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Environmental Product Declaration

ASCER
Spanish Ceramic Tiles

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UNE-EN 17160:2019

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ASCER
Asociación Española de Fabricantes de Azulejos y Pavimentos Cerámicos

GENERALITAT VALENCIANA
Conselleria de Hacienda, Economía y Administración Pública

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The EPD holder is responsible for the content of the Declaration. The holder is responsible for keeping the records and documents supporting the content of the Declaration

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UNE-EN 17160:2020 The Standard UNE-EN 15804:2012+A2:2019 serve as the basis for the PCR
Independent verification of the declaration and data, according to ISO 14025:2010 ☐ Internal ☒External
Verification body AENOR The Certification Body is accredited by ENAC. 1/C-PR468

1. General information

1.1. The organization

The main objective of ASCER (Spanish Ceramic Tile Manufacturers' Association) is to support, defend and promote the general and common interests of the ceramic tile industry, as well as to offer its associates valuable services and help them to improve the management of their companies and to create sustainable competitive advantages.

ASCER activities are based on the need or call for joint action in those areas in which companies are unable to successfully tackle individually, or which require a considerable financial outlay. The high representativeness of the Association as well as the geographical concentration of the companies (95% of the production in the province of Castellon) guarantee that any activity will have an immediate and a global diffusion of the sector.

1.2. Scope of the declaration

This Environmental Product Declaration (EPD) describes average environmental information relating to the life cycle of ceramic tiles manufactured by the companies associated with the Spanish Ceramic Tile Manufacturers' Association, ASCER. The scope of this EPD is cradle to grave.

The results of the Life Cycle Assessment (LCA) underpinning this EPD are based on the data provided by the manufacturers of 55% of the national ceramic tile production.

The results shown are considered representative of the companies associated with ASCER, in a geographical and technological environment of Spain 2022.

1.3. Life cycle and compliance

This EPD has been developed and verified in accordance with EN ISO 14025:2006 and EN 15804:2012+A2:2019 and EN 17160:2019 Product Category Rules for Ceramic Tiles

INFORMATION ABOUT PRODUCT CATEGORY RULES	
Descriptive title	UNE-EN 17160:2019. Product Category Rules for Ceramic Tiles
Registration code and version	UNE-EN 17160:2019
Publication date	2019
Compliance	UNE-EN 15804:2012+A2:2020
Operator of the Programme	AENOR

This Environmental Declaration includes the following life cycle stages:

System boundaries. Information modules considered

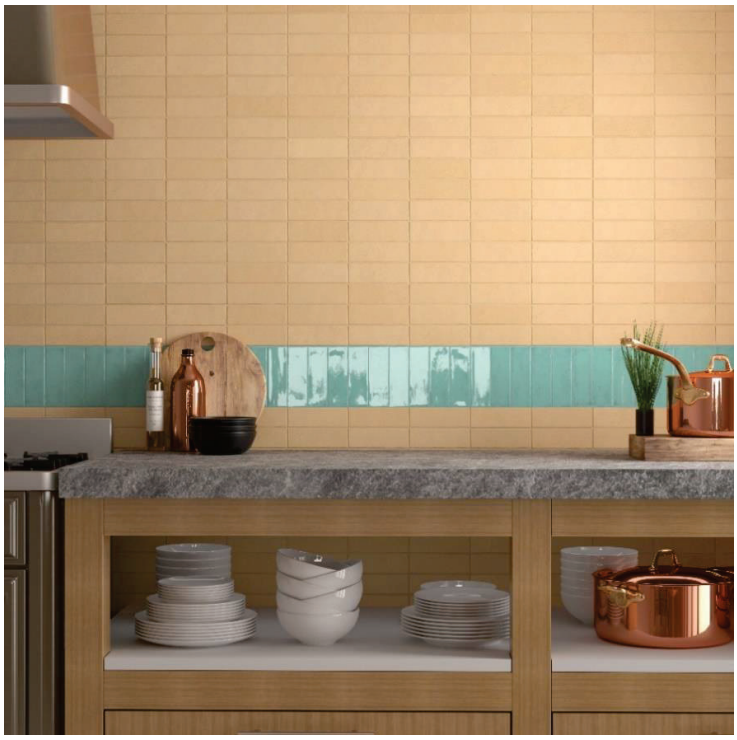
Product Stage	A1	Raw materials supply	X
	A2	Transport	X
	A3	Manufacturing	X
Construction	A4	Transport of the product	X
	A5	Installation and construction processes	X
Use	B1	Use	X
	B2	Maintenance	X
	B3	Repair	X
	B4	Replacement	X
	B5	Refurbishment	X
	B6	Use of energy in service	X
	B7	Use of water in service	X
End of Life	C1	Deconstruction	X
	C2	Transport	X
	C3	Waste management	X
	C4	Waste disposal	X
	D	Potential for reuse, recovery and recycling of materials	X

X = Module included in the LCA

This EPD may not be comparable with those developed in other Programmes or according to different reference documents, in particular it may not be comparable with EPDs not developed according to EN 15804+A2.

Similarly, this EPD may not be comparable if the origin of the data is different (e.g. databases), not all relevant information modules are included or they are not based on the same scenarios.

The comparison of construction products should be done on the same function, applying the same functional unit and at the level of the building (or architectural or engineering work), i.e. including the behaviour of the product throughout its life cycle, as well as the specifications of section 6.7.2 of the ISO 14025 standard.



2. Product information

2.1. Product information

This EPD provides average environmental information on ceramic coverings manufactured by ASCER member companies.

Ceramic tiles are thin slabs, generally used for covering surfaces in the construction sector, manufactured from a mixture of inorganic materials of a plastic and non-plastic nature that undergo grinding and/or kneading, are shaped and then dried and fired at a temperature sufficient for them to stably acquire the properties required for their use (EN 14411:2016). This product category also includes mosaics, complementary and special pieces, which can be of very different sizes and shapes, even non-flat. In short, those ceramic coverings defined by standard EN 14411:2016 (equivalent to standard ISO 13006:2018).

The ceramic tiles presented in this EPD have an average weight of 20.7 kg/m^2.

Los recubrimientos presentados en esta DAP tienen un peso medio de

The CPC code of the product is 37370.

2.2. Product technical features

This EPD collects environmental information on ceramic coverings formed by dry pressing or extrusion, intended for flooring and/or wall and façade cladding, both indoors and outdoors.

For the marketing of the product in the European Union/European Free Trade Association (EU/EFTA) (with the exception of Switzerland) Regulation (EU) No 305/2011 (CPR) applies. The product needs a declaration of performance taking into account EN 14411:2016 Ceramic tiles. Definitions, classification, characteristics, assessment and verification of constancy of performance, and marking - and CE marking. For application and use, EN 14411:2016 applies, which groups the products according to forming mode (A: extrusion and B: dry pressing) and water absorption group into: BIa, BIb, BIIa, BIIb, BIII, AIa, AIb, AIIa, AIIb, AIIb, AIII.

The performance of ceramic tiles varies according to the type of product. The main characteristics and the corresponding performance values and/or ranges covered by the standard, depending on the tile group, include:

- **Water absorption** according to ISO 10545-3 test: between 0.0 and > 10 %.
- **Modulus of rupture** according to ISO 10545-4 test: 8 - 35 N/mm2 (minimum value according to group)
- **Breaking strength** according to ISO 10545-4 test: 600 - 1300 N (minimum value according to group)
- **Abrasion resistance** of glazed tiles according to ISO 10545-7: class 0 - 5
- **Abrasion resistance** of unglazed tiles according to ISO 10545-6: maximum 2365 mm^3 for extruded tiles and 540 mm^3 for pressed tiles.
- **Coefficient of linear thermal expansion** according to ISO 10545-8: test available (for applications with high thermal variation)
- **Thermal shock resistance** according to ISO 10545-9: required

- **Cracking resistance** according to ISO 10545- 11: **required**
- **Frost resistance** according to ISO 10545-12: required for tiles with water absorption less than or equal to 3%.
- **Slip resistance** according to the test established in the national regulations of destination. In Spain, according to the Technical Building Code, tiles for floors in public areas must be tested according to the pendulum method (UNE 41901) and comply with certain minimum requirements/classes depending on the location.
- **Moisture expansion** according to ISO 10545-10: declare value
- **Impact resistance** according to ISO 10545-5: test available
- **Reaction to fire**: no test required, class A1-A1FL
- **Chemical resistance** according to ISO 10545-13: minimum class B (declare class A - C)
- **Stain resistance** according to ISO 10545-14: glazed minimum class 3 and for unglazed declare value
- **Emission of cadmium and lead** according to ISO 10545-15: only when necessary (e.g. applications where food preparation is carried out).

2.3. Product composition

The composition declared by the manufacturer is as follows:

Product composition

Substance/component	Content
Body (clays, feldspars, sands, etc.)	97%
Decoration materials (quartz, clays, feldspars, etc.)	3%

Substances contained in the product that are listed in the "Candidate List of Substances of Very High Concern (SVHC) for authorisation" do not exceed 0.1% by weight of the product.

3. LCA Information

3.1. Life Cycle Assessment

The LCA has been carried out with the support of the LCA for Experts software (Sphera-GaBi) 10.7.1.28 [7] and with the database version 2023.2 (SP40.0) [8]) (SpheraSolutions). The characterisation factors used are those included in the EN 15804:2012+A2:2019 standard.

3.2. Functional unit / declared unit

The main function of this product is to cover surfaces, both floors and walls, indoors and outdoors, according to the technical specifications of each type of covering.

In this EPD, ceramic tiles with water absorption lower than 10% are considered to be used as floor coverings, and those with water absorption higher than 10% are considered to be used as wall coverings. In both cases, the scenario of use considered in the results is an indoor residential use, however, the versatility of ceramic tiles allows their installation as flooring for indoor and outdoor floors, urban areas, walls, façades, roofs, etc. and in any type of building with very different pedestrian traffic intensities, such as dwellings, offices, shopping centres, hospitals, educational centres, etc.

The functional unit considered is ***"Covering 1 m² of the interior floor of a dwelling with average weight of ceramic tiles, 20.7 kg/m², for 50 years".***

3.3. Reference Service Life (RSL)

The reference service life of the product is the same as that of the building where it is installed, provided it is installed correctly, as it is a long-lasting product that does not require replacement.

A useful life of 50 years has been considered, according to the suggestions of the PCRs for ceramic tiles.

Reference Service Life

Parameter	Unit (expressed per functional unit or per declared unit)
Reference service life	Minimum 50 years
Declared product properties (at the gate) and finishes, etc.	Minimum values of the relevant characteristics according to EN14411. For further information, apply for the manufacturer's technical data sheet, for each model.
Design application parameters (manufacturer's instructions), including the references to appropriate practices	For further information, apply for the manufacturer's technical data sheet, for each model.
Assumed quality of work, when installed in accordance with the manufacturer's instructions	For further information, apply for the manufacturer's technical data sheet, for each model.
Outdoor environment (for outdoor applications), e.g. weathering, pollutants, UV radiation and wind exposure, building orientation, shading, temperature	Values of the relevant characteristics according to EN 14411. For further information, apply for the manufacturer's technical data sheet, for each model.
Indoor environment (indoor applications), e.g. temperature, moisture, chemical exposure	Values of the relevant characteristics according to EN 14411. For further information, apply for the manufacturer's technical data sheet, for each model.
Usage conditions, e.g. frequency of use, mechanical exposure	For further information, apply for the manufacturer's technical data sheet, for each model.
Maintenance, e.g. required frequency, type and quality and replacement of replaceable components	For further information, apply for the manufacturer's technical data sheet, for each model.

3.4. Cut-off rule and exclusions

All known flows have been included. In total, more than 95% of all material and energy inputs and outputs of the system have been included, excluding those data that are not available or not quantified. The excluded data are as follows:

- Diffuse emissions of particulate matter into the atmosphere generated during the transport and storage of powdery raw materials
- Atmospheric emissions of pollutants, non-regulated
- Long-term emissions (>100 years).
- The processes of recycling and reuse of the waste generated throughout the life cycle of the ceramic tiles that are part of another system, based on the PCRs.
- Machinery and industrial equipment production

3.5. Representativeness, quality and selection of data

Primary data represent 55% of Spanish production in 2022. The data for stages A5-C4 are scenarios collected by the PCRs for ceramic tiles EN 17160:2019.

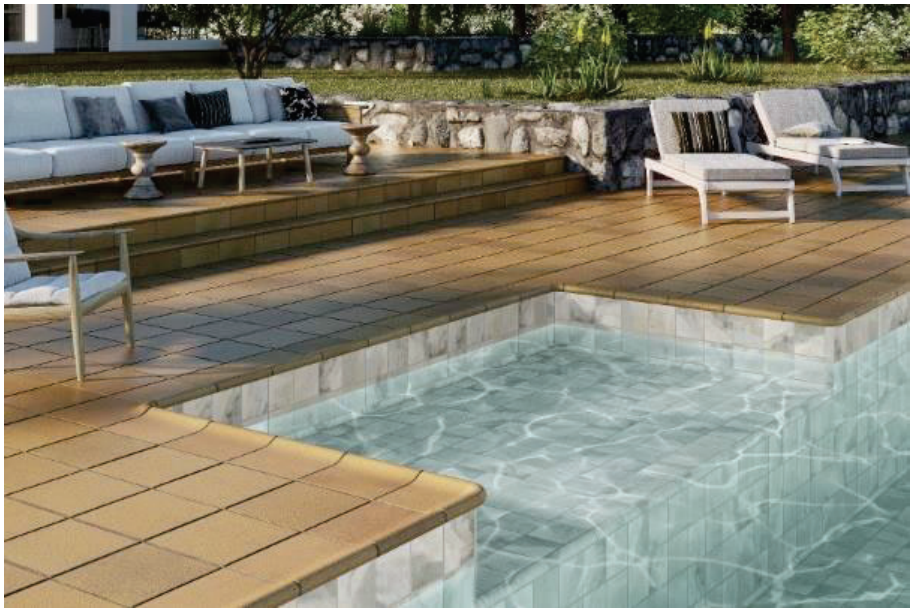
Data for decoration materials (frits, glazes, grits and stains) are taken from the Spanish sectoral Environmental Product Declarations published in 2024.

For secondary data, the most up-to-date *Managed LCA database-Sphera* [8] has been used and modelled with *LCA for Experts* (GaBi) version 10.7.1.28 [7].

3.6. Other calculation rules and assumptions

The information provided from the manufacturers has been treated statistically on an individual basis and, subsequently, a collective treatment has been carried out, studying the dispersion of the data, eliminating non-logical values in order to, finally, make averages weighted by the production of each of the participating companies.

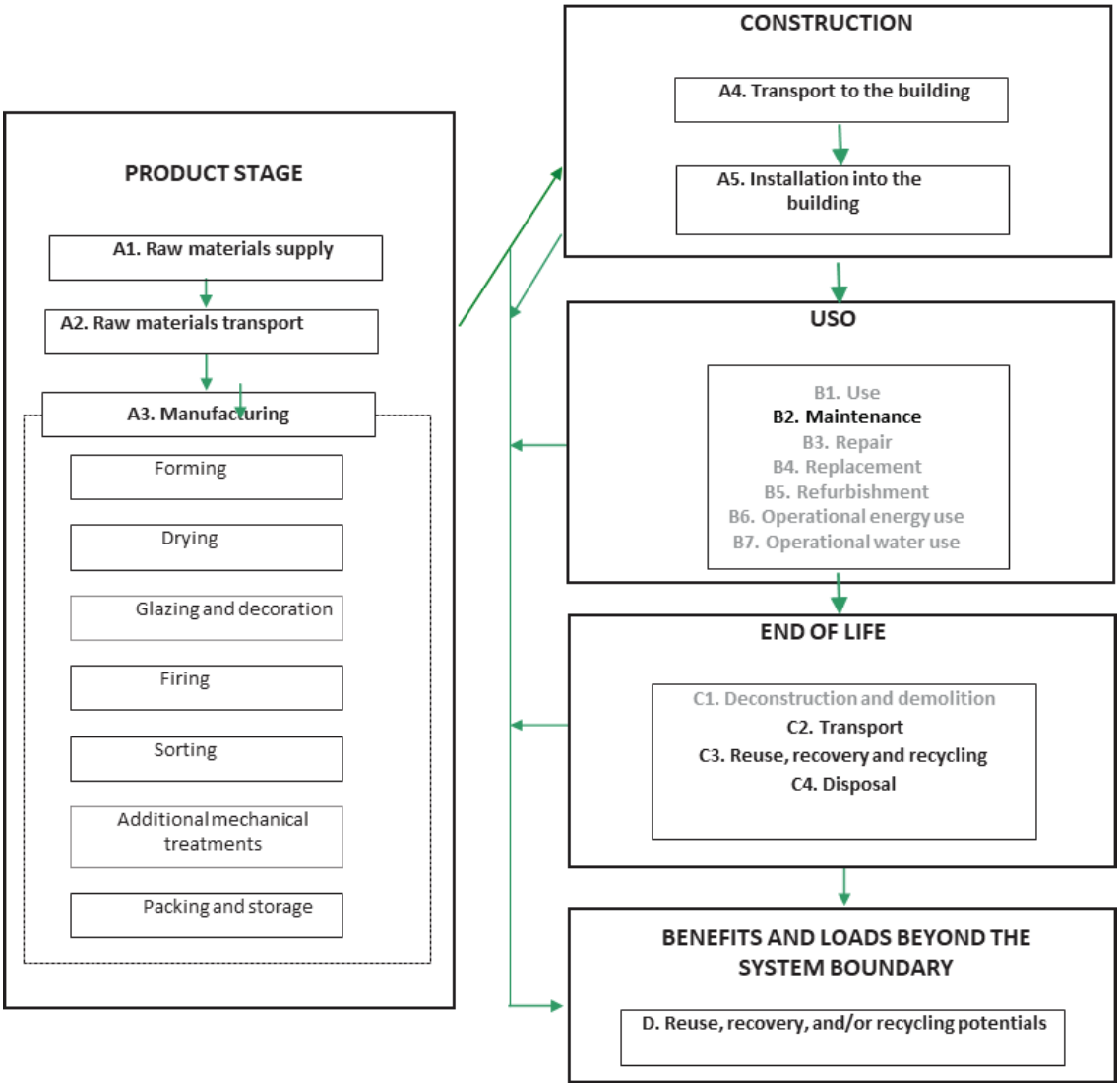
The global warming potential (GWPtotal) of the different technologies that make up the electricity mix used is 0,4284 kgCO2 eq/MJ.



4. System limits, scenarios and additional technical information

All life cycle modules relevant to ceramic tiles according to the PCR have been included:

System diagram



4.1. Pre-manufacturing processes (upstream)

Raw materials (A1) and Transport (A2)

Ceramic tiles are composed of a ceramic body and a decorative layer.

The raw materials included in the composition of the body are mainly clays, feldspars, sands and ceramic waste generated during manufacture.

The raw materials for decoration (glazes, grits and inks) are produced in specialised plants. The most common raw materials are frits, inorganic pigments, inks and other inorganic materials. Ceramic frits are insoluble glasses, prepared in advance by complete melting of their original raw materials and rapid cooling. The data are taken from the Environmental Product Declarations of the Spanish sector (2024).

The raw materials used have different origins, according to their nature and properties; they are transported by road or by ship in bulk, depending on the distance and location of the extraction point.

The raw materials of the support are mainly wet milled in ball mills and dried to obtain a suspension called slurry, which is then spray-dried to obtain granules. To a lesser extent, the raw materials are milled dry using pendulum and hammer mills.

High-efficiency cogeneration systems are installed in the spray dryers for the production of thermal and electrical energy.

The treated raw materials are transported to the ceramic manufacturing plants.

4.2. Manufacturing of the product

Manufacturing (A3)

The ceramic pieces are formed by dry uniaxial pressing mainly and/or by extrusion and also continuous presses are being installed to obtain tiles pieces of large sizes and reduced thicknesses.

In any case, after forming, the pieces are placed in a dryer to reduce their humidity.

The pieces from the dryer are optionally coated with a thin layer or several layers of glazes and in some cases, they are decorated, mainly by injecting inks.

The pieces are then fired in single-layer roller kilns to produce a hard, water- and chemical-resistant material.

Some of the ceramic pieces are then subjected to additional mechanical treatments: pre-cutting, cutting, polishing, grinding or bevelling.

After passing the quality control processes, the sorted parts are boxed and packaged.

4.3. Construction process Transport (A4)

Product distribution is as follows: 34% of the product is distributed in Spain, 29% in Europe and 37% to the rest of the world.

The distances applied are those indicated by EN 17160:2019. For national and European transport, a road transport with a 27 t Euro 6 compliant truck of 300 km and 1390 km, respectively, has been considered. For transcontinental transport, an average transoceanic freighter (transport to the rest of the world, 6.250km) has been estimated.

Module A4 Transport to site

Scenario information	Transport to site
Parameter	Result (expressed per functional unit)
Type and fuel consumption of the vehicle, type of vehicles used for transport, e.g. long distance trucks, ship, etc.	According to the destinations in the distribution as described above: 0.1262 l diesel (Euro truck 6, 27 t) 0.026 l fuel oil (ship)
Distance	300 km national distribution national: 33% 1390 km rest of Europe distribution: 28% 6520 km rest of the world distribution: 39%
Capacity utilisation (including no-load return)	85% in truck 100% ship
Bulk density of transported products	≈1800 kg/m^3
Usable capacity factor (factor: = 1 or < 1 or ≥ 1 for products that are packed compressed or nested)	Not applicable

4.4. Product installation and construction process (A5)

The product is then duly unpacked for installation. Data show that, in a real scenario, the ceramic tiles need to be installed with fast-setting mortars.

Waste from packaging waste are handled separately depending on the geographic location of the installation site. On the other hand, based on data provided by the companies, a 5.6% loss of material has been considered in the installation stage of the coverings.

Module A5 - Installation

Scenario information	Result (expressed per functional unit)
Supplementary materials form installation	3.3 kg mortar
Water use	0.8 l
Use of other resources	Not applicable
Quantitative description of the type of energy (regional mix) and consumption during the installation process	Not applicable
Waste of materials at the construction site before processing of waste generated at the product installation (specified by type)	Product losses: 1.159g Packaging wastes: Cardboard: 151 g Plastic: 48g Wood: 473 g
Output of materials (specified by type) as a result of waste treatment waste at the construction site, e.g. from waste collected for recycling, energy recovery, disposal (specified by route)	Product losses for recycling: 811g Product losses for final deposition:348g Incinerated cardboard: 0g Recycled cardboard: 150g Cardboard for final deposition: 0 g Incinerated plastic: 1g Recycled plastic: 37g Plastic for final deposition: 10g Incinerated wood: 1g Recycled wood: 459g Wood for final deposition: 13g
Direct emissions to ambient air, soil and water	Not applicable

4.5. Use Stage

B1 Use

Once installed, ceramic tiles do not require any energy input for their use and do not require maintenance after they are put on site, except for normal cleaning operations. For this reason, only the environmental loads attributable to the maintenance of the product are considered (module B2).

Ceramic tiles are by nature inert and therefore do not emit any harmful or hazardous substances to human health or the environment.

B2 Maintenance

Cleaning is done with a damp cloth and, if the surface is dirty or greasy, cleaning agents such as detergents or bleaches can be added. This EPD considers the scenarios for floor and wall covering included in the CPR EN 17160:2019. Specifically, for wall coverings a washing frequency of 4 times/year and for floor coverings 1 time/week with water, and 1 time every two weeks with water and detergent. The water and detergent consumption to be taken into account for each cleaning are: 0.1 l water/m2 and 0.134 ml detergent/m2. The declared values represent a sectoral average.

The declared environmental impacts refer to the maintenance required for 50 years.

Module B2 – Maintenance

Scenario information	Result (expressed per functional unit)
Maintenance process	According to RCP for ceramic tiles (UNE-EN17160) residential scenario for cleaning floors and walls.
Maintenance cycle	oors: 1x/week with water, and 1x/2weeks with water and detergent. Walls: Wash 4x/year with water and detergent.
Auxiliary materials for maintenance (e.g. cleaning products) (specify each material)	Detergent: 8.38E-05 kg/m^2 per cleaning
Material wastage during maintenance (specify type))	Not applicable

Scenario information	Result (expressed per functional unit)
Net tap water consumption	0.1 l/m^2 per cleaning
Energy input during maintenance (e.g. vacuum cleaning), type of energy carrier (e.g. electricity) and amount, if applicable and relevant	Not applicable

B3-B4-B5 Repair, replacement and refurbishment

The tiles do not require repair, replacement or renovation if the tiles are correctly installed.

4.6. Use linked to the operation of the building

B6-B7 Operational energy use and Operational water use

These modules are not relevant for ceramic tiles.

4.7 End of Life Stage

C1 Deconstruction and demolition

At the end of its service life, the product will be removed, either as part of a building renovation or during demolition. In the context of the demolition of a building, the impacts attributable to the removal of the product are negligible.

C2 Transport

The product waste is transported in a large tonnage truck (27 t) Euro 6 to be managed, either by being deposited in inert landfills, or recycled. An average distance of 50km from the place of installation to the final destination is considered. The return trip of the trucks is also included (100% empty returns).

C3 Gestión de residuos para reutilización, recuperación y reciclaje

70% of tiles are considered to be recycled and/or reused, as indicated in the PCR.

In the recycling process, a physical treatment of the waste consisting of primary shredding and subsequent screening has been considered.

C4 Final disposal

It was assumed that 30% of the product was sent to controlled landfills after its service life had ended.

End of life

Parameter	Result (expressed per functional unit)
Collection process, specified by type	24.0 kg total
Recovery system, specified by type	16.8 kg for recycing
Disposal, specified by type	7.2 kg for landfilling
Assumptions for scenario development (e.g.: transport)	The product waste is transported in a Euro 6 compliant heavy-duty truck (27 t) to be managed either to landfilling or recycling. An average distance of 50km from the building site to the final destination is considered. The return journey of the lorries is also included (100% empty return).

4.8 Benefits and burdens beyond the system

Module D

The net environmental burdens and net benefits of obtaining the secondary material from waste at the installation stage (coating wastes, coating packaging wastes: cardboard, plastic and wood) and at the end of life of the product have been considered.

4.9 Information on biogenic carbon content

Ceramic coatings are inorganic and do not contain biogenic carbon and their packaging is less than 5% by weight, therefore the biogenic content is not declared.

5. Declaration of environmental parameters of the LCA and LCI.

The estimated impact results are relative and do not indicate the final value of the impact categories, nor do they refer to threshold values, safety margins or risks.

Environmental impact

Parameters	Units	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	12.5	6.2E-01	1.7	0	1.8E-01	0	0	0	0	0	0	2.0E-01	2.9E-03	1.2E-01	-2.5E-01
GWP-fossil	kg CO_2 eq	12.1	3.0E-01	1.7	0	1.8E-01	0	0	0	0	0	0	7.7E-02	2.9E-03	1.2E-01	-2.5E-01
GWP-biogenic	kg CO_2 eq	3.1E-01	3.1E-01	4.3E-02	0	4.9E-03	0	0	0	0	0	0	1.2E-01	1.0E-06	1.2E-03	-1.4E-04
GWP-luluc	kg CO_2 eq	1.6E-02	8.5E-03	2.9E-03	0	4.2E-05	0	0	0	0	0	0	3.2E-03	1.7E-07	5.1E-04	-5.9E-04
GWP-total-IPCC	kg CO_2 eq	12.3	6.1E-01	1.7	0	1.8E-01	0	0	0	0	0	0	1.9E-01	2.8E-03	1.2E-01	-2.5E-01
ODP	kg CFC11 eq	2.4E-08	8.2E-14	1.3E-09	0	6.3E-11	0	0	0	0	0	0	2.8E-14	4.9E-15	6.7E-14	-6.1E-09
AP	mol H+ eq	1.9E-02	3.7E-03	3.3E-03	0	5.7E-04	0	0	0	0	0	0	2.2E-04	3.3E-06	8.6E-04	-1.1E-03
EP-freshwater	kg P eq	1.4E-04	2.2E-06	1.0E-05	0	5.3E-06	0	0	0	0	0	0	8.2E-07	3.1E-10	2.5E-06	-2.1E-06
EP-marine	kg N eq	5.6E-03	9.5E-04	1.1E-03	0	1.3E-04	0	0	0	0	0	0	7.7E-05	9.3E-07	2.4E-04	-2.9E-04
EP-terrestrial	mol N eq	6.2E-02	1.1E-02	1.2E-02	0	1.3E-03	0	0	0	0	0	0	9.1E-04	1.0E-05	2.5E-03	-3.2E-03
POCP	Kg NMVOC eq	1.8E-02	2.8E-03	3.2E-03	0	3.6E-04	0	0	0	0	0	0	2.5E-04	3.0E-06	6.9E-04	-8.1E-04
ADP-minerals& metals [1]	kg Sb eq	3.9E-05	4.6E-08	2.2E-06	0	2.7E-09	0	0	0	0	0	0	1.7E-08	1.0E-10	1.2E-08	-9.4E-08
ADP-fossil [1]	MJ	192.0	7.8	16.8	0	3.1	0	0	0	0	0	0	2.5	6.7E-02	1.6	-4.8
WDP [1]	m^3 depriv.	1.9	8.0E-03	2.2E-01	0	16.8	0	0	0	0	0	0	3.0E-03	8.8E-04	8.9E-03	-4.3E-02

GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential. Accumulated Exceedance; EP-freshwater = Eutrophication potential. Fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential. Fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential. Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential. deprivation-weighted water consumption

Warning 1: The results of this environmental impact indicator should be used with caution, as the uncertainties of the results are high and experience with this parameter is limited.

Additional environmental impacts

Parámetro	Unidades	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
PM	**Incidencia de enfermedades**	1,5E-05	6,2E-08	8,5E-07	0	3,4E-09	0	0	0	0	0	0	2,3E-09	3,0E-11	1,1E-08	-6,6E-09
IRP	**kBq U235 eq**	44,1	5,8	5,6	0	4,1E+00	0	0	0	0	0	0	1,9E+00	8,1E-03	0,9	-1,2
ETP-fw [1]	**CTUe**	4,1E-09	1,2E-10	3,8E-10	0	2,5E-10	0	0	0	0	0	0	3,8E-11	4,1E-13	1,2E-10	-3,9E-13
HTP-c [1]	**CTUh**	1,3E-07	5,0E-09	1,8E-08	0	2,7E-08	0	0	0	0	0	0	1,7E-09	7,6E-12	1,3E-08	-1,2E-09
HTP-nc [1]	**CTUh**	4,4E-01	1,9E-03	5,7E-02	0	2,0E-02	0	0	0	0	0	0	6,7E-04	6,2E-04	2,1E-03	-1,0E-02
SQP [1]	**-**	129,0	3,3	19,2	0	0,7	0	0	0	0	0	0	1,2E+00	1,6E-04	3,7E-01	-1,8

PM: Potential for disease incidence due to emissions of particulate matter (PM)**; IRP** : Exposure efficiency of human potential relative to U235; **ETP-fw** : Ecosystem toxic unit comparative potential - freshwater; **HTP-c** : Ecosystem toxic unit comparative potential - carcinogenic effects**; HTP-nc** : Ecosystem toxic unit comparative potential - non-carcinogenic effects**; SQP :** Soil quality potential index; **NR:** Not relevant

Note 1: This impact category deals mainly with potential impacts of low doses of ionising radiation on human health from the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents or occupational exposure due to disposal of radioactive waste in underground facilities. Ionising radiation potential of soil, due to radon or some building materials is also not measured by this parameter.

Use of resources

Parameters	Units	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
PERE	MJ	34.4	5.8E-01	4.0	0	4.0	0	0	0	0	0	0	2.2E-01	2.6E-03	1.8E-01	-6.8
PERM	MJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PERT	MJ	34.4	5.8E-01	4.0	0	4.0	0	0	0	0	0	0	2.2E-01	2.6E-03	1.8E-01	-6.8
PENRE	MJ	193.0	7.8	16.9	0	3.1	0	0	0	0	0	0	2.5	6.7E-02	1.6	-4.8
PENRM	MJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PENRT	MJ	193.0	7.8	16.9	0	3.1	0	0	0	0	0	0	2.5	6.7E-02	1.6	-4.8
SM	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RSF	MJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FW	m^3	3.7E-02	6.4E-04	4.4E-03	0	2.2E-01	0	0	0	0	0	0	2.4E-04	1.2E-05	3.0E-04	-3.0E-03

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

Waste categories and output flows

Parameters	Units	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
HWD	Kg	2.0E-02	2.9E-10	1.1E-03	0	1.4E-10	0	0	0	0	0	0	9.7E-11	8.0E-12	2.5E-08	-3.5E-08
NHWD	Kg	3.9	1.2E-03	6.7E-01	0	5.9E-02	0	0	0	0	0	0	4.1E-04	7.2	0.0	-1.0E-03
RWD	Kg	5.5E-03	1.3E-05	5.2E-04	0	8.0E-06	0	0	0	0	0	0	4.6E-06	9.7E-06	2.1E-05	-1.5E-05
CRU	Kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MFR	Kg	3.3E-01	0	9.0E-01	0	0	0	0	0	0	0	0	0	16.8	0	0.776
MER	Kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EE	MJ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

HWD: Hazardous waste disposed of; NHWD: Non-hazardous waste disposed of; RWD: Radioactive waste disposed of; CRU: Components for reuse; MFR: Materials for recycling; MER: Materials for energy recovery; EE: Energy exported;

6 Additional environmental impacts

6.1. General

Indoor air emissions

Ceramic tiles, in their manufacturing process, are subjected to a thermal process that exceeds 1000°C. At these temperatures, any organic compounds present in the compositions decompose, resulting in a final product that is inert and free of volatile organic compounds that may be emitted during the use phase.

Release to soil and water

Ceramic tiles do not emit any compounds into the soil or water during the use phase, as it is a totally inert product, which does not undergo physical, chemical or biological transformations, is not soluble or combustible, does not react physically, chemically or in any other way, is not biodegradable, does not adversely affect other materials with which it comes into contact in a way that could lead to environmental pollution or harm human health. It is a non-leaching product and therefore does not pose a risk to surface or groundwater quality.

References

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[4] ISO 14040:2006. Environmental Management. Life Cycle Assessment. Principles and framework.

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[6] EN 17160:2019 Product Category Rules for ceramic tiles.

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