# Environmental Product Declaration

In accordance with ISO 14025 for

## MAPEPLAN PLUS

*(PVC-P Waterproofing Membranes)*

POLYGLASS SpA

| | |
|---|---|
| **Programme:** | **The International EPD® System; www.environdec.com** |
| **Programme operator:** | **EPD International AB** |
| **EPD registration number:** | **S-P-01106** |
| **Approval date:** | **2018-06-14** |
| **Valid until:** | **2023-06-06** |
| **Geographical scope:** | ***International*** |

# 1.Company description / Goal & Scope

The Company's headquarter is located in Ponte di Piave, Treviso (Italy). Over 90.000 $m^2$ of surface, 25.000 $m^2$ covered, 4 production lines of polymer-bitumen membranes, one production line of thermal and acoustic insulation systems and two production lines of synthetic PVC-P and TPO/FPO membranes.

Figure 1: Production equipment

In October 2008 Polyglass was taken over by the MAPEI Group, an international Company in the chemical industry for construction, with 73 production plants in 5 continents, in 34 countries.

Polyglass SpA is ISO 14001 certified since 2010 and ISO 9001 since 1995.

The goal of the study has been to provide necessary data and documentation to produce an EPD according to the requirements of PCR according to EN 15804:2014 and PCR Environdec, version 2.2, date 2017-05-30 and to have more comprehension about the environmental impacts related to Mapeplan Plus manufactured in Polyglass SpA located in Ponte di Piave (TV-Italy), 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 Plus**.
This analysis shall not support comparative assertions intended to be disclosed to the public.

Figure 2: Polyglass S.p.A. head quarter

# 2. Product description

**Mapeplan Plus** is a synthetic roofing waterproofing membrane in PVC produced in one multiextrusion coating process, with high quality raw materials, reinforced with polyester net.

Mapeplan Plus is compliant with EN 13956 (“Flexible sheets for waterproofing – Plastic and rubber sheets for roof waterproofing – Definitions and characteristics”), and is sold with different packaging, as follow:

- Pallet: 14 rolls per pallet
- Length of rolls: 25 m, 20 m and 15 m (according to the thickness)
- Width of rolls: 2,10 m, 1,60 m and 1,05 m

Figure 3: MAPEPLAN PLUS on fully exposed roof

# 3. Content declaration

The main components and ancillary materials of **Mapeplan Plus** are the following:

**Table 1: Composition**

| Materials | Percentage (%) |
|---|---|
| Polyvinyl chloride (PVC) | 30 – 60 |
| Plasticizers | 20 – 40 |
| Fillers | 5 – 10 |
| Pigments | 0 – 5 |
| Reinforcing material | 0 – 5 |
| Other additives | 0 – 1 |

The product contains no substances of very high concern (SVHC) on the REACH Candidate List/ published by the European Chemicals Agency in a concentration more than 0,1 % (by unit weight).

# 4. Declared Unit and Reference Service Life

**The declared unit is 1m$^2$ of packaged finished product having a 1,5 mm thickness.**

Packaging materials include:

- Wooden pallet
- Cardboard
- LDPE used as wrapping material
- PP

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

# 5. System Boundaries & additional technical information

The approach is a “cradle to gate” with option.

The following modules have been considered:

- A1 – A3 (Product stage): extraction and transport of raw materials, packaging included, production process.
- A4 – A5 (Construction stage): transport of the finished product to final customers and installation into the building.
- C1 – C4 (End-of-life stage): de-construction, demolition (C1), transport to waste processing (C2), waste processing for reuse, recovery and/or recycling (C3), disposal (C4).

Table 2: System boundaries

| System Boundaries | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 – A3 | | | A4 – A5 | | B1 – B7 | | | | | | | C1 – C4 | | | |
| PRODUCT STAGE | | | CONSTRUCTION STAGE | | USE STAGE | | | | | | | END OF LIFE STAGE | | | |
| A1 | A2 | A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | | | C1 | C2 | C3 | C4 |
| Raw Material Supply | Transport | Manufacturing | Transport | Installation process | Use | Maintenance | Repair | Replacement | Refurbishment | | | Deconstruction/ Demolition | Transport | Waste Processing | Disposal |
| | | | | | B6 | Operational Energy Use | | | | | | | | | |
| | | | | | B7 | Operational Water Use | | | | | | | | | |

included excluded

A brief description of production process is the following:

The production process of PVC-P roofing membranes is a multi-extrusion coating process. The production plant produces roofing membranes with an internal reinforcing material made of glass matt or polyester net.
PVC powders are mixed inside a heated turbomixer with other additives and liquid plasticizers. The mixture is then cooled at 40 °C and stored under mixing. The mixture is drained inside a hopper by a vacuum equipment, and sent to the extruders. Reinforcing material is integrated inside the roofing membrane during multi-extrusion coating process. The hot liquid compound comes out from the extruders and is combined with the reinforced material.

The membrane is cooled and finally sent to the packaging area, ready to ship.

Figure 4: Production process detail

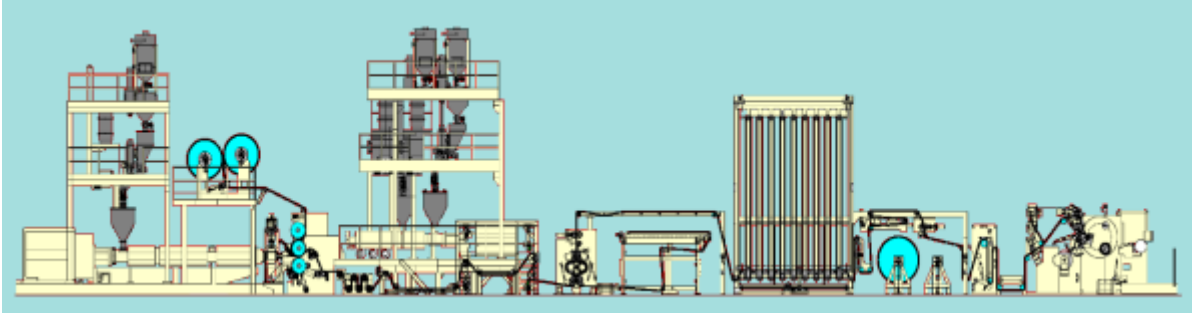


Table 3: Transport to the building site (A4) - referred to 1 DU (declared unit; § 4)

| Name | Value | Unit |
|---|---|---|
| Means of transport : truck euro 4 with 27 tons of payload & ship with a 27500 DWT | | |
| Litres of fuel | 0,002 | 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) - referred to 1 DU (declared unit; § 4)

| Name | Value | Unit |
|---|---|---|
| Auxiliary | - | kg |
| Water consumption | - | $m^3$ |
| Other resources | - | kg |
| Electricity consumption | 0,019 | $kWh/m^2$ |
| Other energy carriers | - | MJ |
| Material loss (membrane) | 3 | % |
| Overlaps (membrane) | 5,5 | % |
| Output substances following waste treatment on site | - | kg |
| Dust in the air | - | kg |
| VOC in the air | - | kg |

Table 5: End of Life (C1-C4) - referred to 1 DU (declared unit; § 4)

| Name | Value | Unit |
|---|---|---|
| Collected separately | - | kg |
| Collected as mixed construction waste | - | kg |
| Reuse | - | kg |
| Transport to recycling /disposal facility | 100 | km |
| Energy recovery | - | kg |
| Landfilling | 1,05 | kg |

# 6. Cut-off rules & 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 followed for the exclusion of inputs and outputs:

- All inputs and outputs to a unit process are included in the calculation, for which data are available.
- Less than 1% of the total mass inputs/outputs of the unit process A3, are cut-off (see 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 $10^{-4}$ kg/kg of finished product | Sensitivity study demonstrates a contribute lower than 0,1% |
| A3: production (particle emissions to air / not compliant finished product) | Less than $10^{-4}$ kg/kg of finished product | Sensitivity study demonstrates a contribute lower than 0,1% |

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

**Table 7: Allocation procedure and principles**

| Module | Allocation Principle |
|---|---|
| A1 | All data are referred to 1 $m^2$ of product<br>• A1: electricity is allocated to the reference line production |
| A3 | All data are referred to 1 $m^2$ of packaged product<br>• A3-wastes: all data are allocated to the whole plant production, except for the CER code 070213 (plastic scrap) which belongs only to the reference line production |
| A5; C1; C2; C3, C4 | All data are referred to 1$m^2$ of packaged product.<br>• A5: all wastes coming from packaging material are considered to be disposed in landfill (100%)<br>• C3 - C4: according to *"European Commission DG ENV Final Report Task 2 – Management of C&D waste",* 46% is to be considered as recycle/reuse and remaining percentage is to be considered as disposed in a landfill<br>**NOTE: No benefits coming from recycling waste treatment process have been considered in this study** |

# 7. Environmental performance & interpretation

Follow a brief description of the environmental indicators considered in the EPD.

| |
|---|
| **ADPe** (elements) - Abiotic Depletion Potential elements refers to the depletion of the mineral resources. |
| **ADPf** (fossil fuel) - Abiotic Depletion Potential fossil fuel refers to the depletion of the fossil fuel resources. |
| **AP** - Acidification Potential refers to the emission of specific acidifying substances (i.e. NOx, SOx) in the air. These substances decrease the pH of the rainfall with predictable damages to the ecosystem. |
| **EP** - Eutrophication Potential refers to the nutrient enrichment of flowing water, which determines unbalance in aquatic ecosystems and causes the death of the aquatic fauna. |
| **$GWP_{100}$** - Global Warming Potential refers to the emission/presence of GHG (greenhouse emission gases) in the atmosphere (mainly $CO_2$, $N_2O$, $CH_4$) which contribute to the increase in temperature of the planet. |
| **ODP** - 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 chlorofluoromethanes (CFM). |
| **POCP** - the Photochemical Ozone Creation Potential is the ozone formation in the low atmosphere. This is quite common in the cities where a great amount of pollutants (like VOC and NOx) are emitted every day (industrial emissions and vehicles). It is mainly diffused during the summertime. |

The following tables show environmental impacts for the product considered according to CML methodology (CML2001 – Jan. 2016) and are referred to 1 DU (declared unit – see § 4).

**Table 8: Mapeplan Plus – Environmental categories**

| System boundary | Modules | $GWP_{100}$ (kg $CO_2$ eq.) | ADPe (element) (kg Sb eq.) | ADPf (fossil) (MJ) | AP (kg SO2 eq.) | EP (kg PO34- eq.) | ODP kg R-11 eq.) | POCP (kg ethylene eq.) |
|---|---|---|---|---|---|---|---|---|
| Upstream + core | A1-A3 | 4,76E+00 | 5,07E-03 | 1,16E+02 | 2,09E-02 | 6,30E-03 | 4,27E-08 | 2,77E-03 |
| Downstream | A4 | 1,34E-01 | 1,00E-08 | 1,81E+00 | 9,12E-04 | 1,66E-04 | 4,35E-14 | -1,60E-04 |
| | A5 | 1,13E-01 | 4,63E-09 | 1,86E-01 | 5,47E-05 | 2,95E-05 | 3,72E-13 | 3,43E-05 |
| | C1 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 | 0,00E+00 |
| | C2 | 1,42E-02 | 1,14E-09 | 1,94E-01 | 5,55E-05 | 1,38E-05 | 4,71E-15 | -2,00E-05 |
| | C3 | 2,28E-03 | 3,97E-09 | 4,22E-02 | 1,52E-05 | 3,63E-06 | 2,37E-15 | 1,64E-06 |
| | C4 | 1,59E-02 | 5,62E-09 | 2,07E-01 | 9,46E-05 | 1,29E-05 | 1,51E-14 | 7,44E-06 |

**GWP100**: Global Warming Potential; **ADPe**: Abiotic Depletion Potential (elements); **EP**: Eutrophication Potential; **AP**: Acidification Potential; **POCP**: Photochemical Ozone Creation Potential; **ODP**: Ozone Depletion Potential; **ADPf**: Abiotic Depletion Potential (fossil)

**Table 9: Mapeplan Plus – Other environmental indicators**

| System boundary | | Ustream + core | Downstream | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Parameter** | **Unit** | **A1-A3** | **A4** | **A5** | **C1** | **C2** | **C3** | **C4** |
| RPEE | MJ | 7,27E+00 | 8,31E-02 | 5,54E-02 | 0,00E+00 | 9,76E-03 | 3,35E-03 | 2,50E-02 |
| RPEM | MJ | - | - | - | - | - | - | - |
| TPE | MJ | 7,27E+00 | 8,31E-02 | 5,54E-02 | 0,00E+00 | 9,76E-03 | 3,35E-03 | 2,50E-02 |
| NRPE | MJ | 1,19E+02 | 1,82E+00 | 2,45E-01 | 0,00E+00 | 1,95E-01 | 4,32E-02 | 2,14E-01 |
| NRPM | MJ | - | - | - | - | - | - | - |
| TRPE | MJ | 1,19E+02 | 1,82E+00 | 2,45E-01 | 0,00E+00 | 1,95E-01 | 4,32E-02 | 2,14E-01 |
| SM | kg | - | - | - | - | - | - | - |
| RSF | MJ | - | - | - | - | - | - | - |
| NRSF | MJ | - | - | - | - | - | - | - |
| W | $m^3$ | 2,18E-01 | 1,88E-03 | 1,96E-04 | 0,00E-03 | 2,22E-04 | 5,03E-05 | 1,48E-04 |

**RPEE** Renewable primary energy as energy carrier; **RPEM** Renewable primary energy as material utilisation; **TPE** Total use of renewable primary energy sources; **NRPE** Non-renewable primary energy as energy carrier; **NRPM** Non-renewable primary energy as material utilization; **TRPE** Total use of non-renewable primary energy sources; **SM** Use of secondary materials; **RSF** Renewable secondary fuels; **NRSF** Non-renewable secondary fuels; **W** Net use of fresh water

**Table 10: Mapeplan Plus – Waste production & other output flows**

| System boundary | | Ustream + core | Downstream | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Parameter** | **Unit** | **A1-A3** | **A4** | **A5** | **C1** | **C2** | **C3** | **C4** |
| NHW | kg | 6,77E-02 | - | - | - | - | - | - |
| HW | kg | 0,00E+00 | - | - | - | - | - | - |
| RW | kg | 0,00E+00 | - | - | - | - | - | - |
| Components for re-use | kg | - | - | - | - | - | - | - |
| Materials for recycling | kg | - | - | - | - | - | - | - |
| Materials for energy recovery | kg | - | - | - | - | - | - | - |
| Exported energy | MJ | - | - | - | - | - | - | - |

**HW** Hazardous waste disposed; **NHW** Non Hazardous waste disposed; **RW** Radioactive waste disposed

To calculate results for different thicknesses (1,2, 1,8, 2,0 and 2,5 mm), please use following multiplicative coefficients for the environmental indicators considered ($EI_x$):

**Table 11: Calculation rules for Environmental Categories of different thickness**

| | 1,5 mm thickness | 1,8 mm thickness | 2,0 mm thickness | 2,4 mm thickness |
|---|---|---|---|---|
| **Mapeplan Plus** | $EI_{1,5}$***1** | $EI_{1,5}$ ***1,22** | $EI_{1,5}$***1,39** | $EI_{1,5}$***1,67** |

$EI_{1,5}$: Environmental Indicator for Mapeplan Plus with 1,5 mm thickness

Tables above show absolute results for each environmental impact category. They clearly indicate that product stage (**A1 – A3)** has the highest contribution in each category and accounts for up to 99% of the total impact in the whole system boundary.

In particular, PVC compounds, plasticizers and reinforcing materials, which are some of the main components in Mapeplan formulations, carry a significant impact for all environmental categories. A detail of the impacts of module A1 on $GWP_{100}$ is shown in Table 13.

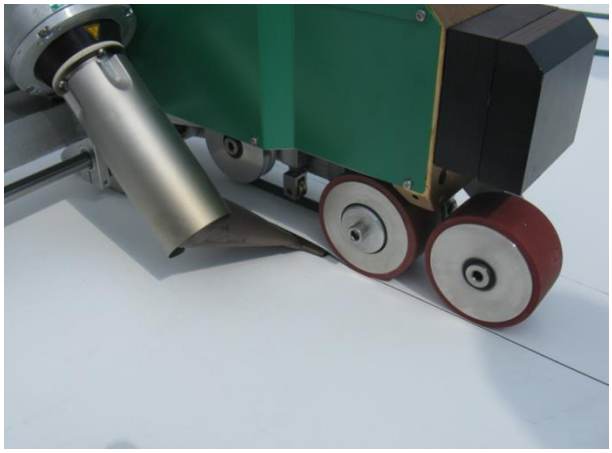


**Figure 5: Installation process detail**

Electricity consumption considerably affects the $GWP_{100}$ and ADP (fossil).

In terms of $GWP_{100}$, module **A5** gives a visible contribution, considering that during the installation phase it's necessary to take into account a membranes overlap between 5% and 6%.

Transportation modules (**A2, A4**), have both relevant importance while **C2** module has an unremarkable impact.

Only for transportation modules **A2** and **A4**, POCP shows negative contributions, due to $NO_2$ and NO emission factors as reported in CML2001 methodology.

Figure 5 shows the hot air welding of Mapeplan by an automatic machine (ref. Leister Varimat V2) and Figure 6 shows the Mapeplan installed on a roof with gravel ballast.

**Figure 6: Installation with ballast**

Following tables show the relative contributes for all environmental categories considered in this EPD.

**Table 12: Environmental Impact as percentage of Mapeplan Plus**

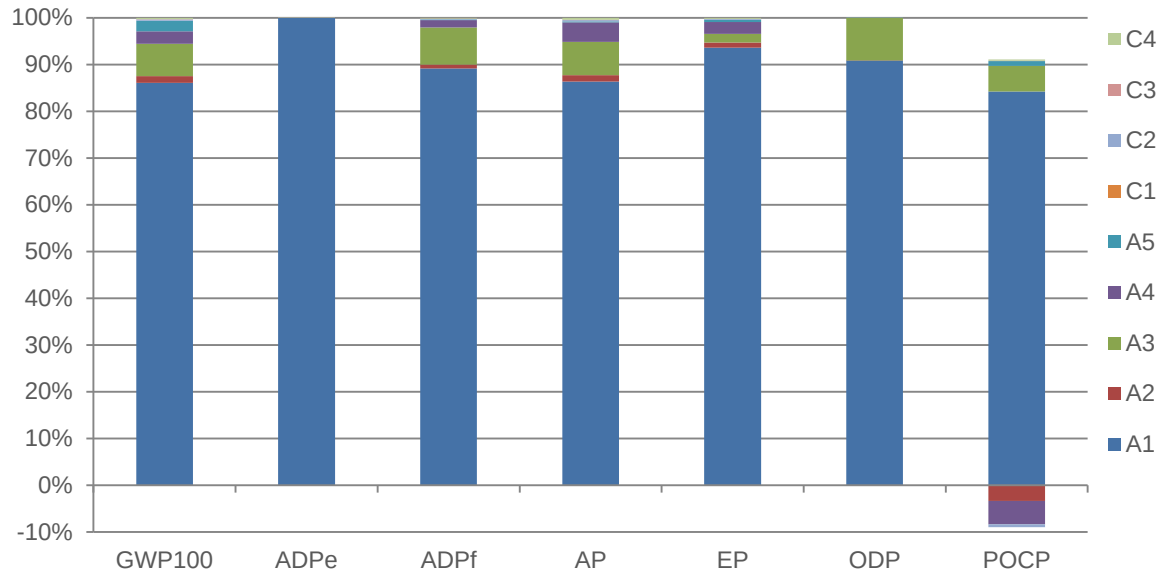
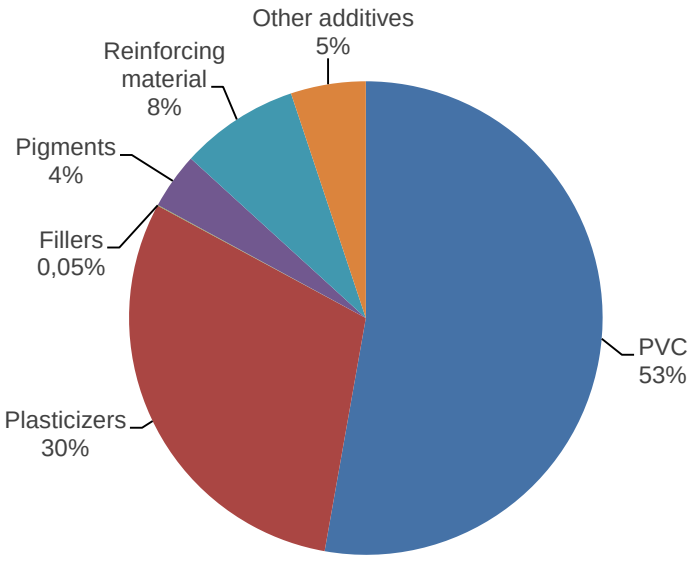



**Table 13: Detail of the module A1 on $GWP_{100}$**




More details about electrical mix used in this EPD (Italian grid mix – 2013), is shown below:

| | Data source | Amount | Unit |
|---|---|---|---|
| Electricity grid mix (IT) – 2013 | GaBi database | 0,429 | kg $CO_2$-eqv/kWh |

# 8. Data Quality

Table 14: data quality

| Dataset & Geographical reference | Database (source) | Temporary reference |
|---|---|---|
| **A1** | | |
| PVC compounds | Ecoinvent 3.3 Database | 2011 - 2012 |
| Reinforcing materials | Thinkstep Database | 2016 |
| Additives | Thinkstep & Ecoinvent 3.3 | 2010 - 2015 |
| Electricity grid mix (IT) | Thinkstep Database | 2013 |
| **A2 (Transport)** | | |
| Truck transport (27 ton payload – GLO) | Thinkstep Database | 2015 |
| Diesel for transport (EU) | Thinkstep Database | 2012 |
| **A3 (production)** | | |
| Wastes (EU & DE) | Thinkstep Database& PlasticEurope | 2005 - 2013 |
| Packaging (EU) | Thinkstep Database& PlasticEurope | 2005 - 2013 |
| Diesel mix (EU) | Thinkstep Database | 2011 |
| Waste water treatment (EU) | Thinkstep Database | 2010 |
| Landfill for plastic waste (EU) | Thinkstep Database | 2016 |
| Landfill for inert matter (EU) | Thinkstep Database | 2016 |
| **A4 (Transport)** | | |
| Truck transport (27ton payload – GLO) | Thinkstep Database | 2015 |
| Diesel for transport (EU) | Thinkstep Database | 2012 |
| Ocean ship (27500 DWT payload – GLO) | Thinkstep Database | 2015 |
| Heavy fuel oil for ship transport (EU) | Thinkstep Database | 2012 |
| **A5 (Installation)** | | |
| Electricity grid mix (EU) | Thinkstep Database | 2012 |
| Landfill for plastic waste (EU) | Thinkstep Database | 2016 |
| Landfill for wood waste (EU) | Thinkstep Database | 2016 |
| Landfill for paper waste (EU) | Thinkstep Database | 2016 |
| Landfill for metal waste (EU) | Thinkstep Database | 2016 |
| **C1-C4 (End of Life)** | | |
| Truck transport (9,3 ton payload – GLO) | Thinkstep Database | 2016 |
| Electricity grid mix ( EU) | Thinkstep Database | 2012 |
| Landfill for inert matter (EU) | Thinkstep Database | 2016 |
| Construction waste treatment (DE) | Thinkstep Database | 2016 |

All data included in table above refer to a period between 2005 and 2016; the most relevant ones are European or specific from supplier, while the others (i.e. transport and minor contribution dataset) come from European and global databases.

All dataset are no more than 10 years old (according to EN 15804 § 6.3.7 *"Data quality requirements"*). Unique exception is due to one packaging component coming from PlasticEurope database.

Primary data are about the years 2016 and 2017 and represent the entire annual production.

# 9. Verification and Registration

EPD of construction products may not be comparable if they do not comply with EN 15804

Environmental product declarations within the same product category from different programs may not be comparable

| CEN standard EN15804 served as the core PCR | |
|---|---|
| PCR: | PCR 2012:01 Construction products and Construction services, Version 2.2, 2017-05-30 |
| PCR review was conducted by: | The Technical Committee of the International EPD® System. Chair: Massimo Marino<br><br>Contact via info@environdec.com |
| Independent verification of the declaration and data, according to ISO 14025 | ☒ EPD Process Certification (Internal)<br><br>☐ EPD Verification (external) |
| Third party verifier: | Certiquality S.r.l.<br><br>Number of accreditation: 003H rev14 |
| Accredited or approved by: | Accredia |

# 10. References


- GENERAL PROGRAMME INSTRUCTIONS OF THE INTERNATIONAL EPD® SYSTEM. VERSION 3.0
- PCR 2012:01; “PRODUCT GROUP CLASSIFICATION: MULTIPLE UN CPC CODES CONSTRUCTION PRODUCTS AND CONSTRUCTION SERVICES”; VERSION 2.2
- PCR 2014:12 FLEXIBLE SHEETS FOR WATERPROOFING - BITUMEN , PLASTIC OR RUBBER SHEETS FOR ROOF WATERPROOFING
- EN 13956 ”FLEXIBLE SHEETS FOR WATERPROOFING – PLASTIC AND RUBBER SHEETS FOR ROOF WATERPROOFING – DEFINITIONS AND CHARACTERISTICS”


## Contact information

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