

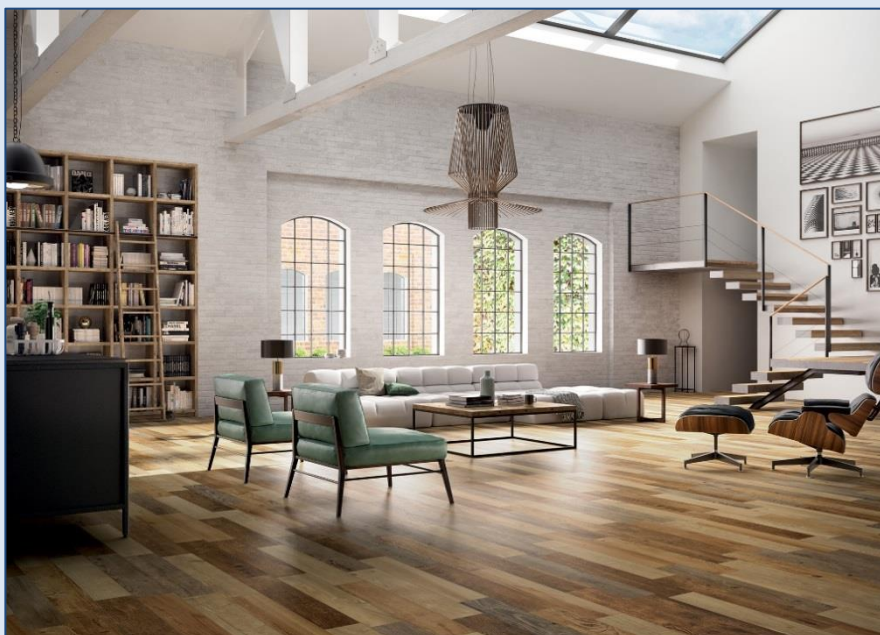
PORCELAIN STONEWARE CERAMIC TILES

MARCA CORONA 1741
EVOLUZIONE CERAMICA



ENVIRONMENTAL PRODUCT DECLARATION

in compliance with ISO 14025 and EN 15804



Program Operator	EPDIItaly
Publisher	Ceramiche Marca Corona
Based on	IBU PCR Part B:2014-07-04 V1.6 EPDIItaly - PCR ICMQ-001/15 rev. 2 21/04/2017
Declaration Number	1234567890
Registration Number	A1234567890
Issue Date	20 / 10 / 2017
Valid until	20 / 10 / 2022

SECTION 1

Owner of program

EPDItaly



Owner of declaration

Ceramiche Marca Corona S.p.A.

Via Emilia Romagna, 7
41049, Sassuolo (MO), Italy

MARCA CORONA 1741
EVOLUZIONE CERAMICA

Number of the declaration

EPD-COI-20160202-ICG1-EN

Date of issue 20.11.2017

Valid until 20.11.2022

Review

Independent review of the EPD and of the data contained therein in compliance with ISO 14025

inside outside

Conducted by ICMQ S.p.A. – Via de Castilia, 10 – 20124 Milano (www.icmq.it)

Scope

This document refers to an average 'ceramic tile' product manufactured at Ceramiche Marca Corona S.p.A. – Via E.Romagna, 7 - 41049 Sassuolo (MO).

Comparability

Environmental declarations published within the same product category but coming from different programs might not be comparable. In particular, the EPDs for building products may not be comparable unless they conform to EN 15804 standards.

Liability

Ceramiche Marca Corona S.p.A. exonerates EPDItaly for any non-compliance with environmental legislation that has been declared by the manufacturer.

The owner of the declaration shall be liable for the information and the required proofs; EPDItaly accepts no liability for the manufacturer's information, for data and for results of the life-cycle assessment.

SECTION 2 - GENERAL INFORMATION

THE COMPANY

For over a century, Marca Corona has been offering a wide choice of floor and wall tiles and mosaics to decorate and enhance homes and business premises, both indoors and outdoors. As Marca Corona is the oldest tile company in Sassuolo, it has always helped drive the industry by respecting tradition and focusing on innovation: using cutting-edge technology, the Corona brand marries visual appeal with outstanding technical performance, in line with the most modern design needs.



Since its origins, way back in 1741, it has distinguished itself by constant evolution of products and processes that has enabled the company to position itself at the top end of the market with collections that are appreciated and bought throughout the world. In 2007 Marca Corona started to reposition the company by overhauling the factory and the product range. This now comprises ceramics for outdoors and indoors, in different finishes and sizes, from large slabs measuring 120x240cm to majolica tiles measuring 10x10cm. A focus on the latest design trends and technological innovations ensures a perfect balance between aesthetic appeal and technical performance.

The porcelain stoneware or white body floor and wall tiles have surfaces that reproduce the effect of concrete, stone, marble, wood, textiles, metal or three-dimensional effects that combine with small-size collections with great visual appeal. Whatever their intended use, all Marca Corona collections encapsulate style, quality and reliability.

CERAMIC TILES

The ceramic tiles are formed by dry pressing starting with natural raw materials such as clay, feldspar, sand and kaolin. The type of tile produced is porcelain stoneware. This type of tile is characterized by a very compact structure and high performance. For this study, an average product has been identified and adopted that is representative of the entire Ceramiche Marca Corona product range.



INTENDED PURPOSE

The ceramic tiles that are the subject of this study are designed to be used both as floor and wall tiles and to be laid both indoors and outdoors in residential, non-residential and environments.

PURPOSE AND TYPE OF EPD

In accordance with the relevant PCRs, the LCA is of the **cradle-to-grave** type. The analyzed system takes account of all the phases from the production of the raw materials to the production of the finished and packaged product (A1-A3), distribution to the end customer (A4), in addition to the end of the product's life, including transport (C2), energy recovery (C3) and placement in landfill sites (C4), with the addition of any energy credits (D).

For the LCA, the tool ATLAS v.3 was used that has been created by thinkstep AG, Leinfelden-Echterdingen, 2016 and validated by ICMQ and IBU Institut Bauen und Umwelt.

The declaration is classified as:

- 1 a: Manufacturer's environmental declaration (product EPD) relating to a specific product by a specific manufacturer

Further, this declaration has been developed according to the program EPDItaly and is based on product category rules (PCR):

- IBU PCR Part B:2014-07-04 V1.6
- EPDItaly - PCR ICMQ-001/15 rev. 2 21/04/2017

Standard EN 15804 is the framework reference for the PCRs.

Declared product / Declared unit of measurement:

1 m² of ceramic tiles.

The data on the LCA (life cycle assessment) study refer to the entire output of 2016.

SECTION 3 – DESCRIPTION OF THE PRODUCT AND OF THE PRODUCTIVE PROCESS

BASIC MATERIALS/SECONDARY MATERIALS

Main raw materials for ceramic tiles:

- clay 33%
- sand 21%
- feldspar 32%

Main glaze components:

- clay powder
- alumina
- natural pigments
- frit

Main secondary additives:

- dispersing agents
- binding agents
- fluidifying agents
- levelling agents
- deaerating agents

PRODUCTIVE PROCESS

The manufacturing process of the ceramic tiles that is the subject of this EPD is shown and described below.

The necessary composition of raw materials, thus including recycled waste, is mixed and milled in milling plants by a wet process; the slip produced (a suspension in about 25-30% water) is treated in spray dryers (atomizers) that use thermal energy generated by natural gas and high atmospheric pressure to produce a dry powder with spherical granules of suitable sizes that is ready to be pressed.

During the drying process, energy is produced by cogeneration.

The ceramic tiles are formed by dry pressing with the help of special moulds (isostatic pressing).

The surfaces of the dried tiles are glazed and decorated.

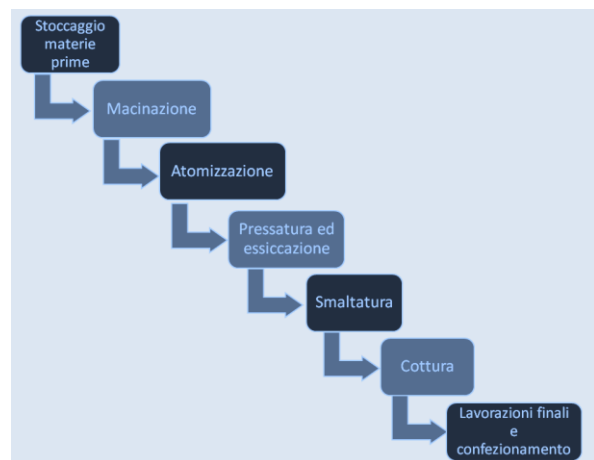
Both wet and dry application techniques are used.

The firing phase is conducted at different temperatures (depending on the ceramic tiles, produced between 1000°C and 1300°C) to obtain the typical characteristics of abrasion, resistance to water and to chemical products and durability of the ceramic tiles.

Before the grading and packaging lines, the ground products are cut and squared to the desired dimensions.

The end product is packaged in cardboard boxes that are stacked on wooden pallets and are protected by PET film. The tiles are stored in the warehouse until the order is made up for dispatch to the customer.

Production performance is mainly monitored by the quality management system and the certification of the processes in conformity to international standards ISO 9001 and OHSAS 18001.



TECHNICAL DATA

The produced ceramic tiles comply with the standards and specifications listed below::

Pursuant to standards EN 14411 in Europe and ISO 13006 at the international level, the ceramic tiles are classified in annex B1a, with $E \leq 0.5\%$.

The requirements listed in annexes A to L of standard ISO 13006 and EN 14411 are:

length and width (in accordance with ISO 10545-2 Section 2), thickness (in accordance with ISO 10545-2 Section 3),

straightness of corners (in accordance with ISO 10545-2 Section 4), orthogonality (in accordance with ISO 10545-2 Section 5),

curvature of centre (in accordance with ISO 10545-2 Section 6),

curvature of corner (in accordance with ISO 10545-2 Section 6), warpage (in accordance with ISO 10545-2 Section 6).

Surface quality (in accordance with ISO 10545-2 Section 7), at least 95% of the tiles must be free of visible defects that may detract from the appearance of the main area of the tiles.

STANDARD	Value	Unit of measurement	Resistance to deep abrasion (unglazed tiles) in accordance with ISO 10545-6
Water absorption in accordance with ISO 10545-3	0.0 - 20	%	<175 mm ³
Tensile strength in accordance with ISO 10545-4	8 - 35 (min)	N/mm ²	<p>APPLICABLE STANDARDS</p> <p>For marketing in the EU/EFTA, except for Switzerland, regulation EU 305/2011 applies.</p> <p>The products require a performance declaration takes account of standard EN 14411 "Ceramic tiles. Definitions, classification, characteristics, evaluation of conformity and marking".</p> <p>DELIVERY STATUS</p> <p>The dimensions of the products can vary according to various sizes; the thickness varies from 6 mm to 20 mm.</p> <p>ENVIRONMENT AND HEALTH - MANUFACTURING</p> <p>Workers are informed about the physical and chemical risks of their job and the workplace. They receive the appropriate training and personal protection equipment.</p> <p>Ceramiche Marca corona is also certified to BS OHSAS 18001</p> <p>Water/Ground</p> <p>The productive process does not cause any contamination of water and the ground: All the waste water is recycled or sent to treatment plants so that it can be used again inside or outside the company.</p> <p>Air</p> <p>Natural gas is known only to produce energy. The emissions generated by the combustion process are kept below strict limits and are monitored. Environmental protection measures are adopted.</p> <p>Furthermore, the company uses electric power that it generates through cogeneration.</p> <p>PROCESSING/LAYING THE PRODUCT</p> <p>The tiles are fixed to the surfaces of walls and floors by different materials and in different quantities, for example dispersion adhesives/cement adhesives and cement, sealants or applied liquid membranes. During tile laying, emissions are not generated and laying tiles does not cause risks for health or the environment.</p>
Flexural strength in accordance with ISO 10545-4	200 - 1300 (min)	N/mm ²	
Surface wear resistance – Glazed tiles in accordance with ISO 10545-7	0 - 5	Abrasion class	
Thermal expansion coefficient in accordance with ISO 10545-8	9 E10-6 (max)	1/K	
Resistance to thermal shock in accordance with ISO 10545-9		Resistant	
Resistance to crazing in accordance with ISO 10545-11		Resistant	
Resistance to frost in accordance with ISO 10545-12		Resistant	
Slip-resistance properties (class A, B or C) in accordance with/CEN/TS 16165/		Resistant	
Cohesive/adhesive resistance in accordance with EN 12004		Resistant	
Impact resistance in accordance with ISO 10545-5		Resistant	
Fire resistance without test (CWT)		A1-A1FL	
Chemical resistance in accordance with ISO 10545-13		A-C	
Resistance to chemical products used in the home and to pool additives in accordance with ISO 10545-13		B (min)	
Resistance to low and high concentrations of acids alkalis in accordance with ISO 10545-13		Resistant	
Resistance to stains in accordance with ISO 10545-14		Resistant	
Release of lead and cadmium – Glazed tiles in accordance with ISO 10545-15		Where required	
Expansion in steam in accordance with ISO 10545-10		Resistant	

PACKAGING

The tiles are packaged in cardboard boxes, wrapped in polyethylene film, fastened with plastic straps and stacked on wooden pallets. The quantity of packaging material can vary according to the dimensions of the tiles.

The end-of-service-life phase of the packaging comprises (in accordance with Eurostat 2013):

- Paper: recycling, energy recovery, disposal;
- Plastic: recycling, energy recovery, disposal;
- Wood: reuse, energy recovery, energy recovery, landfill sites.

CONDITIONS OF USE

The ceramic tiles are tough and insert as they have been fired at high temperatures. The environmental impact generated during phase B1 was very low and therefore not worthy of note.

ENVIRONMENT AND HEALTH-USE

Ceramics are intrinsically inert, chemically stable and thus during use they do not emit pollutants or substances that harm the environment or health. VOC and Radon

RELEVANT SERVICE LIFE

The service life of the tiles is generally more than 50 years (BNB 2011). Moreover, according to the US Green Building Council, the service life of tiles could be as long as the service life of the building. Thus 60 years could be an alternative service life for the U.S. and the UK and Commonwealth.

The results given consider use of the tiles for a year, so multiplying the B2 values by 50 or 60 enables the B2 values for 50 or 60 years to be obtained.

No service life reference value has been given in accordance with ISO 15686.

ABNORMAL CONDITIONS

Fire: in accordance with EN 13501-1:2007+A1:2009, the ceramic tiles can be classified as belonging to Fire Resistance Class A1 because they do not contribute to fire propagation.

Water: the ceramic tiles cannot react with water because they are an insoluble material.

Mechanical destruction: the ceramic tiles can be crushed mechanically but there is no harm to the environment.

REUSE PHASE

After the demolition and removal phase, the ceramic tiles can be crushed and used in a vast range of different applications, for example as aggregates for concrete or in road construction.

DISPOSAL

Pursuant to European Waste Catalogue (EWC), ceramic tiles are part of group 17 "Construction and demolition wastes", tiles and ceramics (code: 17 01 03).

FURTHER INFORMATION

For further information, visit the websites:

www.marcacorona.it

www.confindustriaceramica.it

www.laceramicaitaliana.it

SECTION 4 - LCA (LIFE CYCLE ASSESSMENT): RESULTS

The following tables show the results of the LCA (life cycle assessment). Basic information on all the declared modules are set out in the previous section. There are two projections for the end of service life (C3, C4 and D). In projection 1 there is 100% recycling whereas in projection 2 the tiles are disposed of in landfill sites.

DESCRIPTION OF SYSTEM LIMITS

PRODUCTION PHASE			INSTALLATION PHASE		USE PHASE							END-OF-SERVICE LIFE PHASE				BENEFITS OUTSIDE THE LIMITS OF THE SYSTEM
Provision of raw materials	Transport	Manufacturing	Transport from factory gates to site	Laying	Use	Maintenance	Repair	Replacement	Refurbishment	Use of operating energy	Use of operating water	Dismantling Demolition	Transport	Waste treatment	Disposal	Reuse-recovery-recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

(X = INCLUDED IN THE LCA; MND = NON-DECLARED FORM)

RESULTS OF THE LCA

ENVIRONMENTAL IMPACT: 1M² OF AVERAGE CERAMIC TILES (24.8 KG/M²)

Parameter	GWP	ODP	AP	EP	POCP	ADPE	ADPF	
Unit of measurement	[kg CO ₂ -eq.]	[kg CFC11-eq.]	[kg SO ₂ -eq.]	[kg (PO ₄) ₃ -eq.]	[kg ethylene-eq.]	[kg Sb-eq.]	[MJ]	
LIFE CYCLE PHASE	A1-3	1.21E+01	3.28E-10	2.12E-02	2.79E-03	3.16E-03	3.64E-05	1.87E+02
	A4	1.15E+00	7.60E-12	6.16E-03	7.36E-04	3.48E-04	7.69E-08	1.54E+01
	A5	2.94E+00	3.12E-11	3.69E-03	7.94E-04	4.35E-04	1.12E-05	210E+01
	B1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	B2	8.98E-03	5.07E-13	1.53E-05	2.71E-06	5.30E-06	3.71E-09	2.31E-01
	B3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	B4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	B5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	B6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	B7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	C2	3.38E-02	1.55E-13	1.48E-04	3.64E-05	-5.59E-05	2.25E-09	4.66E-01
	C3/1	7.55E-02	5.67E-12	6.37E-04	1.28E-04	8.45E-05	1.34E-07	1.46E+00
	C3/2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	C4/1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	C4/2	4.69E-01	5.16E-12	2.81E-03	3.82E-04	2.70E-04	1.62E-07	6.09E+00
	D/1	-6.51E-01	-7.03E-11	-1.12E-03	-1.92E-04	-2.96E-04	-1.89E-07	-7.81E+00
	D/2	-5.80E-01	-6.82E-11	-7.93E-04	-1.24E-04	-2.57E-04	-1.65E-07	-6.96E+00

Legend	GWP = Global Warming Potential ODP = Ozone Depletion Potential in the stratosphere AP = soil and water Acidification Potential EP = Eutrophication potential	POCP = formation potential of tropospheric ozone photochemical oxidants ADPE = Non-Fossil Abiotic Resource Depletion Potential ADPF = Fossil Abiotic Resource Depletion Potential
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RESULTS OF THE LCA

USE OF RESOURCES: 1M² OF AVERAGE CERAMIC TILES (24.8 KG/M²)

Parameter	PERE	PERM	PERT	PENRE	PENRM	PENRT	SM	RSF	NRSF	FW	
Unit of measurement	[MJ]	[MJ]	[MJ]	[MJ]	[MJ]	[MJ]	[kg]	[MJ]	[MJ]	[m ³]	
LIFE CYCLE PHASE	A1-3	1.36E+01	8.63E+00	2.22E+01	1.90E+02	9.62E-01	1.90E+02	6.89E-05	0.00E+00	0.00E+00	1.73E-02
	A4	7.75E-01	0.00E+00	7.75E-01	1.55E+01	0.00E+00	1.55E+01	0.00E+00	0.00E+00	0.00E+00	1.91E-03
	A5	1.17E+01	-9.19E+00	3.65E+00	2.27E+01	-1.02E+00	2.18E+01	4.48E-06	0.00E+00	0.00E+00	8.67E-03
	B1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	B2	8.62E-03	0.00E+00	8.62E-03	2.38E-01	0.00E+00	2.38E-01	0.00E+00	0.00E+00	0.00E+00	5.09E-05
	B3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	B4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	B5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	B6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	B7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	C2	2.65E-02	0.00E+00	2.65E-02	4.68E-01	0.00E+00	4.68E-01	0.00E+00	0.00E+00	0.00E+00	6.63E-05
	C3/1	9.07E-02	0.00E+00	9.07E-02	1.52E+00	0.00E+00	1.52E+00	0.00E+00	0.00E+00	0.00E+00	4.73E-04
	C3/2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.73E-04
	C4/1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.73E-04
	C4/2	2.29E-02	0.00E+00	2.29E-02	2.02E-01	0.00E+00	2.02E-01	0.00E+00	0.00E+00	0.00E+00	4.12E-05
	D/1	- 2.82E+00	0.00E+00	-2.82E+00	-8.99E+00	0.00E+00	-8.99E+00	2.85E+01	0.00E+00	0.00E+00	-2.58E-03
	D/2	- -3.91E- 10	0.00E+00	-3.91E-10	-3.46E-09	0.00E+00	-3.46E-09	0.00E+00	0.00E+00	0.00E+00	-2.58E-03

Legend	PERE = Use of renewable primary energy apart from renewable primary energy resources used as raw materials;	PENRM = Use of non-renewable primary energy resources as raw materials;
	PERM = Use of renewable energy resources as raw materials;	PENRT = Total use of non-renewable primary energy resources;
	PERT = Total use of renewable primary energy resources;	SM = Use of secondary materials;
	PENRE = Use of non-renewable primary energy apart from non-renewable primary energy resources used as raw materials;	RSF = Use of renewable secondary fuel;
		NRSF = Use of non-renewable secondary fuel;
		FW = Use fresh water

RESULTS OF THE LCA – OUTGOING WASTE FLOWS AND WASTE CATEGORIES:
1M² OF AVERAGE CERAMIC TILES (24.8 KG/M²)

Parameter	HWD	NHWD	RWD	CRU	MFR	MER	EEE	EET	
Unit of measurement	[kg]	[kg]	[kg]	[kg]	[kg]	[kg]	[MJ]	[MJ]	
LIFE CYCLE PHASE	A1-3	8.01E-04	8.65E-01	1.66E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	A4	1.01E-06	1.17E-03	3.12E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	A5	5.23E-05	1.85E+00	1.32E-03	1.81E-01	1.83E-01	0.00E+00	5.45E-01	1.01E+00
	B1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	B2	5.86E-05	7.89E-04	2.69E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	B3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	B4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	B5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	B6	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	B7	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	C2	3.54E-08	3.93E-05	6.68E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	C3/1	6.37E-08	6.51E-04	2.23E-05	0.00E+00	2.92E+01	0.00E+00	0.00E+00	0.00E+00
	C3/2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	C4/1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	C4/2	4.62E-09	9.37E-01	2.82E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	D/1	-9.40E-08	-1.19E+00	-4.69E-04	-	-	-	-	-
	D/2	-1.87E-18	-2.88E-12	-1.16E-13	-	-	-	-	-

Legend	HWD = Disposed hazardous waste;	MFR = Materials for recycling;
	NHWD = Non-disposed hazardous waste;	MER = Materials for the energy recovery;
	RWD = Disposed radioactive waste;	EEE = Exported electric energy;
	CRU = Components for reuse;	EEET= Exported thermal energy;

RESULTS OF THE LCA – TRACI INDICATORS
1M² OF AVERAGE CERAMIC TILES (24.8 KG/M²)

Parameter	Global Warming Air	Ozone Depletion Air	Acidified air	Eutrophication	Smog Air	
Unit of measurement	[kg CO ₂ -eq.]	[kg CFC11-eq.]	[kg SO ₂ -eq.]	[kg N-eq.]	[kg O ₃ -eq.]	
LIFE CYCLE PHASE	A1-3	1.21E+01	3.46E-10	2.35E-02	1.33E-03	4.82E-01
	A4	1.15E+00	8.09E-12	6.53E-03	3.71E-04	1.16E-01
	A5	2.94E+00	3.30E-11	4.20E-03	7.48E-04	8.34E-02
	B2	9.02E-03	5.41E-13	1.66E-05	3.30E-06	2.65E-04
	C2	3.38E-02	1.65E-13	1.97E-04	1.68E-05	4.24E-03
	C3/1	7.55E-02	6.03E-12	7.98E-04	5.27E-05	2.35E-02
	C3/2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	C4/1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	C4/2	1.50E-02	1.76E-13	9.81E-05	8.24E-06	1.90E-03
	D/1	-6.51E-01	-7.47E-11	-1.26E-03	-1.45E-04	-2.85E-02
	D/2	-1.97E-10	-1.55E-20	-2.64E-13	-2.52E-14	-4.E-12

SECTION 5 - LCA (LIFE CYCLE ASSESSMENT): CALCULATION RULES

DECLARED UNIT OF MEASUREMENT

The declared unit of measurement is 1 m² of wall and floor ceramic tiles weighing on average 24.8 kg.

Declared unit of measurement	1	m ²
Basic weight	24.8	kg/m ²
1 kg conversion factor	0.0403	

SYSTEM LIMITS

The entire life cycle of the product is considered (for example EPD: from the cradle to the grave) and in this EPD the forms are declared below.

Forms A1-A3 includes the processes that supply energy and materials to the system (A1), transport as far as the gate of the production facility (A2), manufacturing and waste treatment processes (A3).

Form A4 comprises transporting from the production facility to the customer or to the point of laying of the tiles.

Form A5 considers all the tile-laying phases (and adhesive consumption) and also treatment of the waste generated by the packaging (recycling, incineration, disposal). The energy replacement credits are declared in form D. During this phase, a 6.5% loss of ceramic material can be considered.

Form B1 considers the use of the tiles. The ceramic tiles do not emit hazardous emissions in indoor environments during their use.

Form B2 relates to cleaning the tiles. The dispensing of detergent water to clean the tiles is considered, including the treatment of the waste water generated over a year of use.

Forms B3-B4-B5 refer to the repair, replacement and refurbishment of the tiles. If the tiles are laid correctly, repair, replacement and refurbishment processes are not necessary.

Forms B6-B7 consider the use of energy to drive the technical systems in the building (B6) and the use of the operating water for the technical systems linked to the building. The use of energy or operating water is not considered. The cleaning water is declared in form B2.

Form C1 relates to the process of demolition and removal of the tiles from the building.

Form C2 considers the transport of the rejected tiles to a recycling or disposal process.

Form C3 considers each process (collection, crushing process, etc), that are suitable for recycling the tiles.

Form C4 includes all the processes for disposal in landfill sites, including pre-treatment and managing the disposal site.

Form D includes the benefits arising from all the net flows in the end of life phase that leave the limit system of the product after passing the waste end phase. The loads from incineration of the packaging and the resulting energy credits (electricity and thermal energy) are declared in form D.

ESTIMATES AND HYPOTHESES

Forms A5 to C4 are projections based on average data that are included in the PCR created by the European Federation of Ceramic Tile Manufacturers CET PCR 2014.

For the materials (glazing compound, pigments and chemical additives) for which no primary data were available and the exact chemical composition of which was not known (obtained from the technical data sheet), an average composition was used and hypotheses were drawn up based on common chemical products.

BACKGROUND DATA

The background data for modelling the life cycle were taken from the latest version of the professional database GaBi 7.

Other background data sources used were ELCD FEFCO, *Perry's Chemical Engineers' Handbook*, *Ceramic Glaze Handbook*, *European Ceramic Tile Manufacturers' Federation*.

QUALITY OF THE DATA

The period of validity of the background data used by the tool ATLAS v.3 that is based on the *thinkstep* database is comprised between 2012 and 2018. Most of the information (energy and water consumption, emissions of polluting substances, atomized powders and production of ceramics) is measured or calculated directly at the company level and declared in the Italian IPPC document known as AIA, which is specific and is reviewed for each plant examined in this study. Carbon dioxide emissions (connected to carbonate oxidation)

are gathered by the ETS (Emissions Trading System) declaration.

Detailed data have been obtained not only for mixtures of raw materials (gathered with specific primary data of the companies) but also for pigments, frits and other raw materials used to manufacture the glaze.

The overall quality of the data can be considered to be optimum.

PERIOD UNDER EXAMINATION

The primary data gathered for this study refer to the entire output of 2016.

ALLOCATIONS

If resorting to allocations cannot be avoided, the allocations are managed in accordance with the relevant ISO standards (14040, 14044) and allocations by mass are used. In particular, supplies of energy and materials have been allocated on the basis of the mass of ceramic tiles produced annually. Further allocations have not been applied for the subsequent form.

In addition, some ceramic waste is recycled in-house; the energy recovery credits are considered of the packaging materials from the end of the product's service life (form D).

CUT-OFF

All incoming and outgoing weight and energy flows have been considered.

SECTION 5 - LCA : PROJECTIONS AND FURTHER TECHNICAL INFORMATION

The following technical information on the declared forms and on the relative projections is based on average data from the European Federation of Ceramic Tile Manufacturers and from Confindustria Ceramica.

Transport to the work site (A4)

Ceramiche Marca Corona markets its ceramic tiles in Italy, in Europe and in the rest of the world. The average pre-defined transport projections are set out and illustrated below.

Name	Value	Unit of measurement
Litres of fuel (per functional unit)	31	l/100km
Capacity volume use factor (including unloaded trips)	0.85	-
27-tonne truck for destinations within Italy (51% of tiles sold)	300	km
27-tonne truck for European destinations (34% of tiles sold)	1390	km
International shipping	6520	Km

Installing building (A5)

For the installation phase, 3 options are defined in which different materials can be used. For option 1, adhesives, cement and water, for option 2, adhesives dispersed in cement and polysulphides, for option 3

also cement adhesives (different quantities for different sizes of tiles). These considerations are based on average data supplied by different manufacturers of ceramic tiles in Europe. In this EPD it is assumed tiles that the tiles are laid with cement adhesive (option 3).

For treatment of packaging waste, an average European projection has been used and illustrated that is taken from "Eurostat, 2013. Accordingly, when plastics and paper come to the end of their service life they are recycled, energy is recovered from them and they are placed in landfill sites and at the end of its service life wood is reused, energy is recovered from it and it is placed in landfill sites. The loss of ceramic material considered is 6.5%.

Use (B1)

The ceramic tiles are tough and have a stiff surface that resist abrasion. There are no environmental impacts during the use phase.

Maintenance (B2)

Ceramic wall tiles can be cleaned regularly, with varying intensity according to the type of building: residential, business premises, health-care facility. Water and disinfectant consumption has therefore been considered. The values declared in this phase refer to a 1 year period of time.

Projection for maintaining floor and wall ceramic tiles:

Residential use: 0.3 ml of detergent and 0.002 l of water for washing 1 m² of ceramic tiles one a week. The projection of this phase is based on average data

supplied by different manufacturers of ceramic tiles in Europe.

Name	Value	Unit of measurement
Water consumption	0.002	L
Detergent	0.0003	L
Maintenance cycle of wall and floor tiles	2400	N°/LS
Maintenance cycle of wall and floor tiles	200	N°/LS

Repairing, replacing and refurbishing (B3, B4, B5)

In general, the service life of ceramic tiles is identical to the building's service life. No repair, replacement or refurbishment for ceramic tiles are required.

Use of energy and operating water (B6, B7):
These forms are not relevant to ceramic tiles.

End of life (C1-C4)

C1: This form, in compliance with the PCRs created by the European Federation of Ceramic Tile Manufacturers, is not relevant for ceramic tiles.

C2: The ceramic tile demolition waste is taken by truck from the building to a container or treatment plant and an average distance of 20 km is considered. The return journey will be included in the system. The average distance from the container or from the treatment plant to the final destination can be considered to be 30 km on average.

The results for the end of the product's service life are declared for the 2 different projections.

Name	Value	Unit of measurement
Projection 1 Recycling percentage	100	%
Projection 1 Material to be recycled	24.7	kg
Projection 2 Percentage in landfill sites	100	%
Projection 2 Material in landfill sites	24.7	kg

C3: The recycling projection comprises treating ceramic material for subsequent use as a mineral/raw material. It is divided into 2 secondary projections: 1)

Recycling 100% 2) Recycling 0%

C4: The disposal in landfill sites projections used are divided into 2 secondary projections: 1) Disposal in landfill sites 0% 2) Disposal in landfill sites 100%

Benefits and costs outside the product system limits (D):

Form D includes credits for recycling tile materials and packaging, energy credits from thermal recovery of the packaging. The results for form D are declared for the 2 different projections.

REQUIRED PROOFS

Ceramics are inert and during use and thus during use they do not emit pollutants or substances that harm the environment or health. Accordingly, and in accordance with the PCR, proofs are not necessary for this group of products.

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