ENVIRONMENTAL PRODUCT DECLARATION OF WATERPROOFING SYSTEMS WITH BITUMINOUS SHEET

TPP1 / TPC1 / TPC2 / TVH1 / TVA1 / NTG1 / NTV1 / NTV2 / NTV5 / NTV6 / EXT1

EPD® registration number: S-P-01493

Ecoplatform registration number: 00000817

Publication date: 2019/02/25

Validity date: 2024/02/24

Scope of the EPD®: international

UN CPC code: 5453

COMPLIANT WITH EN 15804 AND ISO 14025:2010

INDEX

1. PROGRAMME RELATED INFORMATION

Name of the program and program operator	The international EPD ® System, operated by EPD International AB
Reference PCR	PCR 2012:01 Construction products and Construction services (v2.3)
EPD® registration number	S-P-01493
Ecoplatform registration number	00000817
Date of publication	2019/02/25
Validity	5 years (24th of February of 2024)
Geographical scope of the EPD®	International
For more information	www.environdec.com

2. PRODUCT RELATED INFORMATION

2.1. INFORMATION ABOUT THE MANUFACTURING COMPANY

Company responsible of the publication of the EPD®	DANOSA ESPAÑA Polígono Industrial Sector 9 19290 FONTANAR (Guadalajara) ESPAÑA
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2.1.1. Description of the company

DANOSA was established in 1964 with the philosophy of manufacturing products and offering innovative solutions to improve the quality of life. More than 500 million m² of materials manufactured and distributed, and a consolidated presence in the five continents guarantee our commitment acquired with the quality and service over forty years of work. The best guarantee of this commitment are the certifications that the product has achieved: CE marking, ER of BUREAU VERITAS, IQ-Net, the "Avis Techniques" of C.S.T.B. (France) and the "Homologação Documents" of the Portuguese (Portugal).

DANOSA is a pioneer company in the communication and improvement of the environmental performance of the life cycle of its products through the publication of Environmental Product Declarations of its DANOPOL ranges (waterproofing membrane for roofing) and DANOPREN (extruded polystyrene panel), in addition to this EPD. DANOSA is certified with ISO 9001 Quality Management Systems since 2012 (registration number: ES044036-1) and ISO 14001 certification of Environmental Management Systems (registration number ES069274-1).

2.1.2. Commitment of DANOSA with sustainability

DANOSA considers that personal and business integrity is a basic value of its internal relations, with its suppliers, its customers and with the environment, for which it is committed to comply with the legislations and regulations addressed both to Quality and Environment, as well as to comply with other internal commitments subscribed by the company itself.

DANOSA'S products are always manufactured respecting the declared specifications and minimizing the environmental impacts associated with their activities, reducing whenever possible the amount of waste to be treated.

DANOSA considers especially the suppliers and subcontractors in order to achieve its objectives of Quality and Environment, encouraging them to develop the best environmental practices creating a relationship of mutual collaboration.

DANOSA is committed to the continuous improvement of the productivity of its facilities through the rational use of the natural resources and energy reducing, wherever possible, the waste generated in all operations and to ease its recycling.

As indicated, DANOSA is a pioneer in communicating the environmental performance of the life cycle of most of its products through the publication of Environmental Product Declarations. In addition, it participates in the online platform of materials of the Green Building Council Spain (http://materiales.gbce.es/) making available to the public all the necessary information to check the compliance of its products with the different criteria indicated in the main

environmental certification schemes in construction (LEED, BREEAM and VERDE), contributing in this way to sustainability in the construction sector.

2.2. PRODUCT SPECIFICATION

- **Product specification**

This Environmental Product Declaration includes all the ranges of waterproofing systems with SBS sheets manufactured by DANOSA.

The waterproofing solutions with monolayer or bilayer bituminous membrane that DANOSA proposes are formed by the range of asphalt sheets of bitumen modified with SBS-type elastomeric polymers.

These sheets are manufactured by calendering and are reinforced with a reinforcement of polyester fibre, reinforced polyester or fiberglass. The sheets through the lower layer are plasticized and the upper layer can be plasticized or have a mineral self-protection with slate.

During the installation the sheets will conform the bituminous membrane that will give rise to the waterproofing system in flat roof.

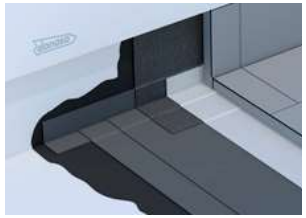
The function of the waterproofing systems is mainly to protect the building against water in its various forms: rain, humidity, snow and hail.

In addition, depending on the system, the solution ensures thermal insulation over time, make the roof accessible to pedestrians and / or vehicles and / or enable the use of vegetation systems on the roof. These complementary functions, which are provided by the insulation and the finish, have not been considered, neither the use of the materials that provide this function.

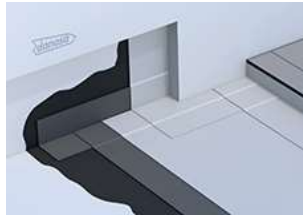
Below the eleven systems included in this EPD and their main characteristics are described:

Waterproofing system		TPP1	TPC1	TPC2	TVH1	TVA1	NTG1	NTV1	NTV2	NTV5	NTV6	EXT1
		Bilayer Adhered System Transitable Private	Bilayer Adhered System Transitable Private	Bilayer Adhered System Transitable Public	Bilayer Adhered System Vehicles Concrete	Bilayer Adhered System Vehicles Agglomerate Asphaltic	Bilayer Adhered System Not Transitable Gravel	Monolayer Adhered System Not Transitable Self-protected	Bilayer Adhered System Not Transitable Self-protected	Monolayer System Fixed Mechanically Not Transitable Self-protected	Bilayer System Fixed Mechanically Not Transitable Self-protected	Bilayer Adhered System Landscaped
Upper sheet	Name	ESTERDAN 40 P ELAST	POLYDAN 180-40 P ELAST	POLYDAN 48 P PARKING	POLYDAN 48 P PARKING	POLYDAN 60 TF ELAST	ESTERDAN 40 P ELAST	ESTERDAN PLUS 50/GP ELAST	ESTERDAN PLUS 40/GP ELAST	POLYDAN PLUS FM 50/GP ELAST	ESTERDAN PLUS 40/GP ELAST	ESTERDAN PLUS 50/GP ELAST VERDE JARDIN
	Weight (kg/m^2)	4	4	4,3	4,3	6	4	5	4	5	4	5
Lower sheet	Name	GLASDAN 30 P ELAST	GLASDAN 30 P ELAST	GLASDAN 30 P ELAST	GLASDAN 30 P ELAST	GLASDAN 30 P ELAST	GLASDAN 30 P ELAST	-	GLASDAN 30 P ELAST	-	ESTERDAN FM 30 P ELAST	GLASDAN 30 P ELAST
	Weight (kg/m^2)	3	3	3	3	3	3	-	3	-	3	3
Quantity used by sheet (m^2/m^2)		1,08	1,08	1,08	1,08	1,08	1,08	1,12	1,12	1,12	1,12	1,08
Weight of the bituminous sheet (kg/m^2)		7,56	7,56	7,884	7,884	9,72	7,56	5,6	7,84	5,6	7,84	8,64
Type of installation		Adhesion with welding torch	Adhesion with welding torch	Adhesion with welding torch	Adhesion with welding torch	Adhesion with welding torch	Adhesion with welding torch	Adhesion with welding torch	Adhesion with welding torch	Mechanical fixation and adhesion with welding torch in joints	Mechanical fixation to the support and adhesion with welding torch between sheets	Adhesion with welding torch

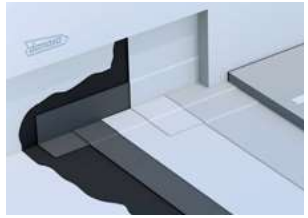
TPP1



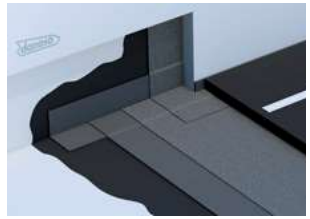
TPC1



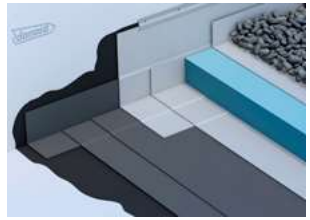
TPC2



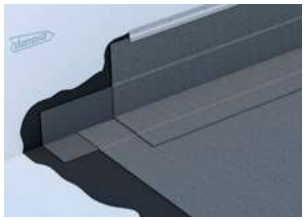
TVH1



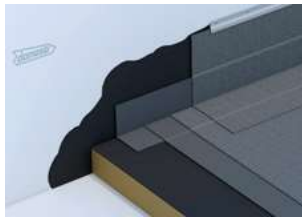
TVA1



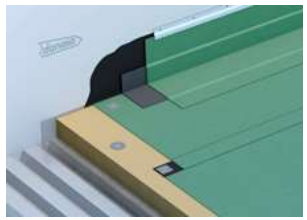
NTG1



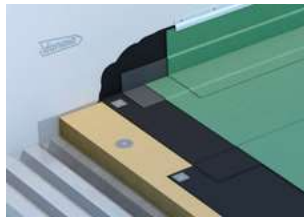
NTV1



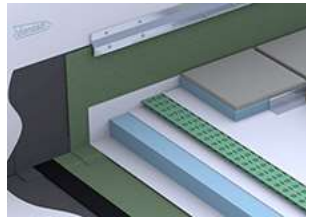
NTV2



NTV5



NTV6



EXT1

- **Materials content**

The materials that are necessary for the configuration of the system are the next:

Material	Weight (%)
Bitumen	33% - 44%
SBS polymer	3% - 5%
Carbonate	15% - 20%
Ashes	15% - 20%
Polyester	0% - 2%
Reinforced polyester	0% - 4%
Bituminous emulsion	0% - 7%
Mineral slate	0% - 22%
Others	3% - 7%

The bituminous sheets contain 27.5% of recycled material in the mastic. Specifically, 12.5% of the bitumen and 100% of the ashes is recycled material. In addition, those membranes with polyester reinforcement contain 50% of recycled polyester.

During the life cycle of the product, hazardous substances listed in "Candidate List of Substances of Very High Concern (SVHC) for authorization[1]" are not used in a percentage bigger than 0.1% by weight.

2.3. FUNCTIONAL UNIT

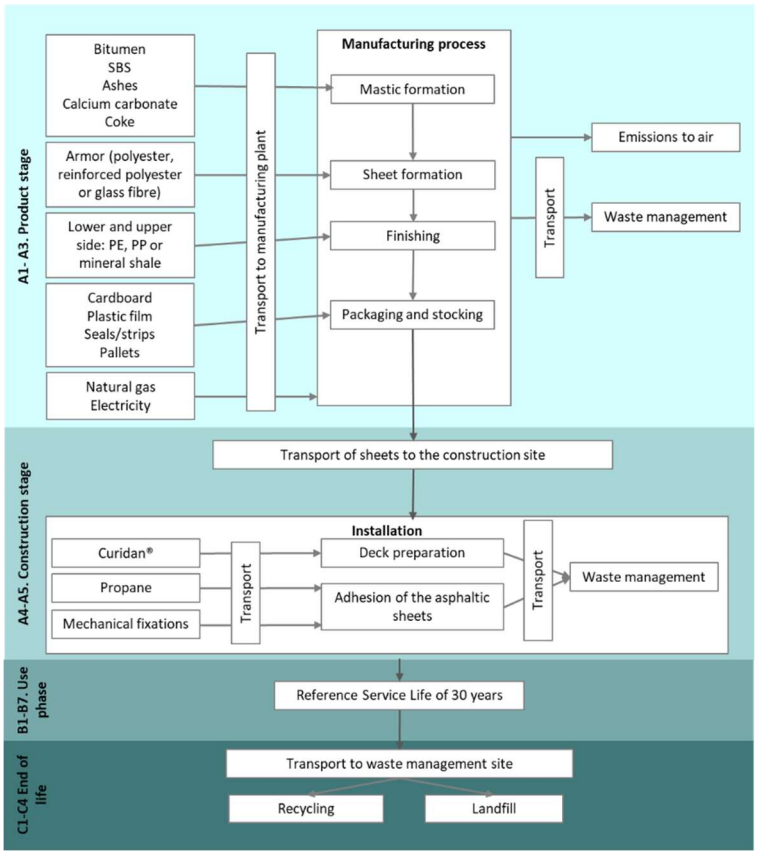
To waterproof a surface of 1 m^2 with bituminous membrane, during a Reference Service Life of 30 years.

Other functions of the systems are not included, such as ensuring thermal insulation over time, making the roof accessible to pedestrians and vehicles and / or enabling the use of vegetation systems on the roof. These complementary functions have not been considered.

[1] http://echa.europa.eu/chem_data/authorisation_process/candidate_list_table_en.asp

2.4. DESCRIPTION OF THE PROCESSES AND LIMITS OF THE SYSTEM

This EPD® is structured with the life cycle stages established according to the reference standard PCR 2012: 01 Construction products and Construction services version 2.3, based on the EN 15804: 2012 + A1: 2013 regulations. This is a cradle to grave EPD®.



2.4.1. Product stage

The product stage is composed of the stages of raw materials supply (A1), raw materials transport (A2) and manufacturing (A3). As allowed by the EN 15804 standard, the results of A1-A3 stages have been grouped in a single product stage.

A1-RAW MATERIALS SUPPLY

This module takes into account the extraction and processing of the raw materials, as well as the energy that is produced during its extraction and processing.

To model the bitumen mastic (bitumen modified with elastomeric polymers [SBS] or plastomers [APP]) the Life Cycle Inventory published by Eurobitume in 2012 for bitumen and SBS has been used.

A2-RAW MATERIALS TRANSPORT

This module includes the transport of raw materials from the manufacturer to DANOSA's manufacturing plant. The real distance and type of truck for every raw material has been introduced.

A3-MANUFACTURING

In this module is included the energy consumption, additives and packaging used during the manufacturing process. At the same time, emissions in the facility which have not been originated during the fuel's combustion are assessed, as well as the transport and management of waste produced in the factory.

The manufacturing process of the bituminous sheets begins with the formation of the mastic. Asphaltic bitumen is discharged into a tank where it is kept at a temperature of 150ºC to keep it in a liquid state. The next phase of the process is the mixing of the bitumen with the other necessary additives, among them the SBS. In these mixing processes there are no chemical reactions, all the mixing and integration of the polymer is a mechanical process. The dosing of all components is performed gravimetrically with calibrated equipment.

Once the mastic is formed, the mixture is transferred to the bath of the manufacturing line. It begins the uncoil of the reinforcement of the sheet, which passes through the bath and by simple adhesion comes out with a quantity of mastic that passes between two rollers achieving the necessary thickness.

Once the sheet is formed the desired finish on each of the faces is added (polyethylene film or slate).

During the packaging, the already cold sheets are rolled and make up the strapped and shrink-wrapped pallet.

2.4.2. Construction stage A4-A5

The construction stage is formed by A4 Transport stage and A5 Construction-Installation stage.

A4-TRANSPORT

The A4 Transport module includes the transport of the asphalt sheets from the factory door to the construction site. The main parameters that affect the results of this stage are described below.

Parameter	Unit (expressed by functional unit)
Type and fuel consumption of the vehicle, types of vehicles used during the transport	>32 Tn truck EURO V Cargo ship
Distance	Truck: 100 – 1.086 km (depending on the sheets composing the system) Cargo ship: 0 – 934 km (depending on the sheets composing the system)
Capacity use (including empty returns)	% assumed in Ecoinvent
Density of the transported products	1.100 kg/m^3

A5-CONSTRUCTION-INSTALLATION

Module A5 Installation and construction includes all the materials and energy used during the installation. At the same time, it is taken into account the transport as well as the management of the waste produced.

The first step to install the system is to apply the Curidan® primer. The sheets are welded to the support with a torch, applying heat to the underside of the sheet. It has been considered an installation scenario in flat roof where the sheets are adhered and / or mechanically fixed. The overlaps (8 or 12 cm) are adhered with a torch in order to ensure waterproofing.

Parameter	Unit (expressed by functional unit)
Auxiliary materials for installation	Curidan®: 0,4 kg in all the systems except for the mechanically fixed systems (TPP1, TPC1, TPC2, TVH1, TVA1, NTG1, NTV1, NTV2, EXT1) Mechanical fixations with galvanized steel: 0,125 kg in systems fixed mechanically (NTV5, NTV6)
Use of water	None
Use of other resources	None
Quantitative description of the regional mix and energy consumption during installation	Propane: • 0,3 kg/m^2 in the bilayer systems not fixed mechanically (TPP1, TPC1, TPC2, TVH1, TVA1, NTG1, NTV2, EXT1) • 0,15 kg/m^2 in the monolayer systems not fixed mechanically (NTV1) and the bilayer systems fixed mechanically (NTV6) • 0,015 kg/m^2 in the monolayer systems fixed mechanically (NTV5)

Material waste in the construction site, before the waste processing, generated during the installation of the product (specified by type)	TPP1, TPC1, NTG1, NTV2, NTV6: • Paper/cardboard: 3,87E-02 kg/m^2 • Plastic film: 8,37E-03 kg/m^2 • Seals/strips: 1,60E-03 kg/m^2 TPC2, TVH1, TVA1 • Paper/cardboard: 4,66E-02 kg/m^2 • Plastic film: 1,01E-03 kg/m^2 • Seals/strips: 1,93E-03 kg/m^2 NTV1, NTV5 • Paper/cardboard: 2,77E-02 kg/m^2 • Plastic film: 6,00E-03 kg/m^2 • Seals/strips: 1,15E-03 kg/m^2 EXT1 • Paper/cardboard: 4,42E-02 kg/m^2 • Plastic film: 9,57E-03 kg/m^2 • Seals/strips: 1,83E-03 kg/m^2
Materials out flow (specified by type) resultant from the waste processing in the construction site, for example, during the recycling, energy recovery or spill (specifying the route)	Packaging wastes are 100% collected and recycled.
Pollutant emissions to air, soil and water	Any significant emission

2.4.3. Use stage B1-B7

B1-USE

The sheets are classified as A + according to Decree No. 2011-321 of March 23, 2011 of the French Ministry of Ecology, Sustainable Development, Transport and Housing referring to volatile organic compounds (VOCs). Therefore, for the waterproofing solutions module B1 is not considered relevant.

B2-MANTENANCE

The product does not require any type of maintenance during its Reference Service Life (30 years).

B3-REPAIR

The product does not require any type of repair during its Reference Service Life (30 years).

B4-REPLACEMENT

The product does not require any replacement during its Reference Service Life (30 years).

B5-REFURBISHMENT

The product does not require any refurbishment during its Reference Service Life (30 years).

B6-OPERATIONAL ENERGY USE

The product does not require any energy consumption during its Reference Service Life (30 years).

B7- OPERATIONAL WATER USE

The product does not require any water consumption during its Reference Service Life (30 years).

2.4.4. End of life stage C1-C4

This stage includes the transport and management of waste produced once the RSL is finished. The end of life stage is composed by the modules C1 Deconstruction, C2 Transport, C3 Waste treatment and C4 Waste disposal.

It has been considered that the impact of deconstruction of the waterproofing system is not significant.

For the management of generated waste, the European scenario for 2014 has been considered (EUROSTAT, 2018).

Parameter	Unit (expressed by functional unit)
Collection process, specified by type	TPP1, TPC1, NTG1: 7,96 kg/m^2 TPC2, TVH1: 8,284 kg/m^2 TVA1: 10,12 kg/m^2 NTV1: 6 kg/m^2 NTV2: 8,24 kg/m^2 NTV5: 5,6 kg/m^2 NTV6: 7,84 kg/m^2 EXT1: 9,04 kg/m^2
Recovery system, specified by type	82% in mass to recycling 6% in mass to reuse
Disposal, specified by type	12% in mass to landfill
Assumptions for scenario development	16-32 Tn truck with a fuel consumption of 25 l per 100 km: 150 km to recycling 100 km to energy recovery 50 km to landfill

2.4.5. Additional information beyond the life cycle of the building

BENEFITS AND LOADS BEYOND THE LIMITS OF THE SYSTEM

Additional information regarding benefits and charges beyond the limits of the system (module D) includes the process of recycling the system at the end of life. According to data at European level for 2014, the recycling rate of construction waste is 82%.

It has been considered the benefits of recycling the bitumen contained in the bituminous membrane, which prevents the production of virgin primary bitumen.

2.5. POTENTIAL IMPACT OVER THE ENVIRONMENT

It has been performed a Life Cycle Assessment of 11 waterproofing systems with bituminous sheet, including all stages of the life cycle (from cradle to grave). The EPD® was carried out following the indications set by the Product Category Rules (PCR): Construction products and Construction services 2012: 01 version 2.3. The impact methods CML IA v 3.05, Cumulative Energy Demand v 1.10 (for the calculation of energy indicators) and EDIP 2003 (for the calculation of waste production) have been used.

Product stage			Construction stage		Use stage							End of life stage				Reuse, recovery and recycling potential
Raw materials	Transport	Manufacturing	Transport	Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction/demolition	Transport	Waste treatment	Disposal	
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

X: Module included

- **Data quality**

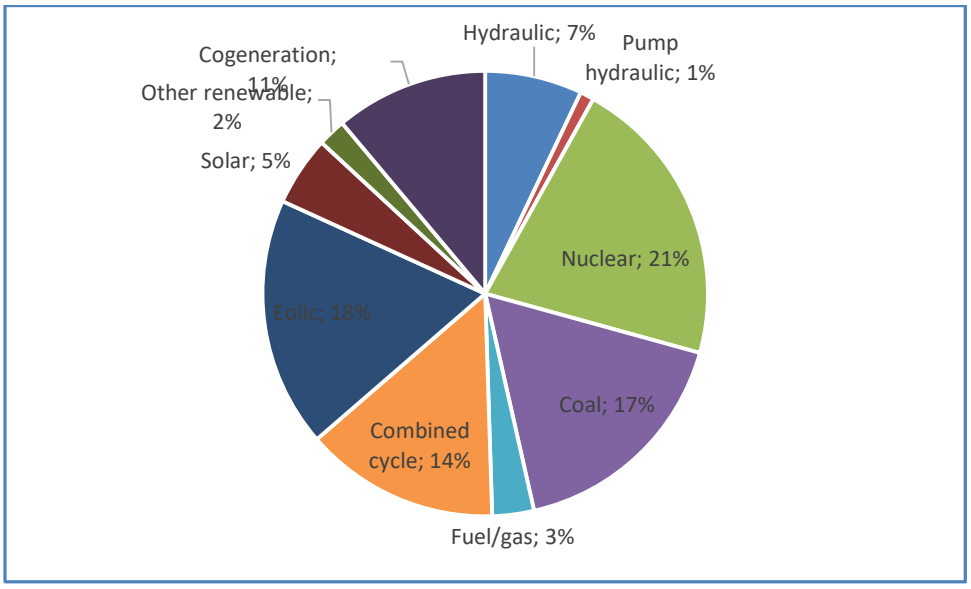
Specific data have been taken for the period from July 2017 to July 2018.

The specific data refer to the amounts of matter and energy used during the life cycle of waterproofing systems with bituminous membrane (use of raw and auxiliary materials, energy consumption and waste production) and the distribution of asphalt sheets. These data have been supplied by DANOSA and have been taken directly from the manufacturing plant.

The results of this EPD® are valid until there are substantial modifications that affect the impact produced. Substantial modifications are an increase of more than 10% in the environmental impact per functional unit.

Generic data on the impact per unit of matter or energy have been taken to determine emissions per kg of matter, kWh of energy or tkm transported. These data have been obtained from the Ecoinvent database version 3.4.

In reference to the electricity production mix, data from Spain in 2017 have been taken[2].



Based on the limits of the system indicated in the PCR Construction products and construction services, the following processes have not been taken into account:

- The manufacturing of equipment with an expected life time of over three years, buildings and other capital goods.
- Maintenance activities in the manufacturing plant.

[2] Source: Red Eléctrica Española

- The commuting transport

Allocation

In reference to the allocation of environmental charges, the polluter-pays principle has been followed. In the production stage, since DANOSA manufactures other products besides asphalt sheets, the consumptions of auxiliary materials, energy and waste generated during the production of the sheets corresponds to the manufacturing line. Within the family of the sheets, the allocation has been made by m^2.

2.6. COMPARISON OF EPDS OF THE SAME PRODUCT CATEGORY

In the case that a comparison of different EPDs® within this product category would be performed, these must be based with the PCR 2012:01 Construction products and Construction services.

“Environmental Product Declarations within the same product category from different programs may not be comparable”

“EPDs of construction products may be not comparable if they do not comply with EN 15804 or ISO 21930”

2.7. EPD® VALIDITY

This EPD® is valid for five years from the date of its publication. In the case of observing modifications that entail a worsening in any of the indicators of environmental impact of the life cycle of the product greater than 10% over the current declaration, the EPD® must be updated.

The verifier and the operator of the program do not make any claim or present any responsibility about the legality of the product.

3. ENVIRONMENTAL PERFORMANCE RELATED INFORMATION

3.1. POTENTIAL IMPACT OVER THE ENVIRONMENT

The results indicated in this section refer to the life cycle of one square meter of the 11 waterproofing systems for 30 years.

The systems with a variation in the environmental impact of less than 10% have been grouped, expressing as representative the system with the greatest impact for the Global Warming category.

The results can be recalculated to be expressed per year, dividing the impact value by 30.

1m² of EXT1/NTV2 during 30 years										
Indicator	Unit	Product stage	Construction process stage		Use stage	End of life stage				Reuse, recovery and recycling potential
		A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Environmental impacts										
Global warming potential (GWP)	kg CO_2 eq	3,64E+00	2,50E-01	1,28E+00	0	0	1,96E-01	7,02E-03	1,36E-01	-5,38E-01
Ozone layer depletion (ODP)	kg CFC-11 eq	2,26E-07	4,92E-08	1,92E-07	0	0	3,63E-08	2,01E-09	2,84E-09	0
Acidification of land and water (AP)	kg SO_2 eq	2,50E-02	8,41E-04	3,35E-03	0	0	6,24E-04	4,51E-05	1,30E-04	-3,73E-03
Eutrophication (EP)	kg $(PO_4)^{3-}$ eq	3,30E-03	1,81E-04	6,71E-04	0	0	1,41E-04	2,17E-05	6,32E-03	-4,33E-04
Photochemical ozone creation (POCP)	kg C_2H_4 eq	2,36E-03	4,08E-05	3,63E-04	0	0	3,19E-05	1,01E-06	2,59E-05	-1,62E-04
Depletion of abiotic resources-elements (ADPe)	kg Sb eq	3,93E-06	4,84E-07	4,90E-07	0	0	5,96E-07	8,12E-10	1,32E-08	-3,95E-10
Depletion of abiotic resources-fossil fuels (ADPf)	MJ	1,99E+02	3,92E+00	2,78E+01	0	0	2,95E+00	8,66E-02	2,42E-01	-1,29E+02
Use of resources										
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE)	MJ	2,28E+00	7,10E-02	1,24E-01	0	0	4,38E-02	6,73E-02	9,01E-03	-1,00E-08
Use of renewable primary energy resources used as raw materials (PERM)	MJ	0	0	0	0	0	0	0	0	0
Total use of renewable primary energy resources (PERT)	MJ	2,28E+00	7,10E-02	1,24E-01	0	0	4,38E-02	6,73E-02	9,01E-03	-1,00E-08
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials (NPERE)	MJ	2,17E+02	4,29E+00	2,98E+01	0	0	3,20E+00	2,60E-01	2,77E-01	-1,37E+02
Use of non-renewable primary energy resources used as raw materials (NPERM)	MJ	0	0	0	0	0	0	0	0	0
Total use of non-renewable primary energy resources (NPERT)	MJ	2,17E+02	4,29E+00	2,98E+01	0	0	3,20E+00	2,60E-01	2,77E-01	-1,37E+02
Use of secondary material (SM)	kg	1,93E+00	0	0	0	0	0	0	0	0
Use of renewable secondary fuels (RSF)	MJ	0	0	0	0	0	0	0	0	0
Use of non-renewable secondary fuels (NRSF)	MJ	0	0	0	0	0	0	0	0	0
Use of net fresh water (FW)	m^3	8,09E-02	8,73E-04	1,81E-03	0	0	5,13E-04	5,55E-05	2,87E-04	-4,03E-04
Waste categories										
Hazardous waste disposed (HWD)	kg	2,35E-05	2,05E-06	8,49E-06	0	0	1,76E-06	1,55E-07	1,14E-07	0
Non-hazardous waste disposed (NHWD)	kg	7,96E-01	3,49E-01	4,83E-02	0	0	1,43E-01	7,50E-05	1,09E+00	0
Radioactive waste disposed (RWD)	kg	1,13E-04	2,84E-05	1,05E-04	0	0	2,07E-05	2,84E-06	1,76E-06	0
Output flows										
Components to reuse (CRU)	kg	0	0	0	0	0	0	0	5,45E-01	0
Materials to recycling (MFR)	kg	3,96E-02	0	6,01E-02	0	0	0	0	7,39E+00	0
Materials for energy recovery (MER)	kg	0	0	0	0	0	0	0	4,70E-02	0
Exported energy (EE)	MJ	0	0	0	0	0	0	0	0	0

1m² of TPP1/NTG1 during 30 years										
Indicator	Unit	Product stage	Construction process stage		Use stage	End of life stage				Reuse, recovery and recycling potential
		A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Environmental impacts										
Global warming potential (GWP)	kg CO_2 eq	3,42E+00	2,41E-01	1,28E+00	0	0	1,73E-01	6,18E-03	1,20E-01	-5,48E-01
Ozone layer depletion (ODP)	kg CFC-11 eq	2,02E-07	4,74E-08	1,92E-07	0	0	3,20E-08	1,77E-09	2,50E-09	0
Acidification of land and water (AP)	kg SO_2 eq	2,36E-02	8,12E-04	3,35E-03	0	0	5,49E-04	3,97E-05	1,14E-04	-3,79E-03
Eutrophication (EP)	kg $(PO_4)^{3-}$ eq	2,91E-03	1,75E-04	6,71E-04	0	0	1,24E-04	1,91E-05	5,57E-03	-4,41E-04
Photochemical ozone creation (POCP)	kg C_2H_4 eq	9,73E-04	3,94E-05	3,63E-04	0	0	2,81E-05	8,88E-07	2,28E-05	-1,65E-04
Depletion of abiotic resources-elements (ADPe)	kg Sb eq	2,76E-06	4,67E-07	4,89E-07	0	0	5,25E-07	7,15E-10	1,16E-08	-4,02E-10
Depletion of abiotic resources-fossil fuels (ADPf)	MJ	1,99E+02	3,78E+00	2,78E+01	0	0	2,59E+00	7,62E-02	2,13E-01	-1,32E+02
Use of resources										
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE)	MJ	1,61E+00	6,85E-02	1,24E-01	0	0	3,86E-02	5,92E-02	7,94E-03	0
Use of renewable primary energy resources used as raw materials (PERM)	MJ	0	0	0	0	0	0	0	0	0
Total use of renewable primary energy resources (PERT)	MJ	1,61E+00	6,85E-02	1,24E-01	0	0	3,86E-02	5,92E-02	7,94E-03	0
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials (NPERE)	MJ	2,17E+02	4,13E+00	2,98E+01	0	0	2,82E+00	2,29E-01	2,44E-01	-1,40E+02
Use of non-renewable primary energy resources used as raw materials (NPERM)	MJ	0	0	0	0	0	0	0	0	0
Total use of non-renewable primary energy resources (NPERT)	MJ	2,17E+02	4,13E+00	2,98E+01	0	0	2,82E+00	2,29E-01	2,44E-01	-1,40E+02
Use of secondary material (SM)	kg	2,02E+00	0	0	0	0	0	0	0	0
Use of renewable secondary fuels (RSF)	MJ	0	0	0	0	0	0	0	0	0
Use of non-renewable secondary fuels (NRSF)	MJ	0	0	0	0	0	0	0	0	0
Use of net fresh water (FW)	m^3	7,73E-02	8,42E-04	1,81E-03	0	0	4,52E-04	4,89E-05	2,53E-04	-4,10E-04
Waste categories										
Hazardous waste disposed (HWD)	kg	1,88E-05	1,98E-06	8,49E-06	0	0	1,55E-06	1,36E-07	1,00E-07	0
Non-hazardous waste disposed (NHWD)	kg	6,81E-01	3,37E-01	4,82E-02	0	0	1,26E-01	6,61E-05	9,56E-01	0
Radioactive waste disposed (RWD)	kg	9,62E-05	2,74E-05	1,05E-04	0	0	1,82E-05	2,50E-06	1,55E-06	0
Output flows										
Components to reuse (CRU)	kg	0	0	0	0	0	0	0	4,80E-01	0
Materials to recycling (MFR)	kg	3,96E-02	0	5,25E-02	0	0	0	0	6,50E+00	0
Materials for energy recovery (MER)	kg	0	0	0	0	0	0	0	4,14E-02	0
Exported energy (EE)	MJ	0	0	0	0	0	0	0	0	0

1m² of TVA1/TVH1/TPC1/TPC2 during 30 years										
Indicator	Unit	Product stage	Construction process stage		Use stage	End of life stage				Reuse, recovery and recycling potential
		A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Environmental impacts										
Global warming potential (GWP)	kg CO_2 eq	4,25E+00	2,76E-01	1,28E+00	0	0	2,19E-01	7,86E-03	1,53E-01	-6,13E-01
Ozone layer depletion (ODP)	kg CFC-11 eq	2,65E-07	5,40E-08	1,92E-07	0	0	4,07E-08	2,25E-09	3,18E-09	0
Acidification of land and water (AP)	kg SO_2 eq	2,90E-02	9,75E-04	3,35E-03	0	0	6,98E-04	5,05E-05	1,45E-04	-4,24E-03
Eutrophication (EP)	kg $(PO_4)^{3-}$ eq	3,97E-03	2,03E-04	6,71E-04	0	0	1,57E-04	2,42E-05	7,08E-03	-4,93E-04
Photochemical ozone creation (POCP)	kg C_2H_4 eq	3,12E-03	4,64E-05	3,63E-04	0	0	3,57E-05	1,13E-06	2,90E-05	-1,85E-04
Depletion of abiotic resources-elements (ADPe)	kg Sb eq	5,10E-06	5,29E-07	4,90E-07	0	0	6,67E-07	9,09E-10	1,48E-08	-4,49E-10
Depletion of abiotic resources-fossil fuels (ADPf)	MJ	2,29E+02	4,31E+00	2,78E+01	0	0	3,30E+00	9,69E-02	2,71E-01	-1,47E+02
Use of resources										
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE)	MJ	2,71E+00	7,83E-02	1,24E-01	0	0	4,91E-02	7,53E-02	1,01E-02	0
Use of renewable primary energy resources used as raw materials (PERM)	MJ	0	0	0	0	0	0	0	0	0
Total use of renewable primary energy resources (PERT)	MJ	2,71E+00	7,83E-02	1,24E-01	0	0	4,91E-02	7,53E-02	1,01E-02	0
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials (NPERE)	MJ	2,49E+02	4,72E+00	2,98E+01	0	0	3,58E+00	2,91E-01	3,10E-01	-1,56E+02
Use of non-renewable primary energy resources used as raw materials (NPERM)	MJ	0	0	0	0	0	0	0	0	0
Total use of non-renewable primary energy resources (NPERT)	MJ	2,49E+02	4,72E+00	2,98E+01	0	0	3,58E+00	2,91E-01	3,10E-01	-1,56E+02
Use of secondary material (SM)	kg	2,21E+00	0	0	0	0	0	0	0	0
Use of renewable secondary fuels (RSF)	MJ	0	0	0	0	0	0	0	0	0
Use of non-renewable secondary fuels (NRSF)	MJ	0	0	0	0	0	0	0	0	0
Use of net fresh water (FW)	m^3	9,38E-02	9,57E-04	1,81E-03	0	0	5,75E-04	6,22E-05	3,22E-04	-4,59E-04
Waste categories										
Hazardous waste disposed (HWD)	kg	2,84E-05	2,26E-06	8,49E-06	0	0	1,97E-06	1,73E-07	1,28E-07	0
Non-hazardous waste disposed (NHWD)	kg	8,86E-01	3,81E-01	4,83E-02	0	0	1,60E-01	8,40E-05	1,22E+00	0
Radioactive waste disposed (RWD)	kg	1,29E-04	3,12E-05	1,05E-04	0	0	2,32E-05	3,18E-06	1,97E-06	0
Output flows										
Components to reuse (CRU)	kg	0	0	0	0	0	0	0	6,10E-01	0
Materials to recycling (MFR)	kg	3,96E-02	0	6,33E-02	0	0	0	0	8,27E+00	0
Materials for energy recovery (MER)	kg	0	0	0	0	0	0	0	5,26E-02	0
Exported energy (EE)	MJ	0	0	0	0	0	0	0	0	0

1m² of NTV1 during 30 years										
Indicator	Unit	Product stage	Construction process stage		Use stage	End of life stage				Reuse, recovery and recycling potential
		A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Environmental impacts										
Global warming potential (GWP)	kg CO_2 eq	2,33E+00	5,23E-02	6,78E-01	0	0	1,30E-01	4,66E-03	9,05E-02	-3,13E-01
Ozone layer depletion (ODP)	kg CFC-11 eq	1,55E-07	1,03E-08	9,75E-08	0	0	2,41E-08	1,34E-09	1,88E-09	0
Acidification of land and water (AP)	kg SO_2 eq	1,54E-02	1,70E-04	1,89E-03	0	0	4,14E-04	2,99E-05	8,60E-05	-2,17E-03
Eutrophication (EP)	kg $(PO_4)^{3-}$ eq	2,24E-03	3,74E-05	3,89E-04	0	0	9,33E-05	1,44E-05	4,20E-03	-2,52E-04
Photochemical ozone creation (POCP)	kg C_2H_4 eq	2,04E-03	8,38E-06	1,91E-04	0	0	2,12E-05	6,69E-07	1,72E-05	-9,45E-05
Depletion of abiotic resources-elements (ADPe)	kg Sb eq	3,06E-06	1,02E-07	2,59E-07	0	0	3,96E-07	5,39E-10	8,75E-09	-2,30E-10
Depletion of abiotic resources-fossil fuels (ADPf)	MJ	1,19E+02	8,20E-01	2,00E+01	0	0	1,96E+00	5,75E-02	1,60E-01	-7,52E+01
Use of resources										
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE)	MJ	1,61E+00	1,48E-02	6,42E-02	0	0	2,91E-02	4,46E-02	5,98E-03	0
Use of renewable primary energy resources used as raw materials (PERM)	MJ	0	0	0	0	0	0	0	0	0
Total use of renewable primary energy resources (PERT)	MJ	1,61E+00	1,48E-02	6,42E-02	0	0	2,91E-02	4,46E-02	5,98E-03	0
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials (NPERE)	MJ	1,29E+02	8,97E-01	2,14E+01	0	0	2,12E+00	1,72E-01	1,84E-01	-7,99E+01
Use of non-renewable primary energy resources used as raw materials (NPERM)	MJ	0	0	0	0	0	0	0	0	0
Total use of non-renewable primary energy resources (NPERT)	MJ	1,29E+02	8,97E-01	2,14E+01	0	0	2,12E+00	1,72E-01	1,84E-01	-7,99E+01
Use of secondary material (SM)	kg	1,10E+00	0	0	0	0	0	0	0	0
Use of renewable secondary fuels (RSF)	MJ	0	0	0	0	0	0	0	0	0
Use of non-renewable secondary fuels (NRSF)	MJ	0	0	0	0	0	0	0	0	0
Use of net fresh water (FW)	m^3	4,96E-02	1,83E-04	1,06E-03	0	0	3,41E-04	3,69E-05	1,91E-04	-2,35E-04
Waste categories										
Hazardous waste disposed (HWD)	kg	1,66E-05	4,29E-07	4,30E-06	0	0	1,17E-06	1,03E-07	7,56E-08	0
Non-hazardous waste disposed (NHWD)	kg	5,11E-01	7,35E-02	3,39E-02	0	0	9,51E-02	4,98E-05	7,21E-01	0
Radioactive waste disposed (RWD)	kg	7,22E-05	5,94E-06	5,33E-05	0	0	1,37E-05	1,88E-06	1,17E-06	0
Output flows										
Components to reuse (CRU)	kg	0	0	0	0	0	0	0	3,62E-01	0
Materials to recycling (MFR)	kg	2,05E-02	0	3,90E-02	0	0	0	0	4,90E+00	0
Materials for energy recovery (MER)	kg	0	0	0	0	0	0	0	3,12E-02	0
Exported energy (EE)	MJ	0	0	0	0	0	0	0	0	0

1m² of NTV5 during 30 years										
Indicator	Unit	Product stage	Construction process stage		Use stage	End of life stage				Reuse, recovery and recycling potential
		A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Environmental impacts										
Global warming potential (GWP)	kg CO_2 eq	2,42E+00	4,96E-02	6,59E-01	0	0	1,21E-01	4,35E-03	8,44E-02	-3,11E-01
Ozone layer depletion (ODP)	kg CFC-11 eq	1,64E-07	9,75E-09	3,77E-08	0	0	2,25E-08	1,25E-09	1,76E-09	0
Acidification of land and water (AP)	kg SO_2 eq	1,58E-02	1,60E-04	3,43E-03	0	0	3,86E-04	2,79E-05	8,02E-05	-2,16E-03
Eutrophication (EP)	kg $(PO_4)^{3-}$ eq	2,37E-03	3,53E-05	1,03E-03	0	0	8,71E-05	1,34E-05	3,92E-03	-2,50E-04
Photochemical ozone creation (POCP)	kg C_2H_4 eq	2,24E-03	7,89E-06	2,22E-04	0	0	1,97E-05	6,25E-07	1,61E-05	-9,39E-05
Depletion of abiotic resources-elements (ADPe)	kg Sb eq	3,38E-06	9,66E-08	1,54E-05	0	0	3,69E-07	5,03E-10	8,17E-09	-2,28E-10
Depletion of abiotic resources-fossil fuels (ADPf)	MJ	1,20E+02	7,77E-01	6,67E+00	0	0	1,83E+00	5,36E-02	1,50E-01	-7,48E+01
Use of resources										
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE)	MJ	1,73E+00	1,40E-02	1,58E+00	0	0	2,72E-02	4,17E-02	5,58E-03	0
Use of renewable primary energy resources used as raw materials (PERM)	MJ	0	0	0	0	0	0	0	0	0
Total use of renewable primary energy resources (PERT)	MJ	1,73E+00	1,40E-02	1,58E+00	0	0	2,72E-02	4,17E-02	5,58E-03	0
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials (NPERE)	MJ	1,30E+02	8,50E-01	7,59E+00	0	0	1,98E+00	1,61E-01	1,72E-01	-7,94E+01
Use of non-renewable primary energy resources used as raw materials (NPERM)	MJ	0	0	0	0	0	0	0	0	0
Total use of non-renewable primary energy resources (NPERT)	MJ	1,30E+02	8,50E-01	7,59E+00	0	0	1,98E+00	1,61E-01	1,72E-01	-7,94E+01
Use of secondary material (SM)	kg	1,17E+00	0	0	0	0	0	0	0	0
Use of renewable secondary fuels (RSF)	MJ	0	0	0	0	0	0	0	0	0
Use of non-renewable secondary fuels (NRSF)	MJ	0	0	0	0	0	0	0	0	0
Use of net fresh water (FW)	m3	5,03E-02	1,74E-04	2,65E-03	0	0	3,18E-04	3,44E-05	1,78E-04	-2,33E-04
Waste categories										
Hazardous waste disposed (HWD)	kg	1,79E-05	4,07E-07	1,44E-05	0	0	1,09E-06	9,58E-08	7,06E-08	0
Non-hazardous waste disposed (NHWD)	kg	5,24E-01	6,97E-02	6,87E-01	0	0	8,87E-02	4,65E-05	6,73E-01	0
Radioactive waste disposed (RWD)	kg	7,51E-05	5,63E-06	1,92E-05	0	0	1,28E-05	1,76E-06	1,09E-06	0
Output flows										
Components to reuse (CRU)	kg	0	0	0	0	0	0	0	3,38E-01	0
Materials to recycling (MFR)	kg	2,05E-02	0	3,90E-02	0	0	0	0	4,57E+00	0
Materials for energy recovery (MER)	kg	0	0	0	0	0	0	0	2,91E-02	0
Exported energy (EE)	MJ	0	0	0	0	0	0	0	0	0

1m² of NTV6 during 30 years										
Indicator	Unit	Product stage	Construction process stage		Use stage	End of life stage				Reuse, recovery and recycling potential
		A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Environmental impacts										
Global warming potential (GWP)	kg CO_2 eq	3,89E+00	2,59E-01	1,20E+00	0	0	1,70E-01	6,09E-03	1,18E-01	-4,68E-01
Ozone layer depletion (ODP)	kg CFC-11 eq	2,68E-07	5,07E-08	1,23E-07	0	0	3,15E-08	1,75E-09	2,46E-09	0
Acidification of land and water (AP)	kg SO_2 eq	2,49E-02	8,92E-04	4,74E-03	0	0	5,41E-04	3,91E-05	1,12E-04	-3,24E-03
Eutrophication (EP)	kg $(PO_4)^{3-}$ eq	3,84E-03	1,89E-04	1,28E-03	0	0	1,22E-04	1,88E-05	5,48E-03	-3,76E-04
Photochemical ozone creation (POCP)	kg C_2H_4 eq	3,68E-03	4,29E-05	3,77E-04	0	0	2,76E-05	8,74E-07	2,25E-05	-1,41E-04
Depletion of abiotic resources-elements (ADPe)	kg Sb eq	5,53E-06	4,98E-07	1,56E-05	0	0	5,17E-07	7,04E-10	1,14E-08	-3,43E-10
Depletion of abiotic resources-fossil fuels (ADPf)	MJ	1,84E+02	4,05E+00	1,37E+01	0	0	2,56E+00	7,51E-02	2,10E-01	-1,12E+02
Use of resources										
Use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE)	MJ	3,05E+00	7,34E-02	1,64E+00	0	0	3,80E-02	5,83E-02	7,82E-03	-1,00E-08
Use of renewable primary energy resources used as raw materials (PERM)	MJ	0	0	0	0	0	0	0	0	0
Total use of renewable primary energy resources (PERT)	MJ	3,05E+00	7,34E-02	1,64E+00	0	0	3,80E-02	5,83E-02	7,82E-03	-1,00E-08
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials (NPERE)	MJ	2,01E+02	4,43E+00	1,51E+01	0	0	2,78E+00	2,25E-01	2,40E-01	-1,19E+02
Use of non-renewable primary energy resources used as raw materials (NPERM)	MJ	0	0	0	0	0	0	0	0	0
Total use of non-renewable primary energy resources (NPERT)	MJ	2,01E+02	4,43E+00	1,51E+01	0	0	2,78E+00	2,25E-01	2,40E-01	-1,19E+02
Use of secondary material (SM)	kg	1,75E+00	0	0	0	0	0	0	0	0
Use of renewable secondary fuels (RSF)	MJ	0	0	0	0	0	0	0	0	0
Use of non-renewable secondary fuels (NRSF)	MJ	0	0	0	0	0	0	0	0	0
Use of net fresh water (FW)	m^3	7,70E-02	9,00E-04	3,33E-03	0	0	4,45E-04	4,82E-05	2,49E-04	-3,50E-04
Waste categories										
Hazardous waste disposed (HWD)	kg	3,05E-05	2,12E-06	1,82E-05	0	0	1,53E-06	1,34E-07	9,88E-08	0
Non-hazardous waste disposed (NHWD)	kg	8,41E-01	3,59E-01	7,00E-01	0	0	1,24E-01	6,51E-05	9,42E-01	0
Radioactive waste disposed (RWD)	kg	1,23E-04	2,93E-05	6,58E-05	0	0	1,80E-05	2,46E-06	1,53E-06	0
Output flows										
Components to reuse (CRU)	kg	0	0	0	0	0	0	0	4,73E-01	0
Materials to recycling (MFR)	kg	4,11E-02	0	5,45E-02	0	0	0	0	6,40E+00	0
Materials for energy recovery (MER)	kg	0	0	0	0	0	0	0	4,08E-02	0
Exported energy (EE)	MJ	0	0	0	0	0	0	0	0	0

4. INTERPRETATION OF RESULTS

The life cycle of waterproofing systems with bilayer bituminous membranes have an impact on the Global warming potential of between 5,24 kg CO_2 eq/m^2 and 6,19 kg CO_2 eq/m^2.

The life cycle of waterproofing systems with monolayer membrane have an impact on the Global warming potential of 3,3 kg CO_2 eq/m^2.

The product stage A1-A3 appears to be the one that contributes the most to the environmental impact for 6 of the 7 impact categories. This stage determines between 93% (Depletion of abiotic resources, fossil fuels) and 18% (Depletion of abiotic resources, elements) of the total impact of the life cycle.

The A4 Transport module presents a significant impact on Ozone layer depletion and Waste generation, representing more than 10% of the total impact of the life cycle. In the case of monolayer membranes, this impact does not exceed 5% of the total impact for any of the indicators under study.

Module A5 Installation is important in mechanically fixed systems, especially in the category of Depletion of abiotic resources- elements, where it represents over 80% of the total impact of the life cycle. In not mechanically fixed systems, the propane gas used to adhere the sheets has relevance in categories such as Ozone layer depletion, with a contribution of between 30% and 40% of the total impact of the life cycle.

More than 36% of the waste generated during the life cycle of the bituminous membrane is generated at the end of life. The end of life of the bituminous membrane has a relatively low contribution in most of the indicators under study.

In the category of Eutrophication, C4 Disposal stage appears to have the greatest contribution with more than 50% of the total life cycle impact.

Module D Potential for reuse and recycling can represent environmental savings of up to 55% of the total impact of the life cycle of the product.

Impact category	A1/A2/A3	A4 Transport	A5 Installation	C2 Transport	C3 Waste treatment	C4 Disposal	D Reuse, recovery and recycling
Global warming	66,1%	4,5%	23,2%	3,6%	0,1%	2,5%	-9,8%
Ozone layer depletion	44,5%	9,7%	37,8%	7,1%	0,4%	0,6%	0,0%
Acidification of soil and water	83,4%	2,8%	11,2%	2,1%	0,2%	0,4%	-12,4%
Eutrophication	31,0%	1,7%	6,3%	1,3%	0,2%	59,4%	-4,1%
Photochemical ozone creation	83,6%	1,4%	12,9%	1,1%	<0,1%	0,9%	-5,7%
Depletion of abiotic resources, elements	71,3%	8,8%	8,9%	10,8	<0,1%	0,2%	0,0%
Depletion of abiotic resources, fossil fuels	85,0%	1,7%	11,9	1,3%	<0,1%	0,1%	-55,1%

Table 1 Potential Environmental impact of the life cycle stages of 1 m^2 of EXT1/NTV2 waterproofing system. In percentage.

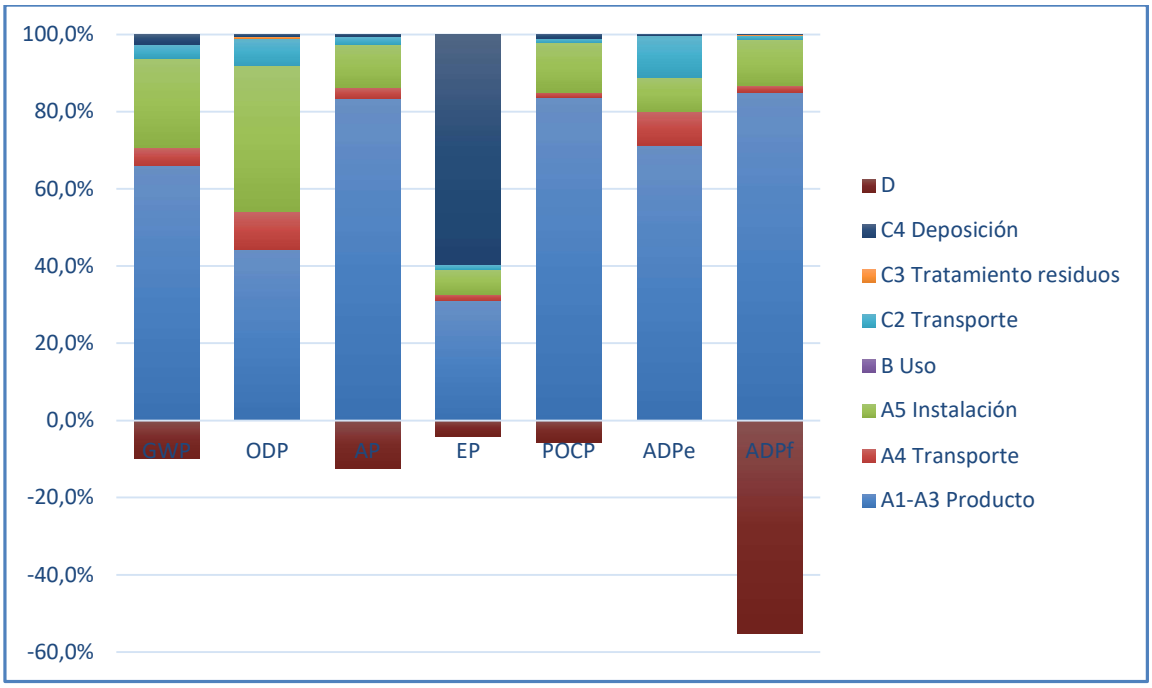


Figure 1 Potential Environmental impact of the life cycle stages of 1 m^2 of EXT1/NTV2 waterproofing system. In percentage.

5. DIFFERENCES WITH OTHER VERSIONS OF THE EPD®

This EPD® is the first version, so no older versions exist.

6. VERIFICATION

CEN standard EN 15804 serves as core PCR	
Product Category Rule (RCP)	PCR 2012:01 Construction products and construction services, Version 2.3
Product Category Rule (PCR) review was conducted by	The Technical Committee of the International EPD® System. Chair: Massimo Marino. Contact:info@environdec.com
Independent verification of the declaration and data, according to ISO 14025:2010	External EPD® verification
Third party verifier	TECNALIA R&I Certificación Name of the verifier: Elisabet Amat eli.amat@tecnaliacertificacion.com
Accredited or approved by	ENAC (accreditation number 125/C-PR283)

7. REFERENCES

- GENERAL PROGRAMME INSTRUCTIONS for Environmental Product Declarations, EPD. Version 2.5
- ISO 14025:2010 Environmental labels and declarations-Type III Environmental Declarations-Principles and procedures
- ISO 14040:2006 Environmental management-Life Cycle Assessment-Principles and framework
- ISO 14044:2006 Environmental management-Life Cycle Assessment-Requirements and guidelines
- PCR 2012:01 Construction products and Construction services (version 2.3)
- EN 15804:2012+A1:2014 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
- DANOSA, February 2019. LCA of 11 waterproofing systems with bituminous membranes of DANOSA.