**ENVIRONMENTAL PRODUCT DECLARATION**
as per ISO 14025 and EN 15804

<table>
<thead>
<tr>
<th>Owner of the Declaration</th>
<th>Marazzi Group S.r.l a socio unico</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programme holder</td>
<td>Institut Bauen und Umwelt e.V. (IBU)</td>
</tr>
<tr>
<td>Publisher</td>
<td>Institut Bauen und Umwelt e.V. (IBU)</td>
</tr>
<tr>
<td>Declaration number</td>
<td>EPD-MAR-20160004-IBC2-EN</td>
</tr>
<tr>
<td>Issue date</td>
<td>23.08.2016</td>
</tr>
<tr>
<td>Valid to</td>
<td>22.08.2021</td>
</tr>
</tbody>
</table>

**Ceramic tiles - Glazed porcelain tiles (Casiglie's plant)**
Marazzi Group Srl

www.ibu-epd.com / https://epd-online.com
1. General Information

Marazzi Group srl

Programme holder
IBU - Institut Bauen und Umwelt e.V.
Panoramastr. 1
10178 Berlin
Germany

Declaration number
EPD-MAR-20160004-IBC2-EN

This Declaration is based on the Product Category Rules:
Ceramic tiles and panels, 07.2014 (PCR tested and approved by the SVR)

Issue date
23.08.2016

Valid to
22.08.2021

Owner of the Declaration
Marazzi Group S.r.l a socio unicco
Viale Regina Pacis, 39
41049, Sassuolo - MODENA
ITALY

Declared product / Declared unit
Glazed Porcelain Tile / 1 m2

Scope:
Within this study a LCA according to ISO 14040/44 is performed for ceramic tiles manufactured by Marazzi Group at the production plant located in Casiglie (Modena, Italy). In this EPD the LCA results of one average square meter of glazed porcelain tiles produced by Marazzi in the Italian production site Casiglie are declared.

This analysis relies on transparent, plausible and documented basis data. The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

Verification
The CEN Norm /EN 15804/ serves as the core PCR
Independent verification of the declaration according to /ISO 14025/

Internal externally

Prof. Dr.-Ing. Horst J. Bossenmayer
(Managing Director IBU)

Vito D’Incognito
(Independent verifier appointed by SVR)

2. Product

2.1 Product description
Ceramic tiles, product by Marazzi into Casiglie’s plant are made primarily of natural raw materials such as sand, clay, feldspar, kaolin and rhyolite. To minimize the use of natural resources, a percentage of recycled material both from external and internal ceramic tiles production is added to the mixing recipe.

Glazed porcelain tiles have extremely low water absorption ≤0.05%.

The declared products represent an average glazed porcelain tile applicable only to the production in Casiglie’s plant.

2.2 Application
The designated application for the EPD object product is both for wall and floor covering, for civilian and residential use.

2.3 Technical Data
Porcelain tiles conform to the following standards and specifications:

Construcational data

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water adsorption acc. to /EN ISO 10545-3/</td>
<td>≤0.05</td>
<td>%</td>
</tr>
<tr>
<td>Bending strength acc. to /ISO 10545-4/</td>
<td>&gt;35</td>
<td>N/mm²</td>
</tr>
<tr>
<td>Thermal shock resistance acc. to /ISO 10545-9/</td>
<td>resistant</td>
<td>-</td>
</tr>
<tr>
<td>Modulus of rupture Breaking strength</td>
<td>≥1300</td>
<td>N</td>
</tr>
<tr>
<td>Shock resistance acc. to /ISO 10545-5/</td>
<td>0.80</td>
<td>-</td>
</tr>
<tr>
<td>Resistance surface abrasion acc. to /ISO 10545-7/ (PEI value)</td>
<td>I-II-III-IV-V</td>
<td>-</td>
</tr>
<tr>
<td>Frost resistance acc. to /ISO 10545-12/</td>
<td>resistant</td>
<td>-</td>
</tr>
<tr>
<td>Linear thermal expansion coefficient acc. to /ISO 10545-8/</td>
<td>≤9</td>
<td>MK⁻¹⁻¹</td>
</tr>
<tr>
<td>Stain resistance acc. to /ISO 10545-14/</td>
<td>Class 3</td>
<td>minimu m</td>
</tr>
<tr>
<td>Resistance to chemicals for household use and swimming-pool salts acc. to</td>
<td>UA</td>
<td>-</td>
</tr>
</tbody>
</table>
ISO 10545-13

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistance to acids and bases acc. to ISO 10545-13</td>
<td>GLA/GL B from GHA/GH B</td>
<td>-</td>
</tr>
<tr>
<td>Colour resistance to light exposure acc. to /DIN 51094</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Skid resistance Ramp Method acc. to DIN 51130/ BGR 181</td>
<td>NC; R9-R10-R11</td>
<td>-</td>
</tr>
<tr>
<td>Skid resistance Ramp Method acc. to DIN 51097/ GUV 26.17</td>
<td>NC; A+A+B+A +B+C</td>
<td>-</td>
</tr>
<tr>
<td>Mean coefficient of friction B.C.R. acc. to /D.M. 236 14/6/89/</td>
<td>NC; µ&gt;0,40</td>
<td>-</td>
</tr>
<tr>
<td>Skid resistance Pendulum acc. to /BS EN13036-4:2011</td>
<td>NC; PTV&gt;36</td>
<td>-</td>
</tr>
<tr>
<td>Skid resistance Pendulum acc. to ENV 12633/ BOE N°74 of 2006</td>
<td>NC; Class 1 2-3</td>
<td>-</td>
</tr>
<tr>
<td>Skid resistance Digital tribometer (D-COF) acc. to ANSI 137.1:2012</td>
<td>NC; µ&gt;0,42</td>
<td>-</td>
</tr>
<tr>
<td>Skid resistance Ramp Method acc. to DIN 51130/ BGR 181</td>
<td>NC; R9-R10-R11</td>
<td>-</td>
</tr>
</tbody>
</table>

2.4 Application rules

For the placing on the market in the EU/EFTA (with exception of Switzerland), the Regulation (EU) No 305/2011 applies. The products need a Declaration of Performance taking into consideration of /EN 14411:2012 Ceramic tiles — Definitions, classification, characteristics, evaluation of conformity and the CE-marking.

For the application and use the respective national provisions apply.

Marazzi Group porcelain tiles comply with the following standards and provisions:

- 2009/607/EC Commission decision of 9 July 2009 establishing the ecological criteria for the award of the Community eco-label to hard coverings,
- CEN Internal Regulation Part 4 Certification; Keymark Scheme Rules for Ceramic Tiles;
- European Technical Approval ETA-03/0055 Special anchor for the rear fixing of façade slabs made of ceramic plates (stoneware) according to EN 14411;
- NF029 Marque NF Carreaux céramiques pour revêtements de sol, associée à la marque UPEC;
- ANSI 137.1:2012 Approved American National Standard;
- SONCAP Standards organization of Nigeria conformity assessment program - Exporter and importer guidelines;
- CNCA-12C-050:2010 Implementation rules for compulsory certification of decorative products and fitment products;
- TIS.2508-2555 Thai Industrial Standard - Ceramic tiles

2.5 Delivery status

The dimensions of products in the delivery status vary between 30cmx60cm to 60cmx120cm. The thickness varies between 10 mm and 10,5 mm

2.6 Base materials / Ancillary materials

Main raw materials for porcelain tile:

- Feldspar 38%
- Clay 35%
- Silica sand 23%
- Rhyolite 2%
- Others raw material <2

Main auxiliary additives:

- Dispersant
- Binder
- Fluidifying agents
- Pigments

2.7 Manufacture

The manufacturing process of the porcelain tile in Casiglie's plant is represented below.
The required composition of raw materials is mixed and grinded in a continuous milling with water and wet ceramics wastes from previous process cycle (internal and external to the plant) to form a slurry. This step includes the use of some chemicals as binders and fluidifying agents. The slurry is sent to spray driers that use thermal energy and high air pressure in order to produce a dry powder with uniform granules ready to be pressed and shaped. The dust pressing powder forms a continuous line with a perfectly even thickness. The powder is pre-compact, decorated by adding polychrome powders, cut in a first big slab of 120x120 cm, trimmed and shaped with a hydraulic press. After another drying step, the slab is cut on line into formats between 60x120 cm and 30x60 cm.

Depending on the product, a protective glaze is applied by spraying or watering. Protective glaze are prepared using many different raw materials as alumina (Al2O3), quartz.

The firing phase takes place at a temperature of 1470 K in order to give the typical ceramic tile features of abrasion, water resistance and longevity.

Before selection and packing lines, rectified products are cut and squared at the desired size. The final product packed in paperboard boxes are stacked on wooden pallets and protected with PET film, in order to be properly stored in the warehouse until the order preparation for customer shipment.

The monitoring of the product performance is managed by the quality management system (QMS) in compliance with:

- ISO 9001:2008/ Quality management systems -Requirements
- ISO 13006:2012/ Ceramic tiles - Definitions, classification, characteristics and marking
- EN 14411:2012/ Ceramic tiles — Definitions, classification, characteristics, evaluation of conformity
- ISO 10545-1÷15/ Ceramic tiles — 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 7976:2-2002/ 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

2.8 Environment and health during manufacturing

Occupational health and safety
The workers are informed about all chemical and physical risks associated to their job and they receive appropriate personal protective equipment and training.

Environmental protection
Marazzi Group decided in 2003 to certify its Environmental Management System in compliance with the international standard /ISO 14001/.

To reduce impacts on habitats and natural resources, the raw materials for the body of ceramic tiles are extracted in quarries that work with regular authorisation for the extraction activity, have an environmental recovery plan and/or environmental impact assessment report, are compliant with the /Council Directive 92/43/EEC/ (habitats) and /Council Directive 79/409/EEC/ (birds) or with the UN conservation on biological diversity (1992).

Casiglie's plant has no wastewater emissions to the near surface water because all the liquids are recovered and treated internally. Casiglie’s environmental authorization permits to further reduce the input of fresh water in the process by recovering wastewater from other ceramic tiles companies. It also reuses a large amount of the unfired ceramic waste resulting from the process, as this material with unfired scraps from external companies is one of the milling inputs.

More than 95% of Casiglie’s plant wastes are sent to final recovery. Casiglie's plant reduces the air emissions impacts generated throughout the manufacturing process with the use of specific bag filters to capture particulates. To minimize fluorine gas emission from the firing process hydrated lime is used. The emission of carbon dioxide is strictly controlled as established from the /European Directive ETS/ (European Emissions Trading Scheme)

Casiglie's plant controls all its noise sources respecting the regulatory limits, in many case the plant's acoustic emissions are lower than other environmental sources (traffic etc.).

The electric energy mix (Italian grid mix) used in the plant originates from renewable sources for at least 30%.

In terms of energy saving Casiglie's plant has adopted the following solutions:

- a cogeneration system, feed with natural gas, is used for electric power generation and the secondary thermal energy created by the process is sent to spry-drier.
- heat saving from kiln's air cooling to drier

Cardboard and PET film used for the packaging of the final product are made out of recycled materials.

2.9 Product processing/Installation
Tiles are fixed to the floors and walls using different materials and amounts: mortar, sealant, dispersion and cementitious adhesive. During the installation, no emissions occur. No health or environmental risks derive from tiles installation.

2.10 Packaging
Products are packed in cardboard boxes, wrapped with PET film and plastic straps and stacked on wooden pallets. The amount of packaging material used depends on the tile size.

2.11 Condition of use
Ceramic tiles are solid and chemically stable materials due to being burnt at high temperatures. The environmental impacts generated during the B1 phase are very low and therefore can be neglected.

2.12 Environment and health during use
Ceramic is intrinsically inert and therefore, during the use stage, do not emit any pollutants or substances which are harmful to environment and health.

2.13 Reference service life
The service life of tiles is in generally higher than 50 years / BNB 2011 /. According also to US Green Building Council the service life of tiles could be as long as the life of the building itself. Therefore 60 years can be an alternative tile’s life for U.S. GBG.

The results reported consider the tile’s use of 1 year, then it could be possible obtain use impacts referred to 50 or 60 years multiplying B2 values for 50 or 60. A reference-life according to / ISO 15686 / is not reported.

2.14 Extraordinary effects

Fire
According to /EN 13501-1:2007+A1:2009/, ceramic tiles can be classified as class A1 of fire resistance rating, because do not contribute to fire.

It has been proven that ceramic tiles coating, in case of fire, reduce the thermal load on them, and thus the collapsing risk.

Water
Ceramic tiles are a material insoluble in water and do not react with it.

Mechanical destruction
The ceramic tiles can be destructed mecanically, but no harmful damage on the environment is expected indeed.

2.15 Re-use phase
After the demolition and deconstruction stage, ceramic tiles can be crushed and then used in a range of different applications, like concrete aggregates, road construction.

2.16 Disposal
According to the European Waste Catalogue ceramic tiles waste belongs to the group 17 "Construction and demolition wastes", tiles and ceramic (code:17 01 03).

2.17 Further information
Additional information about Marazzi Group Srl design,
3. LCA: Calculation rules

3.1 Declared Unit
The declared unit is 1 m² ceramic tile for covering walls and floors with an average weight of 24.7 kg. The average thickness considered for the EPD is 10 mm.

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Declared unit</td>
<td>1</td>
<td>m²</td>
</tr>
<tr>
<td>Grammage</td>
<td>24.7</td>
<td>kg/m²</td>
</tr>
</tbody>
</table>

3.2 System boundary
The entire life cycle of the product is considered (Type of EPD: cradle- to- grave) therefore every module described below is declared in this EPD.

Modules A1-A3 include those processes that provide energy and materials input for the system (A1), transport up to the factory gate of Casiglie’s plant (A2), manufacturing processes as well as waste processing (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 also packaging waste processing (recycling, incineration, disposal). Credits from energy substitution are declared in module D.

Module B1 considers the use of tiles. During the use of ceramic tiles are not expected any kind of hazardous indoor emissions.

Module B2 includes the cleaning of the tiles. Provision of water, cleaning agent for the cleaning of the tile, incl. waste water treatment.

Modules B3-B4-B5 are related to the repair replacement and refurbishment of the tile. If the tile is properly installed no repair, replacement or refurbishment processes are necessary.

Modules B6-B7 consider energy use for operating building integrated technical systems (B6) and operational water use for technical building-related system.

Module C1 regards demolition and de-construction process of the tile 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) for recycle properly the tile.

Module C4 includes all the landfill disposal process, 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 material incineration and resulted energy credits (electricity and thermal energy) are declared within module D.

3.3 Estimates and assumptions
The modules from A5 to C4 are hypotheticals scenarios based on average data created by the European Ceramic Tile Manufacturers' Federation in accordance with Marazzi Group Srl.

For those materials, (glaze compost, colorant, and chemical additives) where no primary data were available and an exact chemical composition (coming from datasheet) was unknown an average composition was used, and assumptions were taken based on common chemicals criteria.

As mentioned B1 stage generates very little impact neglected. Module B3, B4, B5, B6 and B7 were not declared.

3.4 Cut-off criteria
According to PCR (Part A) the cut-off criteria of 1% of the total mass/energy has been used, for single unit process. Cut off criteria for module A1-A3 is 5% of total energy/mass used and environmental potential impacts.

This cut-off criteria are used particularly for raw materials and glazes.

3.5 Background data
Background data for the Life Cycle Modelling have been taken from the last version /Gabi 6/ professional database. Other sources for background data used are /ELCD/FEFCO/, /Perry's Chemical Engineers Handbook/, /European Ceramic Glaze Handbook/, /European Ceramic Tile Manufacturers' Federation/.

3.6 Data quality
The period of validity of background data from the thinkstep database lies between 2011 and 2016. Most of the information are measured or calculated primary data directly coming from Casiglie’s plant. A high detail level is used not only for main raw materials used into the tile mixture, but also for those chemicals, colorants and other raw materials used in the glaze’s manufacturing.

Data collection refers to Casiglie’s plant that produces 20% of the overall Italian porcelain tiles production from the Marazzi's Group that comprises 4 Italian plants.

3.7 Period under review
The primary data collected in the study are from 2014 production year.

3.8 Allocation
Energy and material supplies have been allocated to the product based on annually produced mass of atomized powder internally used and mass of glazed tiles. No further allocations have been applied within the subsequent module.

Moreover, some ceramic wastes are internally recycled; credits from energy recovery of packaging materials from the end- of- life of the product are taken into account.
3.9 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to /EN 15804/ and the building context, respectively the product-specific characteristics of performance, are taken into account.

4. LCA: Scenarios and additional technical information

The following technical information about declared modules and related scenarios are based on average data, according to European Ceramic Tile Manufacturers’ Federation and in accordance with Marazzi Group Srl.

Transport to the building site (A4)

Ceramic tiles are commercialized nationally, in Europe and the rest of the world. Average default transportation scenarios are used and displayed below.

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>National destination Truck with a capacity of 27 tons (51% of tiles sold)</td>
<td>300</td>
<td>km</td>
</tr>
<tr>
<td>European destination Truck with a capacity of 27 tons (34% of tiles sold)</td>
<td>1390</td>
<td>km</td>
</tr>
<tr>
<td>Extra European destination Truck with a capacity of 27 tons (15% of tiles sold)</td>
<td>520</td>
<td>km</td>
</tr>
</tbody>
</table>

Installation into the building (A5)

Three options for the installation stage are defined, where different materials can be used. Adhesives, mortar and water for option 1, mortar dispersion adhesive and polysulfide for option 2 and cementation adhesive (different quantity for different format tile) for option 3. These considerations are based on average data from different manufacturers of ceramic tile in Europe. In this EPD it is assumed that the tiles are installed using cementitious adhesive (option 3).

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cementitious adhesive</td>
<td>6</td>
<td>kg</td>
</tr>
</tbody>
</table>

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)

Throughout their life, the ceramic coverings product 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 it have been considered.

Scenario for maintaining ceramic floor tiles:

Residential use: 0.3 ml of detergent and 0.002 l of water are used to wash 1 m2 of ceramic floor tiles once a week.

Scenario for maintaining ceramic wall tiles:

Residential use: 0.3 ml of detergent and 0.002 l of water are used to wash 1 m2 of ceramic floor tiles once every three months.

This stage scenario is based on average data from different manufacturers of ceramic tiles in Europe.

Operational energy and water use (B6, B7)

These modules are not relevant for ceramic tiles.

End of life (C1-C4)

C1: These module, according to European Ceramic Tile Manufacturers’ Federation (CET PCR 2014) 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.

The results for the end-of-life are declared for the 3 different scenarios:

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario No 1: Material Recycling</td>
<td>100</td>
<td>%</td>
</tr>
<tr>
<td>Scenario No 2: Landfill</td>
<td>100</td>
<td>%</td>
</tr>
<tr>
<td>Scenario No 3: Mixed Scenario (Recycling / Landfill)</td>
<td>70 / 30</td>
<td>%</td>
</tr>
</tbody>
</table>

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

Module D includes credits from recycling materials of tiles and packaging, energy credits from thermal recovery of the packaging. The results are declared for the same 3 different scenarios described in the previous table (End of life C1-C4).
5. LCA: Results

The tables below show the results of the LCA. Basic information on all declared modules provides chapter 4. There are three scenarios for the end-of-life (C3, C4 and D) analyzed: Scenario 1 considers 100% recycling, Scenario 2 considers 100% landfill disposal, Scenario 3 represents a mix of landfill (30%) and recycling (70%).

**DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED)**

<table>
<thead>
<tr>
<th>PRODUCT STAGE</th>
<th>CONSTRUCTION/ PROCESS STAGE</th>
<th>USE STAGE</th>
<th>END OF LIFE STAGE</th>
<th>BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw material supply</td>
<td>Transport</td>
<td>Manufacturing</td>
<td>Assembly</td>
<td>Use</td>
</tr>
<tr>
<td>A1</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

**RESULTS OF THE LCA - ENVIRONMENTAL IMPACT:** Ceramic tiles - Glazed porcelain tiles 1 m²

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>A4</th>
<th>A5</th>
<th>B1</th>
<th>B2</th>
<th>B3</th>
<th>B4</th>
<th>B5</th>
<th>B6</th>
<th>B7</th>
<th>C1</th>
<th>C2</th>
<th>C3</th>
<th>C4</th>
<th>C5</th>
<th>C6</th>
<th>C7</th>
<th>C8</th>
<th>C9</th>
<th>C10</th>
<th>D1</th>
<th>D2</th>
<th>D3</th>
</tr>
</thead>
<tbody>
<tr>
<td>GWP [kg CO₂-eq]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ODP [kg CFC-11]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AP [kg SO₂]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EP [kg (PO₄)₃]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POC [kg ethene-eq]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADPE [kg Sb-eq]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADPF [MJ]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**RESULTS OF THE LCA - RESOURCE USE:** Ceramic tiles - Glazed porcelain tiles 1 m²

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>A4</th>
<th>A5</th>
<th>B1</th>
<th>B2</th>
<th>B3</th>
<th>B4</th>
<th>B5</th>
<th>B6</th>
<th>B7</th>
<th>C1</th>
<th>C2</th>
<th>C3</th>
<th>C4</th>
<th>C5</th>
<th>C6</th>
<th>C7</th>
<th>C8</th>
<th>C9</th>
<th>C10</th>
<th>D1</th>
<th>D2</th>
<th>D3</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERE [MJ]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PERM [MJ]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PERT [MJ]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PENRE [MJ]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PENRT [MJ]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SM [g]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RSF [MJ]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NRSF [MJ]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FW [m²]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Caption**

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POC = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources.

9. Environmental Product Declaration Marazzi Group srl – Ceramic tiles - Glazed porcelain tiles (Casiglione’s plant)
**RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES:**

**Ceramic tiles - Glazed porcelain tiles 1 m²**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>A1/3</th>
<th>A4</th>
<th>A5</th>
<th>B1</th>
<th>B2</th>
<th>B3</th>
<th>B4</th>
<th>B5</th>
<th>B6</th>
<th>B7</th>
<th>C1</th>
<th>C2</th>
<th>C3/1</th>
<th>C3/2</th>
<th>C3/3</th>
<th>C4/1</th>
<th>C4/2</th>
<th>C4/3</th>
<th>D1</th>
<th>D2</th>
<th>D3</th>
</tr>
</thead>
<tbody>
<tr>
<td>HWD</td>
<td>[kg]</td>
<td>5.16E-3</td>
<td>3.85E-3</td>
<td>0.00E+0</td>
<td>5.84E-3</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>5.84E-3</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>2.22E-3</td>
<td>6.13E-3</td>
<td>6.13E-3</td>
<td>6.13E-3</td>
<td>6.13E-3</td>
<td>6.13E-3</td>
<td>6.13E-3</td>
<td>6.13E-3</td>
<td>6.13E-3</td>
<td>6.13E-3</td>
<td></td>
</tr>
<tr>
<td>NHWVD</td>
<td>[kg]</td>
<td>7.94E-3</td>
<td>2.03E-3</td>
<td>0.00E+0</td>
<td>2.89E-3</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>2.89E-3</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>6.65E-3</td>
<td>7.94E-3</td>
<td>6.65E-3</td>
<td>6.65E-3</td>
<td>6.65E-3</td>
<td>6.65E-3</td>
<td>6.65E-3</td>
<td>6.65E-3</td>
<td>6.65E-3</td>
<td>6.65E-3</td>
<td></td>
</tr>
<tr>
<td>RWD</td>
<td>[kg]</td>
<td>3.28E-3</td>
<td>3.17E-3</td>
<td>0.00E+0</td>
<td>1.86E-3</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>1.86E-3</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>6.38E-3</td>
<td>1.67E-3</td>
<td>6.38E-3</td>
<td>6.38E-3</td>
<td>6.38E-3</td>
<td>6.38E-3</td>
<td>6.38E-3</td>
<td>6.38E-3</td>
<td>6.38E-3</td>
<td>6.38E-3</td>
<td></td>
</tr>
<tr>
<td>CRU</td>
<td>[kg]</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td></td>
</tr>
<tr>
<td>MFR</td>
<td>[kg]</td>
<td>0.00E+0</td>
<td>8.76E-3</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td></td>
</tr>
<tr>
<td>MER</td>
<td>[kg]</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td></td>
</tr>
<tr>
<td>EEE</td>
<td>[MJ]</td>
<td>0.00E+0</td>
<td>1.53E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td></td>
</tr>
<tr>
<td>EET</td>
<td>[MJ]</td>
<td>0.00E+0</td>
<td>2.96E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td>0.00E+0</td>
<td></td>
</tr>
</tbody>
</table>

**Caption**

HWD = Hazardous waste disposed; NHWVD = 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; EEE = Exported thermal energy.

The values declared in B2 refer to a time period of 1 year. It's also possible to multiply B2 values by the assumed life (number of years) of the tile, for example 50 years or 60 years (according to BNB 2011 or US GBC) in order to obtain the entire life cycle impacts.

### 6. LCA: Interpretation

A1-A3 is the module with the majority of the impacts. Overall most of the impact categories are dominated by energy processes and raw materials consumption for ceramic mixture. Regarding this module, global warming potential (GWP) is generated by energy process for 80%, by raw materials for 26%.

Energy result influence also for abiotic fossil depletion (ADPe) for 72%.

Ozone layer depletion (ODP) is driven by mixture’s raw materials extraction for 77%.

Eutrophication potential (EP) is distributed between energy consumption (31%) and extraction of raw material (40%).

Production of colors (78%) results important for depletion of abiotic elements (ADPe), due to the production of natural elements like oxides of zinc and tungsten.

Presence of radioactive wastes, particularly in A1, is due to extraction process mainly of feldspar and riolite. The following figures (referred to 1 year of use and end of life Scenario 3) show how impacts are distributed between the phases considered in this EPD.
Energy consumption is due to two main sources: production processes and pollutant reduction processes:

- Energy consumption for pollution reduction [%]
- Energy consumption for production [%]

The figures below show the amount of electricity produced inside Casiglie's plant and the amount of
electricity purchased from the energy supplier:

7. Requisite evidence

Ceramic is intrinsically inert and therefore, during the use stage, do not emit any pollutants or substances which are harmful to environment and health, as demonstrate by test standard:

- #/DEV.L1104875A/ 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/ Indoor Air Quality Certification - ASTM Standards D-5116 and D-6670

8. References

Institut Bauen und Umwelt
Institut Bauen und Umwelt e.V., Berlin(pub.):
Generation of Environmental Product Declarations (EPDs);
www.ibu-epd.de

ISO 14025
DIN EN ISO 14025:2011-10: Environmental labels and declarations — Type III environmental declarations — Principles and procedures

EN 15804
EN 15804:2012-04+A1 2013: Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

IBU PCR Part A:2014-20-08 V1.3
Product Category Rules for Building-Related Products and Services.
Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Background Report.

IBU PCR Part B:2014-07-04 V1.6
Product Category Rules for Building-Related Products and Services.
Part B: Requirements on the EPD for Ceramic tiles and panels

ISO 10545-3:2013-07-01
Ceramic tiles -- Part 3: Determination of water absorption, apparent porosity, apparent relative density and bulk density,

Ceramic tiles - Part 4: Determination of modulus of rupture and breaking strength,

ISO 10545-5: 1996-03-28
Ceramic tiles -- Part 5: Determination of impact resistance by measurement of coefficient of restitution,

ISO 10545-7: 1996-12-19
Ceramic tiles -- Part 7: Determination of resistance to surface abrasion for glazed tiles,

ISO 10545-8: 2013-06-01
Ceramic tiles -- Part 8: Determination of linear thermal expansion,

ISO 10545-9: 2013-07-01
Ceramic tiles -- Part 9: Determination of resistance to thermal shock,

ISO 10545-12: 1995-11-16
Ceramic tiles -- Part 12: Determination of frost resistance,

ISO 10545-13: 1995-10-26
Ceramic tiles -- Part 13: Determination of chemical resistance,

ISO 10545-14: 2015-09-15
Ceramic tiles -- Part 14: Determination of resistance to stains,

DIN 51094:1996-09
Testing of ceramic raw materials and materials; determination of the light fastness of colourings of tiles and flags for wall and floor covering,

DIN 51130:2014-02 BGR 181
Ramp Slip Resistance (Oil/Wet),
DIN 51097:2016-04  GUV 26.17:  
Testing of floor coverings; determination of slip resistance;  
barefoot areas exposed to wet,  

D.M. 236 14/6/89 (Italian Ministerial Decree)  
Prescrizioni tecniche necessarie a garantire l'accessibilità, l'adattabilità e la visitabilità degli edifici privati e di edilizia residenziale pubblica e sovvenzionata e agevoluta, ai fini del superamento e dell'eliminazione delle barriere architettoniche,  

BS EN13036-4:2011-10  
Road and airfield surface characteristics. Test methods . Method for measurement of slip/skid resistance of a surface: The pendulum test,  

ENV 12633 BOE N°74 of 2006  
Method of determination of unpolished and polished slip/skid resistance value,  

ANSI 137.1:2012  
Dynamic Coefficient of Friction (DCOF) STANDARD,  

GaBi 6  
Life cycle assessment software, by thinkstep,  

2009/607/CE Decision  
Ecolabel for ceramic tile,  

ISO 13006:2012-03-01  
Ceramic tiles -- Definitions, classification, characteristics and marking,  

EN 14411:2013-05-29  
Ceramic tiles - Definitions, classification, characteristics, evaluation of conformity and marking,  

CEN:2014 Internal Regulation Part 4  
Certification; Keymark Scheme Rules for Ceramic Tiles,  

DIN 51130:2014-02 Testing of floor coverings  
Determination of the anti-slip properties. Workrooms and fields of activities with slip danger, walking method-ramp test,  

ETA - /03/0055: 2015-01  
European Technical Approval, Special anchor for the rear fixing of façade slabs made of ceramic plates (stoneware) according to EN 14411,  

BS 7976-2:2002-08  
Pendulum test for floor,  

British Ceramic Research Association LTD  
Method for the determination of the coefficient of friction of floor tiles and floor surfaces,  

ENV 12633:2006-09  
Pendulum test for floor,  

NF029 Marque NF: 2015-03  
Carreaux céramiques pour revêtements de sol, associée à la marque UPEC,  

DEVL1104875A: 2011-04  
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  
Indoor Air Quality Certification - ASTM Standards D-5116 and D-6670,  

SAUDI STANDARD SASO 1031-1998  
Ceramics tiles (GS779/1997)-1030-1998 methods of test for ceramics tiles,  

SONCA:2013-01  
Standards organization of Nigeria conformity assessment program - Exporter and importer guidelines,  

CNCA-12C-050:2010-07  
Implementation rules for compulsory certification of decorative products and fitment products,  

TIS.2508-2555:2012-10  
Thai Industrial Standard - Ceramic tiles,  

2014/C 259/01  

ISO 14001:2015-09  
Environmental management international standard,  

ELCD 3.2: 2015-10  
The European reference Life Cycle Database,  

FEFCO 2012  
European Corrugated Packaging Association, database.  

Perry's Chemical Engineers' Handbook  
Don Green, Robert Perry, 8th edition, 13 November 2007,  

US GBC  

BNB 2011  
BBSR table "useful lives of components for Life Cycle Analysis by BNB ", Federal Institute for Building, Urban Affairs and Spatial Development, Division II  
Sustainable Building; available online at http://www.nachhaltigesbauen.de/baustoff-undgebaeuedaten/  
useful lives-of-bauteilen.html;  
stand 12/2015  
Ceramic Glaze Handbook, materials, techniques, formulas  
Marc Burleson, Lark Books,  

Product Category Rules (PCR), Ceramic Tiles, CET PCR 2014-06-23  
European Ceramic Tile Manufacturers’ Federation, Bruxelles.