DAPHabitat System Environmental Product Declaration

www.daphabitat.pt

[according to ISO 14025, EN 15804:2012+A2:2019 and EN 15942]

Declaration number: DAP 010:2024

MONOPOROUS

ISSUE DATE: 25/09/2024 VALID UNTIL: 24/09/2029

PAVIGRÉS CERÂMICAS, S.A.

Version 1.4. Ed. Março 2024

INDEX

1. GENERAL INFORMATION

1.1. The DAPHAbitat System

Program operator:	Associação Plataforma para a Construção Sustentável www.clusterhabitat.pt geral@clusterhabitat.pt
Address:	Departamento Engenharia Civil Universidade de Aveiro 3810-193 Aveiro
Email address:	deptecnico@clusterhabitat.pt
Telephone number:	(+351) 234 401576
Website:	www.daphabitat.pt
Logo	

1.2. EPD owner

Name of the owner:	Pavigrés Cerâmicas, S. A.
Production site:	Pavigrés Cerâmicas, S. A. - Unidade Fabril Cerev, Zona Industrial da Quinta, 3050-481 – Mealhada
Address (head office):	Pavigrés Cerâmicas, S.A., Av. Alto das Domingas, 3780-244 – Aguim
Telephone:	(+351) 231 510 600
E-mail:	geral@pavigres.com
Website:	www.pavigres.com
Logo:	
Information concerning the applicable management Systems:	ISO 9001:2015 – Quality Management Systems ISO 14001:2015 – Environmental Management Systems
Specific aspects regarding the production:	$CAE_{Rev.3}$ n.º 23312 – Manufacture of tiles, mosaics and ceramic plates
Organization's environmental policy:	PAVIGRÉS CERÂMICAS, S.A. is: Mission: To create and produce flooring and ceramic tiles that reinforce PAVIGRES's prestige and trust in the global market, ensuring the Group's sustainability and development. Policy: PAVIGRÉS CERÂMICAS, S.A., assumes, as a fundamental vector for its success, the

permanent focus on the Customer, demonstrated by the constant concern to anticipate and meet market expectations. This company presents global and integrated ceramic coating and flooring solutions, with products that stand out in the market due to their recognized quality and aesthetic value.

This Policy is aligned and developed in the following aspects:

- To promote and encourage the continuous improvement of its Management System, to guarantee high levels of performance of its processes, products and services, with a view to meeting and exceeding the needs and expectations of customers, shareholders and other relevant stakeholders;
- To provide the company with human resources, developing the skills of its employees, encouraging initiative, productivity and a responsible attitude in improving processes and procedures;
- To comply with applicable compliance obligations, namely legal, regulatory, normative and others that PAVIGRÉS endorses as applicable;
- To protect the Environment by promoting the prevention of pollution through the management of the consumption of natural water and energy resources and the implementation of good practices, namely, further the recovery of waste over its elimination, whenever possible, to allow continuous improvement of the environmental performance;
- To provide the necessary resources and means to comply with the established Strategic Guidelines, creating conditions for possible investments in new projects focused on satisfying relevant stakeholders to promote the financial consolidation of PAVIGRÉS.

The Management System Policy is thus adopted by PAVIGRÉS with LOYALTY, RIGOR, AND COMMITMENT, being communicated to all employees and disclosed to other interested parties, as appropriate.

1.3. Information concerning the EPD

Authors:	1. Centro Tecnológico da Cerâmica e do Vidro 2. PAVIGRÉS CERÂMICAS, S.A.
Contact of the authors:	1. CTCV materials: habitat | iParque – Parque Tecnológico de Coimbra – Lote 6 | 3040-540 Antanhol – Portugal (T) +351 239 499 200 Marisa Almeida: marisa@ctcv.pt 2. Pavigrés Cerâmicas, S. A., Av. Alto das Domingas, 3780-244 – Aguim (T) +351 231 510 600 e-mail: ritatovim@pavigres.com
Issue date:	25/09/2024
Registration date:	27/09/2024
Registration number:	DAP 010:2024
Valid until:	24/09/2029
Representativity of the EPD (location, manufacturer, group of manufacturers):	EPD of one (1) product class, produced in one (1) industrial unit, belonging to one (1) single producer (Pavigrés Cerâmicas, S.A.)
Where to consult explanatory material:	www.pavigres.com
Type of EPD:	EPD from Cradle-to-grave and module D (A1-D)

1.4. Demonstration of the verification

External independent verification, according to the standard ISO 14025:2010 and EN 15804:2012+A2:2019

Certification Body	Verifier
	
(CERTIF – Associação para a Certificação)	(Ricardo Mateus)

1.5. EPD Registration

Programme operator

(Plataforma para a Construção Sustentável)

1.6. PCR (product category rules) basic model

Name:	PCR: Basic module for construction products and services
Issue date:	Edition August 2023
Number of registration on the database:	RCP-mb001
Version:	Version 2.3
Identification and contact of the coordinator (s):	Marisa Almeida | marisa@ctcv.pt Luís Arroja | arroja@ua.pt José Dinis Silvestre | jose.silvestre@ist.utl.pt
Identification and contact of the authors:	Marisa Almeida | marisa@ctcv.pt Luís Arroja | arroja@ua.pt José Silvestre | jds@civil.ist.utl.pt Fausto Freire Cristina Rocha Ana Paula Duarte Ana Cláudia Dias Helena Gervásio Victor Ferreira Ricardo Mateus António Baio Dias
Composition of the Sectorial Panel:	-
Consultation period:	18/11/2015 - 18/01/2016
Valid until:	01/06/2027

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

1.7. Relevant c-PCR (Complementary product category rules)*

Name:	1. RCP: Floor covering 2. RCP: Wall covering 3. EN 17160:2019 – Product Category Rules for Ceramic Tiles
Issue date:	1. 10/02/2014 2. 10/02/201a 3. 27/02/2019, in force since 15/04/2019
Number of registration on the database:	1. RCP001:2014 2. RCP002:2014 3. --
Version:	1. Version 1.2 (June 2022) 2. Version 1.2 (June 2022) 3. --
Identification and contact of the coordinator (s):	1. RCP: Floor covering • Luís Arroja | arroja@ua.pt • Marisa Almeida | marisa@ctcv.pt 2. RCP: Wall covering • Luís Arroja | arroja@ua.pt • Marisa Almeida | marisa@ctcv.pt
Identification and contact of the authors:	1. RCP: Floor covering • Marisa Almeida | marisa@ctcv.pt • Luís Arroja | arroja@ua.pt • Ana Cláudia Dias | acdias@ua.pt 2. RCP: Wall covering • Marisa Almeida | marisa@ctcv.pt • Luís Arroja | arroja@ua.pt

	• Ana Cláudia Dias | acdias@ua.pt
Composition of the Sectorial Panel:	1. RCP: Floor covering • RMC - Revestimentos de Mármore Compactos, S.A. • Dominó – Indústrias Cerâmicas, S.A. • APICER – Associação Portuguesa da Indústria de Cerâmica • Sonae Indústria, SGPS, S.A. 2. RCP: Wall covering • RMC - Revestimentos de Mármore Compactos, S.A. • Dominó – Indústrias Cerâmicas, S.A. • Sonae Indústria, SGPS, S.A. • APICER – Associação Portuguesa da Indústria de Cerâmica
Consultation period:	1. 01/08/2013 - 30/11/2013 2. 12/08/2013 - 30/11/2013
Valid until:	1. 01/06/2027 2. 01/06/2027

1.8. Information concerning the product/product class

Identification of the product:	Monoporous for interior wall coverings
Illustration of the product:	
Brief description of the product:	Monoporous produced by the PAVIGRÉS CERÂMICAS, S.A group are used as a covering for interior walls in residential and public areas. This product is available on the market in a range of aesthetic and dimensional options in terms of visual effects, texture and colours. In this EPD, the results are provided per unit area (1 m²) of the product for an average product with a specific weight of 12.62 kg/m². However, the production process (A1-A3) is the same regardless of the thickness or format of the products. Table 1 presents the specific weight of the several product thicknesses. **Table 1: Product thicknesses and their weights**

Thickness (mm)	Weight (kg/m²)	Thickness (mm)	Weight (kg/m²)
6.5	10.8	9.5	14.9
7.0	11.6	10.0	16.1
7.5	12.1	10.5	16.5
8.1	11.6	--	--

Note: Table of average weights per m² (kg/m²), depending on the thickness of the product. For more accurate information on each reference's weight per unit area, please consult the weights and packaging table on the Pavigrés website.

Main technical characteristics of the product:

Table 2: Technical characteristics of monoporous products

Designation	Average value of tolerances	Test standard
Dimensional characteristics	Linear dimensions ± 0,5% Orthogonality ± 0,5% Straightness ± 0,3% Planarity + 0,5% / - 0,3%	NP EN ISO 10545-2

		Thickness ± 10%	
	Water absorption	16-19%	NP EN ISO 10545-3
	Mechanical flexural strength (N)	(<7,5mm) |>300N (≥7,5mm) | >600N	NP EN ISO 10545-4
	Rupture modulus (N/mm^2)	(<7,5mm) |≥16N/mm^2 (≥7,5mm) | ≥16N/mm^2	
	Linear thermal expansion ($x10^{-6}k^{-1}$)	≤7	NP ISO 10545-8
	Thermal shock resistance	Test on request	NP EN ISO 10545-9
	Cracking resistance	Guaranteed	NP EN ISO 10545-11
	Resistance to household cleaning products and pool additives	Guaranteed	NP EN ISO 10545-13
	Resistance to low/high concentration acids and bases	To be confirmed case by case	NP EN ISO 10545-13
	Stain resistance	Guaranteed	NP EN ISO 10545-14
Description of the product's application/use:	Monoporous for covering interior walls in the following applications: • Residential areas and buildings • Public areas and buildings • Industrial areas and buildings		
Placing on the market / Rules of application in the market / Technical rules of the product:	EN 14411:2012 NP EN ISO 10545		
Quality control:	In accordance with the technical standards of the product		
Special delivery conditions:	Not applicable		
Components and substances to declare:	Not applicable		
Where explanatory material may be obtained:	https://www.pavigres.com/ Quality and environmental standards following ISO 9001:2015 and ISO14001:2015 and the provisions described in the relevant regulations. The product can be found through resellers and professional applicators.		
History of the LCA studies:	CTCV, 2019 Project report (EN15804+A1), to sustain the 2019 EPD		

1.9. Calculation rules of the LCA

Functional unit:	--
Declared unit:	1 m^2 of monoporous material for wall covering
System boundaries:	Cradle-to-grave and module D EPD (A1-D)
Criteria for the exclusion:	According to point 6.3.5 of NP EN 15804, the exclusion criterion for unitary processes is 1% of the total energy consumed and 1% of the total mass of the inputs, with particular attention to not exceeding a total of 5% of energy and mass flows excluded in the product stage. The following processes were not considered in this study, as they may fall within the exclusion criteria or scope of the standard: • Environmental loads associated with the construction of industrial infrastructures and the manufacture of machinery and equipment; • Environmental loads related to infrastructure (production and maintenance of vehicles and roads) for transporting pre-products; • Long-term emissions.
Assumption and limitations	For processes over which producers have no influence or specific information, such as the extraction of raw materials, generic data from the Ecoinvent v3.7 databases were used. The dataset used to model the production of electricity and natural gas was adapted to the national reality. The electrical mix was updated for the year 2022 using information from

	the National Energy Networks (REN), the Energy Services Regulatory Entity (ERSE) and the General Directorate of Energy and Geology (DGEG) to obtain actual information regarding the environmental impacts generated by the electricity network in Portugal. The natural gas process was modelled according to the information provided by the Energy in Portugal (2022) report (DGEG) regarding the countries of origin of its import. The environmental impacts presented in this DAP are a simple average of all PAVIGRES products manufactured in monoporous in 2022 (since they are only produced in one industrial unit).
Quality and other characteristics of the information used in the LCA:	The production data collected corresponds to 2022 and is in accordance with reality. The generic data used belong to the Ecoinvent v3.7 databases and comply with the quality criteria (age, geographic and technological coverage, plausibility, etc.) of generic data.
Allocation rules:	The allocation rules adopted were based on the annual production at the Cerev manufacturing unit.
Software used for the assessment:	SimaPro 9.2
Background database used for the LCA:	Ecoinvent 3.7
Comparability of EPD for construction products	The EPD of construction products and services cannot be comparable if they are not produced according to EN 15804 and EN 15948 and according to the comparability conditions determined by ISO 14025.

1.10. Use of average environmental performance

The monoporous ceramic coverings included in the study are made with the same raw materials and auxiliary materials and embrace different models with different formats. The average thickness of the formats included in this EPD is 6.5 and 10.5 mm, with a mean mass of 12.62 kg/m^2.

1.11. Technical information for Reference Service Life (RSL)

Parameter	Units	Results**
Reference Service Life	Years	Minimum 50
Declared product properties (at the gate) and finishes, etc.	Units as appropriate	See Table 2 For more information, contact Pavigrés or request its technical sheets
Design application parameters (if instructed by the manufacturer), including the references to the appropriate practices and application codes	Units as appropriate	For more information, contact Pavigrés or request its technical sheets
An assumed quality of work, when installed following the manufacturer's instructions	Units as appropriate	For more information, contact Pavigrés or request its technical sheets
Outdoor environment (for outdoor applications), e.g. weathering, pollutants, UV and wind exposure, building orientation, shading, temperature	Units as appropriate	Not Applicable
Indoor environment (for indoor applications), e.g. temperature, moisture, chemical exposure	Units as appropriate	Values of relevant characteristics following Annex L of EN 14411. For more information, contact Pavigrés or request technical data sheets.
Usage conditions, e.g. frequency of use, chemical exposure	Units as appropriate	Values of relevant characteristics following Annex L of EN 14411. For more information, contact Pavigrés or request technical data sheets.
Maintenance, e.g. required frequency, mechanical exposure	Units as appropriate	Values of relevant characteristics following Annex L of EN 14411. For more information, contact Pavigrés or request technical data sheets
** expressed by functional unit or declared unit		

1.12. Flow diagram of input and output of the processes

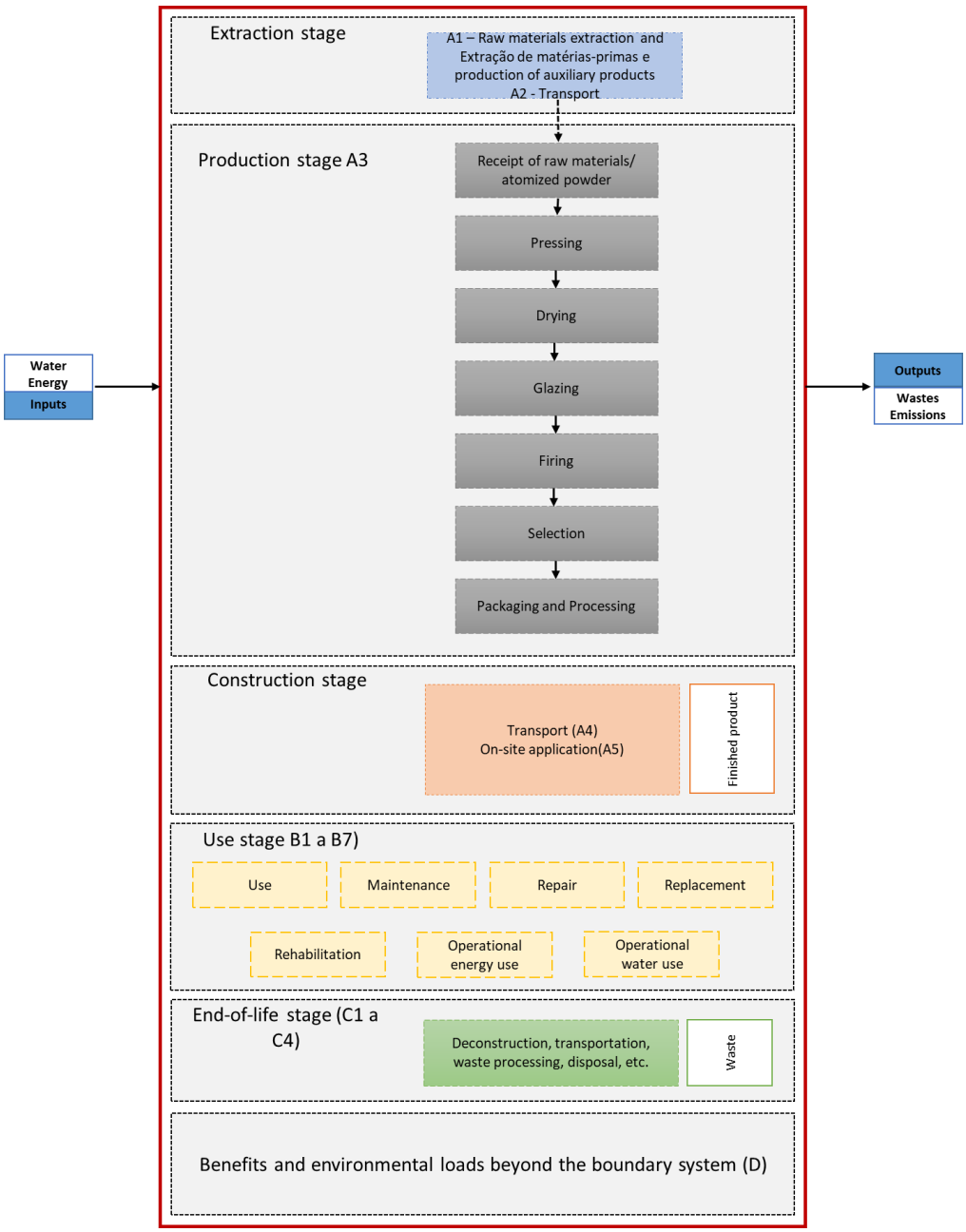

Figure 1: The life cycle stages of the monoporous products (A1-D).

Production stage, A1-A3

The A1 to A3 stages included the extraction of raw materials, their transport to the factory, and the manufacturing the product.

A1 – Extraction and processing of raw materials: this stage includes the extraction and eventual processing of raw materials.

A2 – Transport: The raw materials and auxiliary materials come by tanker truck or by tanker truck, boat and tanker truck again.

A3 – Production: This stage includes design and development, storage of raw materials, paste preparation, shaping (by pressing), drying, glazing or decorating, firing and sorting, subsequent treatment (e.g. polishing), packaging and storage.

Pavigrés Cerâmicas, SA. (at its Pavigrés, Grespor, Cerev and Pavigrés II units) is dedicated to the production of ceramic tiles (flooring and coverings, in porcelain and non-porcelain stoneware, glazed and unglazed) by pressing atomized powder, followed by drying and firing. Natural raw materials, synthesized raw materials and additives are used, and the main ones are clays, feldspars, sands, carbonates and kaolin.

Specifically, at the Cerev manufacturing unit, monoporous coatings are also manufactured; In this case, the manufacturing process at the facility begins with the reception of the atomized coating powder (produced in specialized external facilities in accordance with Cerev's requirements), which is stored in silos. The forming phase consists of pressing the powder, followed by drying (dryers powered by natural gas) and glazing. Depending on the aesthetic characteristics of the final product, the number and type of auxiliary equipment to be activated along the line varies, as well as the type of applications to be used. These applications are prepared in advance in the Glass and Paints Section, from the grinding of the compositions (raw materials such as frits, dyes (metallic oxides), etc.). This is followed by the thermal single-fire process, which is carried out in continuous ovens fueled by natural gas. The material then goes to selection and packaging, with quality control processes in place when choosing.

The product may also undergo subsequent treatment, such as cutting or rectification.

Use stage, B1-B7

B1 - Use or application of the installed product - The environmental impacts generated during the use stage are very low and, therefore, can be neglected following the EN 17160:2019 standard relating to Product category rules for ceramic tiles.

B2 - Maintenance - Throughout its service life, the ceramic coating product must be cleaned regularly, to a greater or lesser extent, depending on the type of building: residential, commercial, sanitary, etc., where it is installed. Cleaning agents such as detergents can be added if the surface is dirty or oily. Therefore, the consumption of water and detergent can be considered.

According to the EN 17160:2019 standard regarding Product category rules for ceramic tiles, it is recommended to consider the following "Scenario for maintaining ceramic floor tiles":

- Residential use: 0.134 ml detergent and 0.1 l of water are used to wash 1 m^2 of ceramic covering (tile) once every three months.

Washing the product was considered during the service life of the coating (50 years).

B3 – Repair - Ceramic tiles do not require repair during the use stage; therefore, no impact must be declared at this stage, per EN 17160:2019 on Product Category Rules for Ceramic Tiles.

B4 – Replacement - Ceramic tiles do not require replacement during the use stage, and therefore, no impact must be declared in this replacement stage.

B5 – Rehabilitation - Ceramic tiles do not require rehabilitation during the use stage. Therefore, no impact must be declared at this stage, following EN 17160:2019 regarding Product Category Rules for Ceramic Tiles.

B6 – Energy requirements during the operational stage - Generally, environmental impacts generated during phase B6 are not applicable and therefore not considered, according to EN 17160:2019 on Product Category Rules for Ceramic Tiles.

B7 – Water requirements during the operational stage - Generally, environmental impacts generated during phase B7 are not applicable and therefore neglected, according to EN 17160:2019 regarding Product Category Rules for Ceramic Tiles.

End of life stage (C1-C4)

C1 – Deconstruction/demolition: According to EN 17160:2019 regarding Product category rules for ceramic tiles, "The environmental impacts generated during the C1 phase are very low and therefore can be neglected." Therefore, environmental impacts can be ignored.

C2 – Transport to waste processing: According to EN 17160:2019, regarding Product Category Rules for Ceramic Tiles, it is recommended to consider an average transportation distance of 20 km.

C3 – Waste processing for reuse, recovery and/or recycling: The coating end of life scenarios were based on table 17 of EN 17160:2019 on Product Category Rules for Ceramic Tiles, corresponding to:

- 70% recycling;

C4 – Elimination: According to the EN 17160:2019 standard, it was considered 30%.

Potential for reuse, recovery and/or recycling, expressed in net impacts or benefits (D): According to EN 17160:2019 on Product Category Rules for Ceramic Tiles, after the demolition/deconstruction phase, ceramic tiles can be crushed and used in a variety of different applications:

- concrete aggregates [2];
- when ceramic tiles are crushed, they form recycled ceramic aggregates that can be integrated as a partial replacement for natural aggregate in hot asphalt mixes ;
- recycled ceramic aggregates can be used in the construction of landfills [8];
- recycled ceramic aggregates can be used to construct base sub-layers on secondary roads [8].

It was considered a replacement of 70% of natural aggregates.

2. CORE ENVIRONMENTAL IMPACT INDICATORS

2.1. Description of the system boundaries

(✓= included; ND = module not declared)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY
Raw material supply	Transport	Manufacturing	Transport	Construction installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-constructions, demolition	Transport	Waste processing	Disposal	Re-use, recovery, recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Modules **A1-A3** include those processes that provide energy and material input for the system (A1), transport up to the factory gate of the plant (A2), manufacturing processes (A3), and waste processing.

Module **A4** includes the transport from the production site to the customer or to the tiles' installation point. Three scenarios were considered for the transport: 300 km (truck), 1390 km (truck) and 6520 km (ship), according to EN 17160.

Module **A5** considers all tile installation steps (like adhesive consumption) and packaging waste processing (recycling, incineration, disposal). The default values were according to EN 17160. Credits from energy substitution are declared in module D.

Module **B1** considers the use of tiles. No hazardous indoor emissions are expected to occur during the use of ceramic tiles.

Module **B2** includes preventive and regular maintenance activities, such as cleaning, correcting or repairing damaged or degraded parts. The use of water and wastewater is included in this module.

Modules **B3-B4-B5** are related to the tiles' repair, replacement and refurbishment. No repair, replacement or refurbishment processes are necessary if the tiles are appropriately installed. For this reason, Modules B3-B4-B5 are not considered according to EN17160.

Modules **B6-B7** consider energy use for operating building-integrated technical systems and operational water use for technical building-related systems (heating systems, cooling, ventilation, lighting, hot water, etc.). No operational energy or water use are considered. Cleaning water is declared under B2.

Module **C1** refers to the demolition and de-construction process of the tiles from the building. According to EN17160, it is considered negligible.

Module **C2** considers the transportation of the discarded tile to a recycling or disposal process. It was considered 20 km.

Module **C3** considers every process (collection, crushing process, etc.) necessary for recycling the tiles (70% following EN17160).

Module **C4** includes all the landfill disposal processes, including pre-treatment and management of the disposal site (20 km) (30% following EN17160).

Module **D** includes benefits or burdens to the environment generated by reusable products, recyclable materials, and/or energy carriers that exit a product system.

2.1.1. Justification for the exemption to declare modules C1, C2, C3, C4 and D

Not applicable.

2.2. Core environmental impact indicators

		Global warming potential - total; GWP-total	Global warming potential - fossil; GWP-fossil	Global warming potential - biogenic; GWP-biogenic	Global warming potential land use and land use change; GWP-luluc	Depletion potential of the stratospheric ozone layer; ODP	Acidification potential; AP
Unit		kg CO_2 eq.	kg CO_2 eq.	kg CO_2 eq.	kg CO_2 eq.	kg CFC 11 eq.	mol H^+ eq.
Modules A1-A3		9.92E+00	1.03E+01	-3.87E-01	1.33E-02	3.94E-07	2.36E-02
Module A4	Scenario A4.1	5.65E-01	5.65E-01	1.71E-04	1.11E-05	1.22E-08	7.11E-04
	Scenario A4.2	2.62E+00	2.62E+00	7.92E-04	5.13E-05	5.66E-08	3.29E-03
	Scenario A4.3	7.83E-01	7.83E-01	1.20E-04	2.62E-05	1.17E-08	2.46E-02
Module A5	Scenario A5.1	1.26E+00	9.59E-01	2.97E-01	5.22E-04	1.41E-08	8.00E-09
Module B1	Scenario B1.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module B2	Scenario B2.1	9.43E-02	9.21E-02	2.09E-03	1.38E-04	4.59E-09	6.37E-04
Module B3	Scenario B3.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module B4	Scenario B4.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module B5	Scenario B5.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module B6	Scenario B6.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module B7	Scenario B7.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module C1	Scenario C1.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module C2	Scenario C2.1	9.42E-02	9.42E-02	2.85E-05	1.85E-06	2.04E-09	1.19E-04
Module C3	Scenario C3.1	7.15E-02	7.10E-02	5.49E-04	3.40E-05	1.17E-09	5.75E-04
Module C4	Scenario C4.1	4.34E-02	4.33E-02	4.12E-05	1.14E-05	7.49E-10	3.41E-04
Module D	Scenario D.1	-1.69E-02	-1.60E-02	-9.22E-04	-4.15E-06	-2.72E-10	-1.27E-04

LEGEND:

- Product stage
- Construction process stage
- Use stage
- End of life stage
- Benefits and loads beyond the system boundary

NOTES[1]:
Units expressed by functional unit or declared unit.

[1] These annotations should be eliminated for the presentation of the final document

		Eutrophication potential aquatic freshwater; EP-freshwater	Eutrophication potential aquatic marine; EP-marine	Eutrophication potential terrestrial; EP-terrestrial	Formation potential of tropospheric ozone; POCP	Abiotic depletion potential for non-fossil resources ADP-minerals&metals	Abiotic depletion potential for fossil resources potential ADP-fossil	Water (user) deprivation potential; WDP
Units		kg P eq.	kg N eq.	mol N eq.	Kg COVNM eq.	kg Sb eq.	MJ, P.C.I	m^3 World eq. deprived
Modules A1-A3		1.01E-04	6.03E-03	6.29E-02	2.43E-02	1.15E-04	1.39E+02	9.19E-01
Module A4	Scenario A4.1	4.44E-07	1.76E-04	1.72E-03	1.32E-03	1.94E-08	7.52E+00	6.88E-03
	Scenario A4.2	2.06E-06	8.17E-04	7.96E-03	6.13E-03	9.01E-08	3.48E+01	3.19E-02
	Scenario A4.3	5.63E-07	6.16E-03	6.82E-02	1.81E-02	8.44E-09	9.64E+00	8.42E-03
Module A5	Scenario A5.1	1.26E-05	6.90E-04	7.31E-03	2.32E-03	3.46E-06	7.42E+00	1.66E-01
Module B1	Scenario B1.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module B2	Scenario B2.1	5.60E-06	7.46E-05	8.32E-04	3.12E-04	1.01E-07	2.49E+00	1.09E+01
Module B3	Scenario B3.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module B4	Scenario B4.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module B5	Scenario B5.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module B6	Scenario B6.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module B7	Scenario B7.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module C1	Scenario C1.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module C2	Scenario C2.1	7.40E-08	2.94E-05	2.86E-04	2.21E-04	3.24E-09	1.25E+00	1.15E-03
Module C3	Scenario C3.1	1.27E-06	2.48E-04	2.70E-03	8.03E-04	3.10E-09	1.05E+00	3.83E-03
Module C4	Scenario C4.1	5.55E-08	1.58E-04	1.71E-03	5.12E-04	1.79E-09	5.73E-01	7.45E-04
Module D	Scenario D.1	-1.33E-07	-5.67E-05	-6.20E-04	-1.88E-04	-6.71E-09	-3.11E-01	-4.73E-03

LEGENDA:

- Product stage
- Construction process stage
- Use stage
- End of life stage
- Benefits and loads beyond the system boundary

NOTES[2]: P.C.I. – Net calorific value. Units expressed by functional unit or declared unit.

"The results obtained for the indicators "Abiotic depletion potential for non-fossil resources (ADP-minerals&metals)", "Abiotic depletion potential for fossil resources potential (ADP-fossil)" and "Water (user) deprivation potential (WDP)", should be used with caution since the uncertainties associated with them are high or there is little experience with the indicator."

[2] These annotations should be eliminated for the presentation of the final document

2.3. Additional environmental impact indicators

		Potential incidence of disease due to PM emissions PM	Potential Human exposure efficiency relative to U235 IRP	Potential Comparative Toxic Unit for ecosystems ETP-fw	Potential Comparative Toxic Unit for humans, cancer effects HTP-c	Potential Comparative Toxic Unit for humans, not cancer effects HTP-nc	Potential soil quality index SQP
Unit		Disease incidence	kBq U 235 eq.	CTUe	CTUh	CTUh	-
Modules A1-A3		3.78E-06	1.41E-01	4.88E+01	1.71E-09	3.88E-08	6.51E+01
Module A4	Scenario A4.1	3.40E-08	1.20E-03	3.34E+00	3.51E-11	3.89E-09	1.43E-02
	Scenario A4.2	1.58E-07	5.54E-03	1.55E+01	1.62E-10	1.80E-08	6.62E-02
	Scenario A4.3	1.87E-08	1.05E-03	4.62E+00	1.17E-10	1.90E-09	1.34E-02
Module A5	Scenario A5.1	1.36E-07	2.11E-02	2.68E+00	1.84E-10	4.07E-09	6.40E+00
Module B1	Scenario B1.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module B2	Scenario B2.1	4.45E-09	1.00E-02	2.57E-01	8.65E-11	1.88E-09	1.98E-01
Module B3	Scenario B3.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module B4	Scenario B4.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module B5	Scenario B5.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module B6	Scenario B6.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module B7	Scenario B7.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module C1	Scenario C1.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module C2	Scenario C2.1	5.67E-09	1.99E-04	5.56E-01	5.84E-12	6.48E-10	2.38E-03
Module C3	Scenario C3.1	9.71E-08	2.62E-03	3.90E-01	6.42E-12	2.30E-10	3.04E-01
Module C4	Scenario C4.1	4.46E-08	1.10E-04	2.78E-01	4.21E-12	1.66E-10	2.02E-01
Module D	Scenario D.1	-3.88E-09	-2.93E-03	-9.54E-02	-8.66E-12	-5.68E-11	-1.49E+00

LEGEND:

- Product stage
- Construction process stage
- Use stage
- End of life stage
- Benefits and loads beyond the system boundary

NOTES[3]:
Units expressed by functional unit or declared unit.

The impact indicator "POTENTIAL HUMAN EXPOSURE EFFICIENCY RELATIVE TO U235" focuses mainly on the possible impact of a low dose of ionising radiation on human health resulting from the nuclear fuel cycle. It does not consider effects arising from possible nuclear accidents, occupational exposure or the disposal of radioactive waste in underground facilities. Potential ionising radiation from soil, radon and some building materials is also not measured by this indicator.
The results of the indicators "POTENTIAL COMPARATIVE TOXIC UNIT FOR ECOSYSTEMS (ETP-FW)", "POTENTIAL COMPARATIVE TOXIC UNIT FOR HUMANS, CANCER EFFECTS", "POTENTIAL COMPARATIVE TOXIC UNIT FOR HUMANS, NOT CANCER EFFECTS" and "POTENTIAL SOIL QUALITY INDEX" should be used with caution as the uncertainties associated with them are high or there is little experience with the indicator.

[3] These annotations should be eliminated for the presentation of the final document

2.4. Indicators describing resource use

		Primary energy					
		EPR	RR	TRR	EPNR	RNR	TRNR
Unit		MJ, P.C.I.	MJ, P.C.I.	MJ, P.C.I.	MJ, P.C.I.	MJ, P.C.I.	MJ, P.C.I.
Modules A1-A3		1.75E+01	3.86E-05	1.75E+01	1.53E+02	2.78E-01	1.53E+02
Module A4	Scenario A4.1	1.07E-02	0.00E+00	1.07E-02	7.69E+00	0.00E+00	7.69E+00
	Scenario A4.2	4.94E-02	0.00E+00	4.94E-02	3.56E+01	0.00E+00	3.56E+01
	Scenario A4.3	1.22E-02	0.00E+00	1.22E-02	9.90E+00	0.00E+00	9.90E+00
Module A5	Scenario A5.1	1.29E+00	2.19E-01	1.51E+00	8.43E+00	0.00E+00	8.43E+00
Module B1	Scenario B1.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module B2	Scenario B2.1	1.97E-01	0.00E+00	1.97E-01	2.81E+00	0.00E+00	2.81E+00
Module B3	Scenario B3.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module B4	Scenario B4.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module B5	Scenario B5.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module B6	Scenario B6.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module B7	Scenario B7.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module C1	Scenario C1.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module C2	Scenario C2.1	1.78E-03	0.00E+00	1.78E-03	1.28E+00	0.00E+00	1.28E+00
Module C3	Scenario C3.1	5.47E-02	0.00E+00	5.47E-02	1.11E+00	0.00E+00	1.11E+00
Module C4	Scenario C4.1	1.01E-02	0.00E+00	1.01E-02	5.94E-01	0.00E+00	5.94E-01
Module D	Scenario D.1	-1.26E-01	0.00E+00	-1.26E-01	-3.63E-01	0.00E+00	-3.63E-01

LEGEND:

Product stage

Construction process stage

Use stage

End of life stage

Benefits and loads beyond the system boundary

EPR = use of renewable primary energy excluding renewable primary energy resources used as raw materials; RR = use of renewable primary energy resources used as raw materials; TRR = total use of renewable primary energy resources (EPR + RR); EPNR = use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; RNR = use of non-renewable primary energy resources used as raw materials; TRNR = total use of non-renewable primary energy resources (EPRN + RNR);

NOTE[4]: Units expressed by functional units or declared units.

[4] These annotations should be eliminated for the presentation of the final document

		Secondary materials and fuels, and use of water			
		MS	CSR	CSNR	Net use of fresh water
Unit		kg	MJ, P.C.I.	MJ, P.C.I.	m^3
Modules A1-A3		4.13E-01	0.00E+00	0.00E+00	2.76E-02
Module A4	Scenario A4.1	0.00E+00	0.00E+00	0.00E+00	1.81E-03
	Scenario A4.2	0.00E+00	0.00E+00	0.00E+00	6.65E-04
	Scenario A4.3	0.00E+00	0.00E+00	0.00E+00	1.34E-04
Module A5	Scenario A5.1	0.00E+00	0.00E+00	0.00E+00	4.02E-03
Module B1	Scenario B1.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module B2	Scenario B2.1	0.00E+00	0.00E+00	0.00E+00	2.63E-01
Module B3	Scenario B3.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module B4	Scenario B4.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module B5	Scenario B5.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module B6	Scenario B6.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module B7	Scenario B7.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module C1	Scenario C1.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Module C2	Scenario C2.1	0.00E+00	0.00E+00	0.00E+00	2.39E-05
Module C3	Scenario C3.1	0.00E+00	0.00E+00	0.00E+00	2.58E-04
Module C4	Scenario C4.1	0.00E+00	0.00E+00	0.00E+00	3.28E-05
Module D	Scenario D.1	0.00E+00	0.00E+00	0.00E+00	-3.06E-03

LEGEND:

Product stage

Construction process stage

Use stage

End of life stage

Benefits and loads beyond the system boundary

MS = use of secondary material; CSR = use of renewable secondary fuels; CSNR = use of non-renewable secondary fuels.

NOTE[5]: Units expressed by functional units or declared units.

[5] These annotations should be eliminated for the presentation of the final document

2.5. Other environmental information describing different waste categories

		Hazardous waste disposed	Non-hazardous waste disposed	Radioactive waste disposed
Unit		kg	kg	kg
Modules A1-A3		7.28E-04	7.33E-01	2.02E-04
Module A4	Scenario A4.1	1.92E-05	3.03E-04	5.25E-05
	Scenario A4.2	8.89E-05	1.40E-03	2.43E-04
	Scenario A4.3	5.49E-06	4.46E-04	6.74E-05
Module A5	Scenario A5.1	2.60E-05	1.02E-01	2.75E-05
Module B1	Scenario B1.1	0.00E+00	0.00E+00	0.00E+00
Module B2	Scenario B2.1	1.22E-06	5.03E-03	8.91E-06
Module B3	Scenario B3.1	0.00E+00	0.00E+00	0.00E+00
Module B4	Scenario B4.1	0.00E+00	0.00E+00	0.00E+00
Module B5	Scenario B5.1	0.00E+00	0.00E+00	0.00E+00
Module B6	Scenario B6.1	0.00E+00	0.00E+00	0.00E+00
Module B7	Scenario B7.1	0.00E+00	0.00E+00	0.00E+00
Module C1	Scenario C1.1	0.00E+00	0.00E+00	0.00E+00
Module C2	Scenario C2.1	3.20E-06	5.05E-05	8.75E-06
Module C3	Scenario C3.1	2.02E-06	1.54E+00	7.44E-06
Module C4	Scenario C4.1	1.46E-06	4.77E+00	4.06E-06
Module D	Scenario D.1	-5.04E-07	-4.14E-04	-3.19E-06

LEGENDA:

- Product stage
- Construction process stage
- Use stage
- End of life stage
- Benefits and loads beyond the system boundary

NOTE[6]: Units expressed by functional units or declared units.

[6] These annotations should be eliminated of the presentation of the final document

2.6. Environmental information describing output flows

		Components for re-use	Materials for recycling	Materials for energy recovery	Exported energy
					Energy carrier 1
Unit		kg	kg	kg	MJ
Modules A1-A3		0.00E+00	7.67E-01	6.36E-03	9.74E-01
Module A4	Scenario A4.1	0.00E+00	0.00E+00	0.00E+00	ND
	Scenario A4.2	0.00E+00	0.00E+00	0.00E+00	ND
	Scenario A4.3	0.00E+00	0.00E+00	0.00E+00	ND
Module A5	Scenario A5.1	0.00E+00	3.80E-01	6.51E-02	8.10E+00
Module B1	Scenario B1.1	0.00E+00	0.00E+00	0.00E+00	ND
Module B2	Scenario B2.1	0.00E+00	0.00E+00	0.00E+00	ND
Module B3	Scenario B3.1	0.00E+00	0.00E+00	0.00E+00	ND
Module B4	Scenario B4.1	0.00E+00	0.00E+00	0.00E+00	ND
Module B5	Scenario B5.1	0.00E+00	0.00E+00	0.00E+00	ND
Module B6	Scenario B6.1	0.00E+00	0.00E+00	0.00E+00	ND
Module B7	Scenario B7.1	0.00E+00	0.00E+00	0.00E+00	ND
Module C1	Scenario C1.1	0.00E+00	0.00E+00	0.00E+00	ND
Module C2	Scenario C2.1	0.00E+00	0.00E+00	0.00E+00	ND
Module C3	Scenario C3.1	0.00E+00	1.11E+01	0.00E+00	ND
Module C4	Scenario C4.1	0.00E+00	0.00E+00	0.00E+00	ND
Module D	Scenario D.1	0.00E+00	0.00E+00	0.00E+00	ND

LEGEND:

- Product stage
- Construction process stage
- Use stage
- End of life stage
- Benefits and loads beyond the system boundary

ND: Not Declared
NOTE[7]: Units expressed by functional units or declared units.

[7] These annotations should be eliminated of the presentation of the final document

2.7. Information describing the biogenic carbon content at the factory gate

Biogenic carbon content*	Units**	Modules A1-A3 (results)
Biogenic carbon content in product	Kg C	Not applicable (inorganic product)
Biogenic carbon content in accompanying packaging	Kg C	9.92E-02

* 1 kg biogenic carbon is equivalent to 44/12 kg of CO2.

** This information can be omitted whenever the content of biogenic carbon in the product, or in the respective packaging, is less than 5% of the mass of the product, or the respective packaging.

3. SCENARIOS AND ADDITIONAL TECHNICAL INFORMATION[8]

3.1. A4 Transport to the building site – Construction process stage

The scenarios for A4 transport to the building site were according to EN 17160 regarding Product category rules for ceramic tiles.

Destination	Type of transport	Average distance (km)
National – Scenario A4.1	Truck with a capacity of 25 tons	300
Europe – Scenario A4.2	Truck with a capacity of 25 tons	1 390
International (Outside Europe) – Scenario A4.3	Transoceanic freight ship	6520

3.2. A5 Installation of the product in the building – Construction process stage

The scenario was also according to the options defined in EN17160 and Almeida, 2019, for the installation stage. The option chosen was 3.3 kg of cementitious adhesive for each m^2 of ceramic tile. The ceramic material loss was considered to be 3%. The waste also included packaging waste.

Option 3 (medium size tiles)	Value	Unit of measure
Cementitious adhesive	3.3	kg

[8] IF THERE IS NO ADDITIONAL TECHNICAL INFORMATION AND NO SCENARIOS HAVE BEEN CARRIED OUT, ENTRIES SHOULD BE FILLED IN WITH "NOT APPLICABLE".

3.3. B1 Use stage

According to the specific PCR for Product category rules for ceramic tiles - EN 17160, the environmental impacts generated during the use phase are very low and, therefore, can be neglected. Ceramic tiles are robust and have a hard, abrasion-resistant surface.

There are no impacts on the environment during the use stage.

3.4. B2 Maintenance

Ceramic covering products shall be cleaned regularly, depending on the type of building: residential, commercial, and healthcare. Thus, the consumption of water and cleaning agents has been considered. The values declared in this stage refer to a period of 50 years. The scenario for maintaining ceramic floor tiles was conservative, according to EN 17160.

The scenario used for maintaining ceramic floor tiles was for residential use, using 0.134 ml detergent and 0.1 l water to wash 1 m^2 of ceramic floor tiles once every three months.

Parameter	Value	Unit of measure
Water consumption	0.1	l
Detergent consumption	0.134	ml
Wall tile maintenance cycle	200	Number per RSL

3.5. B3 Repair

In general, the service life of ceramic tiles is the same as the building lifetime. Repair, replacement and refurbishment are not required for ceramic tiles.

Thus, according to EN 17160, ceramic tiles require no repair during the use phase; therefore, no impact should be declared during the repair phase.

3.6. B4 Replacement

In general, the service life of ceramic tiles is the same as the building lifetime. Repair, replacement and refurbishment are not required for ceramic tiles.

3.7. B5 Rehabilitation

This module is not relevant for ceramic tiles, according to EN 17160.

3.8. B6 Use of energy (operational)

This module is not relevant for ceramic tiles, according to EN 17160.

3.9. B7 Use of water (operational)

This module is not relevant for ceramic tiles, according to EN 17160.

3.10. C1 De-construction, demolition – End of life of the product

C1: According to the PCR developed in EN 17160, this module is irrelevant for ceramic tiles.

3.11. C2 Transport – End of life of the product

C2: The ceramic tile demolition waste is transported from the building site to a container or treatment plant by truck, and an average distance of 20 km is considered, according to the default scenario of EN17160.

3.12. C3 Waste processing for reuse, recovery and/or recycling – End of life of the product

C3: the end-of-life scenario is described in the following table:

Destination	Value	Unit of measure
Recycling (C3)	70	%

3.13. C4 Disposal – End of life of the product

C4: the end-of-life scenario is described in the following table:

Destination	Value	Unit of measure
Landfill (C4)	30	%

3.14. Scenario and technical information for module D

Module D includes credits from materials recycling of tiles and packaging and energy credits from thermal recovery of the packaging.

According to EN 17160, after the demolition/deconstruction stage, ceramic tiles can be crushed and then used in a range of different applications:

- Aggregates for road construction;
- Concrete aggregates;
- When ceramic tiles are crushed, they form recycled ceramic aggregates, which can be integrated as a partial substitute of natural aggregate in hot-mix asphalt [8];
- Recycled ceramic aggregates can be used in the construction of landfills [8];
- Recycled ceramic aggregates can be utilized to construct sub-based courses on secondary roads [8].

In this case, EN17160 refer to 70% of recycling, and according to the Environmental Nacional Agency (APA, 2020), in Portugal, the ceramic materials valorisation rate in construction and demolition waste is 75% approximately therefore, a more conservative value was assumed and aligned with the ceramic-specific PCR (EN 17160).

3.15. Additional information on release of dangerous substances to indoor air, soil, and water during the use stage

The correct use of the product does not display any danger to water, air or soil. It is inert when used correctly.

The product is classified with A+ (Source: Pavigrés self-declaration and CeramUnie guide).

4. REFERENCES

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- ✓ **Ecoinvent database v3.7** (2019). (www.ecoinvent.org)
- ✓ **EN 15804:2012+A2:2019** Sustentabilidade das obras de construção. Declarações ambientais de produtos. Regras fundamentais para a categoria de produto dos produtos de construção.
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- ✓ **Instruções Gerais do Sistema DAPHabitat**, Versão 1.0, Março de 2013 (em www.daphabitat.pt);
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