



ENVIRONMENTAL PRODUCT DECLARATION

PRODUCT NAME:

Ceramic surfaces made of laminated porcelain stoneware and laminated porcelain stoneware reinforced with fibreglass mesh 6 mm

SITE:

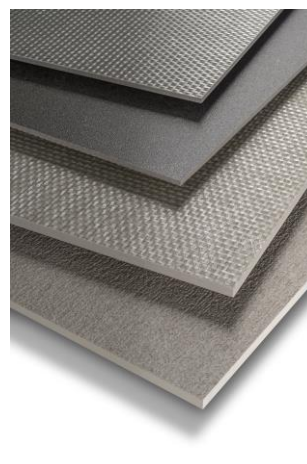
Fiorano Modenese (MO)

**In compliance with ISO 14025 and EN
15804:2012+A1:2013/A2:2019**

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1. GENERAL INFORMATION

EPD OWNER

Company name	Panariagroup Industrie Ceramiche S.p.A.
Legal office	Via Panaria Bassa 22/A, Finale Emilia (MO), Italy
Contacts for information on the EPD	QEHS Office - andrea.palladini@panariagroup.it

PROGRAM OPERATOR

EPDItaly	Via Gaetano De Castillia no. 10 - 20124 Milan, Italy
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INFORMATION ON THE EPD

Product name	Ceramic surfaces made of laminated porcelain stoneware and laminated porcelain stoneware reinforced with fibreglass mesh
Site	Via Cameazzo, no. 21, 41042 Fiorano Modenese (MO), Italy
Short product description	Average EPD for ceramic surfaces made of laminated porcelain stoneware and laminated porcelain stoneware reinforced with 6 mm thick fibreglass mesh
Application area	The ceramic surfaces 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
CPC Code https://unstats.un.org/unsd/classifications/Econ	37370

VERIFICATION INFORMATION

PCR	EN 15804:2012+A2:2019. PCR ICMQ-001/15 rev3
EPDItaly regulation	General Programme Instruction document of EPDItaly v.6
Project Report LCA	EPD based on a verified LCA tool: LCA tool creator for Ceramic Tile V6 [(27/11/2023) - DB version 2023.2]
Project LCA Tool Report	Background report for LCA tool for Confindustria Ceramica - 27/11/2023
Project Short Report	Laminated porcelain stoneware 5+, 6, 6+ of 14/6/2024
Independent Check	External audit of the declaration and data performed according to ISO 14025:2010. ☐ Internal ☒ External Third party verifier: ICMQ S.p.A., Via Gaetano De Castillia no. 10 - 20124 Milan, Italy Accredited by Accredia.
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 15804:2012+A2:2019.
Accountability	The EPD Owner releases EPDItaly from any non-compliance with environmental legislation. The holder of the declaration will be responsible for the information and supporting evidence. EPDItaly accepts no responsibility for the information, data and results provided by the EPD Owner for the life cycle assessment.

ADDITIONAL INFORMATION

Technical Support	 https://www.sphera.com
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2. THE COMPANY



THE STORY OF PANARIAGROUP

- 1974 In 1974, a group of entrepreneurs, including Giuliano Mussini, the patriarch of the Mussini family, who are the current majority owners of Panariagroup Industrie Ceramiche S.p.A., founded Panaria Ceramica.
- 1992 In the 1990's, Panaria implemented a strategy of expansion and enlargement of its brands and products with the acquisition, in 1992, of Ceramiche Artistiche Lea, a company specialised in the production of single-fired floor tiles, and with the constitution, in the same year, of Cotto d'Este, a company created for the design and commercialisation of exclusive and prestigious product lines, destined to conquer the luxury segment of the market.
- 1995 In 1995, the Group's production capacity expanded with the construction of the technologically advanced Toano factory, which was dedicated exclusively to the production of porcelain stoneware. At the same time, the Fiordo Industrie Ceramiche brand was created to provide an increasingly comprehensive market presence.
- 2002 The process of expansion into international markets took shape with the acquisition, in 2002, of Maronâgrès, today Margrès, a leading company in the production of porcelain stoneware in Portugal.
- 2004 In 2004, Panariagroup was established as a result of the merger of all the Italian companies owned by Panaria. In the same year, Panariagroup decided to go public and on 19 November 2004, the Group was listed in the STAR segment of the Italian Stock Exchange. Internationalisation continued with the incorporation, again in 2004, of Lea North America LLC, a company set up to oversee the dedicated distribution of Lea products in the increasingly strategic US market. In the same year, Cotto d'Este launched Kerlite, the revolutionary line of ultra-thin slabs: Panariagroup was the first ceramic group to introduce this innovation to the market, which would significantly change the concept of tiles.
- 2005 In 2005, Panariagroup acquired a second company in Portugal: Novagrés, today Love Tiles, a leading brand in the production of large-format porous single-fired wall tiles and glazed porcelain stoneware floor tiles. The process of internationalisation continued in 2006 with the acquisition of the brand and

main assets of Florida Tile Industries, a long-standing major US brand for the production and distribution of ceramic materials. In December 2006, the two Portuguese companies Novagrés and Margres merged into Gres Panaria Portugal, maintaining the identity of the two brands. In addition, a new company called Panariagroup USA Inc. was created, which controls the two companies Florida Tile and Lea North America.

- 2008 In 2008, Blustyle Ceramica was founded with the aim of presenting itself to the market with an agile and innovative model, both in terms of product logic and approach to distribution. The brand gradually established itself and today is part of the Cotto d'Este family, offering the same quality and innovation but focused on traditional thickness products.
- 2009 After having successfully marketed laminated porcelain stoneware, a revolutionary, high-performance material based on cutting-edge technology, in 2009 Panariagroup installed its first production line for this product at the Fiorano Modenese factory.
- 2010 Expansion continued and in 2010 a new sales organisation, Panariagroup Trade, was created with the aim of gaining market share in the regions of the Middle East, the Far East and Oceania. In particular, Panariagroup Trade responds to the need to distribute the Group's brands in these regions through more targeted sales policies, in full respect of the precise identity and specific characteristics of each brand. In the same year, Panariagroup signed its first agreement with Microban®, a world leader in antibacterial technologies, to produce products for healthy, safe and protected spaces.
- 2012 The process of internationalisation continues, thanks to a joint venture with Asian Granito, a leading company in the Indian market. This is how the Bellissimo brand was born, with the aim of producing and marketing luxury ceramic products, rich in style and technology, on the Asian market. The Group's commitment to the Indian business unit became even stronger in 2019, with the acquisition of 100 per cent of the company's shares.
- 2016 The path of certified sustainability reporting officially began with the publication of the first Report and with the development in subsequent years of targeted initiatives towards certain categories of stakeholders (starting with employees).
- 2017-2020 Industrial development continued significantly with major investments in all business units. The commitment to laminated porcelain stoneware was reinforced. The third production line was built in Fiorano Modenese and the product range was expanded with the introduction of new formats and thicknesses. New sales channels are developed: the Contract & Key-Account Division is born. The company's quality package is gradually being strengthened, in particular with the introduction of new certifications related to product sustainability (e.g. EPD and Green Guard). Maxa Ceramic Slabs is launched, the new Panariagroup brand dedicated to the offer of large-format, high-thickness ceramic maxi-slabs for the furnishing accessories and interior design segments.
- 2021 The company started work on an ambitious long-term Sustainability Plan, which includes initiatives and goals in relation to People, Planet and Prosperity. Expansion and enhancement works at the Fiorano Modenese production site were completed, and at the same time, important investments in technological upgrades at the Finale Emilia plant were carried out. In July, the formal procedures leading to the company's exit, on a voluntary basis, from the Italian Stock Exchange (so-called delisting) were successfully concluded.
- 2022 Panariagroup became the first company in the ceramic industry to produce a 100% Carbon Neutral product line. With the THINK ZERO project, an operation that combines the high degree of sustainability of laminated porcelain stoneware with the voluntary offsetting, starting in September, of all CO2 emissions generated in the material's entire production cycle.
- 2023 Panariagroup further strengthens its international scope. In April, it announced the acquisition of Gresart, a company located in Portugal, where Panariagroup already has two other production sites. In September, Panariagroup signed the agreement to purchase the most important assets from Steuler Filesengruppe, one of the leading players in the German market, taking over the Leisnig factory and established brands Steuler Design, Grohn, Nordceram and Kerateam. Panariagroup USA is reorganised and strengthened: the distribution portfolio is expanded to include all Group brands, further enhancing the production and commercial operations of the entire Group on US soil.
The Group celebrates 30 years of Cotto d'Este, 20 years of Margres and 15 years of Love Tiles.

System certifications:

UNI EN ISO 9001

International Quality Management System Standard.

UNI EN ISO 14001	International Environmental Management System Standard.
EMAS	Eco-Management and Audit Scheme to assess and improve environmental performance.

Product certifications:

QB-UPEC	French quality certification for flooring material
CE	The CE mark is a safety certification required by the European Union.
CCC	Chinese quality certification
ISO 17889-1	International standard for assessing the sustainability performance of ceramic tiles
PRE-CONSUMER RECYCLED MATERIAL CONTENT	Panariagroup has obtained certification for the pre-consumer recycled material content of most of its products

Production and logistics sites:

The Panariagroup's registered office is located in Finale Emilia, in the province of Modena, Italy. The Group currently has an overall structure that includes 8 production plants (3 in Italy, 3 in Portugal, 1 in the United States and 1 in Germany) and 3 logistics hubs (2 in Italy and 1 in the United States).

The Italian production sites of Panariagroup Industrie Ceramiche S.p.A are located in:

- Finale Emilia (Modena) – Via Panaria Bassa 22/a;
- Toano (Reggio Emilia) – Via dell’Industria 15;
- Fiorano Modenese (Modena) – Via Cameazzo 21;



Finale Emilia Panariagroup Facilities:



Toano Panariagroup Facilities, Fora di Cavola



Fiorano Modenese Panariagroup Facilities

3. GOAL AND SCOPE OF EPD

The entire life cycle of the product is considered (Type of EPD: cradle to grave). The modules described below are declared in this EPD:

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 as well as waste processing (A3). (A3). **ENERGY CONSUMPTION EMISSION FACTORS (A1-A3)** The emission factors (DB version 2023.2) of the datasets used to calculate the impact of energy consumption in the production phase (A1-A3) for the indicator Climate Change - Total, were attached to the Project short report. As a matter of data confidentiality, the emission factors used in the study cannot be made public as stipulated in Section 5.3 of the Sphera Terms&Conditions

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 substitution are declared in module D. During this phase a ceramic material loss of 6.5% has been considered.

Module **B1** considers the use of the tiles. No hazardous emissions are expected to be generated indoors during the use of ceramic tiles.

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

Modules **B3-B4-B5** refer to the repair, replacement and renovation of tiles. If tiles are installed correctly, repair, replacement and renovation processes are not necessary and are therefore not considered in the presented study.

Modules **B6-B7** examine the use of energy for the operation of building-integrated technical installations (B6) and the use of operating water for building-related technical installations. This consumption is not considered relevant to the subject matter of this EPD. The cleaning water is declared in module B2.

Module **C1** concerns the process of demolition and de-construction of the tiles from the building. It is not considered relevant for the environmental impacts.

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 (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	X	X	X	X	X	X	X	X	X	X	X	X

MND: Module Not Declared

EPD TYPE:

Average EPD of the product “laminated porcelain stoneware ceramic surfaces reinforced with glass fibre mesh - slabs and tiles” manufactured at the Fiorano Modenese facility. All production and sales figures refer to the year 2022.

According to the PCR ICMQ-001/15 rev. 3 the LCA study and the relative EPD, is “cradle to grave”. Modules included are A1, A2, A3, A4, A5, B1-B7, C1, C2, C3, C4 and D. All manufacturing activities and packaging/auxiliary's production are in module A3, while energy production and input materials are in A1. Transport to clients (A4) and installation (A5) are included together with end-of-life scenarios (benefits and loads included according to D module).

GEOGRAPHICAL VALIDITY:

Performance was calculated with reference to Italian company sites. The reference market is international.

DATABASE: Managed LCA Content (GaBi Database) (version DB 2023.2)

SOFTWARE: LCA for Expert (GaBi) (version 10.7)

4. DETAILED DESCRIPTION OF THE PRODUCT

MANUFACTURING PROCESS DESCRIPTION:

Panariagroup specialises in the production of porcelain stoneware slabs and tiles from 9 mm to 20 mm thick, laminated porcelain stoneware 6 mm thick and laminated porcelain reinforced with fibreglass mesh 3.5 mm, 5.5 mm and 6.5 mm thick.

Panariagroup products are marketed by the company's own Commercial Divisions through the brands: BLUSTYLE, COTTO D'ESTE, LEA CERAMICHE, PANARIA CERAMICA, LOVE TILES, MARGRES, FLORIDA TILE, GRESART, STEULER DESIGN, GROHN, NORD CERAM AND KERATEAM.

Reception, storage and processing of raw materials:

The Panariagroup 04 facility in Fiorano Modenese is based on a partial cycle, i.e. the first three phases of the production cycle for the preparation of atomised mixture (raw material storage, grinding and atomisation) are carried out at the Panariagroup 01 facility in Finale Emilia (MO). Atomised powders are transferred from Finale Emilia to Fiorano by truck.

Production:

The process starts with the pressing phase. The tile is formed by compressing the atomised mix material with powerful hydraulic presses, which give it the desired production format (size and thickness) and surface type (smooth, textured, etc.). The tile formed in this way is transported from the presses to the drying kilns where it undergoes a drastic reduction in humidity and a decisive increase in "raw" mechanical strength, both factors that are necessary before undergoing the subsequent production phases. Generally, the drying process takes 20-30 minutes at maximum temperatures of 200-220 °C. The pressed tiles can be subjected to glazing and digital decoration applications, which give the product high-end aesthetic effects and colouring, similar to those of natural materials (stones, marbles, wood, etc.). The firing phase is carried out in industrial kilns that, thanks to sophisticated flame emission systems, make it possible to keep the temperature uniform in all the zones of the kilns, eliminating problems due to varying shades and differing firing temperatures. The long periods spent at high firing temperatures, up to around 1200-1220°C) ensures the material achieves complete vitrification throughout its mass: thus obtaining ceramic tiles with almost zero porosity, which are therefore completely frost resistant, with considerable mechanical strength (breaking strength, resistance to bending, abrasion, scratches) and resistance to aggressive chemicals. A fibreglass mesh is applied to the back of the slabs, giving the finished product improved requirements in the construction phase (handling, cutting and drilling) and in operation (improved mechanical requirements). Before quality inspection, most of the material is subjected to mechanical processing, such as cutting (to obtain smaller sizes), rectification (to obtain tiles with highly linear and orthogonal sides, which allows installation with very narrow grout lines) and honing (mechanical abrasion of the surface with very high hard tools to obtain softer surfaces, pleasant to the touch, with different degrees of gloss). In the sorting department, each ceramic piece is checked for size, flatness, squareness of edges, colour and surface quality (absence of defects) by specialised operators and automatic sorting machines. Finished products are packaged in homogeneous batches by article, grade, shade and "calibre".

Packaging:

The main materials used for product packaging are wood, plastic and paper.

Wood is the main packaging element, depending on the format, pallets (small formats) or crates (large formats - slabs) are used. Most of the wood is purchased from PEFC or FSC certified suppliers.

Paper is absent or used in very small quantities in slab packaging, while in smaller formats it is used as primary packaging. The use of automatic boxing machines has made it possible to optimise the use of cardboard during the packaging process by using a thinner paper and cardboard format and reducing waste. This technology allows a reduction of up to 50 per cent of the cardboard used compared to previously used traditional systems. About 70 % of the purchased paper and cardboard comes from recycling.

Polyester plastic strapping is used to stabilise and secure tile boxes to each other or the slabs. Polyethylene shrink film sheets are used to enclose and package the entire pallet of boxes or slab cases. The plastic used to package the tile pallets is appropriately recovered through specialised suppliers and returned to the production cycle. The plastic used contains 70% recycled material.

Shipping warehouse:

The pallets on which the boxes of finished product are placed are stored in a special parking area outside the factory. The product is then ready to be shipped, through to the customer. A radio frequency computer system was installed at the plant to manage the handling of finished products in the warehouse (using a new barcode label for pallet identification). This intervention allows greater control of the finished product warehouse and minimises shipping errors.



production process diagram

HEALTH AND SAFETY OF WORKERS:

Panariagroup has adopted an integrated Quality, Environment, Hygiene and Safety management system to guarantee protection and safety in the workplace. In particular, a system complying with ISO 9001, ISO 14001 and, only for the Italian sites, also with the UNI INAIL Guidelines was developed for the European sites with the aim of developing and implementing internal procedures to prevent, monitor and manage accidents and injuries at work. Health and safety training is provided throughout the Group, as required by local legislation.

ENVIRONMENTAL PROTECTION:

All of the group's Italian sites are ISO 14001 and EMAS certified and hold an Integrated Environmental Authorisation (AIA), which requires compliance with stringent requirements concerning emissions of pollutants into the atmosphere, noise impact, waste management, energy consumption, water and raw material balance. Panariagroup monitors pollutant emissions from the production process on a monthly basis, which are always well below authorised limits. Panariagroup has no waste water discharges, all process water is reused, either untreated or purified, in the production cycle avoiding the consumption of fresh water. Panariagroup recovers internally all raw ceramic waste from the production cycle (powders, mixes and raw tiles).

There are energy-efficient systems for heat recovery, for workplace heating, or thermal recovery, for the atomisation process. There are photovoltaic systems for the production of electricity from renewable sources on the roofs of the Finale Emilia and Fiorano facilities. Since 2021, the group has also adopted a Sustainability Plan to increasingly improve the performance of its production sites, in line with the goals of the 2030 Agenda for Sustainable Development.

Technical characteristics: The products meet the requirements defined by the European standard EN 14411 and the international standard ISO 13006, according to the criteria set out in the ISO 10545 test methods below. Porcelain stoneware slabs Group Bla according to UNI EN 14411 Annex G/ISO 13006 Annex G

Name	Average value	Unit
Shaping acc. to EN14411	B: dry-pressed	
Surface quality acc. to ISO 10545-2	> 95	%
Water absorption acc. to ISO 10545-3	≤ 0.1	%
Breaking Strength acc. to ISO 10545-4	Thicknesses < 7.5 mm, ≥ 700	N
Flexural strength acc. to ISO 10545-4	≥ 35	N/mm ²
Resistance to deep abrasion – Unglazed tiles acc. to ISO 10545-6	≤ 175	mm ³
Thermal shock resistance acc. to ISO 10545-8	7 x 10 ⁻⁶	1/K
Thermal shock resistance according to ISO 10545-9	Resistant	
Frost resistance acc. to ISO 10545-12	Resistant	
Non-slip property (class A, B or C) acc. to. EN 16165 -B	Depending on the product	Class
Non-slip property (class R9, R10, R11, R12) acc. to. EN 16165 -B	Depending on the product	Class
Cohesive strength/adhesion according to EN 12004 - Cementitious adhesives	Depending on the product C1 - C2	Class
Impact resistance acc. to ISO 10545-5	0.75 – 0.85	
Reaction to fire	A2fl-s1/A2-s1,d0	Class
Resistance to household chemicals and swimming pool salts acc. to ISO 10545-13	A (resistant)	Class
Resistance to low and high concentrations of acids and alkalis acc. to ISO 10545-13	Depending on the product LA–HA (resistant); LB-HB	Class
Resistance to staining acc. to ISO 10545-14	Depending on the product	
Moisture expansion acc. to ISO 10545-10	0.0	mm/ml

For the specific technical properties of the product and surface finish, please refer to the specifications available on the website of the relevant sales division.

BASIC MATERIALS/ADDITIONAL MATERIALS:

Main raw materials:

- Clay 20 - 35%
- Feldspar 40 - 50%
- Kaolin 10 - 15%
- Flux 10 - 13%.
- Pigments 0 - 5%

Main glaze components:

- Clay powder
- Quartz
- Aluminium
- Pigments
- Frits
- Feldspar

Main auxiliary additives:

- Dispersing agent
- Binding agent
- Fluidifying agents

No substances of “very high concern” (SVHC: Substances of Very High Concern) are intentionally added to Panariagroup products during the production process in quantities exceeding 0.1% w/w. Depending on the type, Panariagroup products may contain more than 40% pre-consumer recycled material (i.e. reused industrial waste).

INSTALLATION/LAYING

Tiles are fixed to the walls and floors surfaces using different materials and amounts, for example, dispersion and cementitious adhesives and mortars, sealants or liquid applied membranes. No emissions are generated during installation and ceramic tile installations do not cause health or environmental hazards.

RELEVANT EFFECTS DURING USE

Fire: In accordance with EN 13501–1:2007+A1:2009, ceramic tiles can be classified as fire resistance class A1 as they are non-flammable. Porcelain stoneware reinforced with fibreglass mesh has a fire resistance class A2fl-s1/A2-s1,d0.

Water: Ceramic tiles are insoluble materials and do not react with water.

ENVIRONMENT AND HEALTH DURING USE

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

DECLARED UNIT AND REFERENCE FLOW

The functional unit is 1 m² of ceramic wall and floor tiles for residential or commercial use, indoors and outdoors for 1 year. The mass of the surface considered is 13.5 kg, while the thickness is 6.0 mm.

Parameter	Minimum value	Maximum value	Average value
Thickness [mm]	5.5	6.5	6
Mass [kg]	12.8	14.2	13.5

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.

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).

5.LCA RESULTS

The tables below show the results of the LCA (Life Cycle Assessment) study with respect to the functional unit used for the LCA study (1 m² of product) for each product family. Basic information on all declared modules can be found in chapter 3.

You can convert the results per kg using the following conversion factor: 0.074.

The environmental indicators for which the corresponding values are given are as follows, divided into the categories foreseen by the technical specifications.

Key environmental impact indicators

GWP total = Global warming potential; **GWP-fossil** = Global warming potential – fossil; **GWP-biogenic** = Global warming potential –biogenic; **GWP-luluc** = Global warming potential - land use and land use change; **ODP** = Depletion potential of the stratospheric ozone layer; **AP** = Acidification potential of land and water; **EP** = Eutrophication potential; **POCP** = Formation potential of tropospheric ozone photochemical oxidants; **ADPE** = Abiotic depletion potential for non-fossil resources; **ADPF** = Abiotic depletion potential for fossil resources; **WDP** = Water (user) deprivation potential

Resource use indicators legend

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.

Legend of waste generation indicators and output streams

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; **ETE** = Exported thermal energy

Biogenic carbon content

Biog. C in packaging = Biogenic carbon content in packaging; **Biog. C in product** = Biogenic carbon content in product

Additional indicators (PM, IR, ETF-fw, HTP-c, HTP-nc and SQP) were calculated and can only be seen in the Background Report. Warning for EN 15804+A2: additional indicators (1) Potential Human exposure efficiency relative to U235 (IRP): This impact category mainly concerns the possible impact of low-dose ionising radiation on human health from the nuclear fuel cycle. It does not take into account effects due to possible nuclear accidents, occupational exposure or the disposal of radioactive waste in underground facilities. Potential ionising radiation from soil, radon and certain building materials are also not measured by this indicator. (2) The results of the environmental impact indicators: ADP, WDP, ETP-fw, HTP-c, HTP-nc, SQP must be used with caution as uncertainties about these results are high or there is limited experience with the indicator.

ENVIRONMENTAL IMPACT per 1m ² of ceramic tile														
Indicators	Unit	A1	A2	A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
GWP total	kg CO ₂ -eq.	8.08	0.711	3.65	0.639	5.15	0	0.0118	0	0.0125	0.058	0.0343	0.0873	-0.38
GWP fossil	kg CO ₂ -eq.	8.05	0.684	5.59	0.615	2.31	0	0.0089	0	0.0119	0.0554	0.0344	0.0868	-0.378
GWP biogenic	kg CO ₂ -eq.	0.0267	0.0278	-1.95	0.0242	2.83	0	0.00285	0	0.000546	0.00253	-0.000355	0.000243	-0.0019
GWP luluc	kg CO ₂ -eq.	0.00119	4.11E-005	0.00205	3.52E-005	0.00115	0	1.34E-006	0	7.48E-007	3.53E-006	0.000263	0.000274	-0.000109
ODP	kg CFC-11-eq.	5.85E-011	2.12E-013	9.89E-012	6.93E-014	8.38E-012	0	4.19E-014	0	1.41E-015	6.64E-015	5.86E-014	2.24E-013	-2.98E-012
AP	mole of H ⁺ -eq.	0.0146	0.00438	0.00641	0.00355	0.00399	0	1.55E-005	0	5.98E-005	8.31E-005	0.000183	0.000625	-0.000577
EP - freshwater	kg P eq.	9.19E-006	1.77E-007	8.28E-006	1.49E-007	1.04E-005	0	3.56E-006	0	2.88E-009	1.36E-008	1.19E-007	1.77E-007	-8.4E-007
EP - marine	kg N eq.	0.00395	0.00156	0.00303	0.000896	0.00142	0	1.75E-005	0	2.84E-005	3.32E-005	8.38E-005	0.000161	-0.000179
EP - terrestrial	mole of N eq.	0.0432	0.0172	0.0331	0.00988	0.0159	0	4.59E-005	0	0.000311	0.000366	0.000926	0.00178	-0.00193
POCP	kg NMVOC eq.	0.0125	0.00355	0.00861	0.00254	0.00368	0	1.94E-005	0	8.02E-005	7.94E-005	0.000227	0.000487	-0.000552
ADPE	kg Sb eq.	7.81E-005	8.86E-009	1.09E-007	7.43E-009	7.93E-006	0	3.96E-010	0	1.47E-010	6.96E-010	3.75E-008	4.07E-009	-2.81E-008
ADPF	MJ	204	9.91	12.7	8.75	22.9	0	0.198	0	0.171	0,807	0.689	1.17	-7.64
WDP	m ³ world eq.	0.778	0.00274	0,328	0.00143	0.238	0	0.00156	0	2.86E-005	0.000135	0.00681	0.00967	-0.0311

USE OF RESOURCES per 1 m ² of ceramic tile														
Indicators	Unit	A1	A2	A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
PERE	[MJ]	22.3	0.102	26	0.0543	0	0	0.0242	0	0.0011	0.00521	0.0641	0.191	-1.92
PERM*	[MJ]	0	0	1.44	0	-1.44	0	0	0	0	0	0	0	0
PERT	[MJ]	22.3	0.102	27.4	0.0543	6.24	0	0.0242	0	0.0011	0.00521	0.0641	0.191	-1.92
PENRE	[MJ]	204	9.94	12.6	8.78	23	0	0.198	0	0.172	0.811	0.691	1.17	-7.64
PENRM*	[MJ]	0	0	0,129	0	-0,129	0	0	0	0	0	0	0	0
PENRT	[MJ]	204	9.94	12.7	8.78	22.9	0	0.198	0	0.172	0.811	0.691	1.17	-7.64
SM	[kg]	0.541	0	0.201	0	0.0482	0	0	0	0	0	0	0	13.3
RSF	[MJ]	0	0	0	0	0	0	0	0	0	0	0	0	0

NRSF	[MJ]	0	0	0	0	0	0	0	0	0	0	0	0	0
FW	[kg]	0.0257	0.00014	0.0105	6.39E-005	0.0071	0	5.62E-005	0	1.28E-006	6.06E-006	0.000197	0.000296	-0.00165

* In order to balance the values of PENRM and PERM related to the use of packaging, the values of module A5 (end-of-life of packaging) are negative.

WASTE GENERATION AND OUTPUT STREAMS per 1m ² of ceramic tile														
Indicators	Unit	A1	A2	A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
HWD	[kg]	5.06E-007	3.62E-011	3.4E-008	1.75E-011	3.55E-008	0	1.03E-011	0	3.16E-013	1.49E-012	-1.79E-012	2.55E-011	-3.62E-010
NHWD	[kg]	0,786	0.00102	2.01	0.000866	1.36	0	0.00604	0	1.71E-005	8.07E-005	0.000182	5.87	-0.557
RWD	[kg]	0.00306	6.27E-005	0.000344	1.41E-005	0.000449	0	4.49E-006	0	2.86E-007	1.35E-006	9.26E-006	1.34E-005	-0.000451
CRU	[kg]	0	0	0	0	0	0	0	0	0	0	0	0	0
MFR	[kg]	0	0	0,189	0	0.0423	0	0	0	0	0	13.7	0	0
MER	[kg]	0	0	0	0	0,497	0	0	0	0	0	0	0	0
EEE	[MJ]	0	0	0	0	1.38	0	0	0	0	0	0	0	0
EET	[MJ]	0	0	0	0	2.09	0	0	0	0	0	0	0	0

6.CALCULATION RULES

FUNCTIONAL UNIT:

Name	Unit	Value
Functional unit	m ²	1
Weight	kg/m ²	13.5
Conversion factor to 1 kg	-	0.074

ASSUMPTIONS:

The modules from A5 to C4 are scenarios based on average data included into the PCR created by the "European Ceramic Tile Manufacturers Federation" /CET PCR 2014/ and subsequently implemented in the PCRB of the IBU program operator "Ceramic tiles and panels".

CUT-OFF CRITERIA:

All flows in known inputs and outputs were considered.

DATA QUALITY:

The period of validity of background data from Sphera database is between 2019 and 2023. Most of the information (energy and water consumption, emissions of pollutants, atomised 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 were obtained not only for raw material mixtures (collected with company-specific primary data) but also for dyes, frits and other raw materials used. The overall quality of the data can be considered satisfactory.

PERIOD UNDER REVIEW:

Primary data collected in the context of this study refer to 2022.

ALLOCATION:

The allocations made concern material and energy flows in and out of the production phase processes. Energy and material consumption for the production of atomised powder in the Finale Emilia plant were allocated to the Fiorano product. The product flows studied were calculated by breakdown based on both mass and surface production data of annually produced ceramic tiles.

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.

VARIABILITY ANALYSIS:

The average EPD covers the thicknesses of fibreglass mesh-reinforced ceramic tiles and slabs manufactured by Panariagroup that fall within the range 5.5 - 6.5 mm. All products considered in the EPD fall within an impact variation of $\pm 10\%$ for the following indicators:

- Climate Change - total
- Acidification
- Photochemical ozone formation, human health
- Resource use, mineral and metals
- Resource use, fossils
- Total use of renewable primary energy resources (PERT)
- Total use of non-renewable primary energy resources (PENRT)

7. SCENARIOS

The following technical information about declared modules and related scenarios is based on average data, according to the "European Ceramic Tile Manufacturers Federation" and subsequently implemented in the PCRb of the IBU program operator "Ceramic tiles and panels".

Transport (A4):

The LCA practitioner should justify the transportation scenario used (if different from the default scenario). For transport distances of less than 300 km, trucks shall be assumed to make the return trip empty, whereas for distances exceeding 300 km, they will return full with other goods, so that the return trip is not included in the inventory of the system analysed.

Name	Quantity	Unit
Truck with national destination having a capacity of 27 tons (37% of tiles sold)	300	km
Truck with European destination having a capacity of 27 tons (40.5% of tiles sold)	1390	km
Transoceanic transport (22.5% of tiles sold)	6520	km

Installation of the product (A5):

Three options are defined for the installation phase, in which different materials can be used.

- Option 1: adhesives, mortar and water;
- Option 2: mortar and polysulphide dispersion adhesives;
- Option 3: cement adhesives (different quantities for different tile sizes).

These considerations are based on average data provided by different ceramic tile manufacturers in Europe. In this EPD it is assumed that tiles are installed with cementitious adhesive (Option 3).

Option 3 (large format tiles)	Quantity	Unit
Cementitious adhesives	6	kg

For the treatment of packaging waste, an average European scenario is used, taken from "Eurostat, 2020"; thus end-of-life consists of recycling, energy recovery and landfill for plastic and paper, and reuse, energy recovery and landfill for wood. The loss of ceramic material considered is 6.5%.

Maintenance (B2):

Only stage B2, the maintenance phase, is considered in terms of impact generation. Throughout its lifetime, the ceramic cladding product must be cleaned regularly, to a greater or lesser extent, depending on the type of building (residential, commercial, etc.) in which it is installed. If the surface is dirty or greasy, cleaning agents such as detergents or bleach can be added. In this way, the consumption of water and disinfectant chemicals has been taken into account.

Name	Value	Unit
Water consumption	0.1	l
Detergents	0.2	ml
Floor tile Maintenance cycle	52	Number/LS
Wall tile Maintenance cycle	4	Number/LS

End-of-life (C1-C4):

C1: This module considers the demolition phase considering an excavator (100kW) with a consumption

of diesel of $1.72E-4$ per kg of product and all the emissions connected with the fuel burning process.

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 table below shows the end-of-life stage.

Name	Value	Unit
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 products 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, they 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

Biogenic carbon content

BIOGENIC CARBON CONTENT per 1 m ² of product	kg
in the packaging	0,039
in the product	0

Additional Environmental Parameters related to Minimum Environmental Criteria according to the Ministerial Decree of 23 June 2022 section 2.5.10.1 “hard coverings”

Panariagroup's slabs and tiles meet the characteristics and requirements of the **minimum environmental criteria** (CAM), developed as part of the national “green procurement” strategy (GPP - Green Public Procurement). These criteria are the tool used by the Italian public administration to manage contracts for the design and construction of new buildings and the renovation of existing ones. CAMs are regulated by art. 34 on “Energy and environmental sustainability criteria” of Legislative Decree no. 50/2016 “Public Contracts Code”, which made it mandatory for all contracting authorities to apply. Panariagroup products comply with the technical specifications for ceramic tiles set out in the CAM as they meet the following criteria included in Decision (EU) 2021/476 for the award of the Ecolabel.

Common criteria

1.1 Mineral extraction

Panariagroup requires all suppliers of raw materials that carry out extraction activities to obtain authorisation for the activity, an environmental restoration plan, an environmental impact assessment and a map with geographical coordinates of the site.

1.2 Restricted substances

The product was manufactured using chemicals or materials supplied that do not contain substances of very high concern, which are included in the candidate list in accordance with Article 59 of Regulation (EC) No 1907/2006, in concentrations greater than 0.10 % (w/w).

1.3 VOC emissions

Ceramic slabs are recognised as an inert material with no harmful emissions.

1.4 Suitability for use

Panariagroup products are CE marked in accordance with technical standard EN 14411 and Regulation (EU) No 305/2011. Panariagroup is ISO 9001 certified and has procedures for quality control and complaint handling

1.5 Information for users

Information on the technical characteristics, installation, cleaning and maintenance of the product is available on all the websites of the group's commercial brands

Specific criteria for ceramic products

4.1 Combustion of fuels

The specific fuel energy consumption for the atomisation processes (production of atomised powder), and drying and firing of the finished product, does not exceed the relevant limits given in the table

- 4.2 CO₂ emissions The specific CO₂ emissions associated with the use of fuels and the process emissions resulting from the decarbonisation of raw materials during the atomisation, drying and firing processes do not exceed the relevant limits given in the table
- 4.3 Water consumption Panariagroup facilities comply with the requirement as they have a closed-loop recycling system for waste water treatment.
- 4.4 Air pollutant emissions The specific emissions of particulates, HF, NO_x into the air associated with the production of Panariagroup products do not exceed the relevant limits shown in the table
- 4.5 Waste water management Panariagroup plants comply with the requirement in that process waste water from production is treated on-site to remove suspended solids and then returned to the production process as part of a zero-liquid discharge system.
- 4.6 Reuse of process waste Panariagroup complies with the requirement as more than 90 % by mass of the process waste generated in the manufacture of ceramic products is incorporated in the on-site production process, in off-site production processes of ceramic products, or reused in other production processes.
- 4.7 Glazes and inks Panariagroup complies with the requirement as the glazes and inks used do not contain or contain less than 0.10% Pb by weight and less than 0.10% Cd by weight.

Parameter		Reported value	Limit value observed	
Fuel consumption	Atomiser^	<1.3 MJ/kg	Threshold for excellence*	1.3 MJ/kg
	Dryer and oven	<5.5 MJ/kg	Mandatory limit*	5.5 MJ/kg
CO ₂ emissions	Atomiser^	<84 kgCO ₂ /t	Mandatory limit*	84 kgCO ₂ /t
	Dryer and oven	<290 kgCO ₂ /t	Threshold for excellence*	290 kgCO ₂ /t
Emissions into the air	Powders (atomiser)^	<90 mg/kg	Mandatory limit	90 mg/kg
	Powders (oven)	<10 mg/kg	Threshold for excellence	10 mg/kg
	HF (oven)	<20 mg/kg	Mandatory limit	20 mg/kg
	NO _x (oven)	<250 mg/kg	Mandatory limit	250 mg/kg
Reuse of process waste	Reuse of process waste	>99% (by weight)	Mandatory limit	>90%
* limit values per product family				
^activity carried out at the Finale Emilia facilities				

Table: Compliance with the relevant limits of criterion 4.4 of Decision (EU) 2021/476 for Panariagroup products

10. REFERENCES

EN 15804+A2	EN 15804:2012+A2:2019. Sustainability of construction works -Environmental Product Declarations - Core rules for the product category of construction products
EN ISO 14025	EN ISO 14025:2011-10 Environmental labels and declarations - Type III environmental declarations - Principles and procedures
EN ISO 14040	EN ISO 14040:2009-11 Environmental management - Life cycle assessment - Principles and framework
EN ISO 14044	EN ISO 14044:2006-10 Environmental management - Life cycle assessment - Requirements and guidelines
LCA for Expert (GaBi)	Life cycle assessment software (version 10), by Sphera Solutions GmbH, Leinfelden-Echterdingen, 2023 https://sphera.com/life-cycle-assessment-lca-software/
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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/baustoffundgebaeuedaten/useful_lives-of-bauteilen.html ; stand 12/2015
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