



ENVIRONMENTAL PRODUCT DECLARATION

*In accordance with ISO 14025 and
EN 15804:2012+A2:2019 for*

MAPEPLAN TU
MAPEPLAN TU S
MAPEPLAN TU WL
MAPEPLAN TU S WL
MAPEPLAN TU CH



An EPD should provide current information and may be updated if conditions change. The stated validity is, therefore, subject to the continued registration and publication at www.environdec.com

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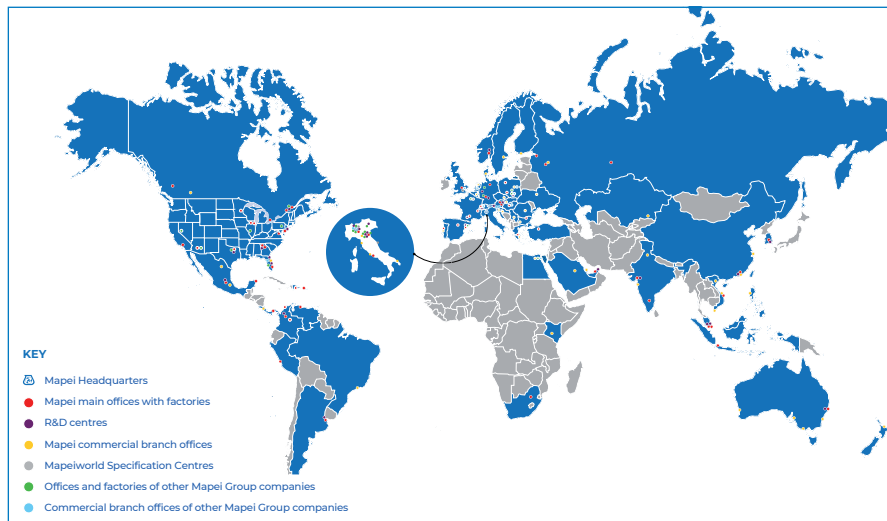


1. COMPANY DESCRIPTION / GOAL & SCOPE

Founded in 1937 in Milan, Italy, Mapei produces adhesives and complementary products for laying all types of floor, wall and coating materials, and also specializes in other chemical products used in the building industry, such as waterproofing products, specialty mortars, admixtures for concrete, cement additives, products for underground constructions and for the restoration of concrete and historical buildings.

There are currently 89 subsidiaries in the Mapei Group, with a total of 81 production facilities located around the world in 36 different countries and in 5 different continents. Mapei also has 31 central laboratories. Most locations are ISO 9001 and ISO 14001 or EMAS-certified.

Mapei invests 12% in its company's total work-force and 5% of its turnover in Research & Development; in particular, 70% of its R&D efforts are directed to develop eco-sustainable and environmentally friendly products, which give important contribution to all major green rating systems for eco-sustainable buildings such as LEED and BREEAM.



LEED V4 is the latest version of Leadership in Environmental and Energy Design, an American protocol that enables buildings to be certified as eco-sustainable according to parameters and credits described in the most widely adopted green building criteria in the world. Issued by the GBC US, it is mandatory for all LEED projects registered after October 2016.

Numerous changes have been made to the previous version: Mapei products play a part in obtaining important credits thanks to their EPD's (type III environmental declarations) and their products with very low emission of VOC.

Launched in the UK in 1990, **BREEAM** (BRE Environmental Assessment Method) is a protocol for sustainable building practices adopted mainly in the United Kingdom and in Scandinavian countries with the version BREEAM NOR.

By adopting this protocol, thanks to their EPD's and very low emission of VOC, Mapei products help towards obtaining relative credits.

Furthermore, Mapei has developed a sales and technical service network with offices all over the world and offers an efficient Technical Assistance Service that is valued by architects, engineers, contractors and owners.

The goal of the study is to provide necessary data and documentation to produce an EPD according to the requirements of PCR 2019:14 Environdec (version 1.11, 2021-02-05) under EN 15804:2012+A2:2019 under EN 15804:2012+A2:2019 and to have more comprehension about the environmental impacts related to **Mapeplan TU**, **Mapeplan TU S**, **Mapeplan TU WL**, **Mapeplan TU S WL** and **Mapeplan TU CH**, manufactured in Polyglass S.p.A.

located in Ponte di Piave (Italy), in year 2020, including packaging of the finished products.

Target audiences of the study are customers and other parties with an interest in the environmental impacts of **Mapeplan TU**, **Mapeplan TU S**, **Mapeplan TU WL**, **Mapeplan TU S WL** and **Mapeplan TU CH**. This analysis shall not support comparative assertions intended to be disclosed to the public.

2. PRODUCT DESCRIPTION

Mapeplan TU is a PVC-P synthetic waterproofing membrane. It's a single layer membrane with grey signal layer.

Mapeplan TU S is a PVC-P synthetic waterproofing membrane. It's a single layer membrane with orange signal layer.

Mapeplan TU WL, **Mapeplan TU S WL** and **Mapeplan TU CH** are PVC-P synthetic waterproofing membrane. They're homogeneous membranes composed of a main black layer and a special orange warning layer.

All the membranes comply with EN 13491. In addition:

- **Mapeplan TU WL** and **Mapeplan TU S WL** comply Richtline 853 DB Netz AG and TL/TP KDB.
- **Mapeplan TU CH** complies SIA 272.

All the membranes can be applied as a water barrier in tunnels and underground constructions.

The products studied are supplied in rolls of 20 m length and 2,10 m width, delivered on wooden pallet wrapped with LD-PE film.

For more information about the products see the TDS (Technical Data Sheet) on Mapei website.

3. CONTENT DECLARATION

The main components and ancillary materials of the products included in this EPD are the following:

Table 1: Composition referred to 1m² of packaged product

| Materials | Percentage (%) by mass |
|--------------------------|--------------------------------------|
| Polyvinyl chloride (PVC) | < 50% (recycled pre-consumer: < 47%) |
| Plasticizers | < 31% |
| Filler | < 20% |
| Additives | < 4% |
| Packaging | Percentage (%) by mass |
| Cardboard | < 2% |
| PP | < 0,02% |
| LD-PE | < 0,2% |
| Wood | < 2% |

The products contain in a concentration higher than 0,1% (by unit weight) neither carcinogenic substances nor substances of very high concern (SVHC) on the REACH Candidate List published by the European Chemicals Agency.

4. DECLARED UNIT AND REFERENCE SERVICE LIFE

The declared unit is 1 m² of packaged finished product having a thickness of 2 mm.

The reference service life of the membranes, according to Polyglass SpA experience, is estimated at least 30 years, if professionally installed and properly used.

5. SYSTEM BOUNDARIES AND ADDITIONAL TECHNICAL INFORMATION

The approach is a “cradle to gate” with options, modules A1-A3 + A4-A5 + C + D. The following modules have been considered:

- A1 – A3 (Product stage): extraction and transport of raw materials, packaging included, production process
- A4 – A5 (Construction process stage): transport of the finished product to final customers and installation into the building
- C1 – C4 (End of life stage): with a collection rate of 100% as C&D waste, the transports are carried out by lorry (EURO 4) over 100 km (C2). In this EPD it is used a conservative approach by considering the 100% of waste to be disposed in landfill (Italian scenario).
- D (Resource recovery stage): due to the absence of specific membrane recycling (module C3), this module is considered zero.

Table 2: System boundaries

| | Product stage | | Construction process stage | | | Use stage | | | | | | | End of life stage | | | | Resource recovery stage | |
|----------------------|---------------------|-------------|----------------------------|-------------|---------------------------|-----------|-------------|--------|-------------|---------------|------------------------|-----------------------|----------------------------|-----------|------------------|----------|------------------------------------|---|
| | Raw material supply | Transport | Manufacturing | Transport | Construction installation | Use | Maintenance | Repair | Replacement | Refurbishment | Operational energy use | Operational water use | De-construction demolition | Transport | Waste processing | Disposal | Reuse-Recovery-Recycling-potential | |
| Module | A1 | A2 | A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D | |
| Modules declared | X | X | X | X | X | MND | MND | MND | MND | MND | MND | MND | X | X | X | X | X | |
| Geography | EU, IT | EU, IT, GLO | IT | EU, IT, GLO | EU | - | - | - | - | - | - | - | EU, IT | EU | EU | EU | EU | |
| Specific data | > 90% | | | | | - | - | - | - | - | - | - | - | - | - | - | - | |
| Variation – products | < 10% | | | | | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Variation – sites | Not-relevant | | | | | - | - | - | - | - | - | - | - | - | - | - | - | - |

MND: Module Not Declared

A brief description of production process is the following:

The production process of PVC-P waterproofing membranes is a multi-extrusion coating process. PVC powders are mixed inside a turbomixer with other additives and liquid plasticizers. The mixture is stored under mixing, drained inside a hopper by a vacuum equipment, and finally sent to the extruders. The hot melt compound comes out and the membrane is cooled and finally sent to the packaging area, ready to ship.

Figure 1: Production process

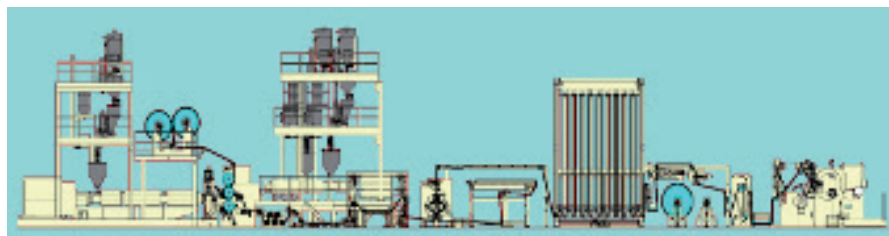


Figure 2: Production equipment



Table 3: Transport to the building site (A4)

| Scenario information | Value | Unit |
|--|--------|-------------------|
| Means of transport: truck euro 4 with 27 tons of payload & ship with a 27500 DWT | | |
| Litres of fuel (diesel for truck) | 0,002 | l/100km |
| Litres for fuel (HFO for ship) | 0,0004 | l/100km |
| Transport distance | 1800 | km |
| Capacity utilisation (including empty runs) | 85 | % |
| Gross density of products transported | ~ 1200 | kg/m ³ |
| Capacity utilisation volume factor | 100 | % |

Table 4: Installation into the building (A5)

| Scenario information | Value | Unit |
|---|--|--------------------|
| Ancillary materials for installation | - | kg |
| Water use | - | m ³ |
| Other resources use | - | kg |
| Energy type and consumption | 0,019, European Grid Mix | kWh/m ² |
| Output materials as result of waste processing at the building site | ~ 0,06 | kg |
| Overlaps (membrane) | 5,5 | % |
| Waste materials on building site before waste processing | 0,0507 (Wood) 0,0549 (Cardboard) 0,0031 (Plastics) | kg |

Table 5: End of Life (C1-C4)

| Scenario information | Value | Unit |
|--|-------|------|
| Collected separately | - | kg |
| Collected with mixed construction waste | ~ 2 | kg |
| Reuse/Recycling/Energy recovery | - | kg |
| Transport to recycling /disposal facility | 100 | km |
| Products or materials for final deposition | ~ 2 | kg |

6. CUT-OFF RULES AND ALLOCATION

Criteria for the exclusion of inputs and outputs (cut-off rules) in the LCA, information modules and any additional information are intended to support an efficient calculation procedure. They are not applied in order to hide data.

The following procedure is applied for the exclusion of inputs and outputs:

- All inputs and outputs to a unit process, for which data are available, are included in the calculation
- Cut-off criteria, where applied, are described in Table 6

Input flows are covered for the whole formula.

Table 6: Cut-off criteria

| Process excluded from study | Cut-off criteria | Quantified contribution from process |
|--------------------------------------|---|--|
| A3: production (auxiliary materials) | Less than 10^{-5} kg/kg of finished product | Sensitivity study demonstrates a relative contribution lower than 0,5% |
| A3: particle emission | Less than 10^{-5} kg/kg of finished product | Sensitivity study demonstrates a relative contribution lower than 0,5% |

For the allocation procedure and principles, consider the table 7.

Table 7: Allocation procedure and principles

| Module | Allocation Principle |
|--------|--|
| A1 | All data are referred to 1 kg of product A1: electricity is allocated to the specific production line |
| A3 | All data are referred to 1 kg of packaged product A3-wastes: all data are allocated to the whole production plant |

Figure 3: Doha Metro Red Line North Underground



Figure 4: Edmonton



7. ENVIRONMENTAL PERFORMANCE AND INTERPRETATION



GWP

Climate change

GWPTotal - Global Warming Potential refers to the emission/presence of GHGs (greenhouse gases) in the atmosphere (mainly CO₂, N₂O, CH₄) which contribute to the increase in the temperature of the planet.

GWP-total considers:

- GWP-fossil
- GWP-biogenic
- GWP-luluc (land use and land use change)



ODP

Ozone Depletion

Ozone Depletion Potential refers to the degradation of the stratospheric layer of the ozone involved in blocking the UV component of sunrays. Depletion is due to particularly reactive components that originate from chlorofluorocarbon (CFC) or chlorofluoromethane (CFM).



AP

Acidification

Acidification Potential refers to the emission of specific acidifying substances (i.e. NO_x, SO_x) in the air. These substances decrease the pH of the rainfall with predictable damages to the ecosystem.



EP

Eutrophication

Eutrophication Potential refers to the nutrient enrichment, which determines unbalance in ecosystems and causes the death of the fauna and decreased biodiversity in flora.

It considers:

- EP-freshwater: aquatic freshwater
- EP-marine: aquatic marine
- EP-terrestrial



POCP

Photochemical ozone formation

The Photochemical Ozone Creation Potential is the ozone formation in low atmosphere. This is quite common in the cities where a great amount of pollutants (like VOC and NO_x) are emitted every day (industrial emissions and vehicles). It is mainly diffused during the summertime.



**ADP
minerals&metals**

Depletion of abiotic resources – minerals and metals

Abiotic Depletion Potential elements refers to the depletion of the mineral resources.



ADP - fossil

Depletion of abiotic resources – fossil fuel

Abiotic Depletion Potential fossil fuel refers to the depletion of the fossil fuel resources.



WDP

Water use

It expresses the potential deprivation of water, that consists in not having the water needs satisfied.

The following tables show the environmental impacts for the products considered according to the requirements of EN15804:2012+A2:2019. The results are referred to the declared unit (see § 4). The additional environmental indicators are not declared (ref. §7.2.3.2 EN15804:2012+A2:2019).

MAPEPLAN TU – M. TU S – M. TU WL – M. TU S WL

(1 m² product + packaging)

Mapeplan TU, Mapeplan TU S, Mapeplan TU WL and Mapeplan TU S WL have similar environmental loads with differences lower than 10%. According to the GPI – General Program Instruction (ref. §9.3), the results are shown as average in a single set of tables.

Table 8: MAPEPLAN TU – M. TU S – M. TU WL – M. TU S WL: Potential environmental impact – mandatory indicators according to EN 15804 referred to 1 m² membrane having 2 mm thickness

| Indicator | Unit | A1-A3 | A4 | A5 | C1 | C2 | C3 | C4 | D |
|--------------------------------------|---|-----------|-----------|----------|----------|-----------|----------|-----------|----------|
| GWP_{TOTAL} | (kg CO ₂ eq.) | 3,74E+00 | 2,10E-01 | 1,95E-01 | 0,00E+00 | 3,45E-02 | 0,00E+00 | 4,24E-02 | 0,00E+00 |
| GWP _{FOSSIL} | (kg CO ₂ eq.) | 3,76E+00 | 2,09E-01 | 1,57E-02 | 0,00E+00 | 3,43E-02 | 0,00E+00 | 4,35E-02 | 0,00E+00 |
| GWP _{BIOGENIC} | (kg CO ₂ eq.) | -2,34E-02 | -2,16E-04 | 1,79E-01 | 0,00E+00 | -4,12E-05 | 0,00E+00 | -1,26E-03 | 0,00E+00 |
| GWP _{LULUC} | (kg CO ₂ eq.) | 2,59E-03 | 1,56E-03 | 1,73E-05 | 0,00E+00 | 2,82E-04 | 0,00E+00 | 1,28E-04 | 0,00E+00 |
| ODP | (kg CFC 11 eq.) | 1,42E-07 | 2,64E-17 | 2,07E-16 | 0,00E+00 | 6,82E-18 | 0,00E+00 | 1,69E-16 | 0,00E+00 |
| AP | (mol H ⁺ eq.) | 8,64E-03 | 1,86E-03 | 5,70E-05 | 0,00E+00 | 1,87E-04 | 0,00E+00 | 3,10E-04 | 0,00E+00 |
| EP _{FRESHWATER} | (kg P eq.) | 6,00E-05 | 5,70E-07 | 6,24E-07 | 0,00E+00 | 1,03E-07 | 0,00E+00 | 7,31E-08 | 0,00E+00 |
| EP _{FRESHWATER} | (kg (PO ₄) ³⁻ eq.) | 1,84E-04 | 1,75E-06 | 1,91E-06 | 0,00E+00 | 3,15E-07 | 0,00E+00 | 2,24E-07 | 0,00E+00 |
| EP _{MARINE} | (kg N eq.) | 1,99E-03 | 7,27E-04 | 2,40E-05 | 0,00E+00 | 9,07E-05 | 0,00E+00 | 8,05E-05 | 0,00E+00 |
| EP _{TERRESTRIAL} | (mol N eq.) | 2,09E-02 | 8,02E-03 | 1,92E-04 | 0,00E+00 | 1,01E-03 | 0,00E+00 | 8,84E-04 | 0,00E+00 |
| POCP | (kg NMVOC eq.) | 7,80E-03 | 1,58E-03 | 1,03E-04 | 0,00E+00 | 1,76E-04 | 0,00E+00 | 2,44E-04 | 0,00E+00 |
| ADP _{MINERALS&METALS} * | (kg Sb eq.) | 1,32E-06 | 1,51E-08 | 2,83E-09 | 0,00E+00 | 3,06E-09 | 0,00E+00 | 4,11E-09 | 0,00E+00 |
| ADP _{FOSSIL} * | (MJ) | 9,44E+01 | 2,78E+00 | 2,48E-01 | 0,00E+00 | 4,60E-01 | 0,00E+00 | 5,77E-01 | 0,00E+00 |
| WDP* | (m ³ world eq.) | 1,27E+00 | 1,69E-03 | 1,91E-03 | 0,00E+00 | 3,21E-04 | 0,00E+00 | 4,67E-03 | 0,00E+00 |

GWP_{TOTAL}: Global Warming Potential total; **GWP_{FOSSIL}**: Global Warming Potential fossil fuels; **GWP_{BIOGENIC}**: Global Warming Potential biogenic; **GWP_{LULUC}**: Global Warming Potential land use and land use change; **ODP**: Depletion Potential of the stratospheric Ozone layer; **AP**: Acidification Potential; **EP_{FRESHWATER}**: Eutrophication Potential, freshwater; **EP_{MARINE}**: Eutrophication Potential, marine; **EP_{TERRESTRIAL}**: Eutrophication Potential, terrestrial; **POCP**: Formation potential of tropospheric ozone; **ADP_{MINERALS&METALS}**: Abiotic Depletion Potential for non-fossil resources; **ADP_{FOSSIL}**: Abiotic Depletion Potential for fossil resources; **WDP**: Water Deprivation Potential.

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

Table 9: MAPEPLAN TU – M. TU S – M. TU WL – M. TU S WL: Potential environmental impact – additional mandatory and voluntary indicators according to EN 15804 referred to 1 m² membrane having 2 mm thickness

| Indicator | Unit | A1-A3 | A4 | A5 | C1 | C2 | C3 | C4 | D |
|----------------|--------------------------|----------|----------|----------|----------|----------|----------|----------|----------|
| GWP-GHG | (kg CO ₂ eq.) | 3,67E+00 | 2,07E-01 | 1,18E-01 | 0,00E+00 | 3,39E-02 | 0,00E+00 | 4,28E-02 | 0,00E+00 |

GWP-GHG: The indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. This indicator is thus equal to the GWP indicator originally defined in EN 15804:2012+A1:2013.

Table 10: MAPEPLAN TU – M. TU S – M. TU WL – M. TU S WL: Use of resources referred to 1 m² membrane having 2 mm thickness

| Indicator | Unit | A1-A3 | A4 | A5 | C1 | C2 | C3 | C4 | D |
|-----------|----------------|----------|----------|----------|----------|----------|----------|----------|----------|
| PERE | MJ | 6,92E+00 | 1,42E-01 | 7,25E-02 | 0,00E+00 | 2,65E-02 | 0,00E+00 | 7,78E-02 | 0,00E+00 |
| PERM | MJ | 1,80E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| PERT | MJ | 8,72E+00 | 1,42E-01 | 7,25E-02 | 0,00E+00 | 2,65E-02 | 0,00E+00 | 7,78E-02 | 0,00E+00 |
| PENRE | MJ | 9,45E+01 | 2,79E+00 | 2,48E-01 | 0,00E+00 | 4,62E-01 | 0,00E+00 | 5,78E-01 | 0,00E+00 |
| PENRM | MJ | 1,50E-01 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| PENRT | MJ | 9,46E+01 | 2,79E+00 | 2,48E-01 | 0,00E+00 | 4,62E-01 | 0,00E+00 | 5,78E-01 | 0,00E+00 |
| SM* | kg | 1,35E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 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 |
| 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 |
| FW | m ³ | 3,10E-02 | 1,63E-04 | 8,11E-05 | 0,00E+00 | 3,03E-05 | 0,00E+00 | 1,43E-04 | 0,00E+00 |

PERE: Use of renewable primary energy excluding renewable primary energy resources used as raw materials; **PERM:** Use of renewable primary energy resources used as raw materials; **PERT:** Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials); **PENRE:** Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; **PENRM:** Use of non-renewable primary energy resources used as raw materials; **PENRT:** Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials); **SM:** Use of secondary material; **RSF:** Use of renewable secondary fuels; **NRSF:** Use of non-renewable secondary fuels; **FW:** Net use of fresh water.

* Referred only to 1 kg of product without packaging

Table 11: MAPEPLAN TU – M. TU S – M. TU WL – M. TU S WL: Waste production and output flows referred to 1 m² membrane having 2 mm thickness

| Indicator | Unit | A1-A3 | A4 | A5 | C1 | C2 | C3 | C4 | D |
|-------------------------------|------|----------|----------|----------|----------|----------|----------|----------|----------|
| HWD | kg | 4,51E-03 | 1,30E-10 | 5,65E-11 | 0,00E+00 | 2,43E-11 | 0,00E+00 | 6,13E-11 | 0,00E+00 |
| NHWD | kg | 1,89E-01 | 4,02E-04 | 7,05E-02 | 0,00E+00 | 7,25E-05 | 0,00E+00 | 2,88E+00 | 0,00E+00 |
| RWD | kg | 1,67E-03 | 3,35E-06 | 2,22E-05 | 0,00E+00 | 8,38E-07 | 0,00E+00 | 6,06E-06 | 0,00E+00 |
| Components for re-use | 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 |
| Materials for recycling | kg | 2,38E-01 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Materials for energy recovery | 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 |
| Exported energy, electricity | 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 |
| Exported energy, thermal | 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 |

HWD: Hazardous waste disposed; **NHWD:** Non-Hazardous waste disposed; **RWD:** Radioactive waste disposed

Table 12: MAPEPLAN TU – M. TU S – M. TU WL – M. TU S WL: Information on biogenic carbon content at the factory gate referred to 1 m² membrane having 2 mm thickness

| Biogenic Carbon Content | Unit | Quantity |
|--------------------------------------|------|----------|
| Biogenic carbon content in product | kg C | 0,00E+00 |
| Biogenic carbon content in packaging | kg C | 4,14E-02 |

MAPEPLAN TU CH

(1 m² product + packaging)

Table 13: MAPEPLAN TU CH: Potential environmental impact – mandatory indicators according to EN 15804 referred to 1 m² membrane having 2 mm thickness

| Indicator | Unit | A1-A3 | A4 | A5 | C1 | C2 | C3 | C4 | D |
|--------------------------------------|---|-----------|-----------|----------|----------|-----------|----------|-----------|----------|
| GWP_{TOTAL} | (kg CO ₂ eq.) | 3,56E+00 | 2,02E-01 | 1,95E-01 | 0,00E+00 | 3,31E-02 | 0,00E+00 | 4,07E-02 | 0,00E+00 |
| GWP _{FOSSIL} | (kg CO ₂ eq.) | 3,59E+00 | 2,01E-01 | 1,57E-02 | 0,00E+00 | 3,29E-02 | 0,00E+00 | 4,18E-02 | 0,00E+00 |
| GWP _{BIOGENIC} | (kg CO ₂ eq.) | -2,40E-02 | -2,08E-04 | 1,79E-01 | 0,00E+00 | -3,95E-05 | 0,00E+00 | -1,21E-03 | 0,00E+00 |
| GWP _{LULUC} | (kg CO ₂ eq.) | 2,35E-03 | 1,50E-03 | 1,74E-05 | 0,00E+00 | 2,71E-04 | 0,00E+00 | 1,23E-04 | 0,00E+00 |
| ODP | (kg CFC 11 eq.) | 1,37E-07 | 2,54E-17 | 2,07E-16 | 0,00E+00 | 6,55E-18 | 0,00E+00 | 1,62E-16 | 0,00E+00 |
| AP | (mol H ⁺ eq.) | 8,18E-03 | 1,79E-03 | 5,71E-05 | 0,00E+00 | 1,80E-04 | 0,00E+00 | 2,98E-04 | 0,00E+00 |
| EP _{FRESHWATER} | (kg P eq.) | 5,86E-05 | 5,48E-07 | 6,25E-07 | 0,00E+00 | 9,86E-08 | 0,00E+00 | 7,01E-08 | 0,00E+00 |
| EP _{FRESHWATER} | (kg (PO ₄) ³⁻ eq.) | 1,80E-04 | 1,68E-06 | 1,92E-06 | 0,00E+00 | 3,03E-07 | 0,00E+00 | 2,15E-07 | 0,00E+00 |
| EP _{MARINE} | (kg N eq.) | 1,86E-03 | 6,99E-04 | 2,41E-05 | 0,00E+00 | 8,71E-05 | 0,00E+00 | 7,72E-05 | 0,00E+00 |
| EP _{TERRESTRIAL} | (mol N eq.) | 1,94E-02 | 7,71E-03 | 1,92E-04 | 0,00E+00 | 9,65E-04 | 0,00E+00 | 8,49E-04 | 0,00E+00 |
| POCP | (kg NMVOC eq.) | 7,37E-03 | 1,51E-03 | 1,03E-04 | 0,00E+00 | 1,69E-04 | 0,00E+00 | 2,34E-04 | 0,00E+00 |
| ADP _{MINERALS&METALS} * | (kg Sb eq.) | 1,29E-06 | 1,45E-08 | 2,83E-09 | 0,00E+00 | 2,94E-09 | 0,00E+00 | 3,94E-09 | 0,00E+00 |
| ADP _{FOSSIL} * | (MJ) | 9,04E+01 | 2,68E+00 | 2,48E-01 | 0,00E+00 | 4,42E-01 | 0,00E+00 | 5,54E-01 | 0,00E+00 |
| WDP* | (m ³ world eq.) | 1,22E+00 | 1,62E-03 | 1,91E-03 | 0,00E+00 | 3,08E-04 | 0,00E+00 | 4,48E-03 | 0,00E+00 |

GWP_{TOTAL}: Global Warming Potential total; **GWP_{FOSSIL}**: Global Warming Potential fossil fuels; **GWP_{BIOGENIC}**: Global Warming Potential biogenic; **GWP_{LULUC}**: Global Warming Potential land use and land use change; **ODP**: Depletion Potential of the stratospheric Ozone layer; **AP**: Acidification Potential; **EP_{FRESHWATER}**: Eutrophication Potential, freshwater; **EP_{MARINE}**: Eutrophication Potential, marine; **EP_{TERRESTRIAL}**: Eutrophication Potential, terrestrial; **POCP**: Formation potential of tropospheric ozone; **ADP_{MINERALS&METALS}**: Abiotic Depletion Potential for non-fossil resources; **ADP_{FOSSIL}**: Abiotic Depletion Potential for fossil resources; **WDP**: Water Deprivation Potential.

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

Table 14: MAPEPLAN TU CH: Potential environmental impact – additional mandatory and voluntary indicators referred to 1 m² membrane having 2 mm thickness

| Indicator | Unit | A1-A3 | A4 | A5 | C1 | C2 | C3 | C4 | D |
|----------------|--------------------------|----------|----------|----------|----------|----------|----------|----------|----------|
| GWP-GHG | (kg CO ₂ eq.) | 3,50E+00 | 1,99E-01 | 1,18E-01 | 0,00E+00 | 3,25E-02 | 0,00E+00 | 4,11E-02 | 0,00E+00 |

GWP-GHG: The indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. This indicator is thus equal to the GWP indicator originally defined in EN 15804:2012+A1:2013.

Table 15: MAPEPLAN TU CH: Use of resources referred to 1 m² membrane having 2 mm thickness

| Indicator | Unit | A1-A3 | A4 | A5 | C1 | C2 | C3 | C4 | D |
|-----------|----------------|----------|----------|----------|----------|----------|----------|----------|----------|
| PERE | MJ | 6,67E+00 | 1,37E-01 | 7,26E-02 | 0,00E+00 | 2,54E-02 | 0,00E+00 | 7,47E-02 | 0,00E+00 |
| PERM | MJ | 1,80E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| PERT | MJ | 8,47E+00 | 1,37E-01 | 7,26E-02 | 0,00E+00 | 2,54E-02 | 0,00E+00 | 7,47E-02 | 0,00E+00 |
| PENRE | MJ | 9,04E+01 | 2,68E+00 | 2,48E-01 | 0,00E+00 | 4,43E-01 | 0,00E+00 | 5,55E-01 | 0,00E+00 |
| PENRM | MJ | 1,49E-01 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| PENRT | MJ | 9,06E+01 | 2,68E+00 | 2,48E-01 | 0,00E+00 | 4,43E-01 | 0,00E+00 | 5,55E-01 | 0,00E+00 |
| SM* | kg | 1,30E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 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 |
| 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 |
| FW | m ³ | 2,99E-02 | 1,57E-04 | 8,12E-05 | 0,00E+00 | 2,91E-05 | 0,00E+00 | 1,37E-04 | 0,00E+00 |

PERE: Use of renewable primary energy excluding renewable primary energy resources used as raw materials; **PERM:** Use of renewable primary energy resources used as raw materials; **PERT:** Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials); **PENRE:** Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; **PENRM:** Use of non-renewable primary energy resources used as raw materials; **PENRT:** Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials); **SM:** Use of secondary material; **RSF:** Use of renewable secondary fuels; **NRSF:** Use of non-renewable secondary fuels; **FW:** Net use of fresh water.

* Referred only to 1 kg of product without packaging

Table 16: MAPEPLAN TU CH: Waste production and output flows referred to 1 m² membrane having 2 mm thickness

| Indicator | Unit | A1-A3 | A4 | A5 | C1 | C2 | C3 | C4 | D |
|-------------------------------|------|----------|----------|----------|----------|----------|----------|----------|----------|
| HWD | kg | 4,33E-03 | 1,25E-10 | 5,66E-11 | 0,00E+00 | 2,34E-11 | 0,00E+00 | 5,89E-11 | 0,00E+00 |
| NHWD | kg | 1,82E-01 | 3,87E-04 | 7,06E-02 | 0,00E+00 | 6,96E-05 | 0,00E+00 | 2,77E+00 | 0,00E+00 |
| RWD | kg | 1,60E-03 | 3,22E-06 | 2,22E-05 | 0,00E+00 | 8,04E-07 | 0,00E+00 | 5,82E-06 | 0,00E+00 |
| Components for re-use | 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 |
| Materials for recycling | kg | 2,28E-01 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| Materials for energy recovery | 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 |
| Exported energy, electricity | 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 |
| Exported energy, thermal | 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 |

HWD: Hazardous waste disposed; **NHWD:** Non-Hazardous waste disposed; **RWD:** Radioactive waste disposed

Table 17: MAPEPLAN TU CH: Information on biogenic carbon content at the factory gate referred to 1 m² membrane having 2 mm thickness

| Biogenic Carbon Content | Unit | Quantity |
|--------------------------------------|------|----------|
| Biogenic carbon content in product | kg C | 0,00E+00 |
| Biogenic carbon content in packaging | kg C | 4,15E-02 |

To obtain the results for different thicknesses, please use the following multiplicative coefficients:

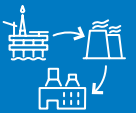











Table 18: Multiplicative coefficients for calculating the Environmental Impacts (EI) for different thickness

| | THICKNESS | | | | | | |
|---|-------------------|----------------|-------------------|-------------------|-------------------|------------------|-------------------|
| | 1,5 mm | 2,0 mm | 2,1 mm | 2,2 mm | 2,5 mm | 3,0 mm | 3,1 mm |
| Mapeplan TU – TU S – TU WL – TU S WL | $EI_{2,0} * 0,75$ | $EI_{2,0} * 1$ | $EI_{2,0} * 1,05$ | $EI_{2,0} * 1,15$ | $EI_{2,0} * 1,25$ | $EI_{2,0} * 1,5$ | $EI_{2,0} * 1,56$ |
| Mapeplan TU CH | – | $EI_{2,0} * 1$ | $EI_{2,0} * 1,03$ | – | – | – | – |

$EI_{2,0}$: Environmental Indicator for 2,0 mm thickness

Tables from 5 to 17 show absolute results for all the environmental categories considered. The module A1 gives an important contribute for most environmental categories considered and it is responsible up to 99% of the impact (considering the different environmental indicators declared in this EPD). The transport modules (A2, A4 and C2) affect several environmental categories; e.g. GWP, EP and POCP, with relative contributions up to 30%. The installation module A5, is the main contributes regarding the environmental category GWP (biogenic) due to the EoL of the different packaging components which are all landfilled. Finally, specific amounts of **recycled material** are used in the formulations, these values are shown in Table 10 and Table 15 as **SM** (Secondary Material) indicator.

Table 19: Some environmental impacts of the products studied as average

| MAPEPLANs (average) |  A1-A3 |  A4 |  A5 |  C1 |  C2 |  C3 |  C4 |  TOT |
|---|--|---|---|---|---|---|---|--|
| CLIMATE CHANGE (total)  | 3,65E+00 | 2,06E-01 | 1,95E-01 | 0,00E+00 | 3,38E-02 | 0,00E+00 | 4,15E-02 | 4,13 kg CO ₂ eq. |
| ACIDIFICATION  | 8,41E-03 | 1,83E-03 | 5,70E-05 | 0,00E+00 | 1,84E-04 | 0,00E+00 | 3,04E-04 | 1,08E-02 mol H ⁺ eq. |
| DEPLETION OF ABIOTIC RESOURCES (fossil)  | 9,24E+01 | 2,73E+00 | 2,48E-01 | 0,00E+00 | 4,51E-01 | 0,00E+00 | 5,66E-01 | 96,4 MJ |
| WATER USE  | 1,24E+00 | 1,65E-03 | 1,91E-03 | 0,00E+00 | 3,14E-04 | 0,00E+00 | 4,58E-03 | 1,25 m ³ world eq. |

More details about electrical mix used in this EPD, is shown below:

| | Data source | GWP _{TOTAL} | Unit |
|---|-----------------|----------------------|-----------------------------|
| Residual electricity grid mix (IT) – 2019 | AIB | 0,535* | kg CO ₂ -eqv/kWh |
| Electricity from photovoltaic (IT) – 2017 | Sphera database | 0,0519* | kg CO ₂ -eqv/kWh |

* CML2001 – Aug. 2016

8. DATA QUALITY

Table 20: Data quality

| Dataset & Geographical reference | Database (source) | Temporary reference |
|--|---------------------------------|---------------------|
| A1; A3 | | |
| PVC Compounds | Sphera Database; ecoinvent 3.7 | 2020 |
| Fillers (EU) | Sphera Database; | 2020 |
| Additives (EU) | Sphera Database; ecoinvent 3.7 | 2020 |
| Plasticizers | Sphera Database | 2020 |
| Residual electricity grid mix (IT) | AIB | 2019 |
| Packaging components (EU) | Sphera Database, PlasticsEurope | 2005 – 2020 |
| A2 | | |
| Truck, Euro 5, 27t payload (GLO) | Sphera Database | 2020 |
| Diesel for transport (EU) | Sphera Database | 2017 |
| A4 | | |
| Truck, Euro 4, 27t payload (GLO) | Sphera Database | 2020 |
| Container ship, 5,000 to 200,000 dwt payload (GLO) | Sphera Database | 2020 |
| Diesel for transport (EU) | Sphera Database | 2017 |
| Heavy fuel oil (EU) | Sphera Database | 2017 |
| A5 | | |
| Electricity grid mix (EU) | Sphera Database | 2017 |
| Plastic waste on landfill | Sphera Database | 2020 |
| Untreated wood on landfill | Sphera Database | 2020 |
| Paper waste on landfill | Sphera Database | 2020 |
| C1 – C4 | | |
| Construction waste treatment (EU) | Sphera Database | 2020 |
| Construction waste dumping (EU) | Sphera Database | 2020 |
| Electricity grid mix (IT) | Sphera Database | 2017 |
| Truck, Euro 6, 9.3t payload (GLO) | Sphera Database | 2020 |
| Diesel for transport (EU) | Sphera Database | 2017 |

All data included in table above refer to a period between 2005 and 2020; the most relevant ones are specific from supplier, while the others (i.e. transport and minor contribution dataset), come from European and global databases.

All dataset are not more than 10 years old according to EN 15804 §6.3.8.2 “Data quality requirements”. The only exception is represented by one raw material used for one packaging component production.

The Quality level concerning datasets used in the EPD can be considered as “very good” or “good” according to Annex E of the EN 15804 (current version); the only exception is represented by a packaging component which has a quality level classified as “poor” in terms of time representativeness.

Primary data concern the year 2020 and represent the whole annual production.

9. REQUISITE EVIDENCE

9.1 Recycled Content

| Products | Recycled material content (Pre-Consumer) |
|------------------|--|
| Mapeplan TU | 47% |
| Mapeplan TU S | 47% |
| Mapeplan TU WL | 47% |
| Mapeplan TU S WL | 47% |
| Mapeplan TU CH | 47% |

10. SIGNIFICANT CHANGES FROM PREVIOUS VERSION

In this version, new primary data referred to 2020 has been adopted; more info regarding the end of life stages and module D has been added in chapter 5. Moreover, additional data quality information has been included in chapter 8. Minor editorial changes have been made in the document.

11. VERIFICATION AND REGISTRATION

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

EPDs within the same product category but from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804. For further information about comparability, see EN 15804 and ISO 14025.

CEN standard EN15804 served as the Core Product Category Rules (PCR)

| | |
|--|---|
| PCR: | PCR 2019:14 Construction products (EN 15804:A2), Version 1.11, 2021-02-05, UN CPC code 54 |
| PCR review was conducted by: | The Technical Committee of the International EPD® System. See 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 . |
| Independent third-party verification of the declaration and data, according to ISO 14025:2006: | <input checked="" type="checkbox"/> EPD Process Certification <input type="checkbox"/> EPD Verification |
| Third party verifier: | Certiquality S.r.l. Number of accreditation: 003H rev15 |
| Accredited or approved by: | Accredia |
| Procedure for follow-up of data during EPD validity involves third-party verifier | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |

12. REFERENCES

- EN 13491: GEOSYNTHETIC BARRIERS - CHARACTERISTICS REQUIRED FOR USE AS A FLUID BARRIER IN THE CONSTRUCTION OF TUNNELS AND ASSOCIATED UNDERGROUND STRUCTURES
- EN 15804: SUSTAINABILITY OF CONSTRUCTION WORKS - ENVIRONMENTAL PRODUCT DECLARATIONS - CORE RULES FOR THE PRODUCT CATEGORY OF CONSTRUCTION PRODUCTS
- EUROPEAN RESIDUAL MIXES VERSION 1.1, 2020-09-08 (AIB: ASSOCIATION OF ISSUING BODIES)
- GENERAL PROGRAMME INSTRUCTIONS OF THE INTERNATIONAL EPD® SYSTEM. VERSION 3.01
- ISO 14025 ENVIRONMENTAL LABELS AND DECLARATIONS - TYPE III ENVIRONMENTAL DECLARATIONS - PRINCIPLES AND PROCEDURES
- ISO 14044 ENVIRONMENTAL MANAGEMENT – LIFE CYCLE ASSESSMENT – REQUIREMENTS AND GUIDELINES
- PCR 2019:14 CONSTRUCTION PRODUCTS (EN 15804: A2), UN CPC CODE 54; VERSION 1.11
- RICHTLINE 853 DB NETZ AG AND TL/TP KDB.

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ANNEX 1

ANNEX 1: Self declaration from EPD owner

Specific Norwegian requirements

1 Applied electricity data set used in the manufacturing phase

The electricity mix for the electricity used in manufacturing (A3) is the electricity grid mix

<0,479 kg CO₂ eqv/kWh>

2 Content of dangerous substances

- The product contains no substances given by the REACH Candidate list or the Norwegian priority list.
- The product contains substances that are less than 0.1% by weight given by the REACH Candidate or the Norwegian priority list.
- The product contains dangerous substances more than 0.1% by weight given in the REACH candidate list or the [Norwegian Priority List](#), concentrations is given in the EPD:

| Dangerous substances from the REACH candidate list or the Norwegian Priority List | CAS No. | Quantity (concentration, wt%/FU(DU)). |
|---|---------|---------------------------------------|
| Substance 1 | | |
| Substance n | | |

3 Transport from the place of manufacture to a central warehouse

Transport distance, and CO₂-eqv./DU from transport of the product from factory gate to central warehouse in Oslo shall be given. The following table shall be included in the EPD:

| Type | Capacity utilisation (incl. return) % | Type of vehicle | Distance km | Fuel/Energy use | Unit | Value (l/t) | kg CO ₂ -eqv./DU |
|---------|---------------------------------------|-----------------|-------------|-----------------|-------|-------------|-----------------------------|
| Boat | | | | | | | |
| Truck | 85 | 27 tonn, EURO 3 | 2054 | 0,0182 | l/tkm | 37,38 | 3,32E-01 |
| Railway | | | | | | | |
| Rail | | | | | | | |
| Air | | | | | | | |
| Total | 85 | 27 tonn, EURO 3 | 2054 | 0,0182 | l/tkm | 37,38 | 3,32E-01 |

4 Impact on the indoor environment

- Indoor air emission testing has been performed; specify test method and reference:
- No test has being performed
- Not relevant; specify : the product is a waterproofing membranes for underground structures. It does not affect the indoor air quality.
