

EPD OWNER:
Soprema

PROGRAMME:
The International EPD® System,
www.environdec.com

PROGRAMME OPERATOR:
EPD International AB

EPD REGISTRATION NUMBER
EPD-IES-0028462

VERSION DATE
2026/05/19

VALIDITY DATE
2031/05/19

EPD VERSION
1

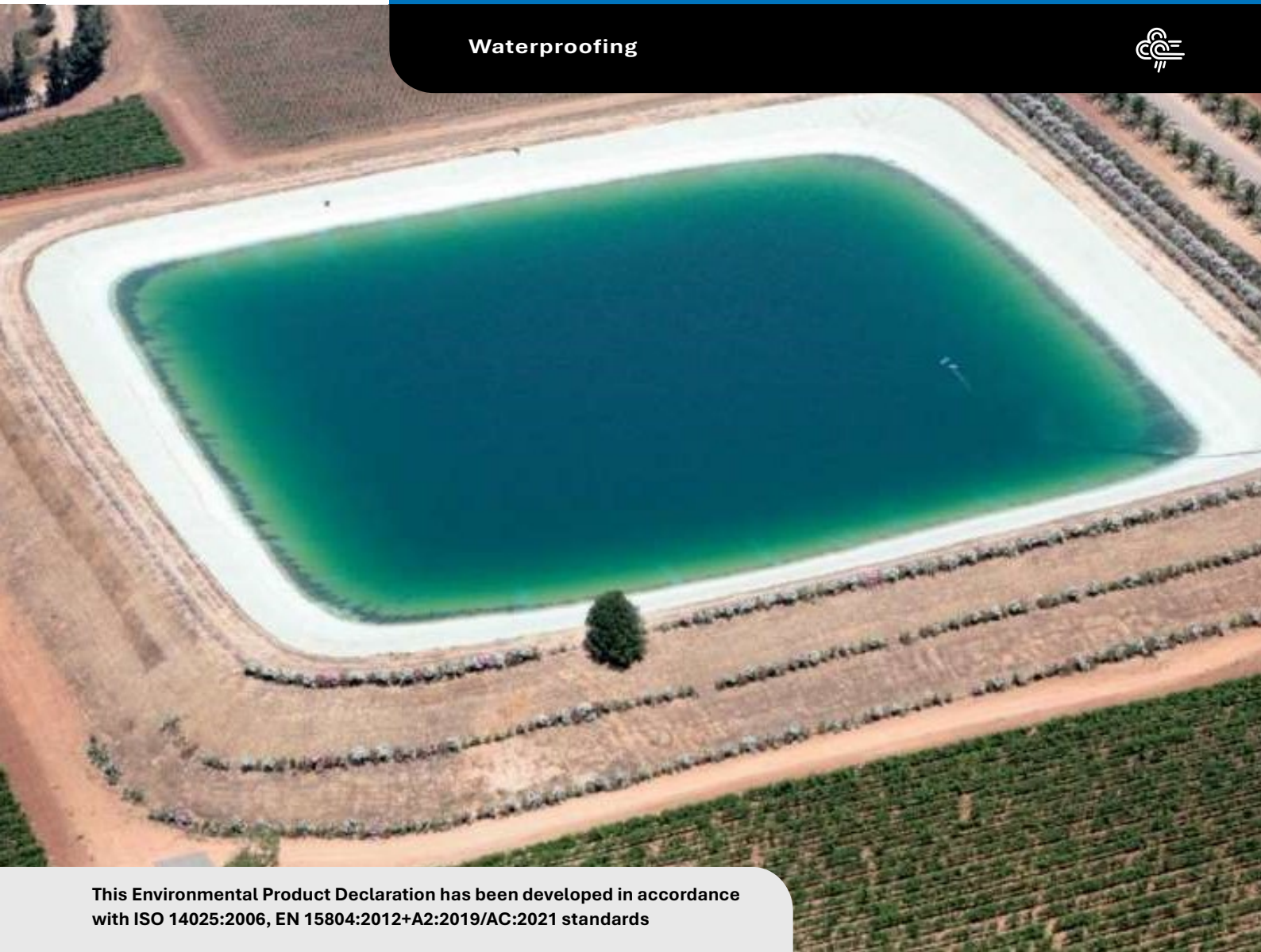
EPD of multiple products, based on the
average results of the product group

FLAGON TPO membranes for Civil Works

FLAGON GEO P and FLAGON GEO P/AT

ENVIRONMENTAL PRODUCT DECLARATION

Waterproofing



This Environmental Product Declaration has been developed in accordance
with ISO 14025:2006, EN 15804:2012+A2:2019/AC:2021 standards



An EPD may be updated or depublished if conditions change. To find the latest
version of the EPD and to confirm its validity, see www.environdec.com



General Information

PROGRAM INFORMATION

EPD International AB, Box 210 60, SE-100 31 Stockholm, Sweden,
Website: www.environdec.com, E-mail: support@environdec.com.

PRODUCT CATEGORY RULES (PCR)

CEN standard EN 15804 serves as the core Product Category Rules (PCR)

Product Category Rules (PCR): PCR 2019:14 Construction products version 2.0.1 (EN 15804+A2)

c-PCR: c-PCR-032 Flexible sheets for waterproofing (EN 17388:2024). Version: 2025-04-24.

PCR review was conducted by: The Technical Committee of the International EPD System. See www.environdec.com for a list of members. Review Chair: Rob Rouwette (chair), Noa Meron (co-chair). The review panel may be contacted via the Secretariat www.environdec.com/contact.

VERIFICATION

☐ Individual EPD verification without a pre-verified LCA/EPD tool

Third-party verifier: **Anni Oviir**, LCA Support - Rangi Maja OÜ

Approved by: International EPD System

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

☐ YES

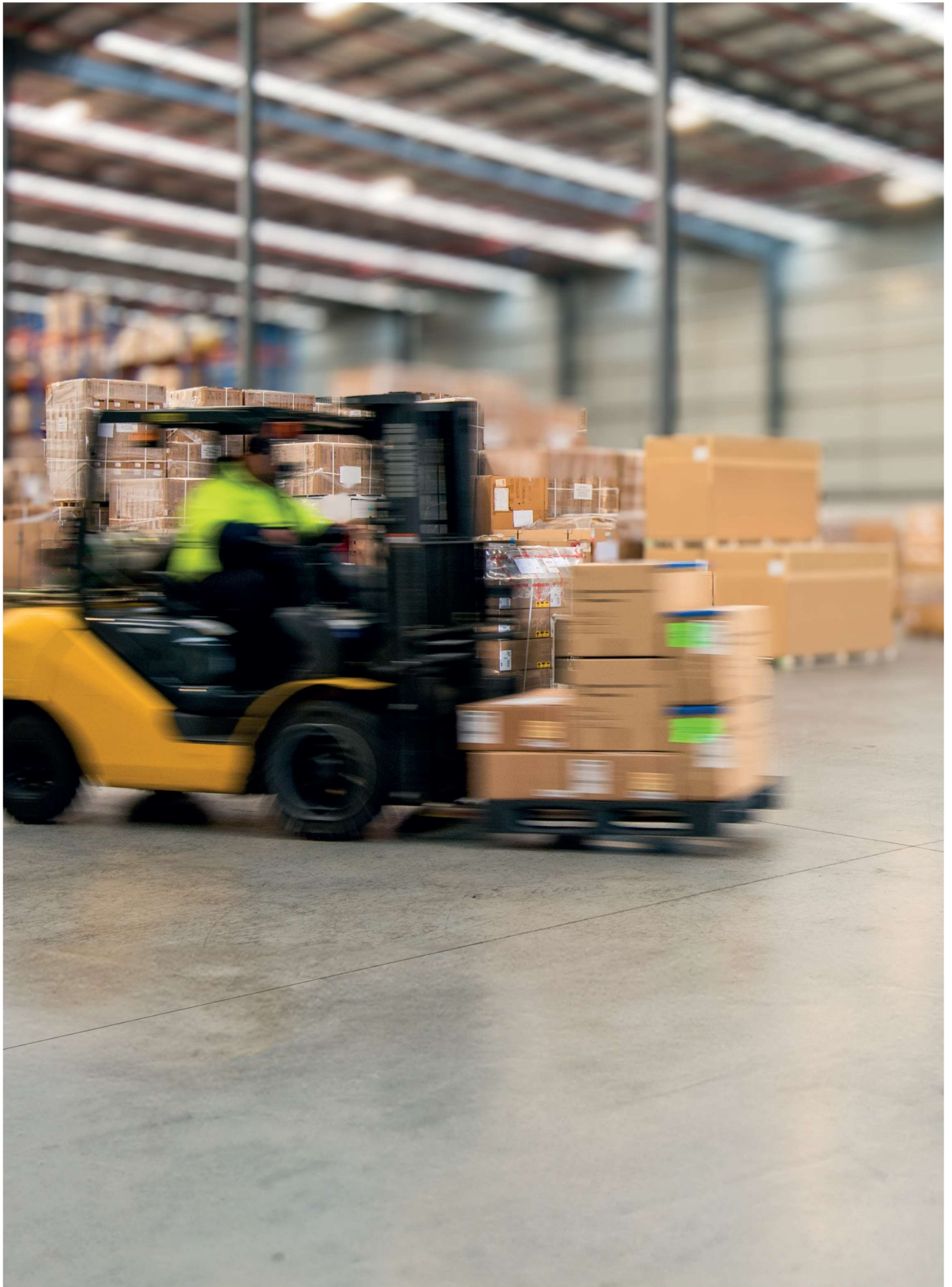
☒ NO

LIFE CYCLE ASSESSMENT (LCA)

LCA accountability: Mariana Amaro, Soprema Group.

The EPD owner has the sole ownership, liability and responsibility of the EPD.

EPDs within the same product category but registered in different EPD programmes may not be comparable. For two EPDs to be comparable, they shall be based on the same PCR (including the same version number up to the first two digits) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.





The Company

THE SOPREMA GROUP

An independent group since its inception in 1908, SOPREMA specializes in the design and implementation of cutting-edge waterproofing systems and thermal and acoustic insulation solutions, in line with the requirements of sustainable construction.

With the collaboration of over 12,000 people worldwide and a turnover of 5,14 billion Euros in 2024, the SOPREMA Group has a global industrial and commercial presence, comprising 128 production plants, more than 130 branches, and over 70 distributors. It operates in 90 countries with 24 Research and Development centers consistently focused on environmentally respectful development and has 62 technical training centers capable of passing on the technical expertise acquired over a century to new generations.

The SOPREMA product range, the result of close collaboration between the marketing and Research and Development departments, is innovative and in perfect harmony with market needs and current standards. SOPREMA's success is based on a fundamental principle: focusing on ideas.

SOPREMA's products and services aim to meet the needs of construction professionals, whether it be waterproofing with synthetic or bituminous membranes, thermal and acoustic insulation, liquid products, or civil engineering works – SOPREMA always has the solution.

SOPREMA offers high-performance technological products, constantly optimized through Research and Development in an eco-design logic, boasting exceptional characteristics in terms of robustness, reliability, and longevity.

At SOPREMA, sustainability is an essential driver that propels us towards the creation of a sustainable construction model in two main aspects: developing high-energy efficiency products and adopting an approach oriented towards the life cycle analysis of our products. Our goal is to promote a renewed vision of construction, with more responsible and environmentally friendly practices.

Chignolo d'Isola production plant has the certification of quality and environmental management system according to ISO 9001:2015 and ISO 14001:2015.

HEADQUARTER

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67100 STRASBOURG - France
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PRODUCTION PLANT

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info@soprema.it - www.soprema.it

Product Information

FLAGON TPO membranes for Civil Works

WATERPROOFING TPO MEMBRANES

FLAGON TPO membranes have been produced by Flag (now Soprema) since 1999, with roofing waterproofing as their primary application, along with use in hydraulic works.

These membranes are produced using the co-extrusion process, which makes it possible to manufacture TPO membranes with thicknesses ranging from 1.5 mm to 3.0 mm.

The co-extrusion system also allows for the production of membranes with different chemical properties on each side, ensuring complete homogeneity between the layers.

During the production process, reinforcing reinforcements (polyester or glass mesh) can be incorporated into the membranes, or protective geotextiles can be laminated onto them.

The thickness of the membrane is automatically regulated by an electronic control device that adjusts the opening of the extrusion head and the calander.

The resulting material is a homogeneous single-layer membrane with high tensile strength and excellent resistance to static and dynamic puncturing.

This production system also allows for the manufacturing of dual-color single-layer membranes that include a signal layer.

FLAGON TPO membranes are CE-marked in accordance with applicable standards.

These membranes do not contain any type of plasticizer, have a surface mass that is 25% lighter than PVC-P, and require less energy for transportation.

In addition, they offer great resistance to aging caused by UV rays and to atmospheric agents.

TPO membranes also possess the following features and benefits (non-exhaustive list), which may be more or less enhanced depending on the additives contained in the membrane:

- Flexibility at low temperatures
- Insensitivity to hot-cold cycles
- High mechanical resistance
- High elongation at break
- Resistance to static and dynamic puncturing
- Excellent UV resistance.
- Excellent dimensional stability
- Resistance to root penetration and attacks by microorganisms
- Site safety: installation without open flames
- Excellent weldability of the membranes
- Wide standard width (2.10 m)
- Custom lengths available (subject to minimum quantity)

Products included in the EPD

The EPD corresponds to a virtual average product, calculated based on production volumes.
The associated variability is set out in the additional information section.

FLAGON GEO P

Thermoplastic TPO membrane, dimensionally stabilized with a glass-fleece insert, specifically designed for the waterproofing of basins, reservoirs, canals and similar structures.

Applications:

- Overflow and drainage basins.
- Basins for water storage.
- Sprinkler tanks.
- Artificial lakes.
- Settling tanks.
- Sedimentation basins.

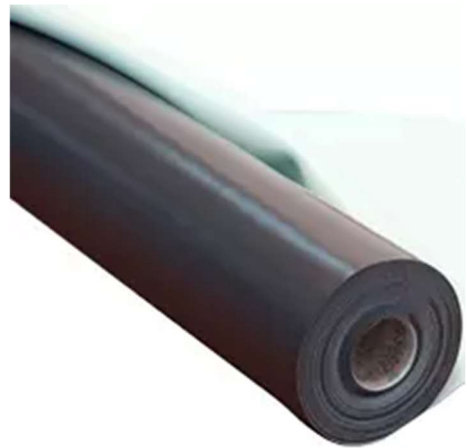


FLAGON GEO P/AT

Thermoplastic TPO membrane, dimensionally stabilized with a glass-fleece insert, specifically designed for the waterproofing of tanks and reservoirs intended for drinking water. This membrane is also recommended for natural swimming pool projects.

Applications:

- Basins for drinking water storage.
- Drinking water tanks.



Note: for all the technical information, refer to the technical data sheet of the products.

Scope and type of EPD

System diagram of the processes included in the LCA, divided into life cycle stages and information modules as defined by EN 15804.

This statement may not be comparable with those developed under other programs or based on different reference

In particular, it may not be comparable with declarations not prepared according to EN 15804 (EN 15804:2012 + A2:2019/AC:2021). Similarly, environmental declarations may not be comparable if the data sources, information modules, or scenarios considered differ.

PRODUCT STAGE			ASSEMBLY STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction 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	ND	✓	✓	✓	✓	✓

GEOGRAPHY

EU	EU	IT	EU	EU	-	-	-	-	-	-	-	EU	EU	EU	EU	EU
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SHARE OF PRIMARY DATA

15%																
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VARIATIONS PRODUCTS

-5% / +96% ¹																
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VARIATIONS SITES

0%																
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PROCESS	SOURCE TYPE	SOURCE	REFERENCE YEAR	DATA CATEGORY	SHARE OF PRIMARY DATA, OF GWP GHG RESULTS FOR A1-A3
Product manufacturing	Database	Ecoinvent v 3.10	2023	Secondary data	0%
Electricity generation for manufacturing	Collected data	EPD owner	2023	Primary data	14%
Raw material transportation	Collected data	EPD owner	2023	Primary data	1%
Packaging production	Collected data	Ecoinvent v 3.10	2023	Secondary data	0%
Other processes	Collected data	Ecoinvent v 3.10	2023	Secondary data	0%
Total share of primary data in GWP-GHG results for A1-A3					15%

1 - The deviation is calculated by comparing the maximum and minimum values with respect to the average value.

LCA Information

TYPE OF EPD

Cradle-to-gate with modules C1-C4, module D and optional modules (A4-A5).

UN CPC 3699 Articles of plastics n.e.c.

DECLARED UNIT

The declared unit is 1 m² of installed membrane, including 5% extra membrane for application, with an average thickness of 1.25 mm.

The weight per 1 m² of installed roof (including overlaps) is 1.43 kg/m² and the conversion factor to 1 kg is 0.70.

Membrane theoretical reference service life (RSL) of 30 years is provided as default value in EN 17388 (PCR) for flexible sheets for waterproofing and it can be used exclusively for theoretical calculations. It is not representative of the real service lifetimes. Service lifetime is influenced by type of membrane, thickness, design, application, use conditions and regular maintenance according to manufacturer's indications.

SOFTWARE

OneClick LCA

ENVIRONMENTAL IMPACT ASSESSMENT METHOD

The life cycle impact assessment was performed in accordance with EN 15804:2012+A2:2019/AC:2021. The global warming potential indicator (GWP100) was calculated using the EN 15804+A2 impact assessment method, based on the Environmental Footprint (EF) reference package version 3.1 (February 2023).

MAIN DATABASES FOR GENERIC DATA

Ecoinvent 3.10 (allocation, cut-off by classification).

GEOGRAPHICAL SCOPE FOR WHICH GEOGRAPHICAL LOCATION OF END-OF-LIFE THE PRODUCT'S PERFORMANCE HAS BEEN CALCULATED

Europe

REPRESENTATIVE YEAR FOR THE INVENTORY FOR THE MANUFACTURING

2023

CUT OFF

A minimum of 99% of energy consumption in manufacturing facilities is accounted for, and 99% of the raw material mass is considered.

Excluded Processes:

- Manufacturing of production equipment, buildings, or other capital goods
- Transportation of personnel to and within the plant
- Research and development activities
- Long-term emissions

ALLOCATION

Whenever possible, allocations have been avoided. When unavoidable, a mass-based physical allocation has been applied. Data on system composition have been directly obtained and analyzed following the principles of modularity and the polluter-pays principle. The allocations in the Ecoinvent 3.10.1 datasets used in this study follow the Ecoinvent system model 'Allocation, cut-off, EN15804'.

AVERAGING

The TPO products have been grouped into a single EPD due to their shared manufacturing process. To achieve this, a weighted average of the environmental impacts was calculated based on the surface area produced for each product in 2023. This approach ensures that the average environmental impacts reflect the proportional contribution of each product to the total production.

The variation in GWP-GHG among different membranes exceeds 10%. Therefore, the variations in other impact categories are also presented in this document.

DATA QUALITY

This EPD is based on specific data and system information.

The data collected on components and energy correspond to the year 2023 and include information on raw material consumption and energy use. The plausibility and consistency of the collected data have been verified, ensuring good data quality.

Material and energy consumption invoices have been collected and checked. The study covers at least 95% of the materials and energy per module and at least 99% of the total material and energy use of each unit process.

Content Declaration including Packaging

The average composition of the products, as a representative range for all the type and thicknesses, is provided in the table below, along with average packaging composition. Based on our knowledge,

no substance listed as a candidate for Authorization (Candidate List SVHC) or subject to Authorization (Annex XIV - REACH) is contained in the product at a concentration greater than 0.1% weight/weight.

PRODUCT COMPONENTS	AVERAGE COMPOSITION kg/m ²	COMPOSITION RANGE %	POST-CONSUMER RECYCLED MATERIAL WEIGHT %	BIOGENIC MATERIAL WEIGHT % PRODUCT	BIOGENIC MATERIAL kg C/m ²
TPO	1,05	70-78%	0%	0%	0,00
Additives and charges	0,34	19-29%	0%	0%	0,00
Reinforcing material	0,04	1-3%	0%	0%	0,00
Total	1,43	100%	0%	0%	0,00

PACKAGING MATERIALS	WEIGHT kg/m ²	WEIGHT % (VERSUS THE PRODUCT)	BIOGENIC MATERIAL kg C/m ²
Pallet	0.036	2,5%	0,017
Cardboard core	0.037	2,6%	0,015
Plastic film	0.005	0,3%	0,000
Total	0.078	5,5%	0,032

BIOGENIC CARBON CONTENT	QUANTITY (kg C)
BIOGENIC CARBON CONTAINED IN THE PRODUCT	0,000
BIOGENIC CARBON CONTAINED IN PACKAGING	0,032

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO₂

Production process

FLAGON TPO membranes are produced on Line 3 at the Chignolo d’Isola plant. The diagram below illustrates the synthetic membrane manufacturing process specific to this production line.

On average, the production process incorporates more than 5% of internally reprocessed TPO. The result is a single-layer homogeneous membrane, with thickness precisely controlled by calendaring and co-extrusion die regulation systems.

This process ensures the complete embedment of the reinforcing material—one of the distinctive features of all FLAGON TPO membranes.

FLAGON TPO membranes are manufactured using a co-extrusion process in a two-tone configuration, incorporating a "signal-layer" system. This technique enables the production of monolayer membranes with differing chemical and physical properties on each side.

The signal-layer system allows for the immediate detection of potential damage (such as holes or tears) in the membrane, as the darker underlying layer becomes visible upon breach.

A fiberglass reinforcement is placed between the two layers to enhance mechanical strength and dimensional stability.

EXTRUSION CHAMBER LOADING

EACH CHAMBER LOADED WITH THE RAW MATERIALS MIXTURE, BY MEANS OF A HOPPER

CO-EXTRUSION

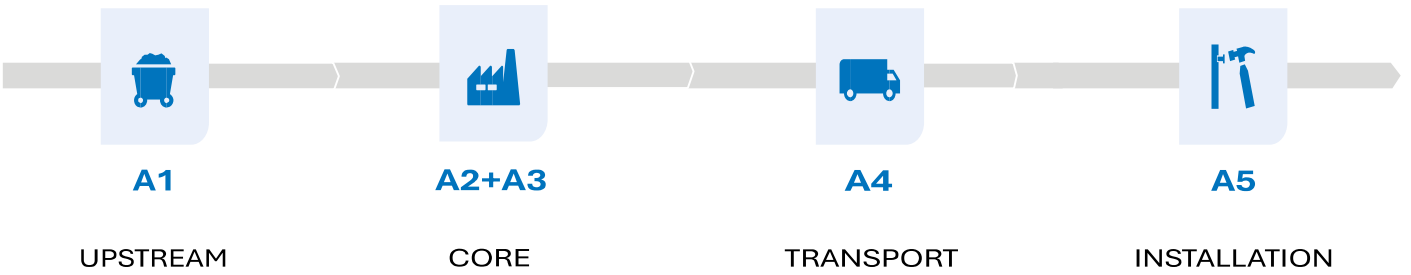
MIXTURE HEATED AND COMPRESSED BY SCREW, THEN FORCED TO A CO-EXTRUSION DIE, WHERE THE EXTRUDERS CONVERGE

LAMINATING

USING A CALENDER, THE DESIRED THICKNESS IS OBTAINED



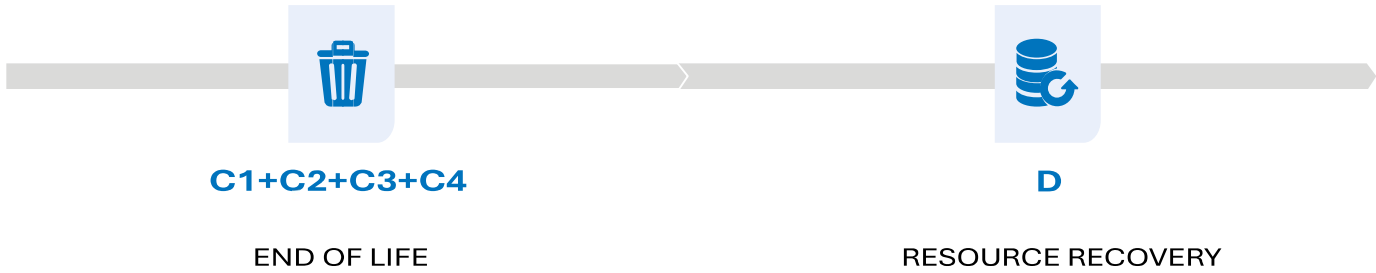
Calculation rules



PRODUCT STAGE
A1 - A3 - Raw material supply. (A1) - Energy sources used in manufacturing. (A1) - Raw materials transport to the plant, taking into account the specific distances provided by the company, considering >32 ton Euro VI trucks. (A2) - Manufacturing process. (A3) - The electricity mix used in manufacturing, based on the manufacturer's energy mix of 0,64 kgCO2/kWh. (A3) - Water usage. (A3) - Emissions to air. (A3) - Manufacturing waste treatment and transport using specific distances data. (A3)

CONSTRUCTION PROCESS STAGE
A4- A5 - Module A4 covers membrane transport from production to application site, including fuel combustion, fuel production, and transport infrastructure emissions. Impacts are calculated using weighted average distances based on sales distribution to final destinations. - Average distance: 728 km land. - Truck with an average load of >32 t (Euro VI) for land transport and medium cargo ship for sea transport. - Module A5 includes product installation and packaging waste for a representative loose-laid application. The membranes are installed in sheets 2.1 m wide and 15 m, 20 m, 25 m or 60 m long, with joints executed by hot-air welding. No additional fastening materials are used or considered: - Overlapping factor: 5% - Electricity consumption: 0.010 kWh/m² - On-site installation product waste: 3% - 0,040 kg/m² - Waste collection and treatment based on Eurostat and PSR-0014 v2 (2023).

Calculation rules



END OF LIFE STAGE

C1+C2+C3+C4

- The consumption of energy and natural resources in the demolition process is assumed to be negligible due to the allocation to the waterproofing membranes. (C1)
- This module includes the out-of-service membranes transportation to waste treatment sites. A realistic average distance of 50 km was assumed for the material sent for landfill; 100 km was assumed for the material sent for incineration and 800 km for the material sent for recycling considering 16-35 ton Euro V trucks. (C2)
- According to the PEF guidelines, the end-of-life scenario for PP waste from the building and construction sector assumes 18% is recycled and 37% undergoes energy recovery. (C3)
- In line with the PEF values, 45% of PP waste from the building and construction sector is considered to be sent to landfill. (C4)

BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES

D

Module D quantifies the environmental benefits of product reuse, recycling, and energy recovery across the life cycle, using the same scenarios applied in stages A5 and C3. Recycling benefits are calculated following the EN 15804 standard formula.

$$e_{module\ D1} = \sum_i (M_{MR\ out\ |i} - M_{MR\ in\ |i}) \cdot \left(E_{MR\ after\ EoW\ out\ |i} - E_{VM\ Sub\ out\ |i} \cdot \frac{Q_{R\ out}}{Q_{Sub}} \right) |i$$

Environmental Performance

Results are declared per 1m² of average product

The results of the end-of-life stage (modules C1-C4) should be considered when using the results of the product stage (modules A1-A3). The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks.

ENVIRONMENTAL IMPACT

IMPACT CATEGORY	UNIT	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP-total	kg CO ₂ eq	3,15E+00	1,15E-01	2,78E-01	ND	ND	ND	ND	ND	ND	ND	0,00E+00	5,70E-02	1,42E+00	7,68E-02	-1,28E+00
GWP-fossil	kg CO ₂ eq	3,25E+00	1,15E-01	1,61E-01	ND	ND	ND	ND	ND	ND	ND	0,00E+00	5,70E-02	1,42E+00	7,68E-02	-1,28E+00
GWP-biogenic	kg CO ₂ eq	-1,11E-01	2,51E-05	1,17E-01	ND	ND	ND	ND	ND	ND	ND	0,00E+00	1,13E-05	1,62E-05	5,72E-05	0,00E+00
GWP-luluc	kg CO ₂ eq	2,30E-03	4,47E-05	8,46E-05	ND	ND	ND	ND	ND	ND	ND	0,00E+00	2,02E-05	2,80E-05	4,69E-06	-1,29E-03
ODP	kg CFC-11 eq	1,36E-07	2,39E-09	4,30E-09	ND	ND	ND	ND	ND	ND	ND	0,00E+00	1,13E-09	3,06E-10	1,85E-10	-2,05E-08
AP	mol H ⁺ eq	1,02E-02	2,71E-04	3,62E-04	ND	ND	ND	ND	ND	ND	ND	0,00E+00	1,78E-04	2,45E-04	5,10E-05	-7,02E-03
EP-freshwater	kg P eq	5,65E-04	8,02E-06	2,11E-05	ND	ND	ND	ND	ND	ND	ND	0,00E+00	3,78E-06	6,32E-06	7,55E-07	-4,04E-04
EP-marine	kg N eq	2,15E-03	7,11E-05	9,82E-05	ND	ND	ND	ND	ND	ND	ND	0,00E+00	6,01E-05	1,29E-04	1,69E-04	-1,13E-03
EP-terrestrial	mol N eq	2,19E-02	7,69E-04	8,25E-04	ND	ND	ND	ND	ND	ND	ND	0,00E+00	6,53E-04	1,11E-03	2,08E-04	-1,17E-02
POCP	kg NMVOC eq	1,65E-02	4,71E-04	5,57E-04	ND	ND	ND	ND	ND	ND	ND	0,00E+00	2,79E-04	2,89E-04	9,04E-05	-4,77E-03
ADPE ¹	kg Sb eq	3,59E-05	3,29E-07	1,15E-06	ND	ND	ND	ND	ND	ND	ND	0,00E+00	1,86E-07	1,93E-07	1,62E-08	-3,52E-06
ADPF ¹	MJ	9,32E+01	1,72E+00	3,00E+00	ND	ND	ND	ND	ND	ND	ND	0,00E+00	8,00E-01	2,68E-01	1,60E-01	-2,16E+01
WDP ¹	m³ depriv.	7,53E-01	8,84E-03	2,78E-02	ND	ND	ND	ND	ND	ND	ND	0,00E+00	5,70E-02	1,42E+00	7,68E-02	-1,28E+00
GWP-GHG ²	kg CO ₂ eq	3,25E+00	1,15E-01	1,61E-01	ND	ND	ND	ND	ND	ND	ND	0,00E+00	5,47E-02	1,42E+00	7,69E-02	-1,28E+00

(1) 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 experience with the indicator. (2) This indicator accounts for all greenhouse gases except biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. As such, the indicator is identical to GWP-total except that the CF for biogenic CO2 is set to zero.

ADDITIONAL ENVIRONMENTAL IMPACT

IMPACT CATEGORY	UNIT	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
PM	disease incident	9,28E-08	1,12E-08	3,68E-09	ND	ND	ND	ND	ND	ND	ND	0,00E+00	4,47E-09	2,02E-09	1,16E-09	-9,16E-08
IRP ¹	kBq U235 eq	2,22E-01	2,08E-03	8,96E-03	ND	ND	ND	ND	ND	ND	ND	0,00E+00	1,02E-03	1,29E-03	1,59E-04	-1,02E-01
ETP-fw ²	CTUe	7,89E+00	2,04E-01	3,31E-01	ND	ND	ND	ND	ND	ND	ND	0,00E+00	1,05E-01	4,04E-01	2,38E-01	-2,68E+00
HTP-c ²	CTUh	7,99E-10	1,91E-11	2,99E-11	ND	ND	ND	ND	ND	ND	ND	0,00E+00	9,71E-12	6,09E-11	3,75E-12	-1,96E-10
HTP-nc ²	CTUh	2,98E-08	1,11E-09	1,19E-09	ND	ND	ND	ND	ND	ND	ND	0,00E+00	5,02E-10	2,31E-09	7,40E-10	-8,60E-09
SPQ ²	dimensionless	1,51E+01	1,73E+00	5,89E-01	ND	ND	ND	ND	ND	ND	ND	0,00E+00	4,76E-01	2,87E-01	3,72E-01	-4,84E+00

(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 soil, radon, and from some construction materials is also not measured by this indicator. (2) The results of this environmental impact indicator should be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

Results are declared per 1m² of average product

The results of the end-of-life stage (modules C1-C4) should be considered when using the results of the product stage (modules A1-A3). The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks.

USE OF RESOURCES

IMPACT CATEGORY	UNIT	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
PERE	MJ	2,44E+00	2,81E-02	-1,04E+00	ND	ND	ND	ND	ND	ND	ND	0,00E+00	1,38E-02	2,09E-02	2,49E-03	-1,53E+00
PERM	MJ	9,95E-01	0,00E+00	-9,95E-01	ND	ND	ND	ND	ND	ND	ND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,52E-01
PERT	MJ	3,44E+00	2,81E-02	-2,03E+00	ND	ND	ND	ND	ND	ND	ND	0,00E+00	1,38E-02	2,09E-02	2,49E-03	-1,38E+00
PENRE	MJ	5,59E+01	1,72E+00	-2,07E-02	ND	ND	ND	ND	ND	ND	ND	0,00E+00	8,00E-01	-3,12E+01	-2,49E+01	-2,29E+01
PENRM	MJ	3,39E+01	0,00E+00	-2,45E-01	ND	ND	ND	ND	ND	ND	ND	0,00E+00	0,00E+00	-1,86E+01	-1,51E+01	5,02E+00
PENRT	MJ	8,98E+01	1,72E+00	-2,66E-01	ND	ND	ND	ND	ND	ND	ND	0,00E+00	8,00E-01	-4,97E+01	-4,00E+01	-1,78E+01
SM	kg	5,15E-02	7,46E-04	1,67E-03	ND	ND	ND	ND	ND	ND	ND	0,00E+00	3,66E-04	1,10E-03	5,76E-05	1,60E-01
RSF	MJ	1,90E-02	9,40E-06	5,71E-04	ND	ND	ND	ND	ND	ND	ND	0,00E+00	4,63E-06	8,04E-06	1,08E-06	-3,27E-04
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	ND	ND	ND	ND	ND	ND	ND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m ³	2,11E-02	2,54E-04	5,91E-04	ND	ND	ND	ND	ND	ND	ND	0,00E+00	1,08E-04	3,45E-04	-2,38E-03	-6,47E-03

OUTPUT FLOWS

IMPACT CATEGORY	UNIT	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
HWD	kg	1,16E-01	2,49E-03	4,64E-03	ND	ND	ND	ND	ND	ND	ND	0,00E+00	1,14E-03	1,41E-02	2,80E-04	-8,82E-02
MHWD	kg	2,26E+01	5,00E-02	9,23E-01	ND	ND	ND	ND	ND	ND	ND	0,00E+00	2,42E-02	6,38E-01	3,19E+00	-5,33E+00
RWD	kg	5,64E-05	5,14E-07	2,28E-06	ND	ND	ND	ND	ND	ND	ND	0,00E+00	2,53E-07	3,29E-07	3,88E-08	-2,53E-05

WASTE PRODUCTION

IMPACT CATEGORY	UNIT	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
CRU	kg	1,20E-01	0,00E+00	3,61E-03	ND	ND	ND	ND	ND	ND	ND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	kg	6,78E-03	0,00E+00	5,25E-02	ND	ND	ND	ND	ND	ND	ND	0,00E+00	0,00E+00	2,62E-01	0,00E+00	0,00E+00
MER	kg	0,00E+00	0,00E+00	0,00E+00	ND	ND	ND	ND	ND	ND	ND	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	MJ	0,00E+00	0,00E+00	1,26E-01	ND	ND	ND	ND	ND	ND	ND	0,00E+00	0,00E+00	2,74E+00	0,00E+00	0,00E+00
EET	MJ	0,00E+00	0,00E+00	1,75E-01	ND	ND	ND	ND	ND	ND	ND	0,00E+00	0,00E+00	3,77E+00	0,00E+00	0,00E+00

ALTERNATIVE END-OF-LIFE SCENARIOS

Alternative End-of-Life scenarios assessed: 100% recycling, 100% Incineration with energy recovery and 100% Landfill

100% RECYCLING						
IMPACT CATEGORY	UNIT	C1	C2	C3	C4	D
GWP-total	kg CO ₂ eq	0,00E+00	2,21E-01	2,38E-01	0,00E+00	-2,56E+00
GWP-fossil	kg CO ₂ eq	0,00E+00	2,21E-01	2,38E-01	0,00E+00	-2,55E+00
GWP-biogenic	kg CO ₂ eq	0,00E+00	4,37E-05	-6,28E-05	0,00E+00	0,00E+00
GWP-luluc	kg CO ₂ eq	0,00E+00	7,79E-05	1,30E-04	0,00E+00	-5,25E-04
ODP	kg CFC-11 eq	0,00E+00	4,39E-09	6,34E-10	0,00E+00	-1,41E-07
AP	mol H+ eq	0,00E+00	6,90E-04	3,73E-04	0,00E+00	-6,33E-03
EP-freshwater	kg P eq	0,00E+00	1,46E-05	2,42E-05	0,00E+00	-3,38E-04
EP-marine	kg N eq	0,00E+00	2,33E-04	2,37E-04	0,00E+00	-1,18E-03
EP-terrestrial	mol N eq	0,00E+00	2,53E-03	1,17E-03	0,00E+00	-1,29E-02
POCP	kg NMVOC eq	0,00E+00	1,08E-03	3,53E-04	0,00E+00	-1,52E-02
ADPE	kg Sb eq	0,00E+00	7,21E-07	8,51E-07	0,00E+00	-2,52E-05
ADPF	MJ	0,00E+00	3,10E+00	7,20E-01	0,00E+00	-9,43E+01
WDP	m ³ depriv.	0,00E+00	1,52E-02	3,39E-02	0,00E+00	-5,65E-01
GWP-GHG	kg CO ₂ eq	0,00E+00	2,21E-01	2,38E-01	0,00E+00	-2,56E+00
PERE	MJ	0,00E+00	5,35E-02	9,54E-02	0,00E+00	-1,48E+00
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,55E-01
PERT	MJ	0,00E+00	5,35E-02	9,54E-02	0,00E+00	-1,32E+00
PENRE	MJ	0,00E+00	3,10E+00	-5,98E+01	0,00E+00	-1,07E+02
PENRM	MJ	0,00E+00	0,00E+00	-3,37E+01	0,00E+00	4,38E+01
PENRT	MJ	0,00E+00	3,10E+00	-9,35E+01	0,00E+00	-6,34E+01
SM	kg	0,00E+00	1,42E-03	4,75E-03	0,00E+00	1,40E+00
RSF	MJ	0,00E+00	1,79E-05	3,85E-05	0,00E+00	-1,11E-04
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m ³	0,00E+00	4,17E-04	5,16E-04	0,00E+00	-1,52E-02
HWD	kg	0,00E+00	4,44E-03	1,50E-02	0,00E+00	-6,22E-02
MHWD	kg	0,00E+00	9,38E-02	4,65E-01	0,00E+00	-2,46E+01
RWD	kg	0,00E+00	9,81E-07	1,58E-06	0,00E+00	-4,98E-05
CRU	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	kg	0,00E+00	0,00E+00	1,43E+00	0,00E+00	0,00E+00
MER	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EET	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

100% INCINERATION WITH ENERGY RECOVERY

IMPACT CATEGORY	UNIT	C1	C2	C3	C4	D
GWP-total	kg CO ₂ eq	0,00E+00	2,76E-02	3,73E+00	0,00E+00	-2,68E+00
GWP-fossil	kg CO ₂ eq	0,00E+00	2,76E-02	3,73E+00	0,00E+00	-2,68E+00
GWP-biogenic	kg CO ₂ eq	0,00E+00	5,47E-06	7,52E-05	0,00E+00	0,00E+00
GWP-luluc	kg CO ₂ eq	0,00E+00	9,74E-06	1,12E-05	0,00E+00	-3,32E-03
ODP	kg CFC-11 eq	0,00E+00	5,48E-10	5,13E-10	0,00E+00	-1,22E-08
AP	mol H+ eq	0,00E+00	8,62E-05	4,77E-04	0,00E+00	-1,70E-02
EP-freshwater	kg P eq	0,00E+00	1,83E-06	5,09E-06	0,00E+00	-9,84E-04
EP-marine	kg N eq	0,00E+00	2,91E-05	2,32E-04	0,00E+00	-2,70E-03
EP-terrestrial	mol N eq	0,00E+00	3,16E-04	2,45E-03	0,00E+00	-2,78E-02
POCP	kg NMVOC eq	0,00E+00	1,35E-04	6,07E-04	0,00E+00	-8,25E-03
ADPE	kg Sb eq	0,00E+00	9,02E-08	9,88E-08	0,00E+00	-1,74E-06
ADPF	MJ	0,00E+00	3,87E-01	3,67E-01	0,00E+00	-2,93E+01
WDP	m ³ depriv.	0,00E+00	1,90E-03	9,54E-02	0,00E+00	-4,29E-01
GWP-GHG	kg CO ₂ eq	0,00E+00	2,76E-02	3,73E+00	0,00E+00	-2,68E+00
PERE	MJ	0,00E+00	6,69E-03	8,98E-03	0,00E+00	-3,80E+00
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,55E-01
PERT	MJ	0,00E+00	6,69E-03	8,98E-03	0,00E+00	-3,65E+00
PENRE	MJ	0,00E+00	3,87E-01	-5,49E+01	0,00E+00	-2,93E+01
PENRM	MJ	0,00E+00	0,00E+00	-3,37E+01	0,00E+00	9,60E-02
PENRT	MJ	0,00E+00	3,87E-01	-8,85E+01	0,00E+00	-2,92E+01
SM	kg	0,00E+00	1,77E-04	6,24E-04	0,00E+00	-7,04E-04
RSF	MJ	0,00E+00	2,24E-06	2,61E-06	0,00E+00	-8,61E-04
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m ³	0,00E+00	5,21E-05	6,77E-04	0,00E+00	-1,19E-02
HWD	kg	0,00E+00	5,55E-04	3,06E-02	0,00E+00	-2,19E-01
MHWD	kg	0,00E+00	1,17E-02	1,50E+00	0,00E+00	-4,80E+00
RWD	kg	0,00E+00	1,23E-07	1,03E-07	0,00E+00	-5,23E-05
CRU	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MER	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	MJ	0,00E+00	0,00E+00	7,43E+00	0,00E+00	0,00E+00
EET	MJ	0,00E+00	0,00E+00	1,02E+01	0,00E+00	0,00E+00

100% LANDFILL

IMPACT CATEGORY	UNIT	C1	C2	C3	C4	D
GWP-total	kg CO ₂ eq	0,00E+00	1,38E-02	0,00E+00	1,71E-01	-1,31E-02
GWP-fossil	kg CO ₂ eq	0,00E+00	1,38E-02	0,00E+00	1,71E-01	-1,31E-02
GWP-biogenic	kg CO ₂ eq	0,00E+00	2,73E-06	0,00E+00	1,27E-04	0,00E+00
GWP-luluc	kg CO ₂ eq	0,00E+00	4,87E-06	0,00E+00	1,04E-05	-1,52E-05
ODP	kg CFC-11 eq	0,00E+00	2,74E-10	0,00E+00	4,12E-10	-3,15E-10
AP	mol H+ eq	0,00E+00	4,31E-05	0,00E+00	1,13E-04	-6,78E-05
EP-freshwater	kg P eq	0,00E+00	9,14E-07	0,00E+00	1,68E-06	-5,99E-06
EP-marine	kg N eq	0,00E+00	1,45E-05	0,00E+00	3,77E-04	-1,07E-05
EP-terrestrial	mol N eq	0,00E+00	1,58E-04	0,00E+00	4,62E-04	-1,08E-04
POCP	kg NMVOC eq	0,00E+00	6,76E-05	0,00E+00	2,01E-04	-5,14E-05
ADPE	kg Sb eq	0,00E+00	4,51E-08	0,00E+00	3,59E-08	-4,81E-08
ADPF	MJ	0,00E+00	1,94E-01	0,00E+00	3,54E-01	-2,85E-01
WDP ¹	m ³ depriv.	0,00E+00	9,51E-04	0,00E+00	1,74E-03	-3,81E-03
GWP-GHG	kg CO ₂ eq	0,00E+00	1,38E-02	0,00E+00	1,71E-01	-1,31E-02
PERE	MJ	0,00E+00	3,35E-03	0,00E+00	5,54E-03	8,82E-02
PERM	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,55E-01
PERT	MJ	0,00E+00	3,35E-03	0,00E+00	5,54E-03	2,43E-01
PENRE	MJ	0,00E+00	1,94E-01	0,00E+00	-5,55E+01	-2,85E-01
PENRM	MJ	0,00E+00	0,00E+00	0,00E+00	-3,37E+01	9,60E-02
PENRT	MJ	0,00E+00	1,94E-01	0,00E+00	-8,91E+01	-1,89E-01
SM	kg	0,00E+00	8,87E-05	0,00E+00	1,28E-04	2,07E-03
RSF	MJ	0,00E+00	1,12E-06	0,00E+00	2,40E-06	-2,67E-07
NRSF	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	m ³	0,00E+00	2,61E-05	0,00E+00	-5,27E-03	-1,35E-04
HWD	kg	0,00E+00	2,78E-04	0,00E+00	6,23E-04	-7,79E-04
MHWD	kg	0,00E+00	5,86E-03	0,00E+00	7,08E+00	-6,78E-02
RWD	kg	0,00E+00	6,13E-08	0,00E+00	8,62E-08	-7,45E-07
CRU	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MER	kg	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EET	MJ	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

Additional LCA results

ENVIRONMENTAL IMPACT

The table below shows the results variations between each product range name and the average ecoprofile. The variations in the results are due, in addition to the different composition of the membranes, mainly to the different average thicknesses.

IMPACT CATEGORY	UNIT	FLAGON GEO P family	FLAGON GEO P/AT family
GWP-total	kg CO ₂ eq	-2%	16%
GWP-fossil	kg CO ₂ eq	-2%	16%
GWP-biogenic	kg CO ₂ eq	-18%	116%
GWP-luluc	kg CO ₂ eq	-2%	13%
ODP	kg CFC-11 eq	-3%	16%
AP	mol H+ eq	-2%	15%
EP-freshwater	kg P eq	-3%	16%
EP-marine	kg N eq	-2%	15%
EP-terrestrial	mol N eq	-2%	16%
POCP	kg NMVOC eq	-3%	16%
ADPE	kg Sb eq	-1%	9%
ADPF	MJ	-2%	16%
WDP	m ³ depriv.	-2%	16%
GWP-GHG	kg CO ₂ eq	-2%	15%
PM	Disease incident	-3%	17%
IRP	kBq U235 eq	-2%	15%
ETP-fw	CTUe	-3%	18%
HTP-c	CTUh	-2%	16%
HTP-nc	CTUh	-2%	15%
SPQ	dimensionless	-3%	19%
PERE	MJ	-3%	22%
PERT	MJ	-3%	22%
PENRE	MJ	-22%	145%
PENRT	MJ	-24%	154%
SM	kg	0%	-1%
RSF	MJ	-1%	5%
FW	m ³	-2%	16%
HWD	kg	-3%	17%
MHWD	kg	-2%	15%
RWD	kg	-2%	15%
CRU	kg	15%	-100%
MFR	kg	-2%	10%
EE	MJ	-2%	12%

Additional Environmental Information

ECOPROFILE CONVSEIRION THROUGHT THE THICKNESS

By means of the following formula, the environmental impact value for the TPO membrane with a different thickness compared to the one obtained for the average ecoprofile can be calculated.

$$Y = X \cdot \frac{\text{new membrane thickness}x}{\text{average thickness}}$$

Where X is the environmental impact value obtained for the average ecoprofile and Y is the interpolated value for the new membrane thickness.

PRODUCT RANGE NAME	AVERAGE MEMBRANE THICKNESS (mm)
FLAGON GEO P	1,24
FLAGON GEO P/AT	1,34
AVERAGE ECOPROFILE	1,25

Version History

Original version of the EPD and LCA, 2026-05-19.

Abbreviations

Abbreviation	Definition
General Abbreviations	
EN	European Norm (Standard)
EPD	Environmental Product Declaration
EF	Environmental Footprint
GPI	General Programme Instructions
ISO	International Organization for Standardization
LCA	Life Cycle Assessment
PCR	Product Category Rules
c-PCR	Complementary Product Category Rules
CPC	Central product classification
PEFCR	Product Environmental Footprint Category Rules
TPO	Thermoplastic Polyolefin
PP	Polypropylene
Environmental Impact Indicators (EN 15804)	
GHG	Greenhouse gas
GWP	Global Warming Potential (kg CO ₂ eq.)
GWP-fossil	Global Warming Potential from fossil sources (kg CO ₂ eq.)
GWP-biogenic	Global Warming Potential from biogenic sources (kg CO ₂ eq.)
GWP-luluc	Global Warming Potential from land use and land use change (kg CO ₂ eq.)
GWP-total	Total Global Warming Potential (kg CO ₂ eq.)
GWP-GHG	Global Warming Potential for greenhouse gases (kg CO ₂ eq.)
ODP	Ozone Depletion Potential (kg CFC-11 eq.)
AP	Acidification Potential (mol H ⁺ eq.)
EP	Eutrophication Potential
EP-freshwater	Freshwater eutrophication potential (kg P eq.)
EP-marine	Marine eutrophication potential (kg N eq.)
EP-terrestrial	Terrestrial eutrophication potential (mol N eq.)
POCP	Photochemical Ozone Creation Potential (kg NMVOC eq.)
ADP	Abiotic Depletion Potential
ADPE	Abiotic depletion potential for non-fossil resources (kg Sb eq.)
ADPF	Abiotic depletion potential for fossil resources (MJ)
WDP	Water Deprivation Potential (m ³)
Additional Environmental Impact Indicators	
PM	Particulate Matter emissions
IRP	Ionizing radiation, human health
ETP-fw	Eco-toxicity, freshwater
HTP-c	Human Toxicity, cancer effect
HTP-nc	Human Toxicity, non-cancer effect
SPQ	Land use related impacts soil quality
Resource Use Indicators	
PERE	Use of renewable primary energy excluding renewable primary energy resources used as raw materials (MJ)
PERM	Use of renewable primary energy resources used as raw materials (MJ)
PERT	Total use of renewable primary energy resources (MJ)
PENRE	Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials (MJ)
PENRM	Use of non-renewable primary energy resources used as raw materials (MJ)
PENRT	Total use of non-renewable primary energy resources (MJ)
SM	Use of secondary material (kg)
RSF	Use of renewable secondary fuels (MJ)
NRSF	Use of non-renewable secondary fuels (MJ)
FW	Use of net fresh water (m ³)

Abbreviation	Definition
Waste Indicators	
HWD	Hazardous Waste (disposed) (kg)
NHWD	Non-Hazardous Waste (disposed) (kg)
RWD	Radioactive Waste (disposed) (kg)
Output Flow Indicators	
CRU	Components for Reuse (kg)
MFR	Material for Recycling (kg)
MER	Materials for Energy Recovery (kg)
EEE	Exported Energy, Electricity (MJ)
EET	Exported Energy, Thermal (MJ)
Lifecycle Stages / Modules	
A1	Raw material supply
A2	Transport
A3	Manufacturing
A4	Transport to site
A5	Construction/Installation
B1	Use
B2	Maintenance
B3	Repair
B4	Replacement
B5	Refurbishment
B6	Operational energy use
B7	Operational water use
C1	Deconstruction/Demolition
C2	Transport to waste processing
C3	Waste processing
C4	Disposal
D	Reuse-Recovery-Recycling potential
Other Relevant Terms	
EC	European Community Number
MJ	Megajoule
kg	Kilogram
mm	Millimeter
m ²	Square Meter
m ³	Cubic Meter
NMVOC	Non-Methane Volatile Organic Compounds
Sb eq.	Antimony Equivalents
P eq.	Phosphorus Equivalents
N eq.	Nitrogen Equivalents
CFC-11 eq.	Chlorofluorocarbon-11 Equivalents
CO ₂ eq.	Carbon Dioxide Equivalents
kg C	Kilograms of Carbon
kg CO ₂ eq.	Kilograms of Carbon Dioxide Equivalent

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Contacts

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Since 1908, SOPREMA has been improving people's well-being and protecting their environment with innovative and sustainable solutions for builders in the roofing, building envelope and civil engineering sectors.



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