MARAZZI GROUP

ENVIRONMENTAL PRODUCT DECLARATION

Product Name: CERAMIC TILES

Site Plant: SASSUOLO
Via Regina Pacis n° 39 – 41049 (MO) Italy

in compliance with ISO 14025 and EN 15804

Program Operator:	EPDItaly
Publisher:	EPDItaly

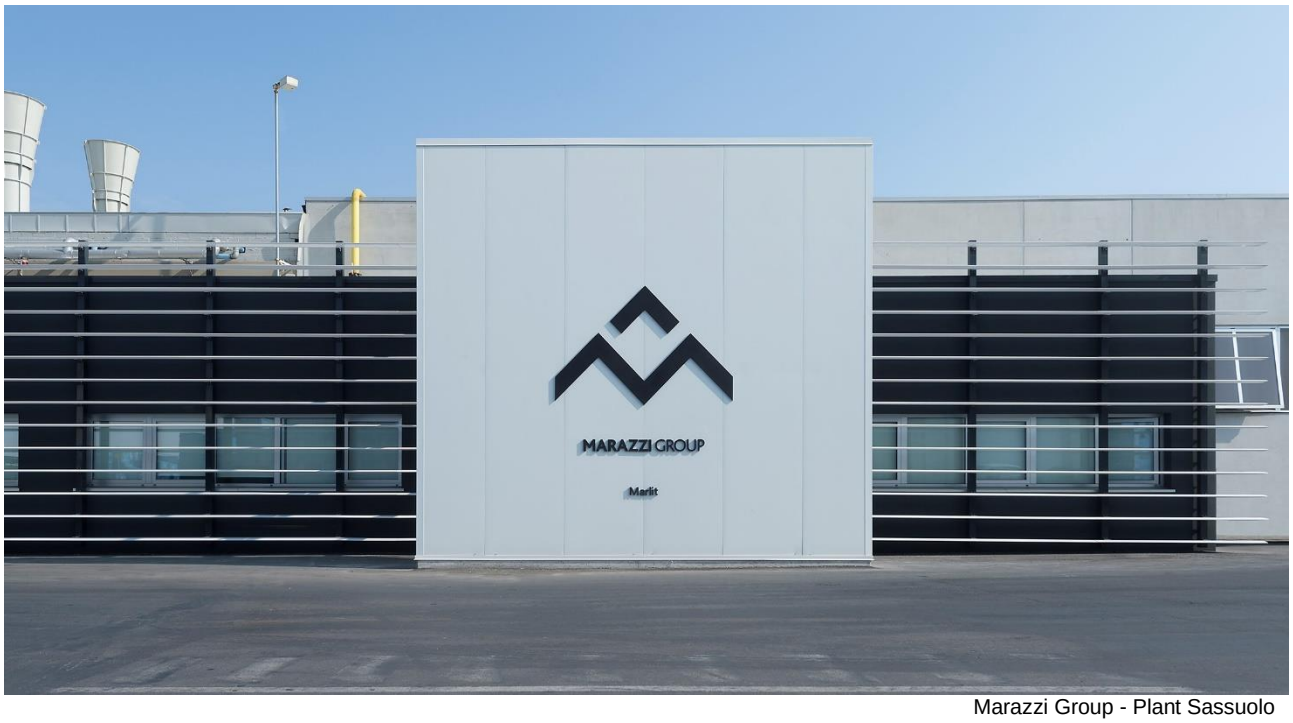
Declaration Number:	MAR_SAS_18_0001
EPDItaly Registration Number:	EPDItaly0099
ECO EPD Registration Number:	00001090

Issue Date:	09/12/2019
Valid to:	09/12/2024

1. GENERAL INFORMATIONS

EPD OWNER:	Marazzi Group Srl a socio unico Via Regina Pacis, n° 39 - 41049, Sassuolo (MO), Italy
PLANT INVOLVED IN THE EPD:	Plant of Sassuolo via Regina Pacis n° 39 – 41049 Sassuolo (MO), Italy
FIELD OF APPLICATION:	Ceramic tiles object of this study are intended to be applied to both floor and wall claddings and to be installed both indoors and outdoors for residential, non-residential and commercial use.
PROGRAM OPERATOR:	EPDITALY (www.epditaly.it) via Gaetano De Castillia n° 10 - 20124 Milano, Italy
EXTERNAL AUDIT:	This declaration has been developed referring to EPDItaly, following the General Program Instruction; further information and the document itself are available at: www.epditaly.it. CEN standard EN 15804 served as the core PCR (PCR ICMQ-001/15 rev 2.1). PCR review was conducted by Daniele Pace - info@epditaly.it Independent verification of the declaration and data, according to EN ISO 14025:2010. ❒ Internal ☒ External Third party verifier: ICMQ S.p.A., via Gaetano De Castillia n°10 - 20124 Milano, Italy (www.icmq.it). Accredited by: Accredia.
CPC CODE:	37370
COMPANY CONTACT:	Silvia Serri - Marazzi Group Srl a socio unico via Regina Pacis, n° 39 - 41049, Sassuolo (MO), Italy silvia.serri@marazzigroup.com
TECHNICAL SUPPORT:	thinkstep Italia via Bovini n°41, Ravenna (IT) **www.thinkstep.com**
COMPARABILITY:	Environmental statements published within the same product category, but from different programs, may not be comparable. In particular, EPDs of construction products may not be comparable if they do not comply with EN 15804.
LIABILITY:	Marazzi Group relieves EPDItaly from any non-compliance with the environmental legislation self-declared by Marazzi Group. The holder of the declaration will be responsible for the information and supporting evidence; EPDItaly disclaims any liability regarding the manufacturer's information, data.
REFERENCE DOCUMENT:	This declaration is based on the EPDItaly regulation, available on the website www.epditaly.com
PRODUCT CATEGORY RULES (PCR):	PCR ICMQ-001/15 rev2.1 IBU PCR Part B:30-11-2017 V1.6 The EN 15804 standard constitutes the framework reference for the PCR.

2. THE COMPANY



Marazzi Group - Plant Sassuolo

Marazzi Group is an international leader in the design, manufacturing and sales of ceramic and porcelain stoneware floor and wall tiles.

Present in more than 140 countries with Marazzi and Ragno brands, the group is universally recognized as synonymous with quality ceramic tiles and symbolizes the best of Italian style and manufacturing in the interior decoration and design sector.

A constant vocation for research and experimentation, the introduction of significant product and process innovation, the ownership of dozens of patents, some of which represent pieces of the history of modern ceramics, the ability to stay one step ahead, evolving home styles, architecture and design, the attention to the environment: these are the qualities that have enabled Marazzi Group to rise to the top in the sector, both in Italy and worldwide, and to strengthen such leadership over time.

Marazzi, founded in 1935 at Sassuolo, Modena, in an area which was to become the world's leading-edge hub in the creation of high-end ceramic tiles, has been responsible for the main process and product innovations in the ceramic tile industry, which have made the company and the district a benchmark for the entire ceramics world.

Today Marazzi Group can have highly sophisticated systems, capable of ensuring in addition to high levels of productivity, significantly above the average of the sector, a considerable production flexibility, which allows to vary the production quickly according to the trends of the various markets.
Marazzi Group ceramic and stoneware tiles are used on the floors and walls of residential buildings and, thanks to their outstanding technical and aesthetic characteristics, increasingly also in public spaces and major architectural projects.

Marazzi Group responds to the needs of contemporary home decoration and architecture with an assortment of over 10 thousand products in porcelain stoneware, crystallized porcelain stoneware, single-fired tiles, large-size ceramics and slabs, in addition to mosaic, marble, granite and natural stones, available in a variety of sizes, colors, thicknesses and surfaces.

Through its Engineering Division, Marazzi Group also provides the planning and construction industries with consultancy and support for the creation of wall and floor covering systems for indoors and outdoors, ventilated walls and raised floors.

Marazzi Group was acquired in April 2013 by Mohawk Industries Inc, the world's biggest flooring manufacturer, listed on the New York Stock Exchange.

MANAGEMENT SYSTEMS, ENVIRONMENTAL AND QUALITY LABELS:

Marazzi Group was the first company operating in the sector to have achieved, since 1994, the certification of its Quality Management System according to ISO 9001 and in 2003 the ISO 14001 certification for its Environmental Management System. In 2018, Marazzi Group obtained the certification for the Occupational Health and Safety management system complying with BS OHSAS 18001 standard.

Products by Marazzi Group comply with the following standards:

- /2009/607/EC/ Commission decision of 9 July 2009 establishing the ecological criteria for the award of the Community eco-label to hard covering
- /ISO 13006/ Ceramic tiles - Definitions, classification, characteristics and marking
- /EN 14411/ Ceramic tiles - Definitions, classification, characteristics, evaluation of conformity and marking
- /ISO 10545-1÷15/ methods for test
- /DIN 51130/ Testing of floor coverings. Determination of the anti-slip properties. Workrooms and fields of activities with slip danger, walking method-ramp test
- /DIN 51097/ ramp method barefoot test
- /BS 7976:2/ pendulum test
- /British Ceramic Research Association LTD/: Method for the determination of the coefficient of friction of floor tiles and floor surfaces
- /ENV 12633/ pendulum test
- /QB32 Marque QB/ Annexe technique et administrative de la certification QB: Carreaux céramiques pour revêtements de sol
- /DEVL1104875A/ Ministère de l'écologie, du développement durable, des transports et du logement - Arrêté du 19 avril 2011 relatif à l'étiquetage des produits de construction ou de revêtement de mur ou de sol et des peintures et vernis sur leurs émissions de polluants volatils
- /GREENGUARD GOLD/ Indoor Air Quality Certification - ASTM Standards D-5116 and D-6670;
- /ANSI 326.3/ digital tribometer
- /SAUDI STANDARD SASO SASO-ISO 13006/ Ceramics tiles (SASO-ISO-10545-1) methods of test for ceramics tiles
- /SONCAP/ Standards organization of Nigeria conformity assessment program - Exporter and importer guidelines
- /CNCA-C21-01/ Implementation rules for porcelain tiles
- /TIS.2508-2555/ Thai Industrial Standard - Ceramic tiles
- /2014/C 259/01 Regulation (EU) No 305/2011/ of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC.

3. SCOPE AND TYPE OF EPD

The entire life cycle of the product (type of EPD: « cradle-to-grave with options») and the Modules described below are considered:

*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, water consumption, ancillary materials, as well as waste processing, liquid and gas emissions (A3).*

*Module **A4** includes the transport from the production site to the customer or to the point of installation of the tiles.*

*Module **A5** considers all tile installation steps (like adhesives consumption) also packaging waste processing (recycling, incineration, disposal). Credits from energy and material substitution are declared in module D.*

*Module **B1** considers the use of tiles. During the use of ceramic tiles, no hazardous indoor emissions are expected to occur.*

*Module **B2** includes the cleaning of the tiles. Provision of water, cleaning agent for the cleaning of the tiles, including wastewater treatment are considered.*

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

*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** is not relevant for the environmental impacts, as it regards demolition and de-construction process of the tiles from the building.*

*Module **C2** considers transportation of the discarded tile to a recycling or disposal process.*

*Module **C3** considers every process (collection, crushing process etc.) properly for recycling the tiles.*

*Module **C4** includes all the landfill disposal processes, including pre-treatment and management of the disposal site.*

*Module **D** includes benefits from all net flows in the end-of-life stage that leave the product boundary system after having passed the end-of-waste stage. Loads from packaging incineration (Module A5) and resulted energy credits (electricity and thermal energy) are declared within module D.*

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction Demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	X	X	MND	X	MND	MND	MND	MND	MND	MND	X	X	X	X

TYPE OF EPD:

This declaration refers to a ceramic porcelain tile as average between the products manufactured by Marazzi Group at the production plant located in Sassuolo.

GEOGRAPHICAL VALIDITY:

Performance has been calculated in reference to the plant of Sassuolo. The reference market is "global".

DATABASE USED: GaBi 2018 SP36.

SOFTWARE:

EPD process Creator, implemented using the GaBi professional 8.7 and GaBi envision 3.0 software. The identification code of the EPD process tool used is: **Marazzi Group EPD Process Tool – V2 of 26/06/2019.**

EPD PERFORMED WITH VALIDATED CALCULATION ALGHORITM:

In 2018 Marazzi Group Srl a socio unico has implemented and certified a Process for the generation of EPDs using a calculation algorithm validated and certified by ICMQ S.p.A., in accordance with the requirements of EPDItaly. The process is based on an automatic data collection at the plants, subsequently integrated, verified and validated in accordance with internal procedures. The validated calculation algorithm allows the automatic generation of EPDs for ceramic tiles product.
This EPD was automatically generated for the selected product or products, in order to evaluate the environmental impacts in relation to their specific use.

4. DETAILED PRODUCT DESCRIPTION

Marazzi Group ceramic tiles are manufactured mainly from natural raw materials as clay, feldspar and sand. Specifically, porcelain stoneware has a water absorption level of less than 0.5%.

DESCRIPTION OF THE PRODUCTION PROCESS:

The manufacturing process of the Sassuolo plant is a typical complete ceramic cycle.

Entry, storage and production of raw materials:
The incoming raw materials are stored in piles inside covered sheds
The dosing of the components for the input in the production cycle is carried out by automatically controlled weighing systems, which implement previously programmed recipes.

Raw material grinding:
The raw materials are finely chopped with a wet milling process in continuous drum mills, with the use of suitable grinding bodies. The slip obtained at the end of the grinding (called "barbottina") is stored in tanks out of ground in reinforced concrete and continuously moved by agitators.

Spray Drying:
This phase consists of spray drying in streams of hot air (about 600 ° C) of the slip to obtain the semi-finished "mixture" (powders), having dimensional characteristics and water contents suitable for the subsequent phase of pressing the tiles. The residual humidity of the spry-dried powder mix obtained is normally between 5% and 6.5%. The product is stored in silos, from which it is transferred to the pressing departments.

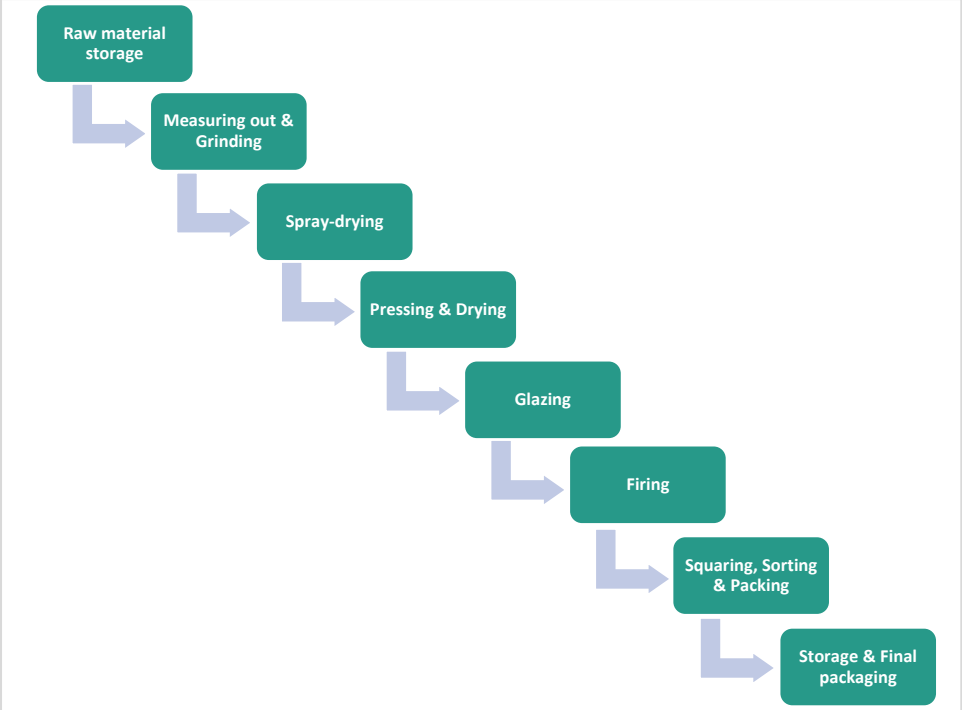
Pressing and Drying:
Pressing is the phase of the production process that provides the spry-dried powder mix a sufficient mechanical consistency for its subsequent handling, creating the unfired tile.
The forming of the tiles is realized by means of a continuous line system. The dust pressing powder is send to a wide conveyor line and forms a continuous line, which is pre-compacted to create a continuous slab. In the following step the slab is cutting online into size compatible with the molds of the traditional hydraulic press. The rapid single firing process requires a drying step of the pressed ceramic support which carries out the residual moisture at levels not exceeding 0.1%. The drying is obtained through systems that use hot air currents at temperatures around 200 ° C

Preparation of glazes and glazing:
Glazes and decorations are applied on the dried ceramic support before the cooking phase. Glazes are "conveyed" by preparing them in aqueous suspensions and applying them along the glazing lines; the need to apply different types of glazes and decorations involves the installation of long transport lines, on which the semi-finished application stations are activated (aerography, rotating disc devices, ink-jet station etc.). The preparation of the glazes is carried out by wet grinding of the various constituents (frits, kaolin, sand, etc.), dosed in mills according to specific recipes. In plant it is also present tintometers, that is systems which automatically mixed wet colored oxides with glaze bases in order to obtain the appropriate applications for the glazing.

Firing:
It is the thermal process that allows to obtain the greification of the ceramic product. In a thermal cycle lasting about 45 minutes, the tiles are brought to a temperature of about 1,200 ° C and then cooled.

Squaring, sorting and packing:
Before being sent to the final choice, the fired tiles can be cut, squared and polished. The final stage of the process is constituted by the selection of the tiles: every single tile is controlled according to predetermined criteria, in terms of size and quality; depending on the results of checks carried out, the tiles are divided into classes of choice, before being suitably boxed.
This phase also includes the final packaging and identification of the finished product. The tiles are packed in cardboard boxes, wrapped in polyethylene film and plastic strapping, and then stacked on wooden pallets. The amount of packaging material can vary depending on the size of the tiles. The cardboard and the PET film used for the packaging of the final product contain recycled material.

Shipping warehouse:
The boxed and palletized material is transported by means of forklift trucks, to the finished product warehouse, where it remains stored until shipment.



WORKERS HEALTH AND SAFETY:

In 2018, Marazzi Group obtained certification for the Occupational Health and Safety Management System, according to the BS OHSAS 18001 standard.
Workers are informed about the physical and chemical risks associated with their profession and workplace. They receive appropriate training and personal protective equipment.

ENVIRONMENTAL PROTECTION:

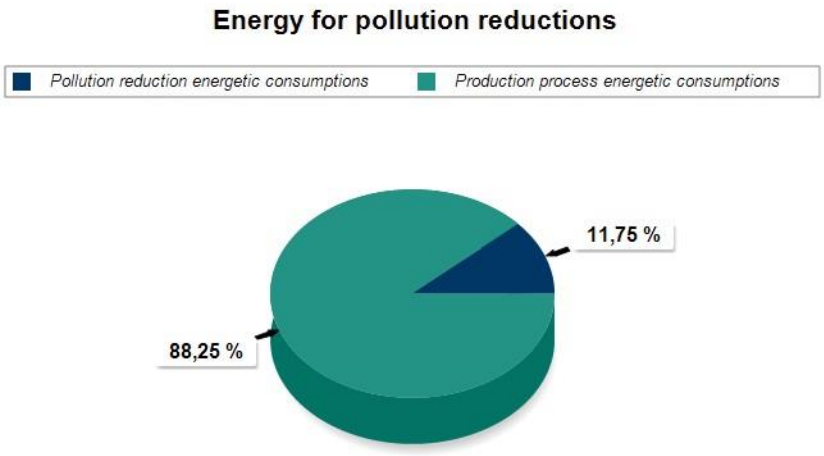
Marazzi Group decided to adhere to the international standard ISO 14001 in 2003, developing and maintaining an Environmental Management System over the years.

To reduce the impacts on habitats and natural resources, the raw materials for ceramic mixtures are extracted from quarries authorized for mining, with an environmental recovery plan, compliant with EU Directive 92/43 / EEC (conservation of natural habitats and semi-natural and wild flora and fauna), EU Directive 79/409 / EEC (conservation of wild birds) and the 1992 United Nations Convention on Biological Diversity.

The Sassuolo plant recycles all the wastewater that is recovered internally and externally.

More than 95% of the waste of the Sassuolo site is sent to the recovery. Furthermore, most of the unfired waste coming from the internal production process is reused.

At the Sassuolo plant, the environmental impact of emissions into the atmosphere, generated during the production process, is reduced using bag filters that retain particulate matter. The energy consumption to reduce these emissions is shown in the figure and is defined by subtraction starting from the consumption directly measured by specific instrumentation.



To minimize the fluorine emissions caused by the firing process, hydrated lime is used.

Carbon dioxide emissions are closely monitored with reference to the ETS (European Emissions Trading Scheme) Directive.

At the Sassuolo site the noise sources are periodically monitored. In many cases the acoustic emissions coming from the site are lower than the surrounding environmental sources (traffic etc ...).

At least 30% of the Italian electricity grid used within the plant comes from renewable sources.
In terms of energy savings, the Sassuolo plant has adopted the heat recovery from cooling air flows inside the kilns for re-use as an energy carrier in the dryers and for heating of the production departments through the installation of exchangers.

TECHNICAL DATA:

Ceramic tiles produced in the plant of Sassuolo comply with the following standards and specifications:

Name	Value	Unit
Water adsorption /EN ISO 10545-3/	BIa ≤0,5	%
Bending strength /ISO 10545-4/	>35	N/mm^2
Thermal shock resistance /ISO 10545-9/	resistant	-
Modulus of rupture Breaking strength	≥1300	N
Shock resistance /ISO 10545-5/	0,80	-
Resistance surface abrasion /ISO 10545-7/ (PEI value)	I-II-III-IV-V	-
Frost resistance /ISO 10545-12/	resistant	-
Linear thermal expansion coefficient /ISO 10545-8/	≤9	MK^-1
Stain resistance /ISO 10545-14/	Class 3 minimum	-
Resistance to chemicals for household use and swimming-pool salts /ISO 10545-13/	UA	-
Resistance to acids and bases /ISO 10545-13/	from GLA/GLB from GHA/GHB	-
Color resistance to light exposure /DIN 51094/	compliant	-
Skid resistance Ramp Method /DIN 51130/ BGR 181	NC; R9-R10-R11	-
Skid resistance Ramp Method /DIN 51097/ GUV 26.17	NC; A; A+B; A+B+C	-
Mean coefficient of friction B.C.R. /D.M. 236 14/6/89/	NC; μ>0,40	-
Skid resistance Pendulum /BS EN13036-4/	NC; PTV>36	-
Skid resistance Pendulum /ENV 12633/ BOE N°74 of 2006	NC, Class 1-2- 3	-
Skid resistance Digital tribometer (D-COF) /ANSI 326.3/	NC; >0,42	-
Skid resistance Ramp Method /DIN 51130/ BGR 181	NC; R9-R10-R11	-

BASE MATERIALS / ANCILLARY MATERIALS:

Main raw materials for ceramic tiles:

- Clay 22-39%
- Sand 1,5-16%
- Feldspar 19-52%
- Other raw materials 7-45%

Main glaze components:

- Clay powder
- Quartz
- Alumina
- Natural pigments
- Frits
- etc.

Main auxiliary additives:

- Dispersant
- Binder
- Fluidifying agents
- Pigments
- etc.

INSTALLATION/LAYING:

The tiles are fixed to the surfaces of walls and floors using specific materials and in different quantities (for example: dispersion adhesives, cementitious adhesives and mortar, sealants or applied liquid membranes). ceramic tile installations do not cause health or environmental hazards and no emissions are generated during installation.

FUNCTIONAL UNIT AND REFERENCE FLOWS:

The functional unit is 1 m2 of ceramic tiles for wall and floor covering, for a period of 1 year. The mass of the considered area is on average 30,426 kg.

REFERENCE SERVICE LIFE (RSL):

The service life of the tiles is generally more than 50 years (BNB 2011). In addition, according to the US Green Building Council, the service life of the tiles could have the same service life as the building itself. Therefore, 60 years can be considered as a realistic service life for the tiles. The results reported take into account the use of the tiles for 1 year, by multiplying the B2 values by 50 or 60 it is possible to obtain B2 values for 50 or 60 years. No RSL has been defined according to ISO 15686.

EXTRAORDINARY EFFECTS DURING USE PHASE:

Fire: According to /EN 13501-1:2007+A1:2009/, ceramic tiles can be classified as A1 class of fire resistance rating, because they do not contribute to fire.
It has been demonstrated that the coating of the ceramic tiles, in case of fire, reduces heat on them and thus the risk of collapse.
Water: Ceramic tiles cannot react with water because they are an insoluble material.

END OF LIFE AND MECHANICAL DESTRUCTION:

Ceramic tiles can be mechanically crushed, and no significant environmental impact is expected.

REUSE:

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

DISPOSAL:

According to the European Waste Catalogue (EWC), ceramic tiles belong to group 17 "Construction and demolition wastes", tiles and ceramics (code: 17 01 03) and are classified as no hazardous waste.

5. LCA RESULTS

The following tables illustrate the results of the LCA (Life Cycle Assessment) study. Basic information on all declared modules can be found in chapter 3.

It is possible to convert the results referring to kg using the following conversion factor: 0,0329.

LCA RESULTS - ENVIRONMENTAL IMPACTS of 1 m² of average ceramic tile (30,426 kg / m²)																
Parameter	**Unit**	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
GWP	[kg CO_2-eq.]	1,79E+01	7,48E-01	3,03E+00	INA	3,33E-02	INA	INA	INA	INA	INA	INA	1,31E-01	6,44E-02	1,74E-01	-2,48E-01
ODP	[kg CFC11-eq.]	1,91E-11	2,86E-14	7,26E-12	INA	6,69E-15	INA	INA	INA	INA	INA	INA	3,60E-15	2,90E-14	3,94E-14	-1,42E-12
AP	[kg SO_2-eq.]	5,66E-02	4,31E-03	6,29E-03	INA	3,64E-05	INA	INA	INA	INA	INA	INA	5,64E-04	4,60E-04	1,03E-03	-7,97E-04
EP	[kg $(PO4)^{3-}$-eq.]	4,97E-03	5,04E-04	9,79E-04	INA	4,01E-05	INA	INA	INA	INA	INA	INA	1,44E-04	1,11E-04	1,42E-04	-1,39E-04
POCP	[kg ethene -eq.]	2,95E-03	2,12E-04	4,09E-04	INA	3,54E-06	INA	INA	INA	INA	INA	INA	-2,35E-04	5,02E-05	8,00E-05	-8,29E-05
ADPE	[kg Sb-eq.]	9,84E-03	5,83E-08	6,44E-04	INA	1,28E-09	INA	INA	INA	INA	INA	INA	1,08E-08	8,50E-08	6,68E-08	-1,30E-07
ADPF	[MJ]	2,79E+02	9,99E+00	2,77E+01	INA	1,84E-01	INA	INA	INA	INA	INA	INA	1,79E+00	1,25E+00	2,25E+00	-5,09E+00
Caption	GWP = Global warming potential; ODP = Ozone depletion potential; AP = Acidification potential; EP = Eutrophication potential; POCP = Photochemical ozone creation potential; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; INA: Indicator Not Assessed															

LCA RESULTS – RESOURCE USE of 1 m² of average ceramic tile (30,426 kg / m²)																
Parameter	**Unit**	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	[MJ]	6,46E+01	4,48E-01	2,42E+01	INA	1,56E-02	INA	INA	INA	INA	INA	INA	9,92E-02	8,75E-02	2,89E-01	-3,52E+00
PERM	[MJ]	1,23E+01	0,00E+00	-1,31E+01	INA	0,00E+00	INA	INA	INA	INA	INA	INA	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	[MJ]	7,70E+01	4,48E-01	1,27E+01	INA	1,56E-02	INA	INA	INA	INA	INA	INA	9,92E-02	8,75E-02	2,89E-01	-3,52E+00
PENRE	[MJ]	2,90E+02	1,00E+01	3,06E+01	INA	1,97E-01	INA	INA	INA	INA	INA	INA	1,80E+00	1,30E+00	2,33E+00	-6,02E+00
PENRM	[MJ]	1,34E+00	0,00E+00	-1,42E+00	INA	0,00E+00	INA	INA	INA	INA	INA	INA	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	[MJ]	2,92E+02	1,00E+01	2,93E+01	INA	1,97E-01	INA	INA	INA	INA	INA	INA	1,80E+00	1,30E+00	2,33E+00	-6,02E+00
SM	[kg]	2,03E+00	0,00E+00	1,32E-01	INA	0,00E+00	INA	INA	INA	INA	INA	INA	0,00E+00	0,00E+00	0,00E+00	2,30E+01
RSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	INA	0,00E+00	INA	INA	INA	INA	INA	INA	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	INA	0,00E+00	INA	INA	INA	INA	INA	INA	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	[m³]	3,13E-01	8,26E-04	2,59E-02	INA	2,63E-04	INA	INA	INA	INA	INA	INA	1,83E-04	3,95E-04	4,46E-04	-1,62E-03

Caption	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 resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water; INA: Indicator Not Assessed

LCA RESULTS – OUTPUT FLOWS AND WASTE CATEGORIES of 1 m² of average ceramic tile (30,426 kg / m²)															
Parameter	**Unit**	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
HWD	[kg]	1,30E-06	4,48E-07	2,82E-07	INA	2,34E-10	INA	INA	INA	INA	INA	INA	1,04E-07	4,21E-08	4,02E-08	-4,70E-08
NHWD	[kg]	2,42E+00	6,92E-04	2,36E+00	INA	9,01E-03	INA	INA	INA	INA	INA	INA	1,51E-04	2,76E-04	1,09E+01	-1,03E+00
RWD	[kg]	8,39E-03	1,96E-05	8,69E-04	INA	4,95E-06	INA	INA	INA	INA	INA	INA	2,46E-06	2,00E-05	3,38E-05	-3,70E-04
CRU	[kg]	0,00E+00	0,00E+00	2,19E-01	INA	0,00E+00	INA	INA	INA	INA	INA	INA	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	[kg]	1,70E+01	0,00E+00	1,45E+00	INA	0,00E+00	INA	INA	INA	INA	INA	INA	0,00E+00	2,55E+01	0,00E+00	0,00E+00
MER	[kg]	0,00E+00	0,00E+00	0,00E+00	INA	0,00E+00	INA	INA	INA	INA	INA	INA	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	[MJ]	0,00E+00	0,00E+00	7,79E-01	INA	0,00E+00	INA	INA	INA	INA	INA	INA	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EET	[MJ]	0,00E+00	0,00E+00	1,15E+00	INA	0,00E+00	INA	INA	INA	INA	INA	INA	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Caption	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy; INA: Indicator Not Assessed														

TRACI INDICATORS:

According to UL, USA program operator.

TRACI indicators (version 2.1), from EPA's Tool for the Reduction and Assessment of Chemical and Other Environmental Impacts http://www.epa.gov/nrmrl/std/traci/traci.html, are listed below:

TRACI indicators: 1 m^2 Ceramic Tile (SL = 1 year)									
Parameter	**Unit**	**A1-3**	**A4**	**A5**	**B2**	**C2**	**C3**	**C4**	**D**
Global Warming Air	[kg CO2-eq.]	1,79E+01	7,48E-01	3,03E+00	3,33E-02	1,31E-01	6,44E-02	1,74E-01	-2,48E-01
Ozone Depletion Air	[kg CFC11-eq.]	1,91E-11	2,86E-14	7,26E-12	6,70E-15	3,60E-15	2,90E-14	3,94E-14	-1,42E-12
Acidification Air	[kg SO2-eq.]	5,69E-02	4,58E-03	6,73E-03	5,99E-05	7,64E-04	6,16E-04	1,13E-03	-9,04E-04
Eutrophication	[kg N--eq.]	3,00E-03	2,32E-04	8,38E-04	8,68E-05	6,35E-05	4,47E-05	9,50E-05	-1,11E-04
Smog Air	[kg O3-eq.]	7,35E-01	8,35E-02	1,05E-01	6,57E-04	1,69E-02	2,04E-02	2,21E-02	-1,96E-02

6. CALCULATION RULES

FUNCTIONAL UNIT:

Name	Value	Unit of measure
Declared unit	1	m^2
Weight	30,426	kg/m^2
Conversion factor to 1 kg	0,0329	-

ASSUMPTIONS:

The modules from A5 to C4 are scenarios based on average data, included in the PCR created by the “European Federation of ceramic tile manufacturers” /CET PCR 2014/ and subsequently implemented in the PCRb of the IBU program operator "Ceramic tiles and panels v1.6".

CUT OFF CRITERIA:

All flows in known inputs and outputs in the production process and in the system boundary were considered.

DATA QUALITY:

The validity period of the background data from the thinkstep database is between 2014 and 2017. Most of the information (energy and water consumption, emissions of pollutants, atomized powders and ceramic production) are measured or calculated directly at the company level and declared in the Italian IPPC document called AIA, which is specific and is checked for each plant involved in this study. Carbon dioxide emissions (related to carbonate oxidation) are collected through the ETS (Emissions Trading Scheme) declaration.
Detailed data was obtained not only for mixtures of raw materials (collected with primary data from the company) but also for pigments, frits and other raw materials for glaze production.
The overall quality of the data can be considered good.

PERIOD UNDER REVIEW:

Primary data collected in the context of this study refer to 2018.

ALLOCATION:

The consumption of energy and materials has been allocated to the product in question based on the mass of ceramic tiles produced annually. No further allocations were applied in the modules subsequent to the production phase. Some ceramic waste is recycled internally. Credits for energy recovery of packaging materials and end of life of the product have been taken into consideration.

7. SCENARIOS

The modules A1-A3 include all processes described in chapter 4.
The technical information concerning the declared modules beyond A1-A3 and related scenarios are based on average data, in accordance with the "European Federation of Ceramic Tile Manufacturers" and subsequently implemented by the PCRb of the IBU program operator "Ceramic tiles and panels v1.6".

Transport (A4):

For transport distances less than 300 km, the return journeys of the vehicles used are considered to be empty. Return journeys over 300 km covered by vehicles are considered at full load. This assumption is applied for any type of transport present in the analyzed system.

Name	Value	Unit of measure
Litres of fuel (per functional unit)	31	l/100 km
Capacity utilization volume factor (including empty runs)	0,85	_
National destination Truck with a capacity of 27 tons (51% of tiles sold)	300	km
European destination Truck with a capacity of 27 tons (34% of tiles sold)	1390	km
Transoceanic freight ship	6520	km

Installation into the building (A5):

For the installation stage, 3 options are defined, where different materials can be used. For option 1: adhesives, mortar and water; for option 2: mortar dispersion adhesives and polysulfides; for option 3: cementitious adhesives (different quantities for different tile size).
These considerations are based on average data from different manufacturers of ceramic tiles in Europe. In this EPD it is assumed that the tiles are installed using cementitious adhesive (option 3).
For the treatment of packaging waste, a European average scenario is used and shown, taken from “Eurostat, 2013”; therefore, the end of life is recycling, energy recovery and landfill for plastic and paper, instead reuse, energy recovery and landfill for wood.
The ceramic material loss considered is 6,5%.

Option 3 (large size tiles)	Value	Unit of measure
Cementitious adhesive	6	kg

Use (B1):

Ceramic tiles are robust and have a hard, abrasion-resistant surface.
There are no impacts on the environment during the use stage.

Maintenance (B2):

Ceramic covering products shall be cleaned regularly, to a greater or lesser degree, depending on the type of building: residential, commercial, healthcare. Thus, the consumption of water and disinfectant has been considered. The values declared in this stage refer to a time period of 1 year for the residential use.
Residential use: 0,2 ml of detergent and 0,1 l of water are used to wash 1 m2 of ceramic tiles once a week for flooring and every three months for wall coverings.
This stage scenario is based on average data from different manufacturers of ceramic tiles in Europe.

Name	Value	Unit of measure
Water consumption	0,1	l
Detergent	0,2	ml
Floor tile maintenance cycle	2600	Number/SL
Wall tile maintenance cycle	200	Number/SL

Repair, replacement and refurbishment (B3, B4, B5):

In general, the service life of ceramic tiles is the same as the building lifetime. No additional repair, replacement and refurbishment are required for ceramic tiles.

Operational energy and water use (B6, B7):

These modules are not relevant for ceramic tiles.

End of life (C1-C4):

C1: This module is not relevant for ceramic tiles.

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. The return trip shall be included in the system. It can be considered an average distance of 30 km from the container or treatment plant to final destination.

C3-C4: the end-of-life scenario is described in the following table:

Name	Value	Unit of measure
Recycling percentage (C3)	70	%
Landfill percentage (C4)	30	%

Benefits and loads beyond the product system boundary (D):

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

8. ENVIRONMENT AND HEALTH DURING USE

Ceramics are inherently inert, chemically stable and therefore, during use, do not emit pollutants or substances which are dangerous for the environment and for health, such as: VOC and radon.

9. OTHER ADDITIONAL ENVIRONMENTAL INFORMATION

MINIMUM ENVIRONMENTAL CRITERIA (CAM):

Ceramic tiles by Marazzi Group comply with the Italian Legislation Minimum Environmental Criteria (CAM), defined under the “Plan for environmental sustainability of consumption in the public administration sector” and adopted by Decree of the Minister of the Environment and Protection of the Territory and the Sea (11 October 2017).
The criteria for the ceramic tiles refer to the following parameters among those adopted at the European level for the allocation of the EU-Ecolabel ecological mark to the "hard covering" category (Decision 2009/607/EC):

4.2 *Consumption and use of water*: the water consumption at the manufacturing stage, from raw material preparation to firing operations, for the fired products shall not exceed the value of 1 litre/kg of product. The wastewater produced by the processes included in the production chain shall reach a recycling ratio of at least 90%.

4.3.b *Emissions to air* (for particulate matter and fluorides): The emissions to air for the firing stage only shall not exceed the following: Particulate matter (dust) 200 mg/m2 (test method EN 13284-1), Fluorides (as HF) 200 mg/m2 (test method ISO 15713); The total cold emissions to air shall not exceed the value: Particulate matter (dust) 5 g/m 2 (test method EN 13284-1).

4.4 *Emissions into the water*: in Marazzi Group plants waste industrial water are completely recycled into the production, without generate water emissions; therefore, the criterion is not applicable.

5.2 *Waste recovery:* at least 85 % (by weight) of the total waste generated by the processes shall be recovered according to the general terms and definitions established by Council Directive 75/442/EEC.

Requirement	Parameter	Declared value	Unit of measure	Test method
Consumption and use of water	Fresh water specific consumption in production (Cwp-a)	≤ 1	l/kg	-
	Rate of wastewater recycling in production	≥ 90	%	-
Emissions to air (the declared values are based on test reports and samples taken in 2019)	Particulate matter (dust) from cold emissions	≤ 5	g/m^2	EN 13284-1
	Particulate matter (dust) from firing stage	≤ 200	mg/m^2	EN 13284-1
	Fluorides (as HF) from firing stage	≤ 200	mg/m^2	ISO 15713
Emissions into the water	Suspended solid emission into water	≤ 40	mg/l	ISO 5667-17
	Cd emission into water	≤ 0.015	mg/l	ISO 8288
	Cr (VI) emission into water	≤ 0.15	mg/l	ISO 11083
	Pb emission into water	≤ 0.15	mg/l	ISO 8288
Waste recovery	Total process waste[1)]	≥ 85	% (by weight)	-

Note 1): assessed according to the general terms and definitions contained in Council Directive 75/442/EEC. Process waste does not include maintenance waste, organic waste and municipal waste generated by ancillary and administrative activities

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