ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	Armacell International S.A.
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-ARM-20240587-IBI1-EN
Issue date	04.04.2025
Valid to	03.04.2030

ArmaPET Struct

Armacell Benelux Scomm

Institut Bauen und Umwelt e.V.

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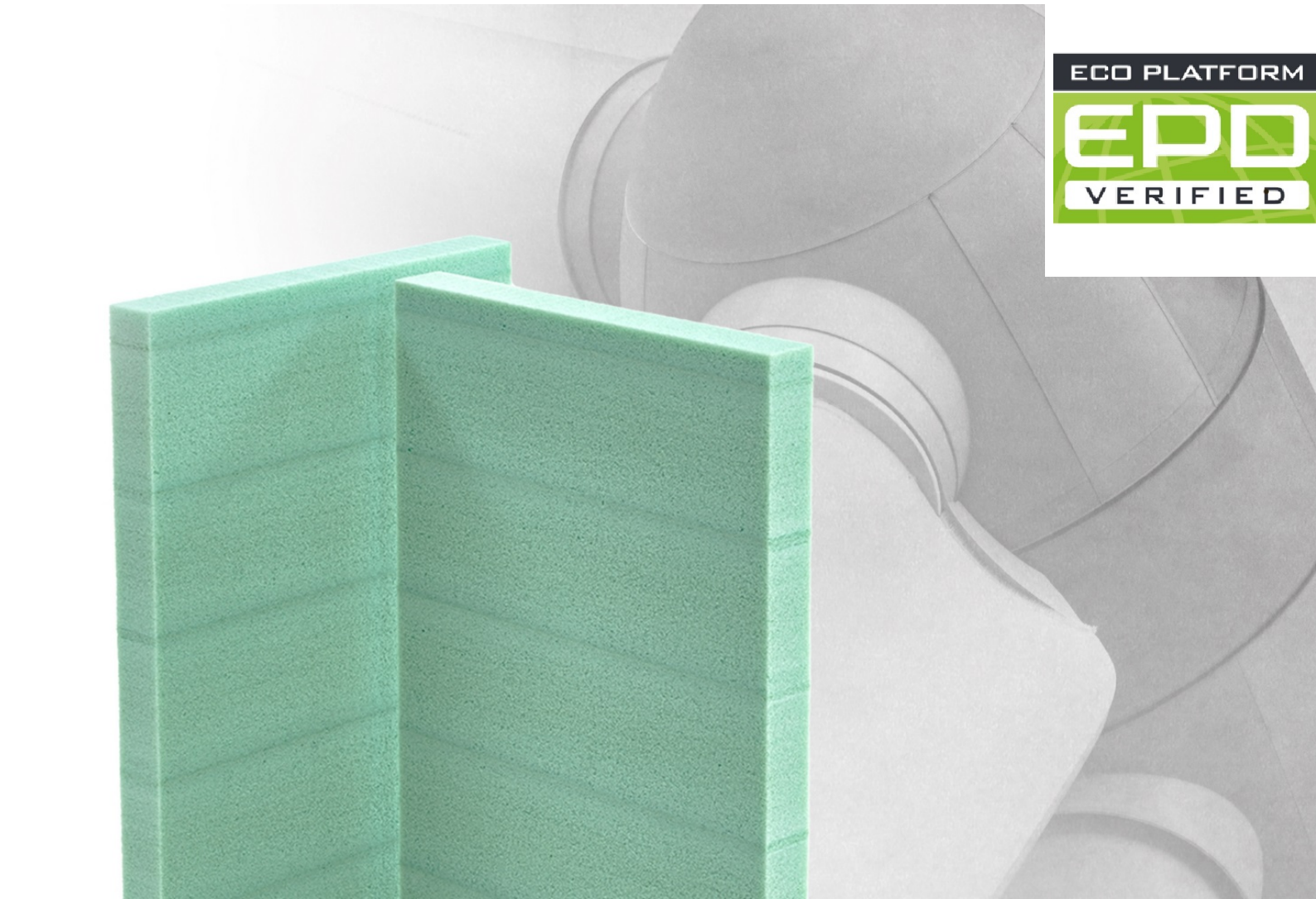


1. General Information

Armacell Benelux Scomm

Programme holder

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number

EPD-ARM-20240587-IBI1-EN

This declaration is based on the product category rules:

Insulating materials made of foam plastics, 01.08.2021
(PCR checked and approved by the SVR)

Issue date

04.04.2025

Valid to

03.04.2030

Dipl.-Ing. Hans Peters
(Chairman of Institut Bauen und Umwelt e.V.)

Florian Pronold
(Managing Director Institut Bauen und Umwelt e.V.)

ArmaPET Struct

Owner of the declaration

Armacell International S.A.
Westside Village, Rue Pafebruch 89B
8308 Capellen
Luxembourg

Declared product / declared unit

The declared product is the ArmaPET Struct. The declared unit relates to 1 m³ of product, with an average density of 100,00 kg/m3. The packaging is also included in the calculation. The declared unit is given in [m³].

Scope:

This document relates to ArmaPET Struct. For the creation of the life cycle assessment, specific data was collected from the manufacturing plant in Thimister-Clermont in Belgium of the Armacell Group, which corresponds to the annual average and is based on data from 2023 (see 3.6 allocation). The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard EN 15804 serves as the core PCR
Independent verification of the declaration and data according to ISO 14025:2011
☐ internally ☒ externally

Dr. Matthew Fishwick,
(Independent verifier)

2. Product

2.1 Product description/Product definition

ArmaPET Struct offers a flexible and long-lasting solution for structural sandwich applications, while also prioritizing environmental sustainability by utilizing 100 % recycled plastic bottles. The material's closed-cell structure and water resistance guarantee consistent thermal conductivity over extended periods of use. Moreover, its limited variation in product properties enhances the stability of the manufacturing process for composite parts. The thermal and dimensional stability of ArmaPET Struct enables a high level of repeatability in various converting processes. Additionally, its good fatigue resistance ensures long-term performance and reduces maintenance costs throughout its lifespan. Moreover, the material is capable of being thermoformed into curved shapes, welded during pre-fabrication or on site, and is adaptable for a wide range of finishing options. Its thermoplastic properties also enable the material to be fully recyclable after its use. Thanks to Armacell's patented rPET technology, ArmaPET Struct is based on recycled PET and is produced using an energy and resource-efficient process: incorporating the reuse of waste materials and eliminating the use of ozone-depleting Hydrofluorocarbon (HFC) or Clorofluorocarbons (CFC) blowing agents. National regulations should be followed for the application and use of the product. For the use and application of the product, the respective national provisions at the place of use apply, in Germany for example the building codes of the federal states and the corresponding national specifications.

2.2 Application

ArmaPET Struct foam boards provide exceptional mechanical properties and minimal resin absorption during infusion processes. With densities ranging from 70-320 kg/m³, these boards are suitable for a wide range of applications in industries including wind rotors, transportation, rail, sports and leisure, building and construction, and general industries.

2.3 Technical Data

The following table provides nominal values for the mechanical properties of ArmaPET Struct. Detailed values for the different density grades and minimum specified properties are available in the supplier technical datasheets or on request.

Technical Datasheet

Name	Value	Unit
Gross density	70 - 320	kg/m^3
Compressive Strength acc. to EN 844	0.75 - 7.0	MPa
Compression Modulus acc. to EN 844	110 - 320	MPa
Thermal conductivity at 23°C	0.03 - 0.05	W/(mK)
Shear Strength acc. to ISO 1922	0.5 - 2.1	MPa
Shear Modulus acc. to ISO 1922	13 - 90	MPa
Shear Strain acc. to ISO 1922	15 - 2	%
Tensile Strength acc. to ASTM C 297	1.8 - 4.8	MPa
Tensile Modulus acc. to ASTM C 297	66 - 350	MPa
Reaction to fire acc. to EN 13501-1	E	Class

Performance data of the product with respect to its characteristics in accordance with the relevant technical provision (no CE-marking)

2.4 Delivery status

ArmaPET Struct is supplied in boards. The thickness range covers 5-150 mm, with standard widths of 1008 and 1220 mm and standard length of 2448 mm. ArmaPET Struct is manufactured in varieties of different densities from 70 kg/m³ up to 320 kg/m³.

2.5 Base materials/Ancillary materials

Name	Value	Unit
Recycled PET	>85	wt.-%
Fillers and modifiers	<15	wt.-%
Blowing agent	0.5-4	wt.-%

ArmaPET® Struct is a low-density, closed-cell foam, produced based on recycled PET. Mechanically recycled PET is mixed in a molten state with additives that ensure a stable foaming process. These include nucleating agents, viscosity modifiers, foam stabilisers and a physical blowing agent.

The nucleating agent determines the foam's cell size distribution. The viscosity modifier ensures sufficient melt strength for foaming by increasing the molecular weight of the PET, broadening its molecular weight distribution and introducing long-chain branches. The physical blowing agent expands the foam to achieve the required density range. Eventually, the additional modifiers and stabilisers support the process stability and help to avoid cell coalescence.

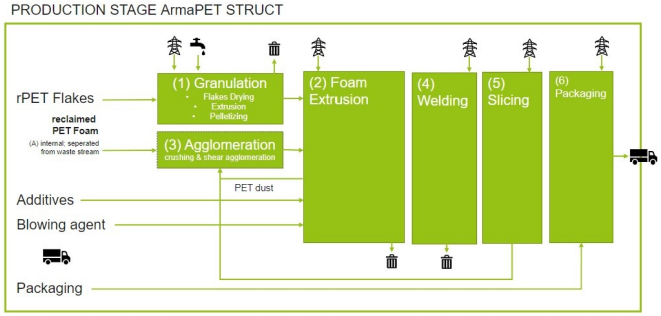
This product contains substances listed in *the candidate list* (date: June 2024) exceeding 0.1 percentage by mass: **no**.

This product contains other carcinogenic, mutagenic, reprotoxic (CMR) substances in categories 1A or 1B which are not on *the candidate list*, exceeding 0.1 percentage by mass: **no**.

Biocide products were added to this construction product or it has been treated with biocide products (this then concerns a treated product as defined by the (EU) Ordinance on Biocide Products No. 528/2012): **no**.

2.6 Manufacture

ArmaPET Struct foam boards are manufactured based on mechanically recycled PET, applying the patented technology of Armacell. This method is based on reprocessing postconsumer PET waste to produce recycled flakes, after separation of the polymer from contaminants. It includes sorting and separating waste, washing it to remove any dirt and contaminants, and further grinding, crushing and sorting carried out by Armacell's suppliers. The recycled product is compliant with the predefined specification of Armacell and is supplied in the form of flakes and granules.
At Armacell, the flakes are processed into granules by melt extrusion. The granulation process includes pre-drying the flakes to avoid hydrolysis in the extrusion process. The predried flakes are fed into an extruder where the material is molten and homogenized. A vacuum extraction section is used to remove volatile contaminants from the melt. After final filtration the material is granulated by underwater cutting followed by crystallization of the obtained rPET granules.



Obtained recycled PET granules are further processed into foam through foaming extrusion, in the presence of halogenfree

supercritical fluid used as a physical blowing agent. Further components of the foam include additives for foam nucleation, cell stabilization and melt modification. The patented method of rPET treatment and modification during melt processing allows Armacell to overcome the main disadvantage of mechanical recycling – a decline in the product quality – and to upgrade the quality despite the thermal degradation, photo-oxidation and mechanical stresses.

Another component of the formulation is 'PET Agglomerate', which is obtained from reclaimed PET foam.
The primary source of agglomerate is the PET dust generated by the lateral and surface grinding operations (in the) downstream of the foam extrusion process (internal loop). Another source of agglomerate is PET foam which is diverted from the waste stream of other PET foam products at Armacell. All reclaimed foam cut-offs are crushed and compacted in a first step. In the second step, the precompacted particles are mixed with reclaimed PET dust and partially molten by shear forces and formed into agglomerate through a template.

In the first step, foamed PET boards with homogeneous and closed-cell structures are extruded, calibrated, edge cut and surface grinded to obtain extruded boards as an intermediate product.

The extruded boards are thermowelded to larger blocks. The final ArmaPET Struct foam panels are sliced from the blocks, perpendicular to the direction of extrusion.

2.7 Environment and health during manufacturing

All our plants employ environmental monitoring systems, and we exchange ideas and best practices via the internal communications network. We collect key performance indicators on energy use, CO_2 emissions, water consumption and waste management in order to evaluate and continually improve our sustainability performance. 13 of Armacell's plants are environmentally certified acc. to *ISO 14001*, and the energy management systems at our German facilities in Münster and Friesenhofen are certified to *ISO 50001* as well. Environmental management at Armacell is implemented in line with the 'Environment' pillar of the World-Class Armacell Mindset Manufacturing program. This program maintains consistency in standards and sustains the implementation of improved processes. It is based on the systematic identification of losses and non-value-added tasks at Armacell's multi-technology sites.

2.8 Product processing/Installation

ArmaPET® Struct can be used on its own and/or as part of a system, depending on the application. It can be handled and installed without any special precautions for personal and environmental protection. Further advice on handling and installation can be found in the related product literature provided by the manufacturer.

2.9 Packaging

ArmaPET Struct boards are stacked on reusable wooden pallets for transport and storage. These pallets comply with the *ISPM15* regulation. All pallets are protected in a way that prevents damage at the corners of the boards, and plastic wrapping ensures protection from moisture and dirt. The polyethylene- and carton-based packaging elements are recyclable and (actually) recycled in the countries having a return system.

2.10 Condition of use

When the products are used for the purpose for which they are intended, there are no changes in the material composition during use, except in the event of extraordinary impacts (see 2.14).

2.11 Environment and health during use

ArmaPET® Struct does not contain any Substances of Very High Concern (SVHC) or any compounds that are persistent, bioaccumulative and/or toxic (PBT). No environmental damage or health risks are to be expected during normal conditions of use.

2.12 Reference service life

ArmaPET® materials are long-lasting products with a designed lifetime of 25 to 50 years. The service life is practically only restricted by the lifetime of the application.
Description of the influences on the ageing of the product when applied in accordance with the rules of technology.

2.13 Extraordinary effects

Fire

According to the European fire classification system, ArmaPET® Struct is classified as combustible insulation material of Euroclass E, tested as per *EN ISO 11925-2* by means of the ignitability test. For classes A2 to D, additional classification using the SBI test procedure (Single Burning Item test) in accordance with *EN 13823* is required.

Fire protection

Name	Value
Building material class acc. to EN13501-1	E

Water

ArmaPET® Struct is chemically neutral, not water soluble, and if used for the intended purpose does not release any water-soluble substances that might pollute groundwater, rivers or oceans.

Mechanical destruction

ArmaPET® Struct is designed for load-bearing and non-load-bearing (semi-) structural insulation applications. It can withstand certain mechanical impacts during handling and storage without significant damage.

2.14 Re-use phase

In the non-contaminated form, the product is fully recyclable by a mechanical recycling scheme for PET. It could be shredded into smaller pieces and reprocessed to granules using extrusion and reused as tertiary recycled pellets in the non-food contact applications (e.g. for foaming processes, fibres spinning, injection moulding, etc.).
In case of severe contamination and problems with separation, the product could be recycled via chemical recycling with bis(2-hydroxyethyl) terephthalate (BHET) or dimethyl terephthalate (DMT) or monomers purified terephthalic acid and monoethylene glycol (PTA and MEG, respectively) recovery, depending on the recycling method (glycolysis or hydrolysis).

2.15 Disposal

Dispose of the materials according to local regulations.
Regulated by the *European Waste Catalogue*: Waste code 07 420 (other non-hazardous plastic waste). Note: Please observe *Commission Decision 2001/118/EC*.

2.16 Further information

Further Information on ArmaPET Struct can be found on the manufacturer's website armacell.com

3. LCA: Calculation rules

3.1 Declared Unit

The declared product is an ArmaPET Struct Portfolio with a reference density of 100 kg/m³. The reference value of 100 kg/m³ allows easy conversion to other densities. The declared unit relates to 1 m³ of product. The packaging with 7.620 kg per m³ is also included in the calculation. The following table shows the data of the declared unit.

Declared unit and mass reference

ArmaPET Struct is produced in a broad range of densities. In this EPD, the results have been evaluated based on the average produced density and are declared for a reference density of 100 kg/m³ for simple conversion to other densities. The carbon footprint of the material is mainly linked to the quantity of raw material used. The energy consumption of the main processes is linked to the quantity of raw material to be molten, and grinding/slicing losses are linked to the density of the foam. Therefore, the linear interpolation of the results based on the density of the individual grade provides robust data.

Name	Value	Unit
Gross density	100	kg/m^3
Declared unit	1	m^3
Weight	100	kg

The ArmaPET Struct range includes densities of 70, 80, 100, 115, 135, 150, 200, 250, kg/m³. Material provision and production can be scaled linearly to the density. Only the packaging does not scale linearly.

Other declared units are allowed if the conversion is shown transparently.

3.2 System boundary

The type of the EPD is from the cradle to the gate with options. The following information modules are defined as system limits in this study:

A1–A5 Product development:
A1 – Production of raw materials
A2 – Transport to the manufacturer
A3 – Production
A4 – Transportation to the construction site
A5 – Installation in the building

End of life stage (C1- C4):
C1, deconstruction/demolition,
C2, transport,
C3, waste treatment ,
C4, disposal.

Reuse, recovery and recycling potential (D)

In order to accurately record the indicators and environmental impacts of the declared unit, a total of 10 information modules are taken into account. Information modules A1 to A5 describe the provision of materials, transportation to the production site and the production processes of the product itself, transportation to the construction site and installation in the building

3.3 Estimates and assumptions

The supplier was unable to provide specific data for the rPET flakes. In the background databases, only rPET pellets are available. Therefore, for the calculation of the rPET flakes in module A1, the background data for rPET pellets without the influence of the electrical energy from the pelletizing process was used. This assumption is important for the overall calculation of the Environmental Product Declaration (EPD) to avoid double counting, as a specific pelletizing process at Armacell is calculated for this material in module A3.

3.4 Cut-off criteria

All information modules of this calculation are recorded in the way, that the requirements of the EN 15804+A2 are met. No inputs and output flows are cut- off in this calculation.

3.5 Background data

The background data from the *LCA for Experts* databases, which are also used in this study, are documented under the following link (Sphera).
The *ecoinvent 3.9.1* database was used as an alternative for datasets that were not available in the LCA for Experts database.

https://lcadatabase.sphera.com
http://www.ecoinvent.org

3.6 Data quality

In preparing the life cycle assessment (LCA), specific data for the Thimister-Clermont plant in Belgium was collected from Armacell International S.A. for the year 2023. The background data sourced from the LCA for Experts and ecoinvent 3.9.1 databases are from the year 2024, ensuring high relevance. The masses of the various components of the insulation boards were derived from composition data. The data quality, along with temporal and geographical classifications, has been evaluated as sufficient.

3.7 Period under review

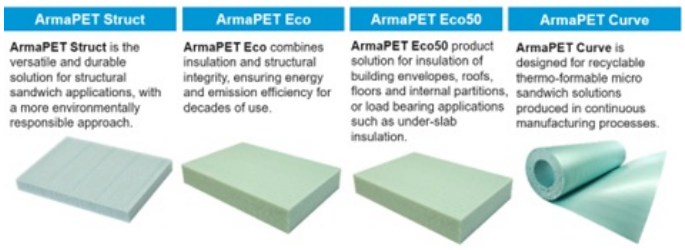
The life cycle inventory data provided by the manufacturer life cycle inventory are from the year 2023 and correspond to the
annual average.

3.8 Geographic Representativeness

Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: Europe

3.9 Allocation

The data presented in this EPD for ArmaPET Struct are collected based on the yearly manufacturing output of the Armacell's plant in Thimister-Clermont/ Belgium. Currently, this is the only location manufacturing Struct. In general, the split between all the manufactured items covers:



with a total mass of all the manufactured foams equal to 8.175.993 kg, out of which 7.644.013 kg accounts for ArmaPET Struct.

The data linked to energy and water consumption are collected collectively at the plant level and are allocated to the processes used in the PET Struct production based on individual allocation factors for the processes. The energy consumption data are collected separately for the extrusion, granulation and warehousing operations and are allocated to PET Struct production based on those allocation factors. The total waste, measured separately on a yearly basis for all the produced items is allocated based on the total allocation factor for Struct.

3.10 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account. The database referred to in this study is *LCA for experts* from *Sphera* and *ecoinvent 3.9.1*

4. LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon

No renewable raw materials are used for the product. The biogenic carbon is therefore indicated as zero. The following raw materials contain biogenic carbon in the packaging.

Information on describing the biogenic carbon content at factory gate

Name	Value	Unit
Biogenic carbon content in accompanying packaging	3.066	kg C

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO_2.

Transport to the building site (A4)

The transportation model assumes a world-wide construction site. The scenario for the distribution phase assumes a standard distance of 1180 km by truck and 7300 km by container ship.
The transported quantity corresponds to the transportation of the products and their packaging to the construction site.

Name	Value	Unit
Transport distance	8480	km
Gross density of products transported	107.62	kg/m^3

Installation into the building (A5)

The application phase considers:
- Product losses
- Waste treatment (product losses, product packaging).

Products are installed on the floor or on the wall manually. There are different ways to install the product, it could be fixed with adhesive, mechanical fixing, etc. The most representative application is just laid out on the floor and kept in place by the weight of the floor. Due to the different methods, auxiliary parts (screws, adhesive) are not included in the model.

Name	Value	Unit
Material loss	3	kg
Plastic Packaging Waste	0,134	kg
Cardboard Waste	1,363	kg
Wood Waste	6,12	kg

End of life (C1-C4)

When the product is installed, there is a material loss of 3 % due to cutting, which is accounted for in module A5.

At the end of its service life, the product is dismantled by hand so that no additional energy expenditure for dismantling is taken into account in module C1. The construction waste produced is transported by truck over 50 km to the waste treatment plant (Module C2).

A recycling rate of 95 % and thermal recovery of 5 % is assumed for module C3. The energy generated during thermal recovery and the recycling potential are shown in Module D.

Alternatively, scenario C3/1 describes 100 % thermal recycling, in which the entire material is incinerated. The energy generated in this process is taken into account as a substitution effect in Module D/1.

Name	Value	Unit
Collected separately waste type waste type	97	kg
Recycling	92.15	kg
Energy recovery	4.85	kg
Energy recovery C3/1	97	kg

In this EPD, the cut-off approach (including recycled content) and the end-of-life allocation method are used for both the foreground and background processes.

Reuse, recovery and/or recycling potentials (D), relevant scenario information

This study assumes 2 scenarios for the end-of-service life:
Scenario D: Module D shows the recovery of waste from the specified unit. It is assumed that 95 % is recycled and 5 % is thermally recovered. Due to the use of 45,957 kg of PET foam from other production lines, these are not taken into account in Module D in order to avoid double counting

Scenario D1: Module D1 shows the utilisation of the waste from the specified unit. It is assumed that 100 % is thermally utilised. Due to the use of 45,957 kg of PET foam from other production lines, these are not included in module D1 in order to avoid double counting.

Name	Value	Unit
Recycling ArmaPET Struct	48,4	kg

5. LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

Product stage			Construction process 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
X	X	X	X	X	MND	MND	MNR	MNR	MNR	MND	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 m³ ArmaPET Struct

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C3/1	C4	C4/1	D	D/1
GWP-total	kg CO_2 eq	1.3E+02	1.83E+01	1.19E+01	0	3.93E-01	3.81E-01	1.2E+02	0	0	-6.55E+01	-3.59E+01
GWP-fossil	kg CO_2 eq	1.42E+02	1.81E+01	1.02E-01	0	3.87E-01	3.75E-01	1.2E+02	0	0	-6.54E+01	-3.59E+01
GWP-biogenic	kg CO_2 eq	-1.18E+01	0	1.18E+01	0	0	0	0	0	0	0	0
GWP-luluc	kg CO_2 eq	4.08E-01	1.62E-01	-6.14E-04	0	6.4E-03	6.21E-03	2.22E-03	0	0	-7.96E-02	-3.28E-03
ODP	kg CFC11 eq	3.12E-06	1.61E-12	-4.04E-11	0	3.84E-14	3.72E-14	9.06E-12	0	0	-2.34E-06	-3.25E-10
AP	mol H^+ eq	3.84E-01	1.65E-01	-7.78E-03	0	4.6E-04	4.46E-04	1.3E-02	0	0	-2.55E-01	-3.8E-02
EP-freshwater	kg P eq	3.47E-02	4.34E-05	-1.74E-06	0	1.62E-06	1.58E-06	2.72E-06	0	0	-2.61E-02	-6.06E-05
EP-marine	kg N eq	1.29E-01	6.88E-02	-1.39E-03	0	1.58E-04	1.53E-04	3.98E-03	0	0	-7.77E-02	-1.16E-02
EP-terrestrial	mol N eq	1.1E+00	7.57E-01	-1.18E-02	0	1.91E-03	1.85E-03	6.34E-02	0	0	-6.27E-01	-1.24E-01
POCP	kg NMVOC eq	9.8E-01	1.89E-01	-4.44E-03	0	4.34E-04	4.21E-04	1.11E-02	0	0	-2.29E-01	-3.27E-02
ADPE	kg Sb eq	5.67E-04	1E-06	-2.4E-07	0	3.24E-08	3.14E-08	3.64E-07	0	0	-4.13E-04	-3.15E-06
ADPF	MJ	3.6E+03	2.23E+02	-1.23E+02	0	4.97E+00	4.82E+00	2.39E+01	0	0	-1.15E+03	-6.42E+02
WDP	m^3 world eq deprived	2.71E+01	1.59E-01	1.76E+00	0	5.67E-03	5.5E-03	1.08E+01	0	0	-2.41E+01	-3.98E+00

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential)

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 m³ ArmaPET Struct

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C3/1	C4	C4/1	D	D/1
PERE	MJ	8.12E+02	1.11E+01	1.09E+02	0	4.07E-01	4.11E+01	5.92E+00	0	0	-1.36E+02	-2.17E+02
PERM	MJ	1.18E+02	0	-1.18E+02	0	0	0	0	0	0	0	0
PERT	MJ	9.31E+02	1.11E+01	-9.06E+00	0	4.07E-01	4.11E+01	5.92E+00	0	0	-1.36E+02	-2.17E+02
PENRE	MJ	1.37E+03	2.23E+02	-1.08E+02	0	4.82E+00	6.2E+01	2.24E+03	0	0	-1.15E+03	-6.42E+02
PENRM	MJ	2.24E+03	0	-1.53E+01	0	0	0	-2.22E+03	0	0	0	0
PENRT	MJ	3.6E+03	2.23E+02	-1.23E+02	0	4.82E+00	6.2E+01	2.39E+01	0	0	-1.15E+03	-6.42E+02
SM	kg	4.6E+01	0	0	0	0	0	0	0	0	6.08E+01	0
RSF	MJ	0	0	0	0	0	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0	0	0	0	0	0
FW	m^3	1.06E+00	1.26E-02	3.22E-02	0	4.58E-04	4.76E-02	2.53E-01	0	0	-5.65E-01	-1.67E-01

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; 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; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 m³ ArmaPET Struct

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C3/1	C4	C4/1	D	D/1
HWD	kg	2.65E-07	7.11E-09	-8.65E-09	0	1.56E-10	8.13E-08	1.13E-08	0	0	-2.69E-08	-4.4E-07
NHWD	kg	1.19E+00	2.89E-02	2.58E-01	0	7.5E-04	8.2E-02	5.7E-01	0	0	-2.05E-02	-3.36E-01
RWD	kg	2.63E-01	2.75E-04	-8.98E-03	0	6.23E-06	9.05E-03	1.15E-03	0	0	-2.94E-03	-4.81E-02
CRU	kg	0	0	0	0	0	0	0	0	0	0	0
MFR	kg	0	0	0	0	0	6.08E+01	0	0	0	0	0
MER	kg	0	0	1.02E+01	0	0	3.2E+01	5.24E+01	0	0	0	0
EEE	MJ	0	0	2.76E+01	0	0	1.05E+01	1.72E+02	0	0	0	0
EET	MJ	0	0	4.96E+01	0	0	1.89E+01	3.09E+02	0	0	0	0

HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1 m³ ArmaPET Struct

Parameter	Unit	A1-A3	A4	A5	C1	C2	C3	C3/1	C4	C4/1	D	D/1
PM	Disease incidence	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
IR	kBq U235 eq	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ETP-fw	CTUe	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HTP-c	CTUh	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
HTP-nc	CTUh	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SQP	SQP	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

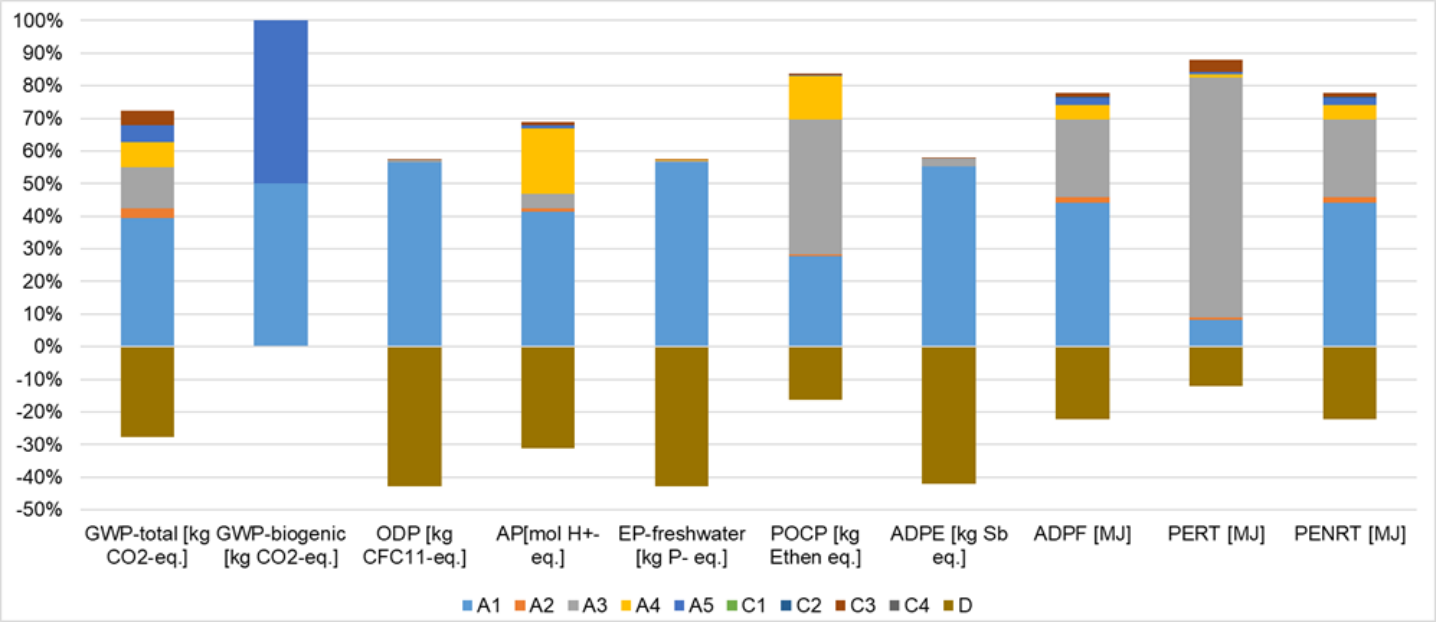
PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

Disclaimer 1 – for the indicator “Potential Human exposure efficiency relative to U235”. 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 or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators “abiotic depletion potential for non-fossil resources”, “abiotic depletion potential for fossil resources”, “water (user) deprivation potential, deprivation-weighted water consumption”, “potential comparative toxic unit for ecosystems”, “potential comparative toxic unit for humans – cancerogenic”, “Potential comparative toxic unit for humans - not cancerogenic”, “potential soil quality index”. The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high as there is limited experience with the indicator.

6. LCA: Interpretation

The dominance analysis shows that the main causes of environmental impacts and indicators are to be found in information module A1. This is reflected in the total global warming potential for the provision of materials at approx. 40 %, based on all information modules and a saving of 28 % from information module D. For the total non-renewable primary energy, the value is approx. 44 % in module A1



If we look at the material provision for the product and the packaging in detail, it becomes clear that two raw materials make a decisive contribution to the respective environmental impacts and indicators.

The material provision of the ArmaPET Struct generates approx. 92 % of the total global warming potential and approx. 96 % of the total non-renewable primary energy in information module A1. In the case of wood, it is approx. 6 % of the total global warming potential and approx. 2 % of the total non-renewable primary energy in information module A1.

If we look at the exact composition of ArmaPET Struct, it becomes clear that the main share of the global warming potential lies with the rPET flakes at approx. 90 %.

In information module A3, it becomes clear that the main source of environmental impacts and indicators is the production of ArmaPET Struct, with a global warming potential of 99 %.

7. Requisite evidence

7.1 VOC Emissions
Indoor air emission testing has been carried out according to *EN16516:2017* 'Construction products: Assessment of release of dangerous substances -Determination of emissions into indoor air' at Eurofins Product Testing Denmark in August 2024. The results (wall application) are summarized in the following table. Data for specific grades of the product is provided on request.

AgBB overview of results (28 days [µg/m³])

Name	Value	Unit
TVOC (C6 - C16)	<200	µg/m^3
Sum SVOC (C16 - C22)	<50	µg/m^3
R (dimensionless)	<0.05	-
VOC without NIK	<50	µg/m^3
Carcinogenic Substances	<1	µg/m^3

7.2 Leaching performance

No performance declared.

8. References

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ISO 1922
Rigid cellular plastics — Determination of shear properties

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ISPM 15
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The literature referred to in the Environmental Product Declaration must be listed in full.Standards already fully quoted in the EPD do not need to be listed here again.
The current version of PCR Part A and PCR Part B of the PCR document on which they are based must be referenced.

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