



European Waterproofing  
Association AISBL

## ENVIRONMENTAL PRODUCT DECLARATION

# Flexible Bitumen Sheets For Roof Waterproofing – sector EPD

The product declared is an average that is not available for purchase on the market.

This EPD has been verified and registered in the International EPD® System. This EPD is also registered in the GlobalEPD Programme operated by AENOR based on a Mutual recognition agreement.

## European Waterproofing Association



**BASED ON:**  
PCR 2019:14  
(version 1.11).  
2021-02-05  
Construction  
products  
UN CPC (5453)

**VERSION DATE:**  
2021/10/15

**REGISTRATION  
NUMBERS**  
International EPD®  
System:  
S-P-00414

GlobalEPD:  
GlobalEPD-IntEPD S-P-00414

**REGISTRATION DATE:**  
2016/02/11

**VALID UNTIL:**  
2026/07/07

**Geographical  
scope:**  
EWA members in:  
Belgium, Belarus,  
Denmark, Finland,  
France, Germany,  
Italy, Lithuania,  
Netherlands,  
Norway, Portugal,  
Russia, Spain and  
Sweden.



## REFERENCES

EPD owner: European Waterproofing Association AISBL, Boulevard du Souverain 68 Box 1, 1170 Brussels, Belgium

Program operator: EPD International AB, Box 210 60, SE-100 31 Stockholm, Sweden

## INDEPENDENT VERIFICATION

This declaration has been developed referring to the International EPD System, following the General Programme Instructions version 3.01; further information and the document itself are available at: [www.environdec.com](http://www.environdec.com)

CEN standard EN 15804 serves as the core the Product Category Rules PCR (PCR 2019:14 Construction products, Version 1.11, 2021-02-05) PCR review was conducted by the Technical Committee of the International EPD® System. See [www.environdec.com/TC](http://www.environdec.com/TC) for a list of members. Review chair: Claudia A. Peña, University of Concepción, Chile. The review panel may be contacted via the Secretariat [www.environdec.com/contact](http://www.environdec.com/contact).

Independent third-party verification of the declaration and data, according to EN ISO 14025:2010

☐ EPD process certification (Internal)

☒ EPD verification (External): Ugo Pretato, Accredited as Individual Verifier by the International EPD® System.

Procedure for follow-up during EPD validity involves third party verifier

☐ Yes

☒ No

According to ISO 14025 "EPDs within the same product category but from different programmes may not be comparable".

According to EN 15804 "EPDs of construction products may not be comparable if they do not comply with EN 15804".

## CONTACTS

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Technical support to EWA was provided by **Life Cycle Engineering**, Italy. ([info@studiolce.it](mailto:info@studiolce.it), [www.lcengineering.eu](http://www.lcengineering.eu))





## EWA

The European Waterproofing Association (**EWA**) was created to provide an authoritative voice for the European Waterproofing industry.

The EWA is Europe's central source of advice and information on all roofing and waterproofing matters, both to the industry and to its user groups.

Sustainable and environmental issues are, quite rightly, matters of great importance to us all in construction. A full understanding of environmental concerns – like 'global warming', 'waste recycling' and 'life-cycle analysis' – is core to maintaining our reputation as a responsible industry. For this reason, EWA represents manufacturers who are committed to ensuring their industry is sustainable, which means to be environmentally, economically and socially responsible over time.

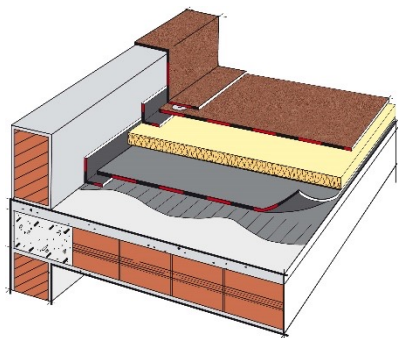
EWA decided to develop this Environmental Product Declaration (**EPD**) for several bitumen waterproofing systems because it is considered an important tool to support manufacturers on the environmental marketing activities from a scientific and holistic perspective. The products declared are an average that is not available for purchase on the market. This document contains key information to help any expert, involved in construction deal, with the assessment of the environmental impact of the building, building materials and systems used.



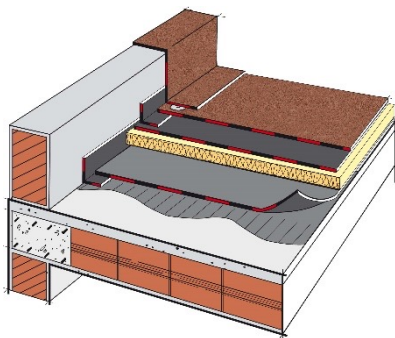
BITUMINOUS MEMBRANES

Bituminous waterproofing membranes are widely used to protect buildings against water in its various forms (e.g., rain, humidity, snow and hail). In addition, their waterproofing qualities preserve and sustain a building's capital value. Indeed, the membrane provides a good protection from rainwater penetration in order to ensure a proper thermal insulation over time. Bituminous waterproofing can also make the roof accessible to pedestrians and vehicles, being also the optimal and durable solution for creating vegetation systems on the roof. Those can help keep a building healthy and support biodiversity.

Bituminous waterproofing membranes can be composed by one or more layers. Hence, they are usually classified as single-layer or multi-layer systems.



Single layer



Multi layer

OBJECT OF THE EPD

This EPD reports the environmental performance for eight waterproofing systems, which represent those commonly used in the European industry. These systems cover modified plastomeric/elastomeric bitumen sheets with polyester/glass reinforcement; with a thickness between 1.9-5.2 mm; with or without mineral auto-protection and PE film; or sand as a back finishing.

Thickness and mass reported in the table are representative for the European average.

Waterproofing systems (data per m²)			Layer	Thickness (mm)	Mass (kg)
Single layer	System 1	Fully torched	Single	4.3	5.3
	System 2	Mechanically fastened	Single	4.4	5.4
	System 3	With ballast	Single	4.2	4.8
	System 4	Self adhesive	Single	3.8	4.5
Multi layer	System 5	Fully torched	Top	3.8	4.8
			Bottom	3.1	3.9
	System 6	Mechanically fastened	Top	3.8	4.9
			Bottom	3.0	3.7
	System 7	With ballast	Top	3.6	4.3
			Bottom	3.0	3.8
	System 8	Self adhesive	Top	3.3	4.0
			Bottom	3.0	3.2



CONTENT OF MATERIALS AND CHEMICALS SUBSTANCES

The main raw materials required to produce the defined waterproofing systems are bitumen (45-52%), polymers (6-10%), reinforcement (2-4%), minerals as fillers or finishing (30-41%) and other materials (3-5%).

The average composition of the products, as a representative range for all the 8 systems defined by EWA Technical Committee, is provided in the table besides, along with average packaging composition and the respective biogenic carbon content declaration.



PRODUCT SPECIFICATION

COMPONENT	WEIGHT (%)	% RECYCLED	% RENEWABLE
Bitumen	45-52%	0	0
Polymers (Polyolefins, SBS)	6-10%	0 - 100	0
Reinforcements (...)	2-4%	0	0
Minerals (...)	30-41%	0	0
Others (...)	3-5%	0	0 *

Product studied do not contain substances listed in the "Candidate List of Substances of Very High Concern" (SVHC).

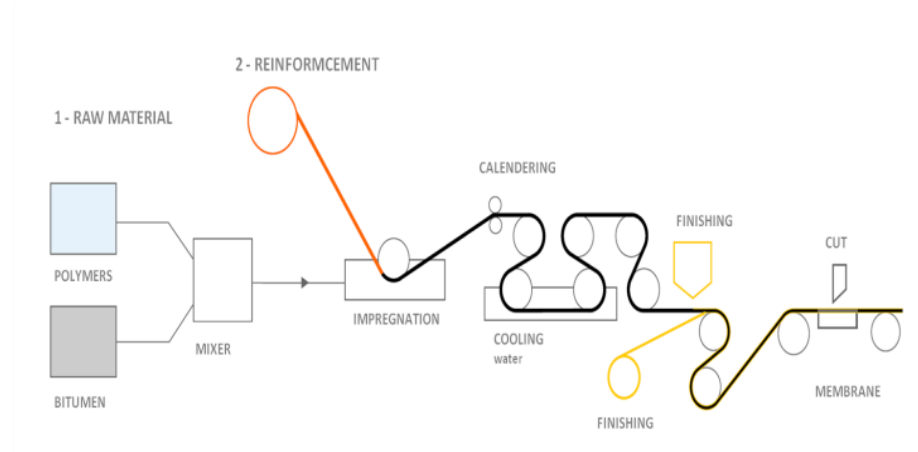
PACKAGING SPECIFICATION

COMPONENT	kg/m²	% RECYCLED	% RENEWABLE
Cardboard	0.01-0.02	89 (FEFCO 2019)	100
PE film	0.01-0.015	0	0
Wooden pallet	0.10	0	100

BIOGENIC CARBON CONTENT	kg C/m²
In product	0
In packaging	0.04 – 0.05

## PRODUCTION PROCESS

Bituminous waterproofing membranes are produced by a continuous process as outlined in the figure below.



Raw materials (bitumen and polymers) are mixed separately at a specific range of temperature and successively reinforced with polyester fleece or glass mat (glass mat, glass grid, glass fabric) by impregnation. After calendering and cooling, the membrane can be finished for practicality and aesthetic reasons by means of different alternative materials, such as polypropylene films, (colored) slates, etc. Membranes are installed on many different type of building roofs as waterproofing, either, as a single or multi-layer, depending on the type of selected product.

## THE WATERPROOFING SYSTEM

Depending on roof typology, design and building structural variables, membranes could be installed in three different modalities:



**Fully Torched:** in which all membranes (single layer, bottom layer and/or top layer) are fully adhered to the substrate of membrane below by heating the bottom surface of the membrane by a gas burner or a hot air welding machine



**Ballasted:** in which the membrane (single layer system) or the bottom layer (multi layer system) are loose laid, whereby the joints and top layer, if applicable, are torched. Eventually, the topside of the system is covered by ballast.



**Mechanically fastened:** in which the membrane (single layer system) or the bottom layer (multi layer system) are loose laid and fixed by metal/plastic fasteners, whereby the joints and top layer, if applicable, are torched.



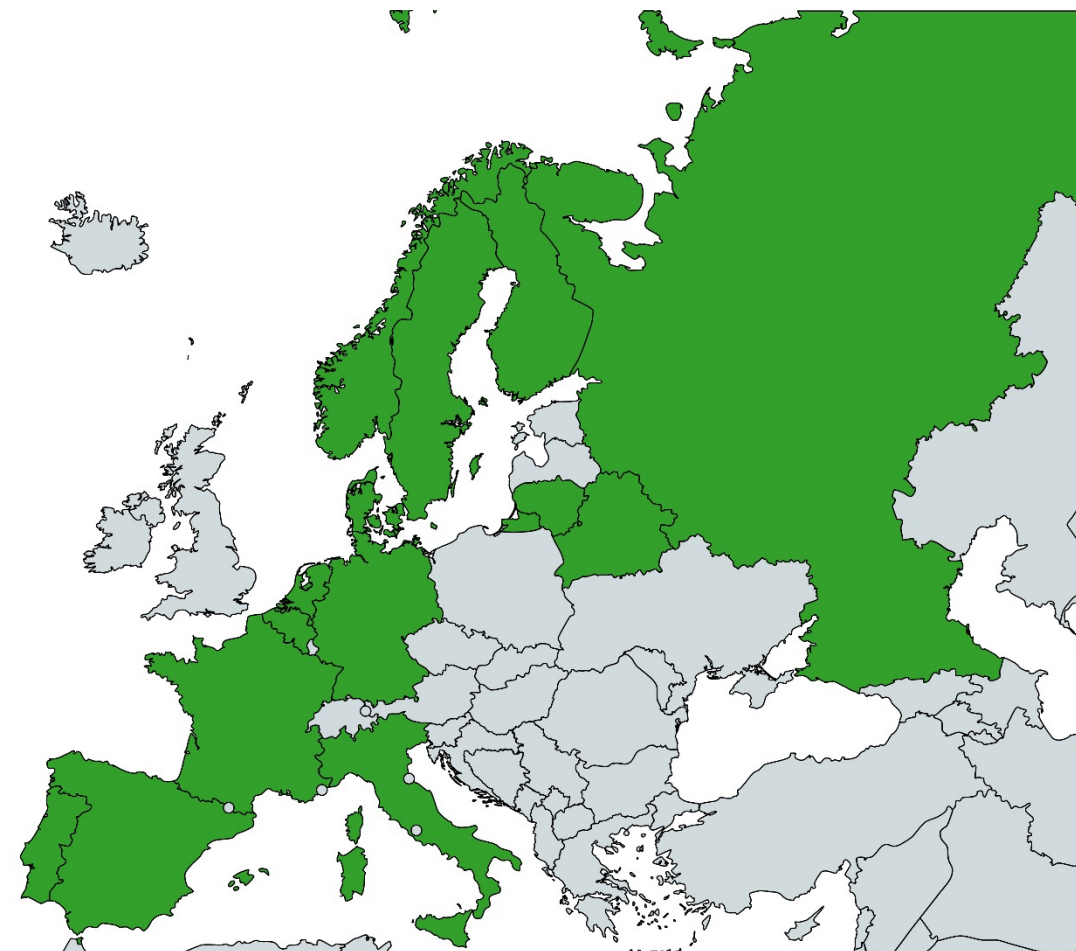
**Self adhesive:** in which the membrane (both single- and multi-layer systems) are directly fixed to the substrate of the membrane.

## SECTORIAL EPD - PARTICIPANTS

A total of 43 plants participated to the EPD data collection phase (further details reported in Appendix). Manufacturing plants are placed in Belgium, Belarus, Denmark, Finland, France, Germany, Italy, Lithuania, Netherlands, Norway, Portugal, Russia, Spain and Sweden. Production sites involved in manufacturing of widely-sold products in the EU market were selected by partners for this study.

Thirty-three EWA members producing bitumen membranes out of thirty-five participated in the data collection for the EPD (percentage of representativeness ca. 95%).

The results presented in this EPD are representative exclusively for the members participating in this study.



## EWA ONLINE LCA TOOL AND DATA COLLECTION

EWA has developed, in close co-operation with Life Cycle Engineering (**LCE** s.r.l., Italy), a customized Life Cycle Analysis (LCA) on-line software tool for all EWA members.

This online tool allows EWA to collect specific data among EWA members and to measure the environmental performance of the waterproofing systems.

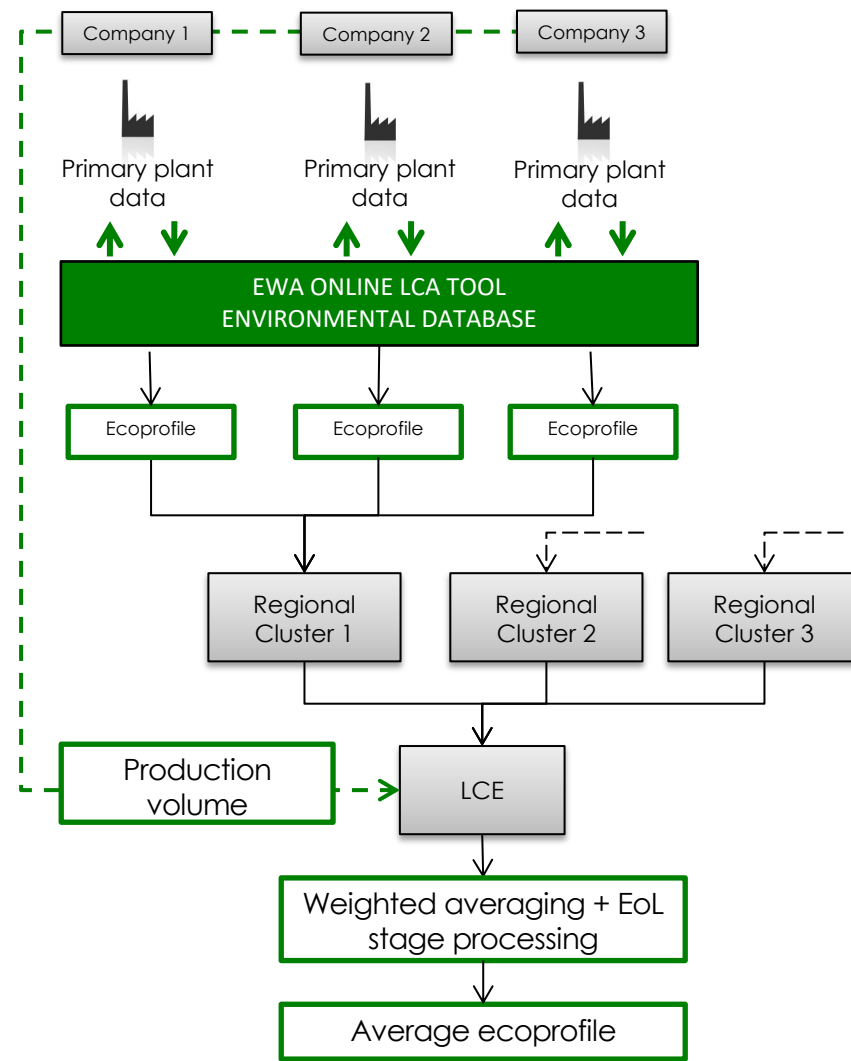
Primary data were collected from the **43 production plants** by means of the EWA on-line tool. Regional Clusters, which a production plant belongs to, were created within the tool to more easily gather and check the different data.

One set of environmental results per product system is presented in the EPD, as a weighted average based on each company production volume of bituminous membranes.

Process flow for one product system is shown besides.

The allocation procedure follows the rules established by PCR 2019:14 v1.11 (§ 4.5).

The reference year is **2019**.





TECHNICAL SPECIFICATIONS OF THE EPD®

**GEOGRAPHICAL SCOPE:** Europe  
**FUNCTIONAL UNIT (FU):** 1 m<sup>2</sup> installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.  
**TYPE OF EPD:** Cradle-to-grave and module D. The list of life-cycle stages is indicated in the table below, according to EN 15804

Information regarding results variations between production sites and products composition – compared with the average products declared – are presented in page [47](#).

	PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Decostruction, demolition	Transport	Waste processing	Disposal	Reuse-recovery-recycling potential
	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
	✓	✓	✓	✓	✓	ND	ND	ND	ND	✓	ND	ND	✓ *	✓	✓	✓	✓
Geography	EU	EU	EU	-	-	-	-	-	-	-	-	-	-	EU	EU	EU	EU
Specific data used	>90%			-	-	-	-	-	-	-	-	-	-	-	-	-	-

✓ = Module assessed; ND = Module not declared

**REPRESENTATIVE YEAR FOR MANUFACTURING DATA:** 2019  
**SOFTWARE:** SimaPro version 9  
**DATABASE:** Ecoinvent 3,6, Plastics Europe (2014)

\* Module however not declared, due to the cut-off. See page 13 for further information

## LIST OF CORE AND ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS

The following table shows the core and additional environmental impact indicators evaluated per each product studied, along with the disclaimers to be considered for part of them

ILCD CLASSIFICATION	INDICATOR	DISCLAIMER
ILCD Type 1	Global warming potential (GWP)	None
	Depletion potential of the stratospheric ozone layer (ODP)	None
	Potential incidence of disease due to PM emissions (PM)	None
ILCD Type 2	Acidification potential, Accumulated Exceedance (AP)	None
	Eutrophication potential, Fraction of nutrients reaching freshwater end compartment (EP-freshwater)	None
	Eutrophication potential, Fraction of nutrients reaching marine end compartment (EP-marine)	None
	Eutrophication potential, Accumulated Exceedance (EP-terrestrial)	None
	Formation potential of tropospheric ozone (POCP)	None
	Potential Human exposure efficiency relative to U235 (IRP)	1
ILCD Type 3	Abiotic depletion potential for non-fossil resources (ADP-m&m)	2
	Abiotic depletion potential for fossil resources (ADP-f)	2
	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	2
	Potential Comparative Toxic Unit for ecosystems (ETP-fw)	2
	Potential Comparative Toxic Unit for humans (HTP-c)	2
	Potential Comparative Toxic Unit for humans (HTP-nc)	2
	Potential Soil quality index (SQP)	2

**Disclaimer 1** This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

**Disclaimer 2** The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.



## SYSTEM 1 – SINGLE LAYER FULLY TORCHED

Potential environmental impacts \*

UNITS PER FU		A1	A2	A3	A4	A5	B5	C2	C3	C4	D
GWP-total	kg CO2 eq	3.32E-02	8.25E-04	3.92E-04	1.78E-03	1.46E-02	9.72E-02	2.30E-03	9.45E-02	5.61E-03	-4.06E-02
GWP-fossil	kg CO2 eq	3.27E-02	8.24E-04	3.12E-03	1.78E-03	1.43E-02	1.01E-01	2.30E-03	9.44E-02	5.58E-03	-4.29E-02
GWP-biogenic	kg CO2 eq	4.49E-04	3.37E-07	-2.73E-03	9.79E-07	2.87E-03	1.29E-03	9.44E-07	4.36E-05	2.37E-05	2.33E-03
GWP-luluc	kg CO2 eq	4.13E-05	6.51E-09	1.78E-06	3.07E-08	5.47E-06	9.45E-05	1.82E-08	2.48E-06	1.44E-06	-4.00E-05
GWP-GHG	kg CO2 eq	3.29E-02	8.25E-04	3.13E-03	1.78E-03	1.44E-02	1.02E-01	2.30E-03	9.44E-02	5.59E-03	-4.31E-02
ODP	kg CFC11 eq	2.71E-08	1.91E-10	6.22E-10	4.11E-10	4.56E-09	6.41E-08	5.34E-10	4.61E-10	9.24E-11	-1.72E-08
AP	mol H+ eq	2.48E-04	5.50E-06	8.05E-06	9.04E-06	8.90E-05	7.03E-04	7.97E-06	2.77E-05	7.68E-06	-1.84E-04
EP-freshwater <sup>1</sup>	kg P eq	1.18E-06	4.89E-10	3.95E-08	1.82E-09	1.62E-07	2.70E-06	1.37E-09	1.08E-07	6.71E-08	-1.76E-06
EP-marine	kg N eq	3.66E-05	2.31E-06	1.80E-06	2.87E-06	3.06E-05	1.45E-04	2.56E-06	9.08E-06	5.04E-06	-2.42E-05
EP-terrestrial	mol N eq	4.06E-04	2.53E-05	1.96E-05	3.16E-05	3.35E-04	1.60E-03	2.81E-05	1.01E-04	1.63E-05	-2.81E-04
POCP	kg NMVOC eq	1.64E-04	6.49E-06	1.33E-05	8.38E-06	9.29E-05	5.58E-04	7.68E-06	2.61E-05	5.53E-06	-9.36E-05
ADP-minerals&metals	kg Sb eq	8.77E-08	4.85E-11	1.69E-08	1.12E-10	1.31E-08	2.29E-07	1.36E-10	4.08E-09	7.75E-10	-2.00E-08
ADP-fossil	MJ	1.68E+00	1.16E-02	6.16E-02	2.52E-02	2.87E-01	4.03E+00	3.26E-02	2.59E-02	1.65E-02	-1.47E+00
WDP	m3 world eq. deprived	1.53E-01	-2.57E-06	2.22E-03	-3.94E-06	1.97E-02	3.40E-01	-7.18E-06	8.29E-04	2.26E-02	-1.54E-02

\* See Annex A for information on the indicators abbreviations

FU: 1 m<sup>2</sup> installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.

<sup>1</sup> Due to a typographical error in EN 15804:2021+A2:2019, PCR 2019:14 indicates that results shall be given in both kg PO<sub>4</sub>eq and kg P<sub>eq</sub>. Results are here presented only as kg P<sub>eq</sub>. To obtain the value in kg PO<sub>4</sub>eq multiply by 3.07 (as indicated in PCR 2019:14)

<sup>†</sup> negative value due water flows accounting of the AWARE method used to calculate water depletion potential. An input of marine salt water is used in the transport process inventory of A2 module, along with an output of freshwater. However, the former is not considered from the AWARE method, hence highlighting a credit for returning freshwater to nature, but not the impact of withdrawing it in the first place.

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks



## SYSTEM 1 – SINGLE LAYER FULLY TORCHED

Potential additional environmental impacts \*

	UNITS PER FU	A1	A2	A3	A4	A5	B5	C2	C3	C4	D
PM	Disease incidence (No.)	1.47E-08	9.74E-11	9.33E-11	1.23E-10	1.98E-09	3.31E-08	1.50E-10	1.84E-10	6.77E-11	-5.65E-10
IRP	kBq U235 eq	7.25E-03	5.13E-05	1.50E-04	1.12E-04	1.22E-03	1.71E-02	1.43E-04	1.73E-04	1.38E-04	-6.54E-03
ETP-fw	CTUe	6.36E-01	5.04E-03	2.08E-02	1.02E-02	1.10E-01	1.52E+00	1.31E-02	6.85E-02	1.27E-02	-3.71E-01
HTP-c	CTUh	1.70E-11	2.64E-13	2.69E-12	1.64E-13	3.29E-12	4.54E-11	1.85E-13	1.34E-11	1.37E-13	-4.39E-12
HTP-nc	CTUh	3.92E-10	1.21E-11	1.42E-11	1.73E-11	1.20E-10	1.08E-09	2.16E-11	8.71E-11	6.78E-12	-2.03E-10
SQP	(-)	4.74E-02	2.89E-05	2.32E-01	9.06E-05	3.45E-02	6.11E-01	8.09E-05	6.64E-03	9.66E-03	-2.96E-01

\* See Annex A for information on the indicators abbreviations

FU: 1 m<sup>2</sup> installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks





## SYSTEM 1 – SINGLE LAYER FULLY TORCHED

Use of resources \*

	UNITS PER FU	A1	A2	A3	A4	A5	B5	C2	C3	C4	D
PERE	MJ	3.48E-02	1.63E-05	1.24E-02	6.52E-05	6.04E-03	1.04E-01	4.56E-05	3.36E-03	2.35E-03	-9.08E-02
PERM	MJ	0.00E+00	0.00E+00	2.21E-02	0.00E+00	2.65E-03	4.82E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	3.48E-02	1.63E-05	3.46E-02	6.52E-05	8.69E-03	1.52E-01	4.56E-05	3.36E-03	2.35E-03	-9.08E-02
PENRE	MJ	5.01E-01	1.16E-02	5.08E-02	2.52E-02	1.43E-01	1.43E+00	3.18E-02	3.13E-02	1.91E-02	-1.01E+00
PENRM	MJ	1.22E+00	0.00E+00	1.40E-02	0.00E+00	1.47E-01	2.68E+00	0.00E+00	0.00E+00	0.00E+00	-5.49E-01
PENRT	MJ	1.72E+00	1.16E-02	6.53E-02	2.52E-02	2.91E-01	4.11E+00	3.18E-02	3.13E-02	1.91E-02	-1.56E+00
SM	kg	2.18E-03	0.00E+00	7.93E-07	0.00E+00	2.62E-04	4.75E-03	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	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	0.00E+00	0.00E+00
FW	m3	4.77E-04	2.31E-07	5.40E-05	6.33E-07	9.26E-05	1.20E-03	6.45E-07	4.54E-05	5.35E-04	-5.75E-04

\* See Annex B for information on the indicators abbreviations

FU: 1 m<sup>2</sup> installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.



SYSTEM 1 – SINGLE LAYER FULLY TORCHED

Other indicators describing waste categories \*

UNITS PER FU		A1	A2	A3	A4	A5	B5	C2	C3	C4	D
HWD	kg	1.70E-05	0.00E+00	3.16E-05	0.00E+00	5.84E-06	1.06E-04	0.00E+00	0.00E+00	0.00E+00	-1.37E-18
NHWD	kg	1.03E-03	0.00E+00	2.45E-03	0.00E+00	3.34E-03	1.22E-02	0.00E+00	0.00E+00	0.00E+00	-2.91E-18
RWD	kg	4.32E-05	3.39E-07	8.45E-07	7.31E-07	5.41E-06	9.83E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU	kg	1.19E-03	0.00E+00	0.00E+00	0.00E+00	1.43E-04	2.60E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	5.68E-06	0.00E+00	0.00E+00	0.00E+00	1.42E-03	2.37E-03	0.00E+00	2.27E-02	0.00E+00	0.00E+00
MER	kg	0.00E+00	0.00E+00	9.63E-05	0.00E+00	3.12E-03	5.05E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	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	0.00E+00	4.60E-01

\* See Annex B for information on the indicators abbreviations

FU: 1 m² installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.



## SYSTEM 2 – SINGLE LAYER MECHANICALLY FASTENED

Potential environmental impacts \*

UNITS PER FU		A1	A2	A3	A4	A5	B5	C2	C3	C4	D
GWP-total	kg CO2 eq	3.65E-02	7.59E-04	4.91E-04	1.68E-03	1.63E-02	1.04E-01	2.35E-03	9.63E-02	5.71E-03	-4.20E-02
GWP-fossil	kg CO2 eq	3.58E-02	7.59E-04	2.99E-03	1.68E-03	1.61E-02	1.07E-01	2.34E-03	9.62E-02	5.69E-03	-4.42E-02
GWP-biogenic	kg CO2 eq	6.99E-04	3.10E-07	-2.50E-03	1.03E-06	2.73E-03	2.11E-03	9.62E-07	4.44E-05	2.42E-05	2.27E-03
GWP-luluc	kg CO2 eq	3.32E-05	6.00E-09	2.03E-06	3.64E-08	7.57E-06	7.75E-05	1.86E-08	2.52E-06	1.47E-06	-4.46E-05
GWP-GHG	kg CO2 eq	3.61E-02	7.59E-04	3.01E-03	1.68E-03	1.62E-02	1.08E-01	2.34E-03	9.62E-02	5.69E-03	-4.44E-02
ODP	kg CFC11 eq	3.23E-08	1.75E-10	3.97E-10	3.84E-10	5.78E-09	7.47E-08	5.44E-10	4.70E-10	9.42E-11	-1.78E-08
AP	mol H+ eq	2.57E-04	5.16E-06	5.58E-06	9.62E-06	6.92E-05	7.18E-04	8.12E-06	2.82E-05	7.83E-06	-1.90E-04
EP-freshwater <sup>†</sup>	kg P eq	1.77E-06	4.50E-10	4.17E-08	2.05E-09	4.42E-07	3.99E-06	1.39E-09	1.10E-07	6.84E-08	-1.81E-06
EP-marine	kg N eq	3.79E-05	2.18E-06	1.64E-06	3.00E-06	1.53E-05	1.48E-04	2.60E-06	9.25E-06	5.14E-06	-2.49E-05
EP-terrestrial	mol N eq	4.22E-04	2.39E-05	1.62E-05	3.31E-05	1.66E-04	1.63E-03	2.87E-05	1.03E-04	1.66E-05	-2.89E-04
POCP	kg NMVOC eq	1.67E-04	6.12E-06	6.73E-06	8.71E-06	5.59E-05	5.49E-04	7.82E-06	2.66E-05	5.64E-06	-9.66E-05
ADP-minerals&metals	kg Sb eq	4.01E-08	4.46E-11	9.73E-09	1.07E-10	2.05E-08	1.10E-07	1.38E-10	4.16E-09	7.89E-10	-1.94E-08
ADP-fossil	MJ	1.64E+00	1.07E-02	5.05E-02	2.36E-02	3.65E-01	3.90E+00	3.32E-02	2.64E-02	1.68E-02	-1.51E+00
WDP	m3 world eq. deprived	1.16E-01	-2.36E-06	3.09E-03	-2.96E-06	2.11E-02	2.62E-01	-7.31E-06	8.45E-04	2.31E-02	-1.63E-02

\* See Annex A for information on the indicators abbreviations

FU: 1 m<sup>2</sup> installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.

<sup>†</sup> Due to a typographical error in EN 15804:2021+A2:2019, PCR 2019:14 indicates that results shall be given in both kg PO<sub>4</sub>eq and kg P<sub>eq</sub>. Results are here presented only as kg P<sub>eq</sub>. To obtain the value in kg PO<sub>4</sub>eq multiply by 3.07 (as indicated in PCR 2019:14)

<sup>†</sup> negative value due water flows accounting of the AWARE method used to calculate water depletion potential. An input of marine salt water is used in the transport process inventory of A2 module, along with an output of freshwater. However, the former is not considered from the AWARE method, hence highlighting a credit for returning freshwater to nature, but not the impact of withdrawing it in the first place.

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks



## SYSTEM 2 – SINGLE LAYER MECHANICALLY FASTENED

Potential additional environmental impacts \*

	UNITS PER FU	A1	A2	A3	A4	A5	B5	C2	C3	C4	D
PM	Disease incidence (No.)	1.41E-08	9.18E-11	7.94E-11	1.25E-10	2.51E-09	3.18E-08	1.53E-10	1.88E-10	6.89E-11	-6.13E-10
IRP	kBq U235 eq	7.68E-03	4.72E-05	5.71E-05	1.05E-04	1.50E-03	1.78E-02	1.46E-04	1.76E-04	1.40E-04	-6.72E-03
ETP-fw	CTUe	6.62E-01	4.65E-03	2.42E-02	9.71E-03	1.70E-01	1.58E+00	1.33E-02	6.98E-02	1.29E-02	-3.79E-01
HTP-c	CTUh	1.76E-11	2.55E-13	2.25E-12	1.65E-13	1.29E-11	4.56E-11	1.89E-13	1.37E-11	1.40E-13	-4.60E-12
HTP-nc	CTUh	3.70E-10	1.13E-11	1.30E-11	1.73E-11	1.93E-10	1.03E-09	2.20E-11	8.88E-11	6.91E-12	-2.09E-10
SQP	(-)	6.91E-02	2.66E-05	2.27E-01	9.77E-05	5.61E-02	6.48E-01	8.25E-05	6.76E-03	9.84E-03	-2.97E-01

\* See Annex A for information on the indicators abbreviations

FU: 1 m<sup>2</sup> installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks





## SYSTEM 2 – SINGLE LAYER MECHANICALLY FASTENED

Use of resources \*

	UNITS PER FU	A1	A2	A3	A4	A5	B5	C2	C3	C4	D
PERE	MJ	4.83E-02	1.50E-05	1.35E-02	7.48E-05	1.38E-02	1.36E-01	4.65E-05	3.43E-03	2.39E-03	-9.38E-02
PERM	MJ	0.00E+00	0.00E+00	2.12E-02	0.00E+00	3.38E-03	4.61E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	4.83E-02	1.50E-05	3.47E-02	7.48E-05	1.72E-02	1.82E-01	4.65E-05	3.43E-03	2.39E-03	-9.38E-02
PENRE	MJ	5.92E-01	1.07E-02	5.22E-02	2.36E-02	1.74E-01	1.62E+00	3.24E-02	3.19E-02	1.94E-02	-1.05E+00
PENRM	MJ	1.10E+00	0.00E+00	3.77E-03	0.00E+00	2.08E-01	2.41E+00	0.00E+00	0.00E+00	0.00E+00	-5.60E-01
PENRT	MJ	1.69E+00	1.07E-02	5.63E-02	2.36E-02	3.81E-01	4.03E+00	3.24E-02	3.19E-02	1.94E-02	-1.61E+00
SM	kg	2.41E-03	0.00E+00	1.16E-05	0.00E+00	3.88E-04	5.29E-03	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	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	0.00E+00	0.00E+00
FW	m3	5.95E-04	2.12E-07	7.37E-05	6.54E-07	1.64E-04	1.50E-03	6.58E-07	4.63E-05	5.45E-04	-6.04E-04

\* See Annex B for information on the indicators abbreviations

FU: 1 m<sup>2</sup> installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.



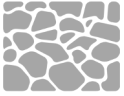
SYSTEM 2 – SINGLE LAYER MECHANICALLY FASTENED

Other indicators describing waste categories \*

UNITS PER FU		A1	A2	A3	A4	A5	B5	C2	C3	C4	D
HWD	kg	1.96E-05	0.00E+00	5.61E-05	0.00E+00	1.21E-05	1.65E-04	0.00E+00	0.00E+00	0.00E+00	-1.07E-18
NHWD	kg	1.04E-03	0.00E+00	1.32E-03	0.00E+00	4.12E-03	9.71E-03	0.00E+00	0.00E+00	0.00E+00	-2.27E-18
RWD	kg	3.99E-05	3.12E-07	2.34E-07	6.83E-07	6.59E-06	8.98E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU	kg	3.00E-03	0.00E+00	0.00E+00	0.00E+00	4.80E-04	6.54E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	5.93E-06	0.00E+00	0.00E+00	0.00E+00	1.81E-03	2.48E-03	0.00E+00	2.31E-02	0.00E+00	0.00E+00
MER	kg	0.00E+00	0.00E+00	2.66E-04	0.00E+00	4.09E-03	5.39E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	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	0.00E+00	4.74E-01

\* See Annex B for information on the indicators abbreviations

FU: 1 m² installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.



## SYSTEM 3 – SINGLE LAYER LOOSE LAID

Potential environmental impacts \*

UNITS PER FU		A1	A2	A3	A4	A5	B5	C2	C3	C4	D
GWP-total	kg CO2 eq	2.92E-02	6.74E-04	1.01E-03	1.77E-03	9.30E-03	8.88E-02	2.08E-03	8.56E-02	5.08E-03	-3.38E-02
GWP-fossil	kg CO2 eq	2.85E-02	6.73E-04	3.07E-03	1.77E-03	1.36E-02	9.09E-02	2.08E-03	8.55E-02	5.06E-03	-3.55E-02
GWP-biogenic	kg CO2 eq	6.94E-04	2.76E-07	-2.06E-03	1.22E-06	2.86E-03	1.80E-03	8.55E-07	3.95E-05	2.15E-05	1.80E-03
GWP-luluc	kg CO2 eq	2.10E-05	5.32E-09	1.44E-06	4.75E-08	4.62E-06	4.96E-05	1.65E-08	2.24E-06	1.31E-06	-3.55E-05
GWP-GHG	kg CO2 eq	2.88E-02	6.74E-04	3.08E-03	1.77E-03	1.37E-02	9.16E-02	2.08E-03	8.55E-02	5.06E-03	-3.56E-02
ODP	kg CFC11 eq	2.66E-08	1.56E-10	4.10E-10	4.05E-10	3.77E-09	6.24E-08	4.83E-10	4.17E-10	8.37E-11	-1.50E-08
AP	mol H+ eq	2.11E-04	4.40E-06	5.42E-06	1.08E-05	5.26E-05	6.17E-04	7.21E-06	2.51E-05	6.96E-06	-1.35E-04
EP-freshwater <sup>1</sup>	kg P eq	1.18E-06	4.00E-10	3.03E-08	2.59E-09	2.96E-07	2.66E-06	1.24E-09	9.74E-08	6.08E-08	-1.50E-06
EP-marine	kg N eq	2.68E-05	1.83E-06	1.57E-06	3.44E-06	1.22E-05	1.24E-04	2.31E-06	8.23E-06	4.57E-06	-9.15E-06
EP-terrestrial	mol N eq	3.00E-04	2.01E-05	1.67E-05	3.79E-05	1.32E-04	1.37E-03	2.55E-05	9.12E-05	1.47E-05	-1.13E-04
POCP	kg NMVOC eq	1.27E-04	5.16E-06	6.68E-06	9.92E-06	4.36E-05	4.63E-04	6.95E-06	2.36E-05	5.01E-06	-4.64E-05
ADP-minerals&metals	kg Sb eq	2.51E-08	3.96E-11	4.50E-09	1.18E-10	1.61E-08	6.57E-08	1.23E-10	3.69E-09	7.02E-10	-1.55E-08
ADP-fossil	MJ	1.56E+00	9.52E-03	5.09E-02	2.50E-02	2.87E-01	3.74E+00	2.95E-02	2.34E-02	1.49E-02	-1.28E+00
WDP	m3 world eq. deprived	2.26E-01	-2.10E-06	4.28E-03	-2.27E-06	2.97E-02	5.04E-01	-6.50E-06	7.51E-04	2.05E-02	-1.41E-02

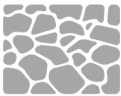
\* See Annex A for information on the indicators abbreviations

FU: 1 m<sup>2</sup> installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.

<sup>1</sup> Due to a typographical error in EN 15804:2021+A2:2019, PCR 2019:14 indicates that results shall be given in both kg PO<sub>4</sub>eq and kg P<sub>eq</sub>. Results are here presented only as kg P<sub>eq</sub>. To obtain the value in kg PO<sub>4</sub>eq multiply by 3.07 (as indicated in PCR 2019:14)

<sup>†</sup> negative value due water flows accounting of the AWARE method used to calculate water depletion potential. An input of marine salt water is used in the transport process inventory of A2 module, along with an output of freshwater. However, the former is not considered from the AWARE method, hence highlighting a credit for returning freshwater to nature, but not the impact of withdrawing it in the first place.

LCA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks



SYSTEM 3 – SINGLE LAYER LOOSE LAID

Potential additional environmental impacts \*

	UNITS PER FU	A1	A2	A3	A4	A5	B5	C2	C3	C4	D
PM	Disease incidenc e (No.)	1.99E-09	7.78E-11	6.84E-11	1.30E-10	4.69E-10	5.29E-09	1.36E-10	1.67E-10	6.13E-11	2.17E-10
IRP	kBq U235 eq	7.01E-03	4.19E-05	5.10E-05	1.11E-04	1.10E-03	1.64E-02	1.30E-04	1.56E-04	1.25E-04	-5.61E-03
ETP-fw	CTUe	5.52E-01	4.11E-03	1.54E-02	1.02E-02	1.28E-01	1.33E+00	1.18E-02	6.20E-02	1.15E-02	-3.17E-01
HTP-c	CTUh	1.25E-11	2.05E-13	1.83E-12	1.81E-13	1.15E-11	3.34E-11	1.68E-13	1.22E-11	1.24E-13	-3.71E-12
HTP-nc	CTUh	2.61E-10	9.70E-12	1.01E-11	1.79E-11	1.62E-10	7.82E-10	1.96E-11	7.89E-11	6.14E-12	-1.65E-10
SQP	(-)	5.92E-02	2.36E-05	1.81E-01	1.19E-04	3.76E-02	5.27E-01	7.33E-05	6.01E-03	8.75E-03	-2.39E-01

\* See Annex A for information on the indicators abbreviations

FU: 1 m² installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks





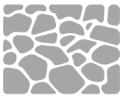
## SYSTEM 3 – SINGLE LAYER LOOSE LAID

Use of resources \*

	UNITS PER FU	A1	A2	A3	A4	A5	B5	C2	C3	C4	D
PERE	MJ	3.79E-02	1.33E-05	1.02E-02	9.54E-05	9.66E-03	1.06E-01	4.13E-05	3.05E-03	2.13E-03	-7.58E-02
PERM	MJ	0.00E+00	0.00E+00	1.71E-02	0.00E+00	2.05E-03	3.73E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	3.79E-02	1.33E-05	2.74E-02	9.54E-05	1.17E-02	1.43E-01	4.13E-05	3.05E-03	2.13E-03	-7.58E-02
PENRE	MJ	4.51E-01	9.52E-03	5.23E-02	2.50E-02	1.30E-01	1.32E+00	2.88E-02	2.83E-02	1.73E-02	-8.61E-01
PENRM	MJ	1.14E+00	0.00E+00	3.53E-03	0.00E+00	1.68E-01	2.49E+00	0.00E+00	0.00E+00	0.00E+00	-4.98E-01
PENRT	MJ	1.59E+00	9.52E-03	5.67E-02	2.50E-02	2.98E-01	3.81E+00	2.88E-02	2.83E-02	1.73E-02	-1.36E+00
SM	kg	3.98E-03	0.00E+00	1.05E-05	0.00E+00	4.79E-04	8.70E-03	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	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	0.00E+00	0.00E+00
FW	m3	2.76E-04	1.88E-07	1.01E-04	7.67E-07	1.02E-04	8.65E-04	5.85E-07	4.11E-05	4.84E-04	-5.15E-04

\* See Annex B for information on the indicators abbreviations

FU: 1 m<sup>2</sup> installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.



SYSTEM 3 – SINGLE LAYER LOOSE LAID

Other indicators describing waste categories \*

UNITS PER FU		A1	A2	A3	A4	A5	B5	C2	C3	C4	D
HWD	kg	2.71E-05	0.00E+00	7.60E-05	0.00E+00	1.24E-05	2.25E-04	0.00E+00	0.00E+00	0.00E+00	-1.22E-18
NHWD	kg	1.57E-03	0.00E+00	3.24E-03	0.00E+00	4.32E-03	1.45E-02	0.00E+00	0.00E+00	0.00E+00	-2.59E-18
RWD	kg	4.00E-05	2.77E-07	2.24E-07	7.23E-07	4.95E-06	8.99E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
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	0.00E+00	0.00E+00
MFR	kg	9.25E-06	0.00E+00	0.00E+00	0.00E+00	1.81E-03	2.11E-03	0.00E+00	7.82E-01	0.00E+00	0.00E+00
MER	kg	0.00E+00	0.00E+00	1.13E-04	0.00E+00	4.06E-03	4.51E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	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	0.00E+00	4.16E-01

\* See Annex B for information on the indicators abbreviations

FU: 1 m² installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.



## SYSTEM 4 – SINGLE LAYER SELF ADHESIVE

Potential environmental impacts \*

UNITS PER FU		A1	A2	A3	A4	A5	B5	C2	C3	C4	D
GWP-total	kg CO2 eq	3.19E-02	6.54E-04	1.80E-03	1.89E-03	8.44E-03	9.62E-02	1.95E-03	8.02E-02	4.76E-03	-3.44E-02
GWP-fossil	kg CO2 eq	3.08E-02	6.53E-04	3.71E-03	1.89E-03	8.12E-03	9.73E-02	1.95E-03	8.02E-02	4.74E-03	-3.62E-02
GWP-biogenic	kg CO2 eq	3.40E-04	2.67E-07	-1.91E-03	1.74E-06	2.01E-03	9.53E-04	8.01E-07	3.70E-05	2.01E-05	1.85E-03
GWP-luluc	kg CO2 eq	7.23E-04	5.17E-09	2.58E-06	7.97E-08	8.72E-05	1.58E-03	1.55E-08	2.10E-06	1.23E-06	-3.78E-05
GWP-GHG	kg CO2 eq	3.18E-02	6.53E-04	3.72E-03	1.89E-03	8.29E-03	9.95E-02	1.95E-03	8.02E-02	4.74E-03	-3.63E-02
ODP	kg CFC11 eq	2.46E-08	1.51E-10	5.05E-10	4.28E-10	3.13E-09	5.84E-08	4.53E-10	3.91E-10	7.85E-11	-1.45E-08
AP	mol H+ eq	2.18E-04	4.24E-06	7.09E-06	1.62E-05	3.12E-05	6.47E-04	6.76E-06	2.35E-05	6.52E-06	-1.55E-04
EP-freshwater <sup>1</sup>	kg P eq	1.79E-06	3.88E-10	4.77E-08	4.10E-09	2.27E-07	4.03E-06	1.16E-09	9.13E-08	5.70E-08	-1.48E-06
EP-marine	kg N eq	3.50E-05	1.77E-06	2.04E-06	4.93E-06	5.94E-06	1.46E-04	2.17E-06	7.71E-06	4.28E-06	-2.05E-05
EP-terrestrial	mol N eq	3.71E-04	1.94E-05	2.19E-05	5.44E-05	6.18E-05	1.57E-03	2.39E-05	8.55E-05	1.38E-05	-2.37E-04
POCP	kg NMVOC eq	1.46E-04	4.98E-06	8.32E-06	1.41E-05	2.24E-05	5.16E-04	6.52E-06	2.21E-05	4.70E-06	-7.94E-05
ADP-minerals&metals	kg Sb eq	1.01E-07	3.85E-11	4.12E-09	1.37E-10	1.28E-08	2.30E-07	1.15E-10	3.46E-09	6.58E-10	-1.54E-08
ADP-fossil	MJ	1.36E+00	9.23E-03	6.52E-02	2.66E-02	1.78E-01	3.32E+00	2.77E-02	2.20E-02	1.40E-02	-1.24E+00
WDP	m3 world eq. deprived	8.73E-02	-2.03E-06	7.42E-03	4.03E-07	1.23E-02	2.08E-01	-6.09E-06	7.04E-04	1.92E-02	-1.72E-02

\* See Annex A for information on the indicators abbreviations

FU: 1 m<sup>2</sup> installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.

<sup>1</sup> Due to a typographical error in EN 15804:2021+A2:2019, PCR 2019:14 indicates that results shall be given in both kg PO<sub>4</sub>eq and kg P<sub>eq</sub>. Results are here presented only as kg P<sub>eq</sub>. To obtain the value in kg PO<sub>4</sub>eq multiply by 3.07 (as indicated in PCR 2019:14)

<sup>†</sup> negative value due water flows accounting of the AWARE method used to calculate water depletion potential. An input of marine salt water is used in the transport process inventory of A2 module, along with an output of freshwater. However, the former is not considered from the AWARE method, hence highlighting a credit for returning freshwater to nature, but not the impact of withdrawing it in the first place.

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks



## SYSTEM 4 – SINGLE LAYER SELF ADHESIVE

Potential additional environmental impacts \*

	UNITS PER FU	A1	A2	A3	A4	A5	B5	C2	C3	C4	D
PM	Disease incidence (No.)	1.55E-08	7.47E-11	8.49E-11	1.40E-10	1.91E-09	3.47E-08	1.27E-10	1.56E-10	5.75E-11	-5.18E-10
IRP	kBq U235 eq	6.18E-03	4.07E-05	7.32E-05	1.19E-04	7.88E-04	1.46E-02	1.22E-04	1.47E-04	1.17E-04	-5.49E-03
ETP-fw	CTUe	5.73E-01	3.98E-03	2.20E-02	1.08E-02	7.68E-02	1.39E+00	1.11E-02	5.81E-02	1.08E-02	-3.09E-01
HTP-c	CTUh	1.62E-11	1.96E-13	1.87E-12	2.28E-13	2.78E-12	4.17E-11	1.57E-13	1.14E-11	1.16E-13	-3.79E-12
HTP-nc	CTUh	2.99E-10	9.32E-12	1.41E-11	1.89E-11	4.57E-11	8.77E-10	1.84E-11	7.40E-11	5.76E-12	-1.72E-10
SQP	(-)	1.00E-01	2.29E-05	1.71E-01	1.75E-04	3.32E-02	5.93E-01	6.87E-05	5.64E-03	8.20E-03	-2.43E-01

\* See Annex A for information on the indicators abbreviations

FU: 1 m<sup>2</sup> installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks



## SYSTEM 4 – SINGLE LAYER SELF ADHESIVE

Use of resources \*

	UNITS PER FU	A1	A2	A3	A4	A5	B5	C2	C3	C4	D
PERE	MJ	4.70E-02	1.29E-05	1.02E-02	1.54E-04	7.09E-03	1.26E-01	3.87E-05	2.86E-03	1.99E-03	-7.73E-02
PERM	MJ	6.40E-04	0.00E+00	1.64E-02	0.00E+00	2.04E-03	3.71E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	4.77E-02	1.29E-05	2.65E-02	1.54E-04	9.13E-03	1.63E-01	3.87E-05	2.86E-03	1.99E-03	-7.73E-02
PENRE	MJ	5.03E-01	9.23E-03	6.35E-02	2.66E-02	7.57E-02	1.45E+00	2.70E-02	2.65E-02	1.62E-02	-8.51E-01
PENRM	MJ	9.02E-01	0.00E+00	7.25E-03	0.00E+00	1.09E-01	1.98E+00	0.00E+00	0.00E+00	0.00E+00	-4.67E-01
PENRT	MJ	1.40E+00	9.23E-03	7.23E-02	2.66E-02	1.85E-01	3.44E+00	2.70E-02	2.65E-02	1.62E-02	-1.32E+00
SM	kg	2.00E-03	0.00E+00	4.50E-05	0.00E+00	2.46E-04	4.47E-03	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	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	0.00E+00	0.00E+00
FW	m3	6.93E-04	1.83E-07	1.75E-04	1.05E-06	1.27E-04	1.93E-03	5.48E-07	3.86E-05	4.54E-04	-5.84E-04

\* See Annex B for information on the indicators abbreviations

FU: 1 m<sup>2</sup> installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.





SYSTEM 4 – SINGLE LAYER SELF ADHESIVE

Other indicators describing waste categories \*

	UNITS PER FU	A1	A2	A3	A4	A5	B5	C2	C3	C4	D
HWD	kg	1.08E-05	0.00E+00	1.47E-04	0.00E+00	1.90E-05	3.45E-04	0.00E+00	0.00E+00	0.00E+00	-1.89E-18
NHWD	kg	7.83E-04	0.00E+00	5.87E-03	0.00E+00	3.61E-03	1.89E-02	0.00E+00	0.00E+00	0.00E+00	-4.00E-18
RWD	kg	3.86E-05	3.13E-07	3.17E-07	8.93E-07	4.81E-06	8.74E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU	kg	0.00E+00	0.00E+00	8.91E-06	0.00E+00	1.07E-06	1.94E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	3.03E-06	0.00E+00	0.00E+00	0.00E+00	1.50E-03	2.52E-03	0.00E+00	2.25E-02	0.00E+00	0.00E+00
MER	kg	0.00E+00	0.00E+00	8.32E-05	0.00E+00	3.05E-03	4.89E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	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	0.00E+00	4.51E-01

\* See Annex B for information on the indicators abbreviations

FU: 1 m² installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.



## SYSTEM 5 – MULTI LAYER FULLY TORCHED

Potential environmental impacts \*

UNITS PER FU		A1	A2	A3	A4	A5	B5	C2	C3	C4	D
GWP-total	kg CO2 eq	5.58E-02	1.38E-03	8.74E-04	2.56E-03	2.27E-02	1.04E-01	2.65E-03	1.09E-01	6.45E-03	-4.60E-02
GWP-fossil	kg CO2 eq	5.50E-02	1.38E-03	6.02E-03	2.56E-03	2.21E-02	1.08E-01	2.65E-03	1.09E-01	6.43E-03	-4.91E-02
GWP-biogenic	kg CO2 eq	7.38E-04	5.64E-07	-5.15E-03	1.39E-06	5.42E-03	5.91E-03	1.09E-06	5.01E-05	2.73E-05	3.17E-03
GWP-luluc	kg CO2 eq	4.26E-05	1.09E-08	3.46E-06	4.28E-08	4.59E-06	7.37E-05	2.10E-08	2.85E-06	1.66E-06	-4.64E-05
GWP-GHG	kg CO2 eq	5.53E-02	1.38E-03	6.04E-03	2.56E-03	2.22E-02	1.09E-01	2.65E-03	1.09E-01	6.43E-03	-4.93E-02
ODP	kg CFC11 eq	5.98E-08	3.19E-10	1.25E-09	5.89E-10	7.86E-09	9.61E-08	6.14E-10	5.31E-10	1.06E-10	-1.97E-08
AP	mol H+ eq	4.13E-04	9.34E-06	1.59E-05	1.33E-05	1.52E-04	7.34E-04	9.17E-06	3.19E-05	8.84E-06	-2.11E-04
EP-freshwater <sup>1</sup>	kg P eq	2.14E-06	8.18E-10	7.76E-08	2.56E-09	2.23E-07	3.46E-06	1.58E-09	1.24E-07	7.73E-08	-2.01E-06
EP-marine	kg N eq	5.73E-05	3.93E-06	3.37E-06	4.21E-06	5.65E-05	1.48E-04	2.94E-06	1.05E-05	5.80E-06	-2.78E-05
EP-terrestrial	mol N eq	6.39E-04	4.31E-05	3.68E-05	4.63E-05	6.18E-04	1.64E-03	3.24E-05	1.16E-04	1.87E-05	-3.21E-04
POCP	kg NMVOC eq	2.71E-04	1.11E-05	2.69E-05	1.23E-05	1.67E-04	5.73E-04	8.83E-06	3.00E-05	6.37E-06	-1.07E-04
ADP-minerals&metals	kg Sb eq	1.11E-07	8.11E-11	3.78E-08	1.59E-10	1.43E-08	1.30E-07	1.56E-10	4.70E-09	8.92E-10	-2.27E-08
ADP-fossil	MJ	2.86E+00	1.95E-02	1.20E-01	3.61E-02	4.18E-01	4.12E+00	3.75E-02	2.98E-02	1.89E-02	-1.68E+00
WDP	m3 world eq. deprived	1.90E-01	-4.29E-06	4.02E-03	-5.79E-06	1.88E-02	2.22E-01	-8.26E-06	9.54E-04	2.61E-02	-1.99E-02

\* See Annex A for information on the indicators abbreviations

FU: 1 m<sup>2</sup> installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.

<sup>1</sup> Due to a typographical error in EN 15804:2021+A2:2019, PCR 2019:14 indicates that results shall be given in both kg PO<sub>4</sub>eq and kg P<sub>eq</sub>. Results are here presented only as kg P<sub>eq</sub>. To obtain the value in kg PO<sub>4</sub>eq multiply by 3.07 (as indicated in PCR 2019:14)

<sup>†</sup> negative value due water flows accounting of the AWARE method used to calculate water depletion potential. An input of marine salt water is used in the transport process inventory of A2 module, along with an output of freshwater. However, the former is not considered from the AWARE method, hence highlighting a credit for returning freshwater to nature, but not the impact of withdrawing it in the first place.

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks



SYSTEM 5 – MULTI LAYER FULLY TORCHED

Potential additional environmental impacts \*

	UNITS PER FU	A1	A2	A3	A4	A5	B5	C2	C3	C4	D
PM	Disease incidenc e (No.)	1.65E-08	1.65E-10	1.78E-10	1.77E-10	1.88E-09	3.45E-08	1.72E-10	2.12E-10	7.79E-11	-6.54E-10
IRP	kBq U235 eq	1.32E-02	8.57E-05	3.12E-04	1.60E-04	1.85E-03	1.97E-02	1.65E-04	1.99E-04	1.59E-04	-7.46E-03
ETP-fw	CTUe	1.07E+00	8.45E-03	4.31E-02	1.46E-02	1.58E-01	1.56E+00	1.50E-02	7.88E-02	1.46E-02	-4.23E-01
HTP-c	CTUh	3.08E-11	4.57E-13	4.82E-12	2.35E-13	4.58E-12	4.48E-11	2.13E-13	1.55E-11	1.58E-13	-5.03E-12
HTP-nc	CTUh	6.08E-10	2.04E-11	2.82E-11	2.49E-11	1.93E-10	9.87E-10	2.49E-11	1.00E-10	7.81E-12	-2.32E-10
SQP	(-)	9.40E-02	4.84E-05	4.39E-01	1.28E-04	4.95E-02	6.52E-01	9.31E-05	7.64E-03	1.11E-02	-3.79E-01

\* See Annex A for information on the indicators abbreviations

FU: 1 m² installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks



## SYSTEM 5 – MULTI LAYER FULLY TORCHED

Use of resources \*

	UNITS PER FU	A1	A2	A3	A4	A5	B5	C2	C3	C4	D
PERE	MJ	6.39E-02	2.72E-05	2.38E-02	9.11E-05	8.45E-03	1.28E-01	5.25E-05	3.87E-03	2.70E-03	-1.10E-01
PERM	MJ	0.00E+00	0.00E+00	4.18E-02	0.00E+00	3.76E-03	4.79E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	6.39E-02	2.72E-05	6.56E-02	9.11E-05	1.22E-02	1.76E-01	5.25E-05	3.87E-03	2.70E-03	-1.10E-01
PENRE	MJ	8.72E-01	1.95E-02	9.76E-02	3.61E-02	2.35E-01	1.62E+00	3.66E-02	3.60E-02	2.19E-02	-1.15E+00
PENRM	MJ	2.06E+00	0.00E+00	2.89E-02	0.00E+00	1.88E-01	2.62E+00	0.00E+00	0.00E+00	0.00E+00	-6.32E-01
PENRT	MJ	2.93E+00	1.95E-02	1.27E-01	3.61E-02	4.23E-01	4.24E+00	3.66E-02	3.60E-02	2.19E-02	-1.79E+00
SM	kg	2.98E-03	0.00E+00	4.90E-06	0.00E+00	2.68E-04	3.50E-03	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	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	0.00E+00	0.00E+00
FW	m3	7.36E-04	3.86E-07	9.84E-05	8.96E-07	1.13E-04	1.28E-03	7.43E-07	5.23E-05	6.16E-04	-7.12E-04

\* See Annex B for information on the indicators abbreviations

FU: 1 m<sup>2</sup> installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.



SYSTEM 5 – MULTI LAYER FULLY TORCHED

Other indicators describing waste categories \*

UNITS PER FU		A1	A2	A3	A4	A5	B5	C2	C3	C4	D
HWD	kg	3.21E-05	0.00E+00	6.30E-05	0.00E+00	8.56E-06	1.06E-04	0.00E+00	0.00E+00	0.00E+00	-1.95E-18
NHWD	kg	1.86E-03	0.00E+00	2.48E-03	0.00E+00	4.31E-03	1.02E-02	0.00E+00	0.00E+00	0.00E+00	-4.12E-18
RWD	kg	7.23E-05	5.67E-07	1.77E-06	1.05E-06	6.81E-06	9.71E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU	kg	1.24E-03	0.00E+00	0.00E+00	0.00E+00	1.11E-04	2.69E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	9.46E-06	0.00E+00	0.00E+00	0.00E+00	2.10E-03	2.28E-03	0.00E+00	2.61E-02	0.00E+00	0.00E+00
MER	kg	0.00E+00	0.00E+00	1.70E-04	0.00E+00	4.09E-03	4.63E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	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	0.00E+00	5.26E-01

\* See Annex B for information on the indicators abbreviations

FU: 1 m² installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.



## SYSTEM 6 – MULTI LAYER MECHANICALLY FASTENED

Potential environmental impacts \*

UNITS PER FU		A1	A2	A3	A4	A5	B5	C2	C3	C4	D
GWP-total	kg CO2 eq	4.90E-02	1.06E-03	1.41E-03	3.02E-03	2.02E-02	9.38E-02	2.66E-03	1.09E-01	6.49E-03	-4.70E-02
GWP-fossil	kg CO2 eq	4.80E-02	1.06E-03	5.16E-03	3.01E-03	1.97E-02	9.60E-02	2.66E-03	1.09E-01	6.46E-03	-4.94E-02
GWP-biogenic	kg CO2 eq	9.83E-04	4.34E-07	-3.76E-03	1.96E-06	4.25E-03	5.14E-03	1.09E-06	5.04E-05	2.74E-05	2.43E-03
GWP-luluc	kg CO2 eq	4.35E-05	8.38E-09	3.01E-06	7.25E-08	6.65E-06	6.36E-05	2.11E-08	2.87E-06	1.67E-06	-4.84E-05
GWP-GHG	kg CO2 eq	4.84E-02	1.06E-03	5.20E-03	3.02E-03	1.98E-02	9.67E-02	2.66E-03	1.09E-01	6.47E-03	-4.96E-02
ODP	kg CFC11 eq	4.12E-08	2.46E-10	6.80E-10	6.92E-10	5.64E-09	4.68E-08	6.18E-10	5.33E-10	1.07E-10	-1.98E-08
AP	mol H+ eq	3.42E-04	7.08E-06	9.42E-06	1.76E-05	1.06E-04	6.17E-04	9.22E-06	3.21E-05	8.89E-06	-2.12E-04
EP-freshwater <sup>1</sup>	kg P eq	2.11E-06	6.30E-10	6.02E-08	4.02E-09	3.74E-07	2.98E-06	1.58E-09	1.24E-07	7.77E-08	-2.02E-06
EP-marine	kg N eq	4.90E-05	2.97E-06	2.66E-06	5.58E-06	3.39E-05	1.37E-04	2.96E-06	1.05E-05	5.83E-06	-2.79E-05
EP-terrestrial	mol N eq	5.49E-04	3.26E-05	2.79E-05	6.16E-05	3.70E-04	1.51E-03	3.26E-05	1.16E-04	1.88E-05	-3.23E-04
POCP	kg NMVOC eq	2.14E-04	8.36E-06	1.17E-05	1.61E-05	1.05E-04	4.85E-04	8.88E-06	3.02E-05	6.40E-06	-1.08E-04
ADP-minerals&metals	kg Sb eq	9.18E-08	6.24E-11	1.17E-08	1.97E-10	2.32E-08	1.95E-07	1.57E-10	4.72E-09	8.97E-10	-2.22E-08
ADP-fossil	MJ	2.26E+00	1.50E-02	8.66E-02	4.26E-02	3.86E-01	3.30E+00	3.77E-02	3.00E-02	1.90E-02	-1.69E+00
WDP	m3 world eq. deprived	2.57E-01	-3.30E-06	6.09E-03	-4.67E-06	2.83E-02	3.51E-01	-8.31E-06	9.59E-04	2.62E-02	-1.91E-02

\* See Annex A for information on the indicators abbreviations

FU: 1 m<sup>2</sup> installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.

<sup>1</sup> Due to a typographical error in EN 15804:2021+A2:2019, PCR 2019:14 indicates that results shall be given in both kg PO<sub>4</sub>eq and kg P<sub>eq</sub>. Results are here presented only as kg P<sub>eq</sub>. To obtain the value in kg PO<sub>4</sub>eq multiply by 3.07 (as indicated in PCR 2019:14)

<sup>†</sup> negative value due water flows accounting of the AWARE method used to calculate water depletion potential. An input of marine salt water is used in the transport process inventory of A2 module, along with an output of freshwater. However, the former is not considered from the AWARE method, hence highlighting a credit for returning freshwater to nature, but not the impact of withdrawing it in the first place.

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks





SYSTEM 6 – MULTI LAYER MECHANICALLY FASTENED

Potential additional environmental impacts \*

	UNITS PER FU	A1	A2	A3	A4	A5	B5	C2	C3	C4	D
PM	Disease incidence (No.)	1.66E-08	1.26E-10	1.26E-10	2.19E-10	2.03E-09	3.17E-08	1.73E-10	2.13E-10	7.83E-11	-6.73E-10
IRP	kBq U235 eq	1.05E-02	6.60E-05	9.44E-05	1.89E-04	1.56E-03	1.37E-02	1.66E-04	2.00E-04	1.59E-04	-7.52E-03
ETP-fw	CTUe	8.56E-01	6.50E-03	3.29E-02	1.73E-02	1.70E-01	1.30E+00	1.51E-02	7.93E-02	1.47E-02	-4.25E-01
HTP-c	CTUh	1.82E-11	3.41E-13	3.49E-12	3.01E-13	1.22E-11	4.47E-11	2.14E-13	1.55E-11	1.59E-13	-5.10E-12
HTP-nc	CTUh	4.45E-10	1.56E-11	1.91E-11	3.03E-11	2.28E-10	9.98E-10	2.50E-11	1.01E-10	7.85E-12	-2.34E-10
SQP	(-)	9.45E-02	3.72E-05	3.37E-01	1.88E-04	5.21E-02	5.12E-01	9.37E-05	7.68E-03	1.12E-02	-3.22E-01

\* See Annex A for information on the indicators abbreviations

FU: 1 m² installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks



## SYSTEM 6 – MULTI LAYER MECHANICALLY FASTENED

Use of resources \*

	UNITS PER FU	A1	A2	A3	A4	A5	B5	C2	C3	C4	D
PERE	MJ	6.49E-02	2.10E-05	1.97E-02	1.47E-04	1.24E-02	1.08E-01	5.28E-05	3.89E-03	2.72E-03	-1.03E-01
PERM	MJ	0.00E+00	0.00E+00	3.15E-02	0.00E+00	3.15E-03	3.65E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	6.49E-02	2.10E-05	5.12E-02	1.47E-04	1.56E-02	1.45E-01	5.28E-05	3.89E-03	2.72E-03	-1.03E-01
PENRE	MJ	7.87E-01	1.50E-02	8.81E-02	4.26E-02	2.14E-01	1.48E+00	3.68E-02	3.62E-02	2.20E-02	-1.16E+00
PENRM	MJ	1.54E+00	0.00E+00	7.33E-03	0.00E+00	1.86E-01	1.93E+00	0.00E+00	0.00E+00	0.00E+00	-6.36E-01
PENRT	MJ	2.33E+00	1.50E-02	9.63E-02	4.26E-02	3.99E-01	3.41E+00	3.68E-02	3.62E-02	2.20E-02	-1.80E+00
SM	kg	5.28E-03	0.00E+00	6.12E-06	0.00E+00	5.29E-04	6.53E-03	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	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	0.00E+00	0.00E+00
FW	m3	8.89E-04	2.97E-07	1.44E-04	1.24E-06	1.62E-04	1.59E-03	7.47E-07	5.25E-05	6.19E-04	-6.96E-04

\* See Annex B for information on the indicators abbreviations

FU: 1 m<sup>2</sup> installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.



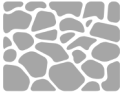
SYSTEM 6 – MULTI LAYER MECHANICALLY FASTENED

Other indicators describing waste categories \*

	UNITS PER FU	A1	A2	A3	A4	A5	B5	C2	C3	C4	D
HWD	kg	5.23E-05	0.00E+00	1.04E-04	0.00E+00	1.56E-05	2.62E-04	0.00E+00	0.00E+00	0.00E+00	-1.64E-18
NHWD	kg	1.86E-03	0.00E+00	3.05E-03	0.00E+00	4.47E-03	1.15E-02	0.00E+00	0.00E+00	0.00E+00	-3.48E-18
RWD	kg	5.59E-05	4.36E-07	4.04E-07	1.23E-06	5.80E-06	7.16E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
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	0.00E+00	0.00E+00
MFR	kg	1.78E-05	0.00E+00	0.00E+00	0.00E+00	2.08E-03	2.17E-03	0.00E+00	2.63E-02	0.00E+00	0.00E+00
MER	kg	0.00E+00	0.00E+00	2.16E-04	0.00E+00	4.25E-03	4.62E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	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	0.00E+00	5.29E-01

\* See Annex B for information on the indicators abbreviations

FU: 1 m² installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.



## SYSTEM 7 – MULTI LAYER LOOSE LAID

Potential environmental impacts \*

UNITS PER FU		A1	A2	A3	A4	A5	B5	C2	C3	C4	D
GWP-total	kg CO2 eq	4.06E-02	1.08E-03	1.67E-03	3.00E-03	1.53E-02	7.78E-02	1.40E-02	9.92E-02	5.89E-03	-3.90E-02
GWP-fossil	kg CO2 eq	3.97E-02	1.08E-03	5.49E-03	3.00E-03	1.48E-02	8.02E-02	1.40E-02	9.92E-02	5.86E-03	-4.13E-02
GWP-biogenic	kg CO2 eq	8.15E-04	4.41E-07	-3.82E-03	2.25E-06	4.03E-03	4.61E-03	5.74E-06	4.58E-05	2.49E-05	2.38E-03
GWP-luluc	kg CO2 eq	3.07E-05	8.52E-09	2.95E-06	9.23E-08	3.36E-06	4.87E-05	1.11E-07	2.60E-06	1.52E-06	-4.21E-05
GWP-GHG	kg CO2 eq	4.00E-02	1.08E-03	5.51E-03	3.00E-03	1.49E-02	8.08E-02	1.40E-02	9.92E-02	5.87E-03	-4.15E-02
ODP	kg CFC11 eq	3.64E-08	2.49E-10	7.25E-10	6.83E-10	4.60E-09	5.49E-08	3.25E-09	4.84E-10	9.71E-11	-1.73E-08
AP	mol H+ eq	3.06E-04	7.23E-06	9.42E-06	2.19E-05	8.79E-05	5.59E-04	4.84E-05	2.91E-05	8.07E-06	-1.60E-04
EP-freshwater <sup>1</sup>	kg P eq	1.59E-06	6.40E-10	5.73E-08	4.93E-09	1.65E-07	2.38E-06	8.33E-09	1.13E-07	7.05E-08	-1.74E-06
EP-marine	kg N eq	3.89E-05	3.04E-06	2.73E-06	6.71E-06	3.02E-05	1.16E-04	1.55E-05	9.54E-06	5.30E-06	-1.25E-05
EP-terrestrial	mol N eq	4.36E-04	3.33E-05	2.91E-05	7.41E-05	3.29E-04	1.28E-03	1.71E-04	1.06E-04	1.71E-05	-1.51E-04
POCP	kg NMVOC eq	1.87E-04	8.54E-06	1.21E-05	1.93E-05	9.07E-05	4.34E-04	4.67E-05	2.74E-05	5.81E-06	-5.93E-05
ADP-minerals&metals	kg Sb eq	1.21E-07	6.34E-11	9.56E-09	2.03E-10	1.23E-08	1.74E-07	8.25E-10	4.28E-09	8.14E-10	-1.79E-08
ADP-fossil	MJ	2.26E+00	1.52E-02	9.04E-02	4.22E-02	2.91E-01	3.28E+00	1.98E-01	2.72E-02	1.73E-02	-1.48E+00
WDP	m3 world eq. deprived	2.58E-01	-3.35E-06	8.05E-03	-2.68E-06	2.52E-02	2.69E-01	-4.36E-05	8.71E-04	2.38E-02	-1.68E-02

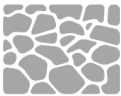
\* See Annex A for information on the indicators abbreviations

FU: 1 m<sup>2</sup> installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.

<sup>1</sup> Due to a typographical error in EN 15804:2021+A2:2019, PCR 2019:14 indicates that results shall be given in both kg PO<sub>4</sub>eq and kg P<sub>eq</sub>. Results are here presented only as kg P<sub>eq</sub>. To obtain the value in kg PO<sub>4</sub>eq multiply by 3.07 (as indicated in PCR 2019:14)

<sup>†</sup> negative value due water flows accounting of the AWARE method used to calculate water depletion potential. An input of marine salt water is used in the transport process inventory of A2 module, along with an output of freshwater. However, the former is not considered from the AWARE method, hence highlighting a credit for returning freshwater to nature, but not the impact of withdrawing it in the first place.

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks



SYSTEM 7 – MULTI LAYER LOOSE LAID

Potential additional environmental impacts \*

	UNITS PER FU	A1	A2	A3	A4	A5	B5	C2	C3	C4	D
PM	Disease incidenc e (No.)	3.48E-09	1.29E-10	1.24E-10	2.18E-10	5.39E-10	7.13E-09	9.11E-10	1.93E-10	7.11E-11	1.30E-10
IRP	kBq U235 eq	1.01E-02	6.70E-05	8.85E-05	1.88E-04	1.26E-03	1.45E-02	8.73E-04	1.81E-04	1.45E-04	-6.49E-03
ETP-fw	CTUe	8.21E-01	6.61E-03	3.11E-02	1.71E-02	1.09E-01	1.19E+00	7.95E-02	7.19E-02	1.33E-02	-3.66E-01
HTP-c	CTUh	1.87E-11	3.50E-13	3.33E-12	3.25E-13	3.03E-12	2.96E-11	1.13E-12	1.41E-11	1.44E-13	-4.33E-12
HTP-nc	CTUh	4.10E-10	1.60E-11	1.89E-11	2.98E-11	1.12E-10	7.32E-10	1.32E-10	9.15E-11	7.13E-12	-1.93E-10
SQP	(-)	7.69E-02	3.78E-05	3.38E-01	2.21E-04	3.85E-02	5.04E-01	4.92E-04	6.97E-03	1.01E-02	-3.01E-01

\* See Annex A for information on the indicators abbreviations

FU: 1 m² installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks



## SYSTEM 7 – MULTI LAYER LOOSE LAID

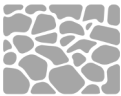
Use of resources \*

	UNITS PER FU	A1	A2	A3	A4	A5	B5	C2	C3	C4	D
PERE	MJ	5.09E-02	2.13E-05	1.93E-02	1.83E-04	6.74E-03	9.50E-02	2.77E-04	3.53E-03	2.46E-03	-9.16E-02
PERM	MJ	0.00E+00	0.00E+00	3.18E-02	0.00E+00	2.86E-03	3.75E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	5.09E-02	2.13E-05	5.12E-02	1.83E-04	9.61E-03	1.33E-01	2.77E-04	3.53E-03	2.46E-03	-9.16E-02
PENRE	MJ	6.30E-01	8.37E-03	9.44E-02	2.13E-02	1.41E-01	1.19E+00	1.94E-01	3.28E-02	2.00E-02	-9.93E-01
PENRM	MJ	1.67E+00	0.00E+00	5.86E-03	0.00E+00	1.51E-01	2.15E+00	0.00E+00	0.00E+00	0.00E+00	-5.77E-01
PENRT	MJ	2.30E+00	1.52E-02	1.01E-01	4.22E-02	2.94E-01	3.34E+00	1.94E-01	3.28E-02	2.00E-02	-1.57E+00
SM	kg	4.58E-03	0.00E+00	6.75E-06	0.00E+00	4.13E-04	5.63E-03	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	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	0.00E+00	0.00E+00
FW	m3	4.76E-04	3.02E-07	1.91E-04	1.39E-06	9.30E-05	9.12E-04	3.93E-06	4.77E-05	5.62E-04	-6.06E-04

\* See Annex B for information on the indicators abbreviations

FU: 1 m<sup>2</sup> installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.





SYSTEM 7 – MULTI LAYER LOOSE LAID

Other indicators describing waste categories \*

UNITS PER FU		A1	A2	A3	A4	A5	B5	C2	C3	C4	D
HWD	kg	2.79E-05	0.00E+00	1.63E-04	0.00E+00	1.72E-05	1.99E-04	0.00E+00	0.00E+00	0.00E+00	-1.33E-18
NHWD	kg	1.73E-03	0.00E+00	1.23E-03	0.00E+00	3.71E-03	6.84E-03	0.00E+00	7.62E-01	0.00E+00	-2.83E-18
RWD	kg	5.98E-05	4.43E-07	3.83E-07	1.22E-06	5.57E-06	7.93E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
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	0.00E+00	0.00E+00
MFR	kg	9.53E-06	0.00E+00	0.00E+00	0.00E+00	1.84E-03	1.99E-03	0.00E+00	2.39E-02	0.00E+00	0.00E+00
MER	kg	0.00E+00	0.00E+00	1.89E-04	0.00E+00	3.65E-03	4.09E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	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	0.00E+00	4.78E-01

\* See Annex B for information on the indicators abbreviations

FU: 1 m² installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.



## SYSTEM 8 – MULTI LAYER SELF ADHESIVE

Potential environmental impacts \*

UNITS PER FU		A1	A2	A3	A4	A5	B5	C2	C3	C4	D
GWP-total	kg CO2 eq	5.01E-02	1.17E-03	2.86E-03	3.46E-03	1.92E-02	7.67E-02	2.20E-03	9.03E-02	5.36E-03	-3.88E-02
GWP-fossil	kg CO2 eq	4.82E-02	1.17E-03	6.76E-03	3.45E-03	1.86E-02	7.73E-02	2.20E-03	9.03E-02	5.34E-03	-4.14E-02
GWP-biogenic	kg CO2 eq	3.15E-04	4.80E-07	-3.91E-03	2.53E-06	4.09E-03	4.83E-03	9.02E-07	4.16E-05	2.27E-05	2.70E-03
GWP-luluc	kg CO2 eq	1.59E-03	9.28E-09	4.63E-06	1.02E-07	1.92E-04	1.95E-03	1.74E-08	2.37E-06	1.38E-06	-4.51E-05
GWP-GHG	kg CO2 eq	5.01E-02	1.17E-03	6.79E-03	3.46E-03	1.89E-02	7.98E-02	2.20E-03	9.03E-02	5.34E-03	-4.16E-02
ODP	kg CFC11 eq	4.15E-08	2.72E-10	9.14E-10	7.88E-10	6.40E-09	5.61E-08	5.10E-10	4.41E-10	8.84E-11	-1.66E-08
AP	mol H+ eq	3.50E-04	7.66E-06	1.35E-05	2.54E-05	1.05E-04	5.28E-04	7.61E-06	2.65E-05	7.34E-06	-1.78E-04
EP-freshwater <sup>1</sup>	kg P eq	3.36E-06	6.97E-10	1.10E-07	5.46E-09	4.35E-07	5.14E-06	1.31E-09	1.03E-07	6.42E-08	-1.69E-06
EP-marine	kg N eq	5.34E-05	3.20E-06	4.25E-06	7.75E-06	3.40E-05	1.18E-04	2.44E-06	8.68E-06	4.82E-06	-2.35E-05
EP-terrestrial	mol N eq	5.50E-04	3.51E-05	4.11E-05	8.56E-05	3.65E-04	1.24E-03	2.69E-05	9.62E-05	1.56E-05	-2.72E-04
POCP	kg NMVOC eq	2.38E-04	9.00E-06	1.59E-05	2.23E-05	1.05E-04	4.31E-04	7.34E-06	2.49E-05	5.29E-06	-9.13E-05
ADP-minerals&metals	kg Sb eq	4.39E-07	6.91E-11	1.24E-08	2.32E-10	5.48E-08	2.12E-07	1.30E-10	3.90E-09	7.41E-10	-1.71E-08
ADP-fossil	MJ	2.37E+00	1.66E-02	1.21E-01	4.87E-02	3.82E-01	3.01E+00	3.12E-02	2.47E-02	1.57E-02	-1.42E+00
WDP	m3 world eq. deprived	1.18E-01	-3.66E-06	8.51E-03	-3.59E-06	1.66E-02	1.36E-01	-6.86E-06	7.92E-04	2.16E-02	-2.33E-02

\* See Annex A for information on the indicators abbreviations

FU: 1 m<sup>2</sup> installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.

<sup>1</sup> Due to a typographical error in EN 15804:2021+A2:2019, PCR 2019:14 indicates that results shall be given in both kg PO<sub>4</sub>eq and kg P<sub>eq</sub>. Results are here presented only as kg P<sub>eq</sub>. To obtain the value in kg PO<sub>4</sub>eq multiply by 3.07 (as indicated in PCR 2019:14)

<sup>†</sup> negative value due water flows accounting of the AWARE method used to calculate water depletion potential. An input of marine salt water is used in the transport process inventory of A2 module, along with an output of freshwater. However, the former is not considered from the AWARE method, hence highlighting a credit for returning freshwater to nature, but not the impact of withdrawing it in the first place.

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks



## SYSTEM 8 – MULTI LAYER SELF ADHESIVE

Potential additional environmental impacts \*

	UNITS PER FU	A1	A2	A3	A4	A5	B5	C2	C3	C4	D
PM	Disease incidence (No.)	1.54E-08	1.34E-10	1.68E-10	2.46E-10	2.11E-09	3.57E-09	1.43E-10	1.76E-10	6.47E-11	-6.12E-10
IRP	kBq U235 eq	1.03E-02	7.31E-05	1.43E-04	2.17E-04	1.62E-03	1.30E-02	1.37E-04	1.65E-04	1.32E-04	-6.26E-03
ETP-fw	CTUe	9.68E-01	7.14E-03	4.89E-02	1.96E-02	1.56E-01	1.17E+00	1.25E-02	6.55E-02	1.21E-02	-3.52E-01
HTP-c	CTUh	2.95E-11	3.56E-13	3.81E-12	3.70E-13	5.23E-12	3.72E-11	1.77E-13	1.28E-11	1.31E-13	-4.38E-12
HTP-nc	CTUh	5.18E-10	1.67E-11	3.47E-11	3.38E-11	1.43E-10	7.49E-10	2.07E-11	8.33E-11	6.49E-12	-1.97E-10
SQP	(-)	1.80E-01	4.12E-05	3.56E-01	2.46E-04	6.57E-02	5.91E-01	7.74E-05	6.34E-03	9.23E-03	-3.25E-01

\* See Annex A for information on the indicators abbreviations

FU: 1 m<sup>2</sup> installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.

LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks



## SYSTEM 8 – MULTI LAYER SELF ADHESIVE

Use of resources \*

	UNITS PER FU	A1	A2	A3	A4	A5	B5	C2	C3	C4	D
PERE	MJ	7.28E-02	2.32E-05	2.18E-02	2.02E-04	1.18E-02	1.03E-01	4.36E-05	3.21E-03	2.24E-03	-9.55E-02
PERM	MJ	2.10E-03	0.00E+00	3.35E-02	0.00E+00	4.27E-03	3.96E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT	MJ	7.49E-02	2.32E-05	5.54E-02	2.02E-04	1.61E-02	1.43E-01	4.36E-05	3.21E-03	2.24E-03	-9.55E-02
PENRE	MJ	7.70E-01	1.66E-02	1.15E-01	4.87E-02	1.89E-01	1.13E+00	3.04E-02	2.99E-02	1.82E-02	-9.83E-01
PENRM	MJ	1.67E+00	0.00E+00	1.53E-02	0.00E+00	2.02E-01	1.94E+00	0.00E+00	0.00E+00	0.00E+00	-5.25E-01
PENRT	MJ	2.44E+00	1.66E-02	1.34E-01	4.87E-02	3.91E-01	3.08E+00	3.04E-02	2.99E-02	1.82E-02	-1.51E+00
SM	kg	2.24E-03	0.00E+00	5.74E-05	0.00E+00	2.76E-04	2.57E-03	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	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	0.00E+00	0.00E+00
FW	m3	9.50E-04	3.29E-07	2.00E-04	1.56E-06	1.77E-04	9.52E-04	6.17E-07	4.34E-05	5.11E-04	-7.54E-04

\* See Annex B for information on the indicators abbreviations

FU: 1 m<sup>2</sup> installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.



SYSTEM 8 – MULTI LAYER SELF ADHESIVE

Other indicators describing waste categories \*

	UNITS PER FU	A1	A2	A3	A4	A5	B5	C2	C3	C4	D
HWD	kg	1.34E-05	0.00E+00	1.85E-04	0.00E+00	2.38E-05	1.89E-04	0.00E+00	0.00E+00	0.00E+00	-2.38E-18
NHWD	kg	9.48E-04	0.00E+00	1.12E-02	0.00E+00	5.47E-03	1.49E-02	0.00E+00	0.00E+00	0.00E+00	-5.05E-18
RWD	kg	5.82E-05	4.83E-07	5.18E-07	1.41E-06	7.28E-06	6.86E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CRU	kg	0.00E+00	0.00E+00	1.14E-05	0.00E+00	1.37E-06	1.37E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	3.72E-06	0.00E+00	0.00E+00	0.00E+00	2.33E-03	2.24E-03	0.00E+00	2.17E-02	0.00E+00	0.00E+00
MER	kg	0.00E+00	0.00E+00	3.92E-04	0.00E+00	4.34E-03	4.39E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE	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	0.00E+00	4.42E-01

\* See Annex B for information on the indicators abbreviations

FU: 1 m² installed roof waterproofing system with flexible sheets for roofing per year of use, with a membrane reference service life of 35 years (105 years considering two renovations). Environmental figures are thus presented divided by 105.

## DIFFERENCES VERSUS PREVIOUS VERSIONS

Table below shows the differences between the current EPD and the previous version. **A1-A3** modules GWP-GHG indicator from current EPD is chosen for the comparison, due to the correspondence with the previous EPD GWP indicator (calculated according to the superseded EN 15804+A1 method).

Current EPD values are found to be generally higher, mainly due to the database update from Ecolinvent 2.2 to Ecolinvent 3.6. The latter is indeed characterised by materials/processes with higher environmental impacts. System 7 alone underwent a reduction of A1-A3 GWP-GHG impact.

It is important to notice that not the same companies (and then products) involved in the previous study are present in the current one. Hence, differences in products composition and manufacturing processes might also have influenced the results.

No comparison for systems 4 and 8 is available, since those products were not assessed in the previous EPD.

	GWP 2015 [kg CO <sub>2,eq</sub> /FU]	GWP-GHG 2020 [kg CO <sub>2,eq</sub> /FU]	Δ
System 1	3.39E-02	3.69E-02	+ 9%
System 2	3.42E-02	3.99E-02	+ 17%
System 3	3.11E-02	3.26E-02	+ 5%
System 4	-	3.62E-02	-
System 5	4.99E-02	6.27E-02	+ 26%
System 6	5.34E-02	5.47E-02	+ 2%
System 7	4.85E-02	4.66E-02	- 4%
System 8	-	5.81E-02	-



## CALCULATION RULES AND HYPOTHESES

### DATABASE

The database used to model the various raw materials and processes is EcolInvent 3.6, the most updated version of the data bank. No primary data from raw materials suppliers were collected.

### CUT-OFF RULES

LCA model has been processed considering all main input/output associated with core process in accordance with the threshold valued stated in EN 15804 (§ 6.3.6), namely the sum of the excluded material flows to the core module shall not exceed 1% of mass and energy.

Hence, the following aspects were considered negligible:

- Production of packaging for the raw materials input transport process
- Machinery production
- Deconstruction, demolition (C1) life cycle stage

### ALLOCATION

Allocation occurs anytime a system is producing more than a single output. In this case it is necessary to choose a technique to proper split the environmental burdens among the output flows; international standards ISO 14044 and PCR 2019:14 v 1.11 provide guidelines about how to deal with this issue, that have been implemented in this project as well. EWA members produce several product types that are not object of the study. Therefore, it is important to establish an allocation method based on physical variables to split input and output flows to the multi-products: allocation by square metres of plant products was chosen as most representative tool for the system understudy.

## CALCULATION RULES AND HYPOTHESES

### PRODUCT REFERENCE SERVICE LIFE (RSL)

The Reference service life (RSL) refers to the declared technical and functional performance of the product within a building. A standard reference service lifetime of 35 years (estimated by EWA Technical Committee and stated in the “*Review of durability of bitumen waterproofing, 2021*” document) for the roof waterproofing system is used for calculations of Use stage figures. In line with common European practice, a maximum of 2 renewals is allowed, whereby the new top layer is fully adhered to the substrate of the former layer by torching the bottom surface of the membrane. A total building service lifetime of 105 years is then considered.

### TRANSPORTATION

Impacts calculations related to transports in SimaPro are performed according to the Ecoinvent model. For module A2, average transportation distances are considered, performed only by truck.

### ELECTRIC ENERGY MODEL

Electricity mix model combines the already-existing Ecoinvent 3.6 European mix, the Russian Federation mix and the Turkey mix. The different mixes are combined on the basis of the electricity production volumes. As a result, 1 kWh of electricity by EWA Electricity mix is produced 65% by fossil fuels and 35% by renewables. The contribution of the electricity energy mix on the overall impact of stages A1 to A3 is less than 10%, so the documentation is not necessary here.

### MODULE D

- The total environmental burden of the incineration with energy recovery is included in the system boundaries (EoL stage), whereas benefits are considered in the Module D
- Avoided impacts and environmental burden relative to bitumen, polymers and ballast recycling process are considered for the module D analysis. Bitumen and polymers were considered recycled together, being the separate recovery of polymers not feasible. Hence, the output is a secondary material flow exploitable as substitute for virgin bitumen.

## LIFE-CYCLE STAGES CONSIDERED



### A1 (PRODUCT STAGE)

- Raw materials supply
- Generation of electricity as European mix (0.48 kg CO<sub>2,eq</sub>/kWh)
- NG supply for internal heat generators
- Diesel supply for internal transportations



### A2 + A3 (PRODUCT STAGE)

- Raw materials transport to plants by truck (A2)
- Manufacturing process
- Heat production from internal generators
- Water usage; emissions to air
- Manufacturing process waste treatment



### A4+A5 (CONSTRUCTION PROCESS STAGE)

- Final product delivery to construction sites
- Installation on buildings, considering accessories needed, installation cutting waste, and direct energy consumption (as heat)



### B5 (USE STAGE)

- Product stage and construction process stage for 2 new membranes, used to renew the waterproofing system in the building reference service lifetime



### C2 (END OF LIFE STAGE)

- Out-of-service membranes transportation to treatment sites by truck. Different distances were chosen for each treatment



### C3 (END OF LIFE STAGE)

- Incineration with energy recovery (45% of the product) and recycling (15% of the product – only sorting process considered)



### C4 (END OF LIFE STAGE)

- Sanitary landfilling operations (40% of the product)



### D (BENEFITS AND LOADS BEYOND SYSTEM BOUNDARIES)

- Benefits and loads of energy recovery and recycling

# GENERAL HYPOTHESIS ADOPTED

### UPSTREAM PROCESS, A1

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All raw materials, including bitumen and polymers, were modelled according to the Ecolnvent 3.6 database.

No primary data were directly collected from raw material suppliers.

Primary data regarding raw materials consumption were provided by the 43 participating EWA plants.

### PRODUCTION AND DELIVERY, A2 + A3 + A4

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Raw materials input transportation were assumed by EURO 3 Truck. Average distances were used, equal for all the plants.

Primary data was collected from the 43 production plants by means of the EWA on-line tool. Firstly, data was averaged by each cluster and finally delivered to EWA to produce the pan-European average. The reference year is 2019.

Distances for product delivery to construction sites, along with transport means used, were provided by each plant. They are hence product-specific primary data.

### MEMBRANE END OF LIFE, C2 + C3 + C4

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The reference scenario considered for the roof membrane end of life waste management is

- 40 % to landfill.
- 45 % to incineration with energy recovery.
- 15 % to recycling

as expert judgement assumption by EWA Technical Committee (also in accordance with PEF Annex C)

Distance covered by a European average EURO 5 lorry 16 t with diesel engine (Module C2):

- 300 km to recycling;
- 100 km to incineration site
- 50 km to disposal

- Waste processing (Module C3) considers the electricity consumption of waste sorting facilities and total burdens of incineration. Recycling process, other than sorting, are not considered
- Landfilling burdens are entirely considered in C4 module

### INSTALLATION & REFURBISHMENT, A5 + B5

.....

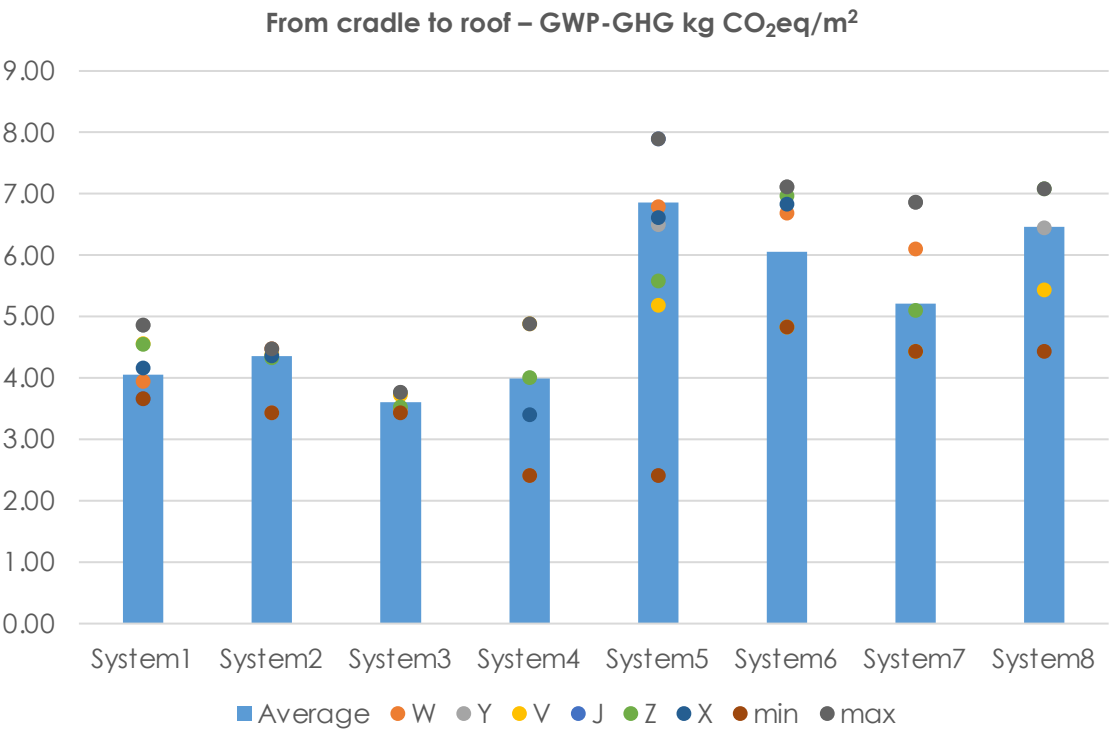
These stages include the cutting waste production, transport and waste processing and disposal.  
The table below reports details regarding to the real membrane consumption and the ancillary materials needed for the installation.

Installation process	System 1 fully adhered	System 2 mechanically fastened	System 3 ballasted	System 4 Self adhesive	System 5 fully adhered	System 6 mechanically fastened	System 7 ballasted	System 8 Self adhesive
Type	Single layer	Single layer	Single layer	Single layer	Multi layer	Multi layer	Multi layer	Multi layer
Gas propane – kg/m <sup>2</sup>	0.150	0.030	0.030	-	0.300	0.150	0.150	-
Fasteners* – u/m <sup>2</sup>	-	4 (17 g PP + 14 g steel each)	-	-	-	4 (17 g PP + 14 g steel each)	-	-
Ballast – kg/m <sup>2</sup>	-	-	80	-	-	-	80	-
Real consumption of membrane	+ 12%	+ 16%	+ 12%	+12%	+ 9%	+ 10%	+ 9%	+12%

Refurbishment stage includes all activities for the maintenance of the roof. In line with the European common practice two renewals are allowed: a new top layer is fully bonded by torching on the existing waterproofing system.  
Transportation of waste generated at the building site considers a European average EURO 5 lorry 16 t with diesel engine (300 km to recycling; 100 km to incineration site; 50 km to disposal)

Refurbishment	Single layer/Multi-layer
Gas propane – kg/m <sup>2</sup>	0.150
Real membrane consumption	+ 9% (each time)

GWP-GHG VARIATION FROM AVERAGE ECOPROFILE (A1-A3 MODULES)



	System 1	System 2	System 3	System 4	System 5	System 6	System 7	System 8
Δ min	-10%	-21%	-5%	-40%	-65%	-20%	-15%	-31%
Δ max	+20%	+3%	+4%	+22%	+15%	+17%	+32%	+10%

Graph besides shows the ecoprofiles variability with respect to the average figures declared in the EPD.

Due to the high number of products analysed by participants, only environmental figures for each Regional Cluster for the 8 systems analysed are reported. Variation in GWP-GHG results with respect to the average value are provided, per each product system.

Each Cluster name is replaced by a capital letter in order to preserve confidentiality.

Multilayer systems have an higher impact than single layer systems due to mass properties.

## REFERENCES

- ISO 14025: 2010 “Environmental labels and declarations – Type III environmental declarations”
- ISO 14040:2006 “Environmental Management, Life Cycle Assessment – Principle and framework”
- ISO 14044:2017 “Environmental Management, Life Cycle Assessment – Requirements and guidelines”
- General Programme Instructions for the International EPD® System 3.01 (2019-09-18)
- EN 15804: 2012+A2:2019 “Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products”
- PCR “Construction products” – 2019:14 version 1.11 (date 2021-02-05)
- G.L. Baldo, M. Marino, S. Rossi “Analisi del ciclo di vita LCA – nuova edizione aggiornata” Edizioni Ambiente, 2008
- EWA bituminous membranes LCA report 2021
- Review of durability of bitumen waterproofing, EWA Technical Committee 2021

## LIST OF PARTICIPANTS

Cluster	Plant	Address
Benelux	BMI Group – Icopal B.V.	Groningen, Netherlands
	IKO Europe N.V.	Antwerpen, Belgium
	Imperbel SA, Perwez	Perwez, Belgium
	Soprema B.V.	Ijlst, Netherlands
	Soprema N.V.	Grobbendonk, Belgium
	Soprema N.V.	Schoten, Belgium
EWA	Imperialum	Montijo, Portugal
	Danosa, Derivados Asfálticos Normalizados S.A.	Fontanar, Spain
	LLC “Technoflex”	Ryazan, Russia
	Vyborg branch of LLC “Technoflex” Ltd	Vyborg, Leningrad region, Russia
	Voskresenkiy branch LLC “Technoflex” Ltd, Ltd	Voskresenk, Moscow region, Russia
	FLLC “Roofing plant TechnoNICOL”	Osipovichi, Republic of Belarus
	UAB „Mida LT“	Gargjdai, Lithuania
France	Axter SAS	Courchelettes, France
	BMI Group – Icopal SAS	Cormenon, France
	BMI Group – Icopal SAS	Loriol, France
	IKO SAS	Tourville-la-Rivière, France
	Soprema SAS	Strasbourg, France
	Soprema SAS	Val de Reuil, France
	Soprema SAS	Sorgues, France



## LIST OF PARTICIPANTS

Cluster	Plant	Country
Germany	Binné & Sohn GmbH & Co. KG	Pinneberg, Germany
	BMI Group – BMI Flachdach GmbH	Bamberg, Germany
	Georg Börner Chemisches Werk für Dach- und Bautenschutz GmbH & Co. KG	Bad Hersfeld, Germany
	C. Hasse & Sohn Inh. E. Räddecke GmbH & Co. KG	Uelzen, Germany
	Mogat-Werke Adolf Böving GmbH	Mainz, Germany
	Paul Bauder GmbH & Co. KG	Stuttgart, Germany
	Soprema GmbH	Mannheim, Germany
	W. Quandt GmbH & Co. KG	Berlin, Germany
Italy	Casali S.p.A.	Castelferretti, Italy
	Copernit S.p.A.	Pegognaga, Italy
	General Membrane S.p.A.	Ceggia, Italy
	Imper Italia S.r.l.	Mappano, Italy
	Index S.p.A.	Castel D'Azzano, Italy
	Matco S.r.l.	Ronco all'Adige, Italy
	Polyglass S.p.A.	Negrizia di Ponte di Piave, Italy
	Soprema S.r.l. Italia	Salgareda, Italy
	Technicol Italia	Pordenone, Italy
	Valli Zabban S.p.A.	Trecastelli, Italy
Nordic	BMI Group – Icolpal AB	Malmö, Sweden
	BMI Group – Icopal Denmark APS	Ikast, Denmark
	BMI Group – Icopal Oy	Espoo, Finland
	Katepal Oy	Lempäälä, Finland
	Isola AS	Porsgrunn, Norway

# **ANNEX A**

## **-**

### **ENVIRONMENTAL IMPACT CATEGORIES AND INDICATORS**

## CORE ENVIRONMENTAL IMPACT INDICATORS

Abbreviation	Impact category	Indicator
<b>GWP-total</b>	Climate change - total	Global Warming Potential total
<b>GWP-fossil</b>	Climate change - fossil	Global Warming Potential fossil fuels
<b>GWP-biogenic</b>	Climate change - biogenic	Global Warming Potential biogenic
<b>GWP-luluc</b>	Climate change – land use and land use change	Global Warming Potential land use and land use change
<b>ODP</b>	Ozone Depletion	Depletion potential of the stratospheric ozone layer
<b>AP</b>	Acidification	Acidification potential, Accumulated Exceedance
<b>EP-freshwater</b>	Eutrophication aquatic freshwater	Eutrophication potential, fraction of nutrients reaching freshwater end compartment
<b>EP-marine</b>	Eutrophication aquatic marine	Eutrophication potential, fraction of nutrients reaching marine end compartment
<b>EP-terrestrials</b>	Eutrophication terrestrial	Eutrophication potential, Accumulated Exceedance
<b>POCP</b>	Photochemical ozone formation	Formation potential of tropospheric ozone
<b>ADP-minerals&amp;metals</b>	Depletion of abiotic resources – minerals and metals	Abiotic depletion potential for non-fossil resources
<b>ADP-fossil</b>	Depletion of abiotic resources – fossil fuels	Abiotic depletion potential for fossil resources
<b>WDP</b>	Water use	Water (user) deprivation potential, deprivation-weighted water consumption

ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS

Abbreviation	Impact category	Indicator
PM	Particulate matter emissions	Potential incidence of disease due to PM emissions
IRP	Ionising radiation, human health	Potential Human exposure efficiency relative to U235
ETP-fw	Ecotoxicity (freshwater)	Potential Comparative Toxic Unit for ecosystems
HTP-c	Human toxicity, cancer effects	Potential Comparative Toxic Unit for humans
HTP-nc	Human toxicity, non-cancer effects	Potential Comparative Toxic Unit for humans
SQP	Land use related impacts / soil quality	Potential Soil quality index

## **Annex B**

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### **INDICATORS DESCRIBING RESOURCE USE AND OUTPUT FLOWS BASED ON LIFE CYCLE INVENTORY**

## USE OF RESOURCES INDICATORS

Abbreviation	Indicator
<b>PERE</b>	Use of renewable primary energy excluding renewable primary energy resources used as raw materials
<b>PERM</b>	Use of renewable primary energy resources used as raw materials
<b>PERT</b>	Total use of renewable primary energy resources
<b>PENRE</b>	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials
<b>PENRM</b>	Use of non-renewable primary energy resources used as raw materials
<b>PENRT</b>	Total use of non-renewable primary energy resources
<b>SM</b>	Use of secondary raw materials
<b>RSF</b>	Use of renewable secondary fuels
<b>NRSF</b>	Use of non-renewable secondary fuels
<b>FW</b>	Use of net fresh water

OUTPUT FLOWS INDICATORS

Abbreviation	Indicator
HWD	Hazardous waste disposed
NHWD	Non-hazardous waste disposed
RWD	Radioactive waste disposed
CRU	Components for re-use
MFR	Materials for recycling
MER	Materials for energy recovery
EE	Exported energy