

DAPHABITAT SYSTEM ENVIRONMENTAL PRODUCT DECLARATION

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[ACCORDING TO ISO 14025, EN 15804:2012+A2:2019 AND EN 15942]



Declaration number: DAP 003:2024



PORCELAIN TILES

ISSUE DATE: 12/04/2024

VALID UNTIL: 11/04/2029

TOPCER – INDÚSTRIA DE CERÂMICA, S.A.



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1. GENERAL INFORMATION

1.1. The DAPHabitat System

Program operator:	Sustainable Construction Platform www.clusterhabitat.pt geral@clusterhabitat.pt	 Cluster Habitat Sustentável
Address:	Departamento Engenharia Civil Universidade de Aveiro 3810-193 Aveiro	
Email address:	deptechnico@clusterhabitat.pt	
Telephone number:	(+351) 234 401576	
Website:	www.daphabitat.pt	
Logo:		

1.2. EPD owner

Name of the owner:	TopCer – Indústria de Cerâmica, S.A.
Production site:	Rua do Monte Grande n.º 10, Zona Industrial de Oiã, 3770-068 Oiã
Address (head office):	Rua do Monte Grande n.º 10, Zona Industrial de Oiã, 3770-068 Oiã
Telephone:	+351 234 722 395
E-mail:	av@topcer.com
Website:	https://topcer.com/
Logo:	
Information concerning the applicable management Systems:	ISO 9001:2015 Quality and Management System ISO 14001:2015 Environmental Management System
Specific aspects regarding the production:	CAE: 23312 – Tiles, mosaics and ceramic plates
Organization's environmental policy:	<p>Topcer commits to adopting measures that protect the environment throughout the conception, manufacturing and commerce of pavements and porcelain stoneware. It assures sustainability along the production process and, simultaneously, ensures that the needs and expectations of its clients are achieved according to the legal normative requirements.</p> <p>During its activity, Topcer maintains a concern regarding the environment throughout the entire product life cycle, mainly:</p> <ul style="list-style-type: none"> • Adopting good environmental practices in a continuous improvement perspective and pollution prevention; • Assuring that all the raw materials used in the production process are supplied by environmentally concerned suppliers, preferably with an environmental certification; • Assuming a commitment to reduce the consumption of energy in all the stages of the product life cycle; • Assuring that the sludges of the wastewater treatment plant generated by the production process are sent to licensed operators to be reused in the production processes of ceramics since, due to the technical characteristics of the porcelain stoneware, it isn't possible to



reuse these residues in its production process;

- Encouraging the separation of other residues in the production areas where they are produced through the placement in containers properly identified to ensure and improve the separation of several types of plastic, paper, cardboard, packages, wood, etc., ensuring that a specialized organization in the respective ranks makes the recycling of each type of residue.


1.3. Information concerning the EPD

Authors:	1. Technological Center of Ceramics and Glass 2. TopCer – Indústria de Cerâmica, 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. TopCer – Indústria Cerâmica, S. A. Rua do Monte Grande N.º 10, Zona Industrial de Oiã, 3770-068 Oiã (T) +351 234 722 395
Issue date:	12/04/2024
Registration date:	06/05/2024
Registration number:	DAP 003:2024
Valid until:	11/04/2029
Representativity of the EPD (location, manufacturer, group of manufacturers):	EPD of one product class, produced in one production unit, belonging to a single producer (TopCer – Indústria de Cerâmica, S.A.)
Where to consult explanatory material:	https://topcer.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 (19/01/2016)
Number of registration on the data base:	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

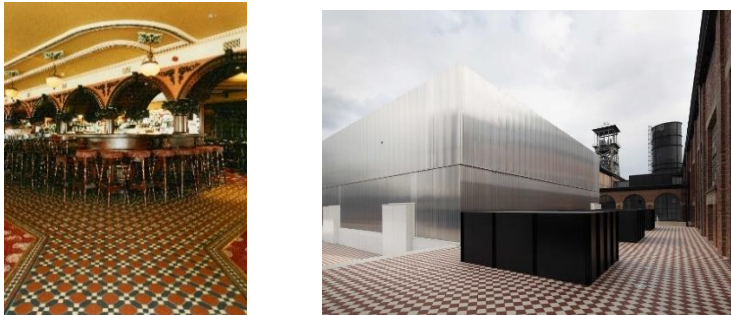
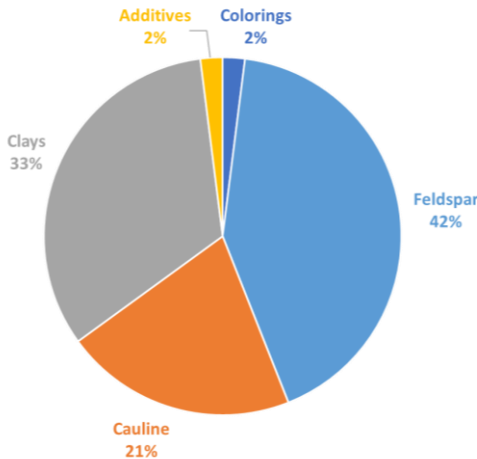
CEN standard EN 15804 serves as the core Product Category Rules (PCR)

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

Name:	1. PCR: Floor covering 2. PCR: Wall covering 3. EN 17160:2019 – Product category rules for ceramic tiles
Issue date:	1. 10/02/2014 2. 10/02/2014 3. 27-Feb-2019, in force since 15-Apr-2019
Number of registration on the database:	1. RCP001:2014 2. RCP002:2014 3. --
Version:	1. Version 1.2 (junho 2022) 2. Version 1.2 (junho 2022) 3. --
Identification and contact of the coordinator (s):	1. PCR: Floor covering • Luís Arroja arroja@ua.pt • Marisa Almeida marisa@ctcv.pt 2. PCR: Wall covering • Luís Arroja arroja@ua.pt • Marisa Almeida marisa@ctcv.pt
Identification and contact of the authors:	1. PCR: Wall coverings • Marisa Almeida marisa@ctcv.pt • Luís Arroja arroja@ua.pt • Ana Cláudia Dias acdias@ua.pt 2. PCR: Floor coverings • Marisa Almeida marisa@ctcv.pt • Luís Arroja arroja@ua.pt • Ana Cláudia Dias acdias@ua.pt

Composition of the Sectorial Panel:	<ol style="list-style-type: none"> 1. RCP: Wall coverings <ul style="list-style-type: none"> • 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: Floor coverings <ul style="list-style-type: none"> • 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:	<ol style="list-style-type: none"> 1. 01/08/2013 – 30/11/2013 2. 12/08/2013 – 30/11/2013
Valid until:	<ol style="list-style-type: none"> 1. 01/06/2027 2. 01/06/2027 3. --

1.8. Information concerning the product/product class

Identification of the product:	Porcelain Tile (porcelain stoneware tile). Group Bla (EN 14411 Annex G).
Illustration of the product:	
Brief description of the product:	<p>TopCer specializes in producing porcelain stoneware tiles in small formats, producing an extensive range of products characterized by low water absorption, high resistance to rupture load, and high resistance to abrasion wear.</p> <p>The modular formats with a joint of 4mm are produced in the following dimensions: 7,5x15, 15x15, 10x10, 10x30 and 30x30.</p> <p>There is the production of stoneware tiles with 4 different nonslip textures and formats, by special finishing the pieces. There are two different collections, the Victorian and Contemporary compositions, in modules assembled in net.</p> <p>In the production process of porcelain stoneware tiles, the main raw materials are the feldspar, clay, kaolin, colourings and additives (Figure 1).</p>  <p>Figure 1 - Main raw materials for the manufacturing of porcelain stoneware tiles.</p>

Main technical characteristics of the product:	Table 1: Technical characteristics of the porcelain stoneware tiles.		
	Main characteristics	Performance	Test Norm
	Reaction to fire	Class A1/A1FL	CWT (Dec. 96/603/EC)
	Water absorption	Conform	EN ISO 10545-2
	Thickness	Conform	EN ISO 10545-2
	Breaking strength	≥ 1800 N	EN ISO 10545-4
	Modulus of rupture	≥50 N/mm2	EN ISO 10545-4
	Impact resistance	No visible defects	EN ISO 10545-5
	Resistance to deep abrasion	123 mm3	EN ISO 10545-6
	Coefficient of linear thermal expansion	5,6x10-6 °C-1	EN ISO 10545-8
	Thermal shock resistance	Conform	EN ISO 10545-9
	Moisture expansion	<0,1 mm/m	EN ISO 10545-10
	Durability	Conform	EN ISO 10545-12
	Frost/defrost resistance	Conform	EN ISO 10545-12
	Chemical resistance	Conform	EN ISO 10545-13
	Resistance to stains	Conform	EN ISO 10545-14
Release of dangerous substances: <ul style="list-style-type: none">• Lead• Cadmium	NPD NPD	EN ISO 10545-15	
	Adhesion resistance for: - Glue cement (type C2) - Aqueous dispersion type D1 - Reaction resins type R2	2.0 N/mm2 1.6 N/mm2 > 2.8 N/mm2	EN 1348
Description of the product's application/use:	<p>The applications of porcelain ceramic tile produced by TopCer, from the Bla group (according to EN 14411), are essentially for covering floors and walls, indoors and outdoors.</p> <p>These materials can also be applied in pavements and coatings with high technical requirements, such as pools, saunas, dressing rooms, and all types of zones with a large circulation, such as hospitals, schools, hotels, private houses, restaurants, bars, malls, stores, industrial areas, industrial kitchens and including train, subway, fuel stations, among others.</p> <p>The special lines of “Victorian Compositions and Banners” and “Contemporary Series” are assembled in a network. These lines are mainly used in palaces, museums, hotels, restaurants, bars, private homes, restoration of old floors, etc.</p>		
Placing on the market / Rules of application in the market / Technical rules of the product:	EN 14411:2012 EN ISO 10545 ASTM – ANSI A 137.1-2012 AS 45866:2013 CEN/TS 16165:2016 UNE 41901:2017 EX DIN 51130 DIN 51097 ISO 13006		
Quality control:	<p>TopCer follows a corporate strategy based on sustained growth, promoting all collaborators' involvement and motivation to comply with the proposed policies and objectives.</p> <p>The goals of TopCer include improving competitiveness, promoting innovation, quality, productivity, and optimization of resources, always considering the environmental aspects associated, promoting the protection of the environment and preventing pollution in its activity.</p> <p>The company commits to ensuring a Quality Management System that responds to the Clients and remaining stakeholders, to the development and continuous improvement of its services and products, and to complying with all the legal and statutory requirements and regulations. To complement, TopCer assumes the satisfaction of all the requisites of its QMS and continuous improvement of its efficiency</p>		
Special delivery conditions:	Not applicable		
Components and substances to declare:	Not applicable		
Where explanatory material may be obtained:	See www.topcer.com		
History of the LCA studies:	No other LCA studies were identified for these products from this manufacturer.		

1.9. Calculation rules of the LCA

Functional unit:	1 m ² of ceramic floor tiles (average of all floor tiles manufactured corresponds to 16.8 kg/m ² of weight) for walls and pavements finishing and for a reference service life (RSF) of 50 years.
Declared unit:	--
System boundaries:	EPD from cradle to grave
Criteria for the exclusion:	<p>According to the point 6.3.5. of the NP EN 15804, the criteria for the exclusion of unitary processes is 1% of the total energy consumed and 1% of the total mass of the entries, with special attention for what doesn't exceed a total of 5% of the energy and mass flows excluded in the product stage.</p> <p>The following processes weren't considered in this study since they can be covered by the exclusion criteria or by the norm scope:</p> <ul style="list-style-type: none"> • Environmental loads associated with the construction of industrial infrastructures and manufacturing of machinery and equipment; • Environmental loads related to the infrastructures (production and maintenance of vehicles and roads) of transport of pre-products; • Long-term emissions.
Assumption and limitations	<p>For the processes to which the producers don't have any influence or specific information, such as the extraction of raw materials, generic data were used from the database Ecoinvent version 3.7.</p> <p>The dataset used to model the production of electricity and natural gas was adapted to the national reality. The electric mix was updated for the year 2020 through the information supplied by the Nacional Energetic Network (REN), the Regulating Entity of Energetic Services (ERSE) and the Directorate-General for Energy and Geology (DGEG) to obtain the most recent results regarding the environmental impacts generated by the electric network in Portugal. The natural gas process was modelled from the information available in Portugal's Energy Report (2020) of the DGEG regarding the origin countries of importation.</p> <p>The environmental impacts presented in this EPD are related to a weighted average of all the products of TopCer manufactured in porcelain stoneware in 2020.</p>
Quality and other characteristics of the information used in the LCA:	<p>The production data collected correspond to 2020 and align with reality (compared with 2019 and 2021). The generic data used belong to the Ecoinvent v3.7 databases and meet the quality criteria (age, geographical and technological coverage, plausibility, etc.) of generic data.</p> <p>The validity period of the background data from the Ecoinvent database is between 2013 and 2020. Most information (energy and water consumption, emissions of pollutants, atomized powders and ceramic production) is measured or calculated directly at the company level, which is specific and checked. Carbon dioxide emissions (related to carbonate oxidation) are according to the ETS (Emissions Trading Scheme) declaration.</p> <p>Detailed data were obtained for mixtures of raw materials (collected with primary data from the company) and for dyes.</p> <p>The overall quality of the data can be considered good.</p>
Allocation rules:	<p>The factory only produces porcelain tiles (Bla). No allocations were applied in the modules. Credits for energy recovery of packaging materials and end of life of the product have been considered.</p> <p>The excluded data were the following:</p> <ul style="list-style-type: none"> • Diffuse emission of particles into the atmosphere during the transport and storage of raw materials in the form of powder; • Production of industrial machinery and equipment; • Long-term issues were not considered.
Software used for the assessment:	SimaPro 9.2
Background database used for the LCA:	Ecoinvent 3.7
Comparability of EPD for construction products:	The EPDs of construction products and services cannot be comparable if they are not produced according to EN 15804 and EN 15942 and according to the comparability conditions determined by ISO 14025.

1.10. Use of average environmental performance

The porcelain stoneware tiles included in the study cover different models with different formats. The thickness format included in the scope of this EPD is 8 mm, with an average weight of 16.8kg/m². The references include from 30x30; 10x10; 15x15; 10x30; 7.5x15; hexagonal; and Octogonal.

1.11. Technical information for Reference Service Life (RSL)

Parameter	Units	Results*
Reference Service Life	Years	Minimum of 50
Declared product properties (at the gate) and finishes, etc.	Units as appropriate	See Table 1. For more information contact TOPCER or request technical data 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 TOPCER or request technical data sheets.
An assumed quality of work, when installed in accordance with the manufacturer's instructions	Units as appropriate	For more information, contact TOPCER or request technical data sheets
Outdoor environment, (for outdoor applications), e.g. weathering, pollutants, UV and wind exposure, building orientation, shading, temperature	Units as appropriate	For more information, contact TOPCER or request technical data sheets
Indoor environment (for indoor applications), e.g. temperature, moisture, chemical exposure	Units as appropriate	Values of the relevant characteristics according to Annex G of the EN 14411 standard.
Usage conditions, e.g. frequency of use, mechanical exposure	Units as appropriate	For more information, contact TOPCER or request technical data sheets
Maintenance e.g. required frequency, type and quality and replacement of components	Units as appropriate	Values of the relevant characteristics according to Annex G of the EN 14411 standard.
* expressed by functional unit or declared unit		

1.12. Flow diagram of input and output of the processes

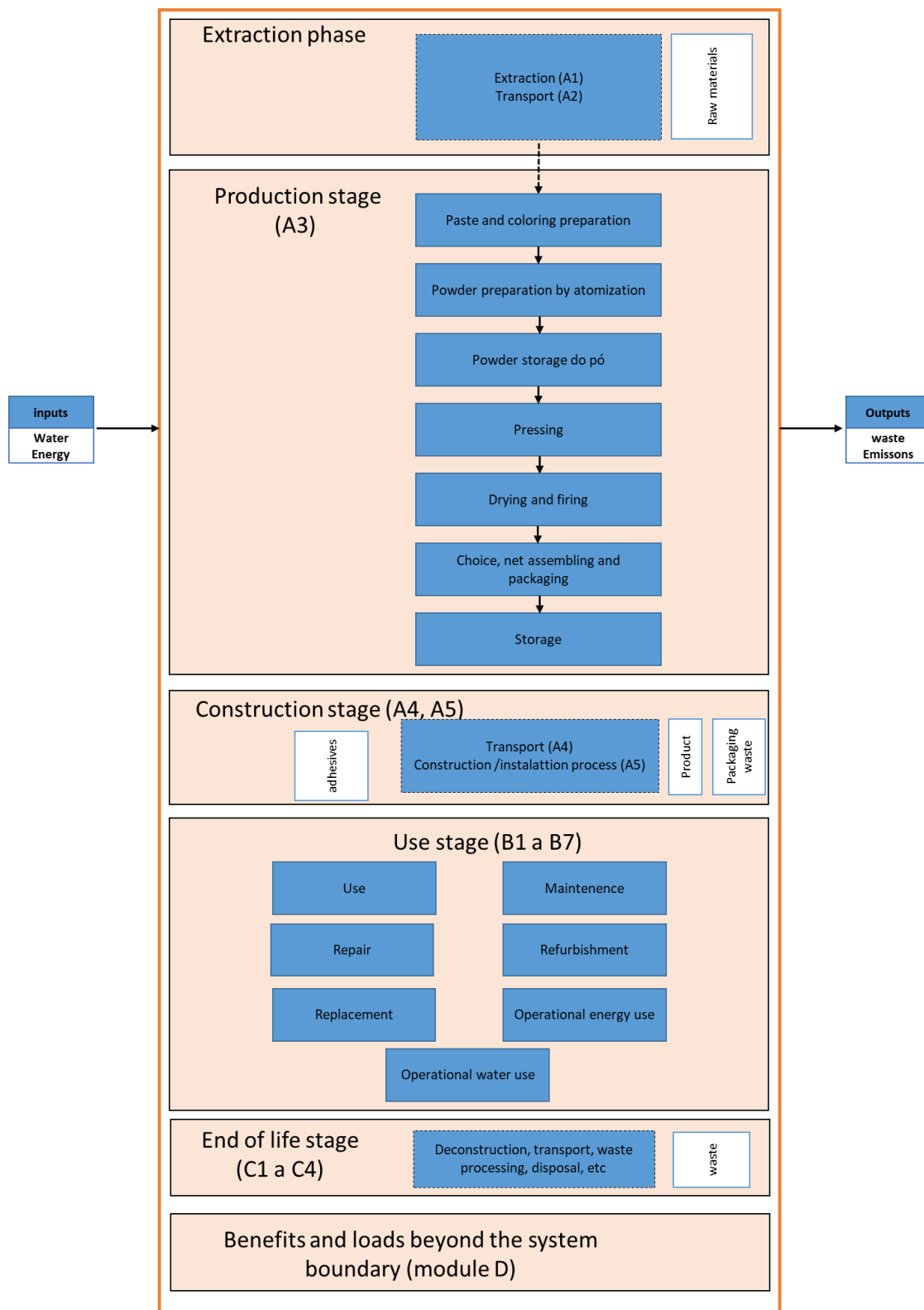


Figure 1: Flowchart of the production process.

Production stage, A1 – A3:

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

A1 – Extraction and transformation of raw materials: this stage includes the extraction and possible transformation of raw materials. The raw materials used are natural, synthetic, and additives; the main ones are clays, feldspar and caoline.

A2 – Transport: the raw and auxiliary materials are transported by a cistern truck or boat followed by a cistern truck. Some materials are transported only by truck (namely colourants, which are packed in bags of 25 kg).

A3 – Production: this stage includes the following steps:

- Raw material storage

The raw materials (clays, feldspar, caoline, colourings and additives) are properly stored and identified in places previously defined. Its storage is made in covered and separated granaries.

After their reception, the raw materials are subjected to laboratory controls to be approved.

- Paste preparation

The preparation of the paste begins with the weighing of the bulk raw materials and with the dosing of the raw materials that come in bags. According to the formulations supplied by the Director of Production, the raw materials are gathered in loads in well-defined proportions and transported to Alsing-type mills with balls of alubite for grinding operations or turbo diluters for operations of turbo diluting.

After the turbo dilution or grinding, which takes around 13 and 16 hours, a paste is obtained, to which the name of barbotine is given. It passes through a sieving phase deposited in homogenizing tanks equipped with agitators to maintain the barbotine in suspension. In this phase, colouring for the pastes with a homogeneous colour is also added.

- Atomization

After, the barbotine is transferred by pumping to an intermediate feeding tank that will supply the atomizer, starting the atomization process, through which a powder with set characteristics is obtained for the following stage. The atomizer works with a hot air generator fed by natural gas and possesses an evaporation capacity of 1000 dm³ per hour. The maximum operation temperature is around 150°C (in the burners is around 550°C). In the pastes with a pigmented look, the colouring is added individually to the paste portion intended to be coloured before entering the atomizer.

The resulting powder of this operation is placed into silos and kept at rest, being after transported by canvas to the stages that follow (9 silos).

- Pressing

The conformation of the pieces is made by the compression of the atomized powder in unidirectional hydraulic presses (6) and presses for special finishing pieces (3). This way, pieces with the desired shape and size can be obtained.

- Drying and firing

After, the first stage of thermal processing (drying) takes place, during which the residual moisture of the pieces is removed. Without this process, the conformation in the pressing phase would be impossible. The drying occurs in horizontal dryers, contiguous to the kiln, that use the recovered hot air from the kilns. The maximum temperatures are around 130°C.

The following thermal process is the firing, where the pressed material is vitrified to obtain the desired characteristics. The firing is performed in three roll kilns, with a length of 38 meters, fed by natural gas. The maximum temperature is around 1200°C (firing zone), with programmed control of the firing times and curves.

The loading and unloading of the roll kilns are automatic.

- Choice and packaging

The fired material is transported to a stock park, where it remains until it is retrieved and transported to the choice machines, where it is chosen and packed in cardboard boxes stacked into pallets and later sealed with plastic.

The choice is a visual process of human intervention that analyses defects on its surface and where the products are classified and separated by each type of choice.

- Storage

After the packaging, the products are kept in a warehouse, according to the reference of each product.

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 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 adhesives 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 the cleaning of the tiles. Provision of water and cleaning agents for the cleaning of the tiles, including wastewater treatment, are considered. Based on EN 17160, it was considered once every week, and the quantities previewed: "Residential use: 0,134 ml detergent once every two weeks and 0,1 l water are used to wash 1 m² of ceramic floor tiles once a week."

Modules B3-B4-B5 are related to the tiles' repair, replacement, and refurbishment. If the tiles are properly installed, no repair, replacement or refurbishment processes are necessary. For this reason, Modules B3-B4-B5 are not considered according to EN 17160.

Modules B6-B7 consider energy use for operating building-integrated technical systems (B6) and operational water use for technical building-related systems. 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 EN 17160, 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.) properly for recycling the tiles (70% following EN 17160).

Module C4 includes all the landfill disposal processes, including pre-treatment and management of the disposal site (20 km) (30% following EN 17160).

Module D includes benefits from all net flows in the end-of-life stage that leave the product boundary system after passing the end-of-waste stage.

This EPD evaluates the A1-A3 stage of the product life cycle, including the extraction stage, as well as the production of all the products and materials used as raw materials, the transport of these materials from the suppliers to the TopCer and the processing of these materials to the production of the final products, including their packaging.

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		1.54E+01	1.52E+01	1,30E-01	3.97E-02	2.99E-06	4.80E-02
Module A4	Scenario A4.1	6.78E-01	6.77E-01	5.42E-04	5.14E-06	1.57E-07	1.34E-03
	Scenario A4.2	3.11E+00	3.11E+00	2.49E-03	2.36E-05	7.23E-07	6.13E-03
	Scenario A4.3	9.60E-01	9.59E-01	6.20E-04	9.97E-06	2.02E-07	3.31E-02
Module A5	Scenario A5.1	1,62E+00	1.11E+00	5,16E-01	1.28E-03	1.16E-07	3.52E-03
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	5.78E-01	5.63E-01	1.48E-02	3.36E-04	6.16E-08	3.84E-03
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	4.52E-02	4.52E-02	3.61E-05	3.43E-07	1.05E-08	8.91E-05
Module C3	Scenario C3.1	4.49E-02	4.49E-02	3.31E-05	6.57E-07	1.01E-08	4.84E-04
Module C4	Scenario C4.1	5.01E-02	5.00E-02	1.43E-04	1.13E-06	1.13E-08	4.50E-04
Module D	Scenario D.1	-2.40E-02	-2.25E-02	-1.49E-03	-1.33E-05	-4.18E-09	-1.93E-04

LEGEND:

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

NOTES:

Values expressed by functional unit (1 m²).

		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	m³ World eq. deprived
Modules A1-A3		1,95E-04	1.92E-02	1.05E-01	4.34E-02	2.92E-03	2.14E+02	7.56E+00
Module A4	Scenario A4.1	3.70E-07	2.23E-04	2.48E-03	8.77E-04	2.88E-08	9.62E+00	-2.04E-03
	Scenario A4.2	1.70E-06	1.02E-03	2.48E-03	4.03E-03	1.32E-07	4.41E+01	-9.35E-03
	Scenario A4.3	5.72E-07	8.13E-03	9.05E-02	2.30E-02	8.00E-09	1.24E+01	-2.91E-03
Module A5	Scenario A5.1	1.67E-05	1.24E-03	9.37E-03	3.02E-03	8.76E-05	1.01E+01	2.58E-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	2.24E-05	5.18E-04	5.68E-03	2.50E-03	2.51E-07	1.94E+01	1.15E+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	2.47E-08	1.49E-05	1.65E-04	5.85E-05	1.92E-09	6.41E-01	-1.36E-04
Module C3	Scenario C3.1	3.35E-08	2.17E-04	2.38E-03	6.51E-04	2.23E-09	6.21E-01	1.28E-04
Module C4	Scenario C4.1	5.53E-08	1.96E-04	2.15E-03	5.85E-04	2.41E-09	6.98E-01	1.17E-04
Module D	Scenario D.1	-5.32E-07	-7.69E-05	-8.45E-04	-2.34E-04	-6.46E-09	-4.62E-01	-6.93E-03

LEGENDA:

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

NOTES: P.C.I. – Net calorific value
Values expressed by functional unit (1 m²).

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		1.47E-06	5.36E-01	2.23E+02	2.03E-08	1.18E-07	1.04E+02
Module A4	Scenario A4.1	3.91E-08	4.23E-02	3.84E+00	5.06E-11	6.01E-09	3.06E-02
	Scenario A4.2	1.79E-07	1.94E-01	1.76E+01	2.32E-10	2.76E-08	1.40E-01
	Scenario A4.3	2.43E-08	5.43E-02	3.97E+00	1.56E-10	3.28E-09	3.89E-02
Module A5	Scenario A5.1	6.96E-08	4.10E-02	1.29E+01	7.48E-10	8.47E-09	1.07E+01
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	3.52E-08	1.67E-02	8.65E+00	1.86E-09	1.87E-08	9.60E-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	2.61E-09	2.82E-03	2.56E-01	3.38E-12	4.01E-10	2.04E-03
Module C3	Scenario C3.1	6.86E-08	2.71E-03	2.08E-01	2.73E-12	2.17E-10	2.28E-03
Module C4	Scenario C4.1	3.50E-08	3.08E-03	2.65E-01	5.43E-12	3.67E-10	2.56E-01
Module D	Scenario D.1	-5.11E-09	-5.35E-03	-2.26E-01	-1.74E-11	-1.88E-10	-7.86E-01

LEGEND:

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

NOTES:
Values expressed by functional unit (1 m²).

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		3.61E+01	1.31E+00	3.75E+01	2.34E+02	2.30E-01	2.34E+02
Module A4	Scenario A4.1	1.41E-02	0.00E+00	1.41E-02	1.02E+01	0.00E+00	1.02E+01
	Scenario A4.2	6.49E-02	0.00E+00	6.49E-02	4.69E+01	0.00E+00	4.69E+01
	Scenario A4.3	1.62E-02	0.00E+00	1.62E-02	1.31E+01	0.00E+00	1.31E+01
Module A5	Scenario A5.1	1.81E+00	2.97E-01	2.11E+00	1.09E+01	0.00E+00	1.09E+01
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	4.37E-01	0.00E+00	4.37E-01	2.06E+01	0.00E+00	2.06E+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	9.43E-04	0.00E+00	9.43E-04	6.81E-01	0.00E+00	6.81E-01
Module C3	Scenario C3.1	9.86E-04	0.00E+00	9.86E-04	6.59E-01	0.00E+00	6.59E-01
Module C4	Scenario C4.1	1.27E-02	0.00E+00	1.27E-02	7.46E-01	0.00E+00	7.46E-01
Module D	Scenario D.1	-1.67E-01	0.00E+00	-1.67E-01	-1.26E+00	0.00E+00	-1.26E+00

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 (EPNR + RNR);

NOTE: Values expressed by functional unit (1 m²).

		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		2.51E+00	0.00E+00	0.00E+00	1.81E-01
Module A4	Scenario A4.1	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Scenario A4.2	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Scenario A4.3	0.00E+00	0.00E+00	0.00E+00	2.52E-04
Module A5	Scenario A5.1	0.00E+00	0.00E+00	0.00E+00	5,59E-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	2.69E-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	0.00E+00
Module C3	Scenario C3.1	1.40E+01	0.00E+00	0.00E+00	1.56E-05
Module C4	Scenario C4.1	0.00E+00	0.00E+00	0.00E+00	4.12E-05
Module D	Scenario D.1	0.00E+00	0.00E+00	0.00E+00	-6.49E-05

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: Values expressed by functional unit (1 m²).

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		1.45E-03	3.51E+00	7.46E-04
Module A4	Scenario A4.1	2.55E-05	4.02E-04	6.97E-05
	Scenario A4.2	1.17E-04	1.85E-03	3.20E-04
	Scenario A4.3	7.29E-06	5.92E-04	8.94E-05
Module A5	Scenario A5.1	4.77E-05	1.70E-01	4.40E-05
Module B1	Scenario B1.1	0.00E+00	0.00E+00	0.00E+00
Module B2	Scenario B2.1	9.78E-06	1.78E-02	1.54E-05
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	1.70E-06	2.68E-05	4.65E-06
Module C3	Scenario C3.1	1.62E-06	3.88E-05	4.47E-06
Module C4	Scenario C4.1	1.83E-06	6.01E+00	5.09E-06
Module D	Scenario D.1	-1.80E-06	-6.85E-04	-1.45E-05

LEGENDA:

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

NOTE: Values expressed by functional unit (1 m²).

2.6. Environmental information describing output flows

		Components for re-use	Materials for recycling	Materials for energy recovery	Exported energy
Unit		kg	kg	kg	MJ
Modules A1-A3		0,00E+00	5,17E-01	6,59E-03	ND
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	6,03E-01	8,39E-02	ND
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	1,40E+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

NOTE: Values expressed by functional unit (1m²)
 ND – Not determined

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	1.69E-01
* 1 kg biogenic carbon is equivalent to 44/12 kg of CO ₂ .		

3. SCENARIOS AND ADDITIONAL TECHNICAL INFORMATION

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	Truck with a capacity of 25 tons	300
Europe	Truck with a capacity of 25 tons	1 390
International (Outside Europe)	Transoceanic freight ship	6 520

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

The scenario was also according to the options defined in EN 17160 and Almeida, 2019, for the installation stage. The option chosen was 3.3 kg of cementitious adhesive for each m² of ceramic tile. The ceramic material loss considered was 3%. The waste also included packaging waste.

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

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 stage 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, based on 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 m² of ceramic floor tiles once a week.

Parameter	Value	Unit of measure
Water consumption	0.1	l
Detergent consumption	0.134	ml
Wall tile maintenance cycle	2600	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 repairing during the use stage, and therefore, no impacts should be declared in 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 Refurbishment

Thus, according to EN 17160, ceramic tiles require no repairing during the use phase, and therefore, no impacts should be declared in the refurbishment phase.

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 EN 17160.

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:

- road construction in filled embankment.
- concrete aggregates;
- when ceramic tiles are crushed, they form recycled ceramic aggregates, which can be integrated as a partial substitute for natural aggregate in hot-mix asphalt [8];

- recycled ceramic aggregates can be used in the construction of landfills [8];
- recycled ceramic aggregates can be used to construct sub-based courses on secondary roads [8].

In this case, and in accordance with EN 17160, it was considered that 70% of ceramic tiles can be crushed and used in a variety of applications, as recycled ceramic aggregates that can be integrated as a partial replacement for natural aggregate.

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

The product is classified with A+ in terms of indoor air quality. Source: TOPCER self-declaration and CeramUnie guide.

When applied indoors, the ceramic tile only comes into contact with water during cleaning. Cadmium and lead emissions were measured according to the ISO 10545-15 test method. The measured values are below the lower detectable limits.

TOPCER carried out leachate analyses, following NEN 7375 and EN 12457 standards, with the determination of pH; As; Ba; Ca; Cd; Co; Cr; Cu; Hg; Mn; Mo; Ni; Pb; Zn; Sb; Se; Sn; V; Sulphates, Chlorides, Fluorides; Bromides; phenol index; BTEX; PCB; Mineral oils and PAHs, for inert disposal to landfill, showing values allowing classification as inert waste, most of which are below the limit of quantification.

4. REFERENCES

- ✓ Almeida. M. (2019). Desempenho ambiental de produtos no sector cerâmico em Portugal. Tese de doutoramento. Universidade de Aveiro.
- ✓ Direção-Geral de Energia e Geologia (DGEG) – Energy in Portugal Report (2019)
- ✓ Direção-Geral de Energia e Geologia (DGEG) – Monthly Data of Electrical Energy (2019). (in <http://www.dgeg.gov.pt?cr=15125>)
- ✓ Ecoinvent database v3.7 (2019). (www.ecoinvent.org)
- ✓ EN 15804:2012+A2:2019 Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products;
- ✓ EN 15942:2011 Sustainability of construction works – Environmental product declarations – Communication format business-to-business.
- ✓ EN 17160:2019 – “Product category rules for ceramic tiles”.
- ✓ Entidade Reguladora dos Serviços Energéticos (ERSE) – Special Regime Production (PRE) (2019) (in <http://www.erse.pt/pt/desempenhoambiental/prodregesp/2019/Paginas/2019.aspx>)
- ✓ General Instructions of the DAPHabitat System, Version 1.0, Edition March 2013 (in www.daphabitat.pt);
- ✓ ISO 14025:2009 Environmental declarations and labels – Type III environmental declarations – Principles and procedures;
- ✓ RCP – basic module for construction products and services. DAPHabitat System. Version 2.3, 2023 (in www.daphabitat.pt);
- ✓ Redes Energéticas Nacionais (REN) – Information Centre – Monthly Statistics (2020). (in <http://www.centrodeinformacao.ren.pt/PT/InformacaoExploracao/Paginas/EstatisticaMensal.aspx>)
- ✓ Regras para a Categoria de Produto (RCP) – Modelo base para produtos e serviços de construção. RCP-MB001 DAPHabitat System. Version 2.2, January of 2016 (in www.daphabitat.pt);
- ✓ Regras para a Categoria de Produto (RCP) – Revestimento de Paredes. Wall covering. RCP002:2014. DAPHabitat System. Version 1.2, June 2022 (in www.daphabitat.pt);
- ✓ Regras para a Categoria de Produto (RCP) – Revestimento de Pavimento. Floor covering. RCP001:2014 DAPHabitat System. Version 1.2, June 2022 (in www.daphabitat.pt).