, as well as any fasteners or adhesive substances, are manually removed from the building and then landfilled. In the EU, because the membranes are petroleum-based, they have an energy content and are therefore assumed to be incinerated at EoL. Transport to landfill was approximated with 20 miles via large dump truck.

Life Cycle Assessment – Product Systems and Modeling

Functional Unit

The functional unit evaluated is 1,000 m² of installed watertight roofing surface over 60 years, for a stated product thickness.

Life Cycle Stages Assessed

The life cycle assessment (LCA) conducted includes the production, transport to installation site, installation, use, and end-of-life (EoL) stages.

System Boundaries

System boundaries are summarized in Figure 2 for the analysis scope of “cradle-to-grave”. As is typical of works of life cycle assessment, the construction and maintenance of capital equipment, such as production equipment in the manufacturing stage, are not included in the system, nor are human labor and employee commute.

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PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END-OF-LIFE STAGE			
Raw material supply	Transport	Manufacturing	Transport	Construction-installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Figure 2: Life cycle stages included in system boundary

Assumptions

In cases where no matching life cycle inventories were available to represent a flow, proxy data were applied based on conservative assumptions regarding environmental impacts.

Transportation

Unless specified by manufacturers, estimated transportation distances and modes of transport are included for the transport of the raw materials, operating materials, and auxiliary materials to production facilities.

Period under Consideration

All primary data were collected for the year 2014. All secondary data come from the GaBi Professional databases and are representative of the years 2010-2013.

Manufacturing Locations

Holcim manufactures its membranes in the United States. Installation, use, and end-of-life are considered for the EU as well. Whenever US background data were not readily available, European data or global data were used as proxies.

Background Data

The LCA model was created using the GaBi software system for life cycle engineering, developed by thinkstep AG. The GaBi Professional LCI database provides the life cycle inventory data for several of the raw and process materials obtained from the background system.

Cut- Off Criteria

Per the PCR, the cut-off criteria for flows to be considered within each system boundary are as follows:

- **Mass:** If a flow is less than 1% of the cumulative mass of the model flows, it may be excluded, provided its environmental relevance is minor, based on a sensitivity analysis.
- **Energy:** If a flow is less than 1% of the cumulative energy of the system model, it may be excluded, provided its environmental relevance is minor, based on a sensitivity analysis.
- **Environmental relevance:** If a flow meets the above two criteria but is determined to contribute 2% or more to the selected impact categories of the products underlying the EPD, based on a sensitivity analysis, it is included within the system boundary.

At least 95% of the mass flows shall be included and the life-cycle impact data shall contain at least 95% of all elementary flows that contribute to each of the declared category indicators. A list of hazardous and toxic materials and substances shall be included in the inventory and the cut-off rules do not apply to such substances.

No cut-off criteria had to be applied for this study. All available energy and material flow data were included in the model.

Data Quality Requirements

As the majority of the relevant foreground data are measured data or calculated based on primary information sources of the owner of the technology, precision is considered to be high. Seasonal variations were balanced out by collecting annual data. All background data are sourced from GaBi databases with the documented precision. Each foreground process was checked for mass balance and completeness of the emission inventory. No data were knowingly omitted. Completeness of foreground unit process data is considered to be high. All background data are sourced from GaBi databases with the documented completeness.

Allocation

When several products were manufactured at the same plant, Holcim used mass allocation to report data. Mass allocation was selected since the environmental burden in the industrial process (energy consumption, emissions, etc.) is primarily governed by the mass throughput of each sub-process.

Life Cycle Assessment – Results and Analysis

All results for the roofing membranes are presented in the below tables, separated by production (A1-A3), transport to installation site (A4), installation (A5), Use (B1-B7), and EoL (C1-C4) stages.

Table 4: 1.1 mm non-reinforced EPDM overall results, EU scenario, per functional unit

	Production (A1-A3)	Transport (A4)	Installation (A5)	Use (B1-B7)	EoL (C1-C4)	Total
TRACI 2.1 Impact Categories						
GWP (kg CO ₂ -eq.)	6,990	721	3,410	-	336	11,500
AP (kg SO ₂ eq.)	18.5	12.9	9.05	-	1.02	41.5
EP (kg N-eq.)	1.18	0.526	0.791	-	0.344	2.84
ODP (kg O ₃ -eq.)	7.50E-07	5.50E-09	2.20E-07	-	6.61E-09	9.83E-07

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	Production (A1-A3)	Transport (A4)	Installation (A5)	Use (B1-B7)	EoL (C1-C4)	Total
SFP (kg O ₃ -eq.)	256	260	1,120	-	18.4	1,650
CML Impact Categories						
ADPe (kg Sb-eq.)	0.052	8.96E-05	1.76E-02	-	4.70E-05	0.070
ADPf (MJ)	162,000	9,510	84,000	-	3,700	260,000
GWP (kg CO ₂ -eq.)	6,990	721	3,410	-	336	11,500
AP (kg SO ₂ eq.)	18.5	11.9	8.60	-	0.91	39.9
EP (kg Phosphate-eq.)	2.08	1.43	1.14	-	0.73	5.37
ODP (kg CFC11-eq.)	7.06E-07	5.18E-09	2.06E-07	-	6.22E-09	9.23E-07
POCP (kg Ethene-eq.)	2.40	0.795	156	-	0.133	160
Inventory metrics						
<i>Total primary energy consumption</i>						
Non-renewable fossil [MJ]	162,000	9,510	84,000	-	3,700	260,000
Non-renewable nuclear [MJ]	6,680	47.9	1,970	-	115	8,810
Renewable (solar, wind, hydroelectric, geothermal) [MJ]	3,480	91.5	3070	-	197	6,840
Renewable (biomass) [MJ]	4.83E-06	8.17E-09	1.11E-10	-	4.75E-06	9.59E-06
<i>Material resource consumption</i>						
Non-renewable materials [kg]	6,240	40.7	3,070	-	946	10,300
Renewable materials [kg]	1,770,000	25,700	955,000	-	101,000	2,850,000
Fresh Water [L]	47,700	1,040	188,000	-	-1.21	237,000
Waste generated [kg]	163	0.220	28.9	-	3,370	3,560
FDES NF EN 15804 Categories						
Air Pollution [m ³]	341,000	70,900	2,340,000	-	52,000	2,800,000
Water Pollution [m ³]	3,840	132	1,030	-	11,100	16,100
ADPe (kg Sb-eq.) (incl. complementary factors)	0.052	8.83E-05	0.0176	-	4.68E-05	0.070
EN 15804 Parameters describing resource use						
PERE [MJ]	1,530	92	3070	-	197	4,880
PERM [MJ]	1,950	-	-	-	-	1,950
PERT [MJ]	3,480	92	3070	-	197	6,840
PENRE [MJ]	126,000	9,560	86,000	-	3,820	226,000
PENRM [MJ]	42,700	-	-	-	-	42,700
PENRT [MJ]	169,000	9,560	86,000	-	3,820	268,000

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	Production (A1-A3)	Transport (A4)	Installation (A5)	Use (B1-B7)	EoL (C1-C4)	Total
SM [kg]	-	-	-	-	-	-
RSF [MJ]	-	-	-	-	-	-
NRSF [MJ]	-	-	-	-	-	-
Net use of fresh water [m3]	47.7	1.04	188	-	-0.00121	237.0
EN 15804 Other environmental information describing waste categories						
HWD [kg]	0.0138	0.00103	0.0192	-	7.23E-04	0.0348
NHWD [kg]	163	0.220	28.9	-	3,370	3,560
RWD [kg]	2.62	0.0188	0.776	-	0.0453	3.46

Table 5: 1.5 mm non-reinforced EPDM overall results, EU scenario, per functional unit

	Production (A1-A3)	Transport (A4)	Installation (A5)	Use (B1-B7)	EoL (C1-C4)	Total
TRACI 2.1 Impact Categories						
GWP (kg CO ₂ -eq.)	9,430	898	3,410	-	425	14,200
AP (kg SO ₂ eq.)	24.9	16.1	9.05	-	1.26	51.3
EP (kg N-eq.)	1.60	0.655	0.790	-	0.429	3.47
ODP (kg CFC11-eq.)	1.01E-06	6.85E-09	2.20E-07	-	7.71E-09	1.25E-06
SFP (kg O ₃ -eq.)	345	324	1,120	-	22.9	1,810
CML Impact Categories						
ADPe (kg Sb-eq.)	0.0705	1.12E-04	0.0176	-	5.82E-05	0.0883
ADPf (MJ)	219,000	11,800	84,000	-	4,580	319,000
GWP (kg CO ₂ -eq.)	9,430	898	3,410	-	425	14,200
AP (kg SO ₂ eq.)	24.9	14.9	8.60	-	1.13	49.5
EP (kg Phosphate-eq.)	2.80	1.78	1.14	-	0.904	6.63
ODP (kg CFC11-eq.)	9.52E-07	6.44E-09	2.06E-07	-	7.25E-09	1.17E-06
POCP (kg Ethene-eq.)	3.23	0.989	156	-	0.167	161
Inventory metrics						
<i>Total primary energy consumption</i>						
Non-renewable fossil [MJ]	219,000	11,800	84,000	-	4,580	319,000
Non-renewable nuclear [MJ]	9,000	59.6	1,970.0	-	139	11,200
Renewable (solar, wind, hydroelectric, geothermal) [MJ]	4,690	114	2,990	-	242	8,030
Renewable (biomass) [MJ]	5.50E-08	1.38E-10	4.75E-06	-	6.24E-09	4.81E-06

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	Production (A1-A3)	Transport (A4)	Installation (A5)	Use (B1-B7)	EoL (C1-C4)	Total
Material resource consumption						
Non-renewable materials [kg]	8,420	50.7	3,070	-	1,170	12,700
Renewable materials [kg]	2,390,000	31,900	954,000	-	124,000	3,500,000
Fresh water [L]	64,300	1,290	188,000	-	-4.70	254,000
Waste generated [kg]	220	0.274	28.9	-	4,180	4,430
FDES NF EN 15804 Categories						
Air Pollution [m³]	460,000	88,300	2,340,000	-	64,700	2,950,000
Water Pollution [m³]	5,180	164	1,030	-	13,700	20,100
ADPe (kg Sb-eq.) (incl. complementary factors)	0.0704	1.10E-04	0.0176	-	5.80E-05	0.0883
EN 15804 Parameters describing resource use						
PERE [MJ]	2,060	114	2990	-	242	5,400
PERM [MJ]	2,630	-	-	-	-	2,630
PERT [MJ]	4,690	114	2990	-	242	8,030
PENRE [MJ]	170,000	11,900	85,900	-	4,720	273,000
PENRM [MJ]	57,600	-	-	-	-	57,600
PENRT [MJ]	228,000	11,900	85,900	-	4,720	330,000
SM [kg]	-	-	-	-	-	-
RSF [MJ]	-	-	-	-	-	-
NRSF [MJ]	-	-	-	-	-	-
Net use of fresh water [m³]	64.3	1.29	188	-	-0.00470	254.0
EN 15804 Other environmental information describing waste categories						
HWD [kg]	0.0186	0.00128	0.0192	-	8.91E-04	0.0400
NHWD [kg]	220	0.274	28.900	-	4,180	4,430
RWD [kg]	3.54	0.0234	0.775	-	0.0545	4.39

Additional Environmental Information

Exceptional Durability:

Today, major environmental concerns result in a strong commitment within the building industry to provide long-term solutions that not only save money by extending the life of the roof but also aim to reduce the demand for energy and other natural resources and minimize the environmental impact.

The chemical composition of the Elevate RubberGard EPDM membrane (saturated carbon chains and more than 25% carbon black) and the fact that it is completely vulcanised (highly cross-linked chains) gives it almost unlimited

resistance to UV, ozone, micro-organisms and extreme weather conditions. Tests conducted on the RubberGard EPDM membrane and observations carried out on EPDM membranes exposed over many years to actual weather conditions (exposure to rain, UV, ozone, heat, thermal variations, micro-organisms etc.) have shown that under normal exposure in Western Europe, an EPDM waterproofing membrane has a life expectancy of more than 50 years without exhibiting any obvious signs of ageing such as cracks, fissures, bleaching etc. (SKZ, 2004).

High puncture resistance/resistance to hail damage:

Due to its good flexibility and high elasticity, RubberGard EPDM membranes have excellent puncture resistance. This characteristic is crucial in order to withstand mechanical stresses that the membrane can undergo during its utilisation, service or when under weather-related stress such as hail. EPDM roofing membranes have had a great track record of resisting hail damage and keeping water out of buildings, which can cut down on the owners' financial losses considerably. EPDM stays flexible throughout its lifecycle providing good hail resistance. A white paper by ERA on "Comparative performance of EPDM rubber roofing membrane as protection against hail damage" and laboratory study conducted by Jim D Koontz and Thomas W. Hutchinson confirms that both new and aged EPDM roof assemblies offer a high degree of hail resistance over a variety of roofing substrates.

Respect for the environment:

Several studies have shown that the intrinsic advantages of EPDM membranes towards the environment offer the optimal solution for sustainable roof sealing systems. The combination of exceptional life expectancy, easy extension of lifespan and the recycling of materials are the main assets allowing the RubberGard EPDM membrane to have a smaller environmental impact than that of traditional waterproofing membranes. GreenTeam Inc. has conducted a life-cycle analysis of the impact on the climate, the atmosphere, water and toxicity of various synthetic membranes and that of modified asphalts. The results show that the environmental impact of EPDM membranes is less pronounced than other roofing systems (LCA Study by ERA).

No toxic/rain water harvesting:

The RubberGard membrane is chemically inert and releases no toxic ingredients. Consequently, the water quality upon contact with the RubberGard EPDM membrane is compliant with environmental standards for recuperation of surface water and does not present any abnormal bacterial presence. Physical tests at Eurofins, an accredited Belgian laboratory recognised for environmental analyses, have shown that the RubberGard EPDM membrane and its assembly system allow the recovery of rainwater. It is therefore possible to recycle the collected water for use as domestic water for sanitation purposes.

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LCA Development



thinkstep

The EPD and background LCA were prepared by thinkstep, Inc.

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