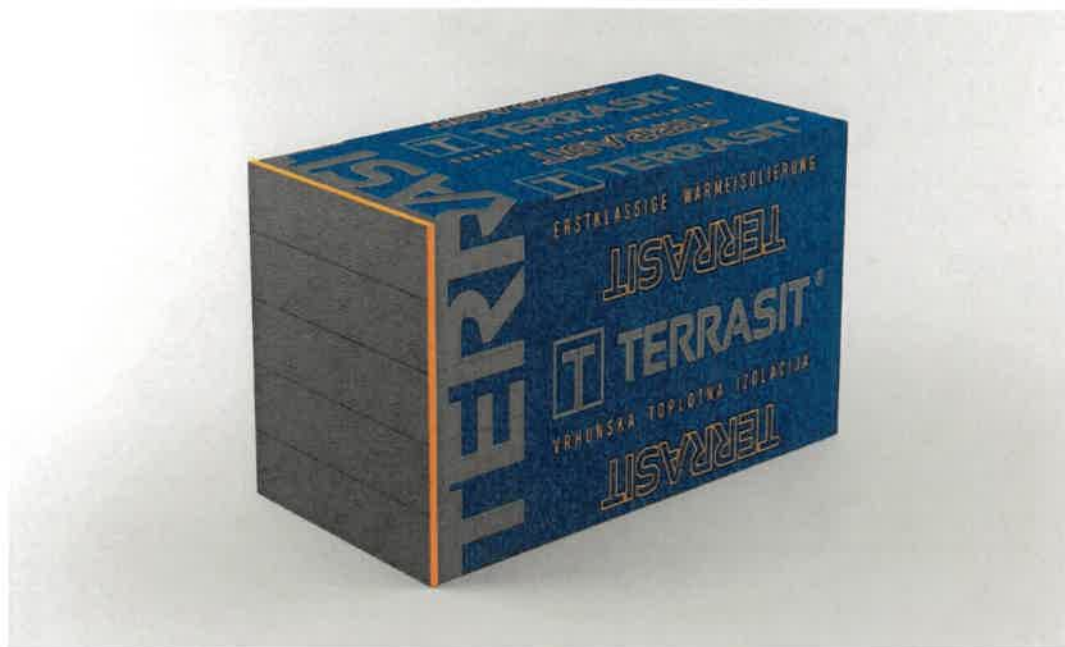


# Environmental Product Declaration

According to ISO 14025 and EN 15804:2012+A2:2019



## Terrasit EPS INSULATION (Gray)

EPD number  
EPD owner  
EPD Program operator  
Issue date  
Valid until

EPD-22/0007  
TERRASIT INSULATION d.o.o., Branilaca grada b.b., BiH  
ZAG EPD  
07. 11. 2022  
06. 11. 2027



[www.zag.si](http://www.zag.si)



<b>General information</b>	<b>Commercial name</b> EPS F GRAPHITE EPS F GRAPHITE R
<b>Program holder:</b> Slovenian National Building And Civil Engineering Institute - ZAG Dimičeva 12 1000 Ljubljana <a href="http://www.zag.si">http://www.zag.si</a>	<b>Owner of the Environmental Product Declaration:</b> TERRASIT INSULATION d.o.o. Branilaca grada b.b. 75320 Gračanica Bosnia and Herzegovina (BiH) <a href="http://www.terrasit.com">www.terrasit.com</a>
<b>Number of the Environmental Product Declaration:</b> EPD-22/0007	<b>Declared unit:</b> 1 m <sup>3</sup> expanded polystyrene rigid foam
<b>This Environmental Product Declaration is based on the Product Category Rules (PCR):</b> Product Category Rules (PCR) Part B: Requirements on the EPD for Insulating materials made of foam plastics. Institut Bauen und Umwelt e.V. (08.01.2019)	<b>Scope:</b> A1-A3, C1-C4 and D EPD for specific products. No average data were used.
<b>Issue date:</b> 07.11.2022  <b>Valid until:</b> 06.11.2027	<b>Verification:</b> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;">         The CEN standard SIST EN 15804 serves as the core Product Category Rule (PCR)       </div> <div style="border: 1px solid black; padding: 5px; margin-top: 5px;">         Independent verification of the EPD according to EN ISO 14025       </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <span><input type="checkbox"/> external</span> <span><input checked="" type="checkbox"/> internal</span> </div>
<b>Production plant:</b> TERRASIT INSULATION d.o.o. Branilaca grada b.b. 75320 Gračanica Bosnia and Herzegovina (BiH)	<b>Title and the handwritten signature of verifier:</b> Anja Lešek, MSc  Slovenian National Building And Civil Engineering Institute - ZAG
<b>Title and the handwritten signature issuer:</b>  mag. Franc Capuder, B.Sc. in Civil Engineering Slovenian National Building And Civil Engineering Institute - ZAG	<b>Title and handwritten signature of leading expert:</b>  Jure Turk, PhD Slovenian National Building And Civil Engineering Institute - ZAG

## 1 Product

### 1.1 Product description



The products (Terrasit EPS F GRAPHITE and Terrasit EPS F GRAPHITE R) are used for thermal and acoustic insulation of buildings. Products are available in different dimensions and with different manufacturing processes. The standard dimensions

of the insulation panels are 1000 x 500 mm and the thickness ranges from 50 mm to 300 mm. The product density is in the range of 13–17 kg/m<sup>3</sup>.

### 1.2 Technical Data

Basic characteristic of Terrasit EPS panels are summarised in Table 1.

*Table 1: Overview of the products and their properties*

Commercial name	Technical data	Picture of product
EPS F GRAPHITE	Gross density 17 kg/m <sup>3</sup> Tensile strength 0.15 N/mm <sup>2</sup> Flexural strength 0.15 N/mm <sup>2</sup> Thermal conductivity 0.031 W/(mK) Water vapour diffusion resistance factor 20-70 (EN 12088) Maximum water absorption 2.5%	
EPS F GRAPHITE R	Gross density 17 kg/m <sup>3</sup> Tensile strength 0.1 N/mm <sup>2</sup> Flexural strength 0.07 N/mm <sup>2</sup> Thermal conductivity 0.031 W/(mK) Water vapour diffusion resistance factor 20-40 (EN 12088) Maximum water absorption 2.0%	

### 1.3 Application

The range of products considered in this EPD is used in construction for wall insulation, External Thermal Insulation Composite System (ETICS), pitched roof insulation and ceiling insulation.

### 1.4 Base materials

Insulation boards Terrasit EPS Insulation (Gray) are made of polystyrene (90% of weight) and graphite (up to 4%). The pentane is used as a blowing agent (up to 5.5% of weight). The pentane is being partially removed during or at the end of production. For the preparation of the flame-retardant polystyrene granulate up to 1.5% of polymeric flame-retardant is added. Polymer FR (FR-2025) is a brominated styrene-butadiene copolymer (CAS no. 1195978-93-8) that is not subjected to the REACH Regulation for substances

of very high concern. Terrasit EPS panels also include <1,5% of isopentane gas.

### 1.5 Manufacturing process

The process of converting EPS beads into cellular plastic insulation (figure 1) consists of three production phases: pre-expansion, conditioning and block forming. During the pre-expansion and moulding phase, the steam-assisted heating causes the expansion of the pearls by the pentane blowing agent. The finished shape of panels is obtained by hot wire cutting or grinding of the EPS blocks. The cut-off parts are used for the production of EPS F GRAPHITE R with 12% of recycled EPS beads and 88% of virgin EPS beads. EPS granulate is transported from producer to the plant located in Branilaca grada b.b., BiH.

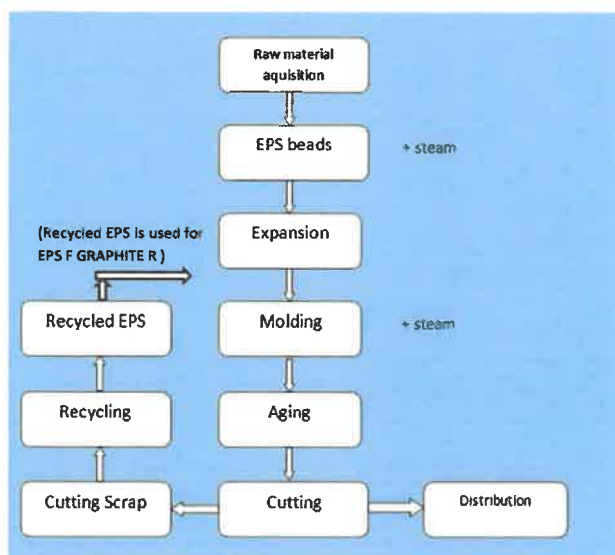


Figure 1: Flowchart of the production process.

## 1.6 Packaging

The boards are packed with polyethylene foil. The packaging foil is recyclable and is collected by qualified disposal companies.

## 1.7 Environment and health during manufacturing

No special precautions shall be taken with regard to the safety and protection of the environment with regard to the use of the product and its installation. Product-specific handling recommendations can be found in product and application literature, brochures and data sheets. No further health protection measures, other than those prescribed for the production process are required at any step of the EPS conversion. EPS insulation has been in use for more than 50 years and has no known negative effects on people, animals or the environment. For the production of EPS, no substances are used that are ozone depleting, such as CFCs and HCFCs as prescribed by the EU.

## 1.8 Product installation

Terrasit EPS panels are installed by gluing and (or) mechanical anchoring. Terrasit EPS panels must be

assembled exclusively in accordance with the Terrasit construction instructions, which include amount and layout of the adhesive used.

The products may be applied to buildings, mainly in the European countries.

## 1.9 Condition of use

The Terrasit insulation boards are foreseen to be used for thermal insulation in construction, such as insulation of walls, pitched roofs, insulation of hollow walls, insulation of ceilings, etc.

## 1.10 Extraordinary effects

Extreme impacts during the use phase of the product (mechanical damage/earthquake, fire, flood) and their impact on the physical and chemical properties of the product and the impact on the environment and human health by classification into classes according to the supporting standards.

- Mechanical damage/earthquake; There is no risk to the environment and to humans from extreme mechanical damage and earthquakes when installed correctly.
- Fire; Terrasit EPS panels belong to the construction material class E (material that resists low flame ignition for a short period of time and does not produce a large flame spread).
- Flooding; Due to the used polystyrene in Terrasit EPS panels, no water polluting components can be washed out in the event of a flood.

## 1.11 Further information

Additional information can be found on the website

[www.terrasit.com](http://www.terrasit.com).



## 2 LCA: Calculation rules

### 2.1 Declared unit

The declared unit is 1 m<sup>3</sup> of expanded polystyrene rigid foam.

Gross densities and thermal conductivities of the Terrasit EPS F GRAPHITE and Terrasit EPS F GRAPHITE R are indicated in Table 1. Conversion factors from 1 m<sup>3</sup> to 1 kg is 1/17.

### 2.2 System boundary

The system boundary was defined according to the standard EN 15804. The system boundaries determine the unit processes that are included in LCA analysis.

This LCA study is based on cradle to gate with modules C1-C4 and module D.

The schematic representation of system boundaries can be seen in Figure 2. The LCA of Terrasit EPS panels covers the following life cycle stages:

A1: raw material extraction and processing, processing of secondary material input (e.g. recycling processes),

A2: transport to the manufacturer,

A3: manufacturing,

including provision of all materials, products and energy, as well as waste processing up to the end of-waste state, or disposal of final residues, during the production stage;

C1: de-construction, demolition,

C2: transport to waste processing,

C3: waste processing for reuse, recovery and/or recycling,

C4: disposal,

including provision and all transport, provision of all materials, products and related energy and water use;

D: reuse, recovery and/or recycling potentials, expressed as net impacts and benefits.

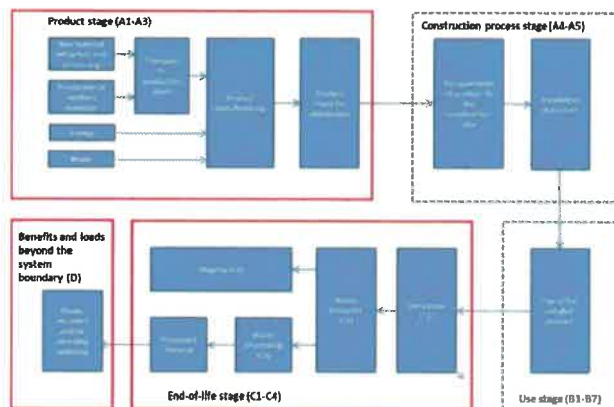


Figure 2: Schematic representation of system boundaries (included modules are outlined with red).

For the Terrasit EPS three different end-of-life scenarios are considered: landfilling (80%), recycling (15%) and incineration (5 %). The end-of-life scenarios are characteristic for the European region.

In module D, the substitution of waste Terrasit EPS for pumice (15%) as a lightweight aggregate in concrete production was taken into account.

### 2.3 Cut-off rules

The cut-off rules are defined in EN 15804, with the following procedure being followed for the exclusion of inputs and outputs in this LCA study:

- all inputs and outputs to the studied system have been included in the calculation, for which data are available;

in case of insufficient input data or data gaps for a unit process, the cut-off criteria has been 1% of renewable and non-renewable primary energy usage and 1% of the total mass input of that unit process. The total of neglected input



flows per module has been a maximum of 5% of energy usage and mass.

All raw materials, their transport, water, energy and packing materials are included. No machine amortisation is considered.

## 2.4 Data quality

The quality of the data used for calculations within the LCA analysis corresponds to the requirements of EN 15804:2012+A2:2019:

- generic data have been checked for plausibility;
- data sets are complete according to the system boundary within the limits set by the criteria for the exclusion of inputs and outputs;
- data is as current as possible. Data sets used for calculations are valid for the current year and represent a reference year within 10 years for generic data and 5 years for producer specific data;
- the reference year refers to the year which the overall inventory best represents, considering the age/representativeness of the various specific and background data included, i.e. not automatically the year of modelling, calculation or publication year. Validity refers to the date to which the inventory is still judged sufficiently valid with the documented technological and geographical representativeness;
- all datasets are based on 1 year averaged data;
- the time period over which inputs to and outputs from the system has been accounted for is 100 years from the year for which the data set is deemed representative.

The applied European average polystyrene data set "EU-28: Expandable Polystyrene (EPS)- white and grey" (provided by /PlasticsEurope/ valid until 2022) already include blowing agent and flame retardant as a defined recipe. Due to the limited

variation of ingredients within the EPS production, this generic data set fulfills the requirement of an LCA in an adequate way.

## 2.5 Background data

The LCA analysis of Terrasit EPS insulation has been conducted with the GaBi 9.2.1 modeling software, developed by Thinkstep (Sphera Solutions GmbH) in collaboration with the University of Stuttgart. All processes have been modelled on the inventory data given in the Professional and extension. Where Professional and extension datasets were not available, ecoinvent 3.8 database was used. This occurred with printing ink and salt datasets, both representing minor mass inputs.

## 2.6 Period under review

The data collected by the manufacturer was based on the yearly production amounts of the company. The reference year is 2021.

## 2.7 Allocation

There are no co-products in the production process of the Terrasit. Therefore, no allocation procedure has been required in this regard.

## 2.8 Comparability

Comparison of the environmental performance of construction products using the EPD information has to be based on the product's use in and its impacts on the building. Comparisons are possible in the sub-building level if the conditions, listed in EN 15804:2012+A2:2019 are met.

## 2.9 List of substances

Terrasit EPS insulation does not contain substances listed in the »Candidate List of Substances of Very High Concern for authorisation« (<https://echa.europa.eu/candidate-list-table>). Absence of these substances is declared by the producer.

### 3 LCA: Scenarios and additional technical information

#### 3.1 Information about biogenic carbon content

The biogenic carbon is present predominantly in the packing material, it is also present in the product to the lesser extend. Its values are summarized in Table 2.

*Table 2: Biogenic carbon content*

Name	Value	Unit
Biogenic Carbon Content in product	0.01	kg C
Biogenic Carbon Content in accompanying packaging	0.44	kg C

*\*1kg biogenic carbon is equivalent to 44/12 kg of CO<sub>2</sub>.*

#### 3.2 Technical information

The following technical information is the basic for the declared modules or can be used for the development of specific scenarios in the context of building assessment. Undeclared modules are labelled with the abbreviation MNA (Module Not Assessed).

##### 3.2.1 Raw material supply (A1)

The environmental loads related with the supply of the raw materials are included in the module A1.

##### 3.2.2 Transport (A2)

The environmental loads related with the transportation of materials from the supplier to the factory of Terrasit EPS insulation are included in the module A2.

##### 3.2.3 Manufacturing (A3)

The environmental loads connected with the manufacturing are included in the module A3, including energy and auxiliary materials consumed during the manufacturing process of Terrasit EPS Insulation.

##### 3.2.4 End of life (C1-C4)

End of life includes the demolition of Terrasit EPS Insulation, transport of EPS to the landfill or waste processing facilities and landfilling. 80% of EPS is delivered to the landfill at the end of life stage, 15% is recycled and 5% is incinerated.

##### 3.2.5 Benefits and loads beyond the system boundaries (D)

Module D includes the reuse, recovery and/or recycling potentials, expressed as net impacts and benefits. These included the substitution of pumice aggregates in lightweight concrete production. While incineration of waste EPS yields no benefits in form of heat or electricity production, due to low heating value of the waste.



## 4 LCA: Results

Table 3: Selected phases of the LCA

SYSTEM BOUNDARY																
PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Production	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
☒	☒	☒	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	☒	☒	☒	☒	☒
The modules of the product lifecycle, which are included in EPD are marked by "X", modules not included are marked with a "MNA" = module not assessed																

### 4.1 Indicators of environmental impacts

According to the standard EN 15804, the environmental impacts are presented with thirteen indicators (Table 4).

Table 4: Abbreviations and units of indicators of environmental impacts.

Indicators of environmental impacts	Abbreviation	Unit
Global warming potential total	GWP-total	kg CO <sub>2</sub> eq.
Global warming potential fossil fuels	GWP-fossil	kg CO <sub>2</sub> eq.
Global warming potential biogenic	GWP-biogenic	kg CO <sub>2</sub> eq.
Global warming potential land use and land use change	GWP-luluc	kg CO <sub>2</sub> eq.
Depletion potential of the stratospheric ozone layer	ODP	kg CFC 11 eq.
Acidification potential, accumulated exceedance	AP	mol H <sup>+</sup> eq.
Eutrophication potential, fraction of nutrients reaching freshwater end compartment	EP-freshwater	kg PO <sub>4</sub> <sup>-</sup> eq.
Eutrophication potential, fraction of nutrients reaching marine end compartment	EP-marine	kg N eq.
Eutrophication potential, accumulated exceedance	EP-terrestrial	kg N eq.
Formation potential of tropospheric ozone	POCP	kg NMVOC eq.
Abiotic depletion potential for non-fossil resources	APD-minerals&metals	kg Sb eq.
Abiotic depletion for fossil resources potential	APD-fossil	MJ, net calorific value
Water (user) deprivation potential, deprivation-weighted water consumption	WDP	m <sup>3</sup> world eq.deprived



The results for the environmental impact indicators for 1 m<sup>3</sup> expanded polystyrene rigid foam are shown in Tables 5 - 6:

*Table 5: Indicators of environmental impacts of Terrasit EPS F GRAPHITE.*

	Module	A1-A3	C1	C2	C3	C4	D
Indicators	Unit						
GWP-total	[kg CO <sub>2</sub> eq.]	5,65E+01	0,00E+00	5,48E-02	7,06E-03	3,10E+00	-1,73E+00
GWP-fossil	[[kg CO <sub>2</sub> eq.]	5,80E+01	0,00E+00	5,50E-02	7,02E-03	3,11E+00	-1,73E+00
GWP-biogenic	[kg CO <sub>2</sub> eq.]	-1,44E+00	0,00E+00	-5,33E-04	1,72E-05	-6,01E-03	-2,83E-03
GWP-luluc	[kg CO <sub>2</sub> eq.]	1,33E-02	0,00E+00	3,71E-04	2,14E-05	3,84E-04	-1,55E-04
ODP	[kg CFC-11 eq.]	5,99E-08	0,00E+00	5,41E-15	1,90E-14	6,05E-13	4,95E-13
AP	[Mole of H <sup>+</sup> eq.]	1,93E-01	0,00E+00	6,03E-05	3,46E-05	1,72E-03	-2,09E-04
EP-freshwater	[kg P eq.]	2,23E-04	0,00E+00	1,97E-07	1,61E-08	3,77E-07	-7,16E-08
EP-marine	[kg N eq.]	3,32E-02	0,00E+00	1,92E-05	1,61E-05	4,29E-04	-2,45E-04
EP-terrestrial	[Mole of N eq.]	3,58E-01	0,00E+00	2,30E-04	1,78E-04	5,29E-03	-2,70E-03
POCP	[kg NMVOC eq.]	1,35E-01	0,00E+00	5,17E-05	4,35E-05	1,30E-03	-8,82E-04
ADP-m&m	[kg Sb eq.]	5,98E-06	0,00E+00	5,55E-09	7,97E-09	2,40E-08	-4,76E-07
ADP-fossil	[MJ]	1,94E+03	0,00E+00	7,23E-01	1,33E-01	3,01E+00	-2,86E+01
WDP	[m <sup>3</sup> world equiv.]	1,29E+01	0,00E+00	6,16E-04	1,19E-03	2,57E-01	2,23E-02

*Table 6: Indicators of environmental impacts of Terrasit EPS F GRAPHITE R.*

	Module	A1-A3	C1	C2	C3	C4	D
Indicators	Unit						
GWP-total	[[kg CO <sub>2</sub> eq.]	5,09E+01	0,00E+00	5,48E-02	7,06E-03	3,10E+00	-1,80E+00
GWP-fossil	[kg CO <sub>2</sub> eq.]	5,24E+01	0,00E+00	5,50E-02	7,02E-03	3,11E+00	-1,79E+00
GWP-biogenic	[kg CO <sub>2</sub> eq.]	-1,53E+00	0,00E+00	-5,33E-04	1,72E-05	-6,01E-03	-3,14E-03
GWP-luluc	[kg CO <sub>2</sub> eq.]	1,57E-01	0,00E+00	3,71E-04	2,14E-05	3,84E-04	-8,85E-05
ODP	[kg CFC-11 eq.]	2,30E-07	0,00E+00	5,41E-15	1,90E-14	6,05E-13	-1,46E-14
AP	[Mole of H <sup>+</sup> eq.]	1,76E-01	0,00E+00	6,03E-05	3,46E-05	1,72E-03	-6,53E-04
EP-freshwater	[kg P eq.]	2,70E-04	0,00E+00	1,97E-07	1,61E-08	3,77E-07	-1,33E-07
EP-marine	[kg N eq.]	3,05E-02	0,00E+00	1,92E-05	1,61E-05	4,29E-04	-2,52E-04
EP-terrestrial	[Mole of N eq.]	3,24E-01	0,00E+00	2,30E-04	1,78E-04	5,29E-03	-2,76E-03
POCP	[kg NMVOC eq.]	1,23E-01	0,00E+00	5,17E-05	4,35E-05	1,30E-03	-9,25E-04
ADP-m&m	[kg Sb eq.]	8,00E-06	0,00E+00	5,55E-09	7,97E-09	2,40E-08	-4,87E-07
ADP-fossil	[MJ]	1,76E+03	0,00E+00	7,23E-01	1,33E-01	3,01E+00	-2,98E+01
WDP	[m <sup>3</sup> world equiv.]	1,17E+01	0,00E+00	6,16E-04	1,19E-03	2,57E-01	2,09E-02

## 4.2 Indicators of raw material use

The results of the raw materials use are in accordance with the standard EN 15804, shown with ten indicators (Table 7).

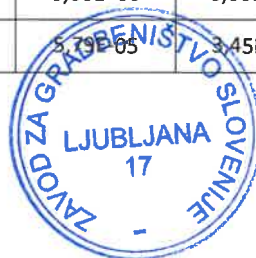
*Table 7: Abbreviations and units of indicators of raw material use.*

Indicators of raw material use	Abbreviation	Unit
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	PERE	MJ, net calorific value
Use of renewable primary energy resources used as raw materials	PERM	MJ, net calorific value
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	PERT	MJ, net calorific value
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	PENRE	MJ, net calorific value
Use of non-renewable primary energy sources used as raw materials	PENRM	MJ, net calorific value
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	PENRT	MJ, net calorific value
Use of secondary materials	SM	kg
Use of renewable secondary fuels	RSF	MJ, net calorific value
Use of non-renewable secondary fuels	NRSF	MJ, net calorific value
Net use fresh water	FW	m <sup>3</sup>

The results for 1 m<sup>3</sup> expanded polystyrene rigid foam of the use of raw materials are shown in Tables 8-9.

*Table 8: Indicators of raw material use for Terrasit EPS F GRAPHITE.*

	Module	A1-A3	C1	C2	C3	C4	D
Indicators	Unit						
PERE	[MJ]	6,46E+01	0,00E+00	5,01E-02	1,30E-02	4,80E-01	4,84E-01
PERM	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	[MJ]	6,46E+01	0,00E+00	5,01E-02	1,30E-02	4,80E-01	4,84E-01
PENRE	[MJ]	1,94E+03	0,00E+00	7,26E-01	1,33E-01	3,02E+00	-2,86E+01
PENRM	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	[MJ]	1,94E+03	0,00E+00	7,26E-01	1,33E-01	3,02E+00	-2,86E+01
SM	[kg]	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
NRSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	[m <sup>3</sup> ]	3,19E-01	0,00E+00	5,79E-05	3,45E-05	6,19E-03	7,94E-04



*Table 9: Indicators of raw material use for Terrasit EPS F GRAPHITE R.*

	Module	A1-A3	C1	C2	C3	C4	D
Indicators	Unit						
PERE	[MJ]	6,39E+01	0,00E+00	5,01E-02	1,30E-02	4,80E-01	-1,32E-01
PERM	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	[MJ]	6,39E+01	0,00E+00	5,01E-02	1,30E-02	4,80E-01	-1,32E-01
PENRE	[MJ]	1,76E+03	0,00E+00	7,26E-01	1,33E-01	3,02E+00	-2,98E+01
PENRM	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	[MJ]	1,76E+03	0,00E+00	7,26E-01	1,33E-01	3,02E+00	-2,98E+01
SM	[kg]	2,35E+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
NRSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	[m <sup>3</sup> ]	2,91E-01	0,00E+00	5,79E-05	3,45E-05	6,19E-03	3,57E-04

### 4.3 Other indicators of environmental impacts

According to the standard EN 15804, the results for other environmental information (waste disposal data) are presented with three indicators, and the results of the output flows from the system are based on four indicators (Table 10).

*Table 10: Abbreviations and units of other indicators of environmental impacts*

Indicators for other environmental information	Abbreviation	Units
Hazardous waste disposal	HWD	kg
Non-hazardous waste disposal	NHWD	kg
Radioactive waste disposal	RWD	kg
Output flow indicators	Abbreviation	Units
Components for re-use	CRU	kg
Material for recycling	MFR	kg
Materials for energy recovery	MER	kg
Exported energy	EE	MJ on the energy carrier

Results in indicators for other environmental information and output flow indicators for 1 m<sup>3</sup> expanded polystyrene rigid foam are shown in Tables 11-12.



**Table 11: Other indicators of environmental impacts of Terrasit EPS F GRAPHITE.**

	Module	A1-A3	C1	C2	C3	C4	D
Indicators	Unit						
HWD	[kg]	1,33E-02	0,00E+00	3,54E-12	1,79E-12	1,69E-10	-5,69E-09
NHWD	[kg]	6,05E-01	0,00E+00	1,09E-04	3,98E-05	1,38E+01	-4,62E-03
RWD	[kg]	1,73E-02	0,00E+00	1,24E-06	1,03E-06	4,85E-05	-1,75E-04
CRU	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	[kg]	0,00E+00	0,00E+00	0,00E+00	2,58E+00	0,00E+00	0,00E+00
MER	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EE	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

**Table 12: Other indicators of environmental impacts of Terrasit EPS F GRAPHITE R.**

	Module	A1-A3	C1	C2	C3	C4	D
Indicators	Unit						
HWD	[kg]	1,60E-02	0,00E+00	3,84E-12	1,79E-12	1,69E-10	-6,08E-09
NHWD	[kg]	7,19E-01	0,00E+00	1,18E-04	3,98E-05	1,38E+01	-4,60E-03
RWD	[kg]	1,95E-02	0,00E+00	1,35E-06	1,03E-06	4,85E-05	-1,72E-05
CRU	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	[kg]	2,35E+00	0,00E+00	0,00E+00	2,58E+00	0,00E+00	0,00E+00
MER	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EE	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00

#### 4.4 Additional impact categories and indicators

According to the standard EN 15804, the results for additional impact categories and indicators are presented with six indicators (Table 13).

**Table 13: Abbreviations and units of additional impact categories and indicators.**

Indicators for additional impact	Abbreviation	Unit
Potential incidence of disease due to PM emissions	PM	disease incidence
Potential human exposure efficiency relative to U235	IRP	kBq U235 equiv
Potential comparative toxic unit for ecosystems	ETP-TW	CTUe
Potential comparative toxic unit for humans-carcinogenic	HTP-c	CTUh
Potential comparative toxic unit for humans-non-carcinogenic	HTP-nc	CTUh
Potential soil quality index	SQP	dimensionless

Results for indicators for additional impact for 1 m<sup>3</sup> expanded polystyrene rigid foam are shown in Tables 14-15.

*Table 14: Additional impact of Terrasit EPS F GRAPHITE.*

	Module	A1-A3	C1	C2	C3	C4	D
Indicators	Unit						
PM	[Disea.incid.]	1,55E-06	0,00E+00	4,20E-10	6,69E-10	1,94E-08	-3,57E-08
IRP	[kBq U235 eq.]	1,17E+01	0,00E+00	2,03E-04	1,01E-04	6,34E-03	9,94E-03
ETP-fw	[CTUe]	4,05E+03	0,00E+00	5,12E-01	1,00E-01	1,65E+00	4,25E-02
HTP-c	[CTUh]	1,98E-08	0,00E+00	1,06E-11	2,16E-12	2,46E-10	-7,97E-10
HTP-nc	[CTUh]	6,54E-07	0,00E+00	5,72E-10	1,12E-10	2,60E-08	-9,33E-09
SQP	[dimensionless]	3,12E+02	0,00E+00	3,06E-01	2,95E-02	6,81E-01	2,45E-01

*Table 15: Additional impact of Terrasit EPS F GRAPHITE R.*

	Module	A1-A3	C1	C2	C3	C4	D
Indicators	Unit						
PM	[Disea.incid.]	1,43E-06	0,00E+00	4,20E-10	6,69E-10	1,94E-08	-9,69E-09
IRP	[kBq U235 eq.]	1,04E+01	0,00E+00	2,03E-04	1,01E-04	6,34E-03	-4,78E-03
ETP-fw	[CTUe]	3,60E+03	0,00E+00	5,12E-01	1,00E-01	1,65E+00	-3,35E-01
HTP-c	[CTUh]	1,82E-08	0,00E+00	1,06E-11	2,16E-12	2,46E-10	-8,16E-10
HTP-nc	[CTUh]	6,02E-07	0,00E+00	5,72E-10	1,12E-10	2,60E-08	-9,79E-09
SQP	[dimensionless]	3,20E+02	0,00E+00	3,06E-01	2,95E-02	6,81E-01	-1,08E-01

Disclaimer 1 –IRP impact category deals mainly with the eventual impact of low dose ionizing radiation on the human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure or due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators ADPE, ADPF, WDP, ETP-fw, HTP-c, HTP-nc, SQP the results shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.





## 5 Interpretation of results

The presented results show that the product stage (i.e. modules A1-A3) contributes the most to the impact categories in life cycle of Terrasit EPS panels. It contributes around 95% of the total environmental impact. In terms of ODP, the product stage contributes nearly 100% of the total impact.

The end-of-life stage (modules C1-C4) contributes up to 5% of the total impact, the highest contribution is in terms of GWP-fossil.

The results further show that the majority of the raw materials are used within the product stage (i.e. modules A1-A3) of Terrasit EPS panels. While end-of-life stage (modules C1-C4) consumes a minor amount of raw materials.

A potential environmental benefit and loads beyond the system boundary have been calculated for module D. The potential benefits are associated with recycling.

The most significant benefit of module D is for GWP-fossil (around 3%) and ADP-minerals&metals (8-9%). In terms of indicators of raw material use, the potential benefits are expressed for use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials (PENRE) and total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PENRT). While in case of Terrasit EPS F GRAPHITE R, the potential benefits are expressed also for the use of renewable primary energy excluding renewable primary energy resources used as raw materials (PERE) and total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials) (PERT).

### Contributor analysis

EPS beads contribute the most to the environmental impacts in the product stage of the Terrasit EPS F GRAPHITE and EPS F GRAPHITE R.

In terms of climate change (i.e. GWP-total as sum of GWP-fossil, GWP-biogenic and GWP-luluc), requirements of EPS beads represent 80-100% in terms of the total parameter value. Electricity requirements represents a further 5-8% followed by LPG requirements 7-15%. Other factors contribute smaller percentages.

In case of impact on ozone layer depletion (ODP), the evaporation of pentane gas represents 95% of the total ODP value. While EPS beads represents a further 3% and printing ink 2% of the total parameter value.

Terrestrial and marine eutrophication (EP-terrestrial and EP-marine) are mainly caused by EPS beads (80-83%), followed by LPG (6-7%) and electricity requirements (3-4%). Packaging material contributes additional 3-4%. Other factors contribute smaller percentages. The eutrophication of freshwater (EP-freshwater) is also mainly caused by EPS beads (around 70%), followed by evaporation of pentane gas (18-20%), LPG (4-5%) and electricity requirements (2-3%).

Acidification (AP) is also mainly caused by EPS beads (around 77%), followed by electricity (9-10%) and LPG requirements (6-7%).

Impact on Photochemical Ozone Creation Potential (POCP) is dominated by EPS beads (around 82%). Smaller impacts have LPG (8%) and electricity requirements (3%), followed by evaporation of pentane gas (3%).

Depletion of abiotic resources – minerals and metals (ADP-minerals&metals) and depletion of abiotic resources – fossil fuels (ADP-fossil) are mainly dominated by EPS beads (65-80%), followed by LPG (10-15%) and electricity requirements (2.5-8%).

In terms of water use (WDP), EPS beads contribute the majority of the impact (77%), followed by direct water requirements in the Terrasit EPS panels production process (18%) and PE foil (3.5-4%).

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## 6 References

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1. GaBi 2021 (v. 9.2.1). Sphera Solutions GmbH.
2. EN 15804:2012+A2:2019 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
3. EN ISO 14040:2006 Environmental management - Life cycle assessment - Principles and framework (EN ISO 14040:2006)
4. EN ISO 14044:2006 Environmental management - Life cycle assessment - Requirements and guidelines (EN ISO 14044:2006)
5. EN ISO 14025:2010 Environmental labels and declarations - Type III environmental
6. Product Category Rules for Building-Related Products and Services - Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report according to EN 15804+A2:2019, version 1.0. Institut Bauen und Umwelt e.V.
7. Product Category Rules (PCR) Part B: Requirements on the EPD for Insulating materials made of foam plastics. Institut Bauen und Umwelt e.V.
8. Report no. 939/21-520-1: Life Cycle Assessment of Terrasit EPS, date 07. 11. 2022.

*The data specified in the EPD are calculated on the basis of the data provided by the manufacturer. In the event that the manufacturer's information is incorrect, calculations do not apply.*

