CERAMICHE PIEMME
FLOOR AND MORE

INDUSTRIE CERAMICHE PIEMME S.P.A.

ENVIRONMENTAL PRODUCT DECLARATION

Product Name:

Porcelain stoneware tiles for floors and walls, indoor and outdoor - Thickness 8,5-9,5

Site Plant:

Production plant located in S.S. 569 N. 222 – 41014 Castelvetro (MO)

In compliance with ISO 14025 and EN 15804+A2:2019

Program Operator	EPDItaly
Publisher	EPDItaly

Declaration number	001ICPFA062025
Registration number:	EPDITALY0803

Date of publication (first issue)	2025/06/25
Date of validity	2030/06/25

1. GENERAL INFORMATION

EPD OWNER	
Company name	**Industrie Ceramiche Piemme S.p.A**
Legal head office	**Via del Crociale, 42/44 – 41042 Fiorano (MO)**
Contacts for information on the EPD	**HSE Manager, Ing. Francesco Accardi** f.accardi@ceramichepiemme.it
PROGRAM OPERATOR	
EPDITALY (www.epditaly.it)	via Gaetano De Castillia n° 10 - 20124 Milano, Italia
INFORMATION ON THE EPD	
Product name	**Porcelain stoneware tiles for floors and walls, indoor and outdoor - *Thickness 8,5-9,5 mm***
Plant involved in the declaration	***S.S. 569 N. 222 – 41014 Castelvetro (MO)***
Short product description	Dry-pressed ceramic tiles with water absorption Ev ≤ 0,5% - BIA Group – Annex G - ISO 13006/EN 14411
Application area	Ceramic tiles for floors and walls, suitable for installation in both internal and external environments, for residential and commercial use. - ***Thickness 8,5-9,5 mm***
CPC Code	37370
VERIFICATION INFORMATION	
Product Category Rules (PCR)	EN 15804:2012+A2:2019 is the framework reference for PCRs. PCR ICMQ-001/15 rev3.1 - 12.11.2024
EPDItaly regulation	General Programme Instruction document of EPDItaly v.6
LCA tool	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	Dry-pressed ceramic tiles with water absorption Ev ≤ 0,5% - BIA Group - ISO 13006/EN 14411 - Thickness 8,5-9,5 mm
INDIPENDENT CHECK	Independent verification of the declaration and data, according to EN ISO 14025:2010. Internal □ External ☑ Third party verifier: ICMQ SpA, via De Castillia, 10 20124 Milano (www.icmq.it). 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	Industrie Ceramiche Piemme exempts EPDItaly from any non-compliance with environmental legislation. The holder of the declaration will be responsible for the information and supporting evidence. EPDItaly declines all responsibility for the information, data and results provided by the EPD Owner for the life cycle assessment.
Additional information	
TECHNICAL SUPPORT	Sphera https://www.sphera.com sphera®

2. THE COMPANY

Ceramiche Piemme was founded in 1962 in Maranello, with the aim of producing high-quality ceramic floors and wall tiles with high aesthetic and technological content, as in the best tradition of Made in Italy.

As a small company with 13 employees and a daily production capacity of 40 square meters of tiles, it is now an independent company with 270 employees, and the ability to produce up to 16,000 square meters per day of floors and walls coverings.

Ceramiche Piemme boasts in its catalogue a wide range of products and formats, which are chosen for the realization of prestigious projects of private and commercial construction worldwide.

While maintaining a strong link with tradition and its origins, Ceramiche Piemme looks to the present and the future where it sees new business opportunities.

New opportunities linked to new forms of collaboration with its partners, the discovery of new challenges, new projects to be implemented, research, technological innovation, new forms of environmental and social sustainability.

Management systems, environmental and quality brands:

Our company policy stays on the principles of reducing risk factors and respecting the environment. We intend to pursue renewal at all levels, adopting appropriate and cutting-edge technologies, methods, and approaches that allow an improvement of the technical and aesthetic performance of the product and a reduction of the environmental impact. Investments in 4.0 technologies contribute to the optimization of material and energy consumption thanks to the reuse of waste in the production process and to the reduction of emissions.

SUSTAINABLE INNOVATION

In early 2023 we installed machinery with new technologies to improve energy efficiency and reduce our environmental footprint.

The adoption of a new kiln, 170m long, has allowed PIEMME to achieve significant energy savings and advantages on quality production.

– The kiln is equipped with an "oxygenator" to properly regulate the volumes of combustion and optimize the amount of methane's consumption.

– The latest-generation burners are designed to reduce NOx emissions and improve the heat exchange with the material.

– The heat generated during the indirect heating phase is recovered and is then used by the new "Zero-Fuel" dryer, also recently installed.

The inline pressing machine along with the possibility of cutting the material to the required size, allows the system to recycle 100% the waste material, further improving the productivity.

ENERGY AND SAFETY SYSTEM MANAGEMENT

ItalyIn 2022, the Management System of Industrie Ceramiche Piemme passed the compliance checks, obtaining the important ISO 45001 and ISO 50001 Certifications. These two certifications, which are added to the previous ones on Quality (ISO 9001) and Environment (ISO 14001) are strategic for the company path in continuous renewal and innovation.

3. GOAL AND SCOPE OF EPD

The entire life cycle of the product is considered (Type of EPD: cradle to grave) and 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).*

***ENERGY CONSUMPTION EMISSION FACTORS (A1-A3)** The emission factors (version DB 2023.2) of the datasets used to calculate the impact of energy consumption in the production phase (A1-A3) for the Climate Change – Total indicator, have been attached to the Project short report. For data confidentiality reasons, the emission factors used in the study cannot be made public as stipulated in point 5.3 of the "Terms & Conditions" of Sphera".*

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

*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:
The type of EPD is an average (thickness 8,5-9,5 mm) EPD for the product "Porcelain stoneware surfaces - tile and slab" produced in production plant located in Solignano – Castelvetro (MO), S.S. 569 N. 222. All data refer to the Production reference year 2024 production and sales.
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 the company sites. The reference market is worldwide.

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

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

4. DETAILED PRODUCT DESCRIPTION

MANUFACTURING PROCESS DESCRIPTION:

Entry, storage and entry into production of raw materials:
The mixture consists mainly of a plastic component (clays), a fondant (feldspar), a "structural" component that ensures good mechanical resistance (sands and granites), a portion of recycled material. The raw materials, properly mixed automatically in the established percentages, are introduced into the grinding mills along with water, grinding media, and a blend of deflocculants.

Manufacturing:
Atomization
This phase of the production process consists of spray drying of the "barbottina", the suspension obtained at the end of grinding, which forms small almost spherical grains (atomized) with a moisture content of about 5-6%. The mixture is then stored in silos.

Pressing
The tile forming phase takes place using hydraulic presses equipped with molds suitable for the desired format. This results in the raw tile, which is ejected from the press and transported to the dryers.

Drying

The ceramic process requires a drying phase for the pressed support to reduce its residual moisture to levels not exceeding 0.5%.

Glazing and preparation of glazes

In the single-fired production processes, glazes are applied to the dried ceramic substrate before the firing phase.
The preparation of the glazes is carried out by wet grinding the various components, measured according to specific recipes, in batch-operated drum mills.

Firing

The firing of ceramic tiles aims to produce the chemical-physical reactions that give the piece its final mechanical strength and provide the generally glazed surface with its definitive technical and aesthetic characteristics.

Processing after firing

Some of the fired tiles, before proceeding to the selection phase, may undergo further processing: cutting, grinding, and polishing.

Selection Department

The selection department is located at the end of the production process when the tile has already acquired all the physical and aesthetic characteristics of the product. From the finishing line, the finished product loads are sent to a designated external temporary warehouse.

Packaging

The boxed and palletized material is transported from the selection area to the finished goods warehouse using forklifts, where it is stored until shipment.

HEALTH AND SAFETY OF WORKERS:

Industrie Ceramiche Piemme adopts an ISO 45001 certified system for the management of issues relating to health and safety at work. This certification certifies that the internal safety management system, in addition to being compliant with regulations, is organized to pursue continuous improvement and the reduction of risk factors, in order to protect the health and safety of workers.

ENVIRONMENTAL PROTECTION:

Product sustainability

We have achieved an important goal in terms of circular economy: we reuse all process waste. Terracotta, raw materials, water, and process sludge are totally reused in the production cycle, also limiting the use of water resources, reaching over 99% of reused material.

The pre-consumer recycled material allows us to reach the LEED standard for the construction of eco-sustainable buildings.

Low Emissions

With the purpose to safeguard the employees' health and safety, we have been using low emission inks for some years now, which can significantly reduce the spread of odorous and organic substances.

Technical data: Porcelain stoneware is composed of clay, quartz and feldspar-based materials mixed and fired at temperatures above 1200°C to create a vitrified and inert product, with almost zero water absorption, highly resistant to mechanical stress and scratches.

It is decorated with digital applications of enamels and inks. The ceramic tiles produced by Industrie Ceramiche Piemme comply with the following standards and technical specifications according to EN 14411 in Europe and ISO 13006 in the rest of the world. For the placing on the market of ceramic tiles, EU regulation no. applies. 305/2011. The products require a Declaration of Performance that consider the EN 14411 standard.

Name	Value	Unit
Shaping acc. to EN14411	In accordance	/
Small color differences acc. to ISO1045-16	In accordance	/
Tactility acc to CEN/TS 15209	/	/
Surface quality acc. to ISO 10545-2 § 7	In accordance	/
Water absorption acc. to ISO 10545-3	< 0,1	%
Breaking Strength acc. to ISO 10545-4	S > 1300	N
Modulus of Ropture acc. to ISO 10545-4	> 45	N/mm^2
Resistance to deep abrasion – Unglazed tiles acc. To ISO 10545-6	< 140	mm^3
Resistance to surface wear– Glazed tiles acc. to ISO 10545-7	0-5	Classes
Coefficient of linear thermal expansion acc. to ISO 10545-8	$6,7x10^{-6}$	$°C^{-1}$
Thermal shock resistance acc. to ISO 10545-9	Resistant	/
Crazing resistance acc. to ISO 10545-11, glazed tiles	Resistant	/
Frost resistance acc. to ISO 10545-12	Resistant	/
Nonslip property (class A, B or C) acc. to. CEN/TS 16165	In accordance	/
Bond strength /adhesion acc. to. EN 12004	Resistant	/
Impact resistance acc. to ISO 10545-5	Resistant	/
Reaction to fire NO testing (CWT)	A1FL	Class
Resistance to low concentrations of acids and alkalis acc. to ISO 10545-13	from LA, LB to LC	Class
Resistance to household chemicals and swimming pool salts acc. to ISO 10545-13	min B.	Class
Resistance to low concentrations of acids and alkalis acc. to ISO 10545-13	LA	Class
Resistance to high concentrations of acids and alkalis acc. to ISO 10,545-13	available on request	Class
Resistance to staining acc. to ISO 10545-14	5	Class
Release of lead and cadmium – Glazed tiles acc. to ISO 10545-15	if required	/
Moisture expansion acc. to ISO 10545-10	Resistant	/

BASE MATERIALS / ANCILLARY MATERIALS:

Main raw materials for ceramic tile:

- Clays 40 %
- Feldspar 40 %
- Sand 10 %
- Other 10 % (colourant, frit, glaze, etc.)

PRODUCT PROCESSING/INSTALLATION

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. During the installation, no emissions occur and no health or environmental risks derive from ceramic tile installations.

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.

Coating ceramic tiles in the event of fire has been shown to reduce the heat input on them and thus the risk of collapse.

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

DECLARED UNIT and REFERENCE FLOW

The declared unit is 1 m^2 ceramic tiles for covering walls and floors for 1 year. The mass of the surface considered is 21,15 kg, while the thickness is 9,0 mm (average 8,5-9,5 mm).

Parameter	Minimum value	Maximum value	Average value
Thickness [mm]	8,5	9,5	9,0
Mass [kg]	19,64	22,51	21,15

REFERENCE SERVICE LIFE (RSL)

The service life of tiles is typically more than 50 years (BNB 2011). Furthermore, according to the US Green Building Council, the useful life of tiles could be the same as the useful life of the building itself. Therefore, 60 years represents an alternative for tiles. The reported results consider the use of tiles for 1 year, multiplying the B2-values by 50 or 60 gives B2-values for 50 or 60 years. No RSL was defined according to ISO 15686.

MECHANICAL DESTRUCTION

Ceramic tiles can be smashed mechanically, but no harmful damage on the environment is expected.

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 or road construction.

DISPOSAL

According to the /European Waste Catalogue/ (EWC) ceramic tiles waste belongs to the group 17 “Construction and demolition wastes”, tiles and ceramic (code:17 01 03).

5. LCA RESULTS

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

You can convert the results per kg using the following conversion factor: 21,15 kg/m² (1/tile density)

Environmental Impact indicators for 1m² of ceramic tile														
Parameter	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3-B7**	**C1**	**C2**	**C3**	**C4**	**D**
GWP total	kg CO_2-eq.	4,96	0,606	7,7	1,14	3,69	0	0,0118	0	0,0172	0,0799	0,0473	0,12	-0,248
GWP fossil	kg CO_2-eq.	4,93	0,58	8,79	1,09	2,32	0	0,0089	0	0,0165	0,0765	0,0474	0,12	-0,247
GWP biogenic	kg CO_2-eq.	0,0272	0,0255	-1,09	0,0425	1,38	0	0,00285	0	0,000753	0,00349	-0,00049	0,000336	-0,00134
GWP luluc	kg CO_2-eq.	0,000802	3,76E-005	0,000923	6,2E-005	0,00106	0	1,34E-006	0	1,03E-006	4,87E-006	0,000363	0,000377	-0,000132
ODP	kg CFC-11-eq.	2,46E-011	2,73E-013	2,38E-012	1,22E-013	5,65E-012	0	4,19E-014	0	1,94E-015	9,16E-015	8,08E-014	3,09E-013	-1,93E-012
AP	mole of H^+-eq.	0,00862	0,00208	0,00913	0,0068	0,00362	0	1,55E-005	0	8,25E-005	0,000115	0,000252	0,000862	-0,00045
EP - freshwater	kg P eq.	5,19E-006	1,58E-007	2,99E-006	2,65E-007	9,28E-006	0	3,56E-006	0	3,97E-009	1,88E-008	1,64E-007	2,45E-007	-7,05E-007
EP - marine	kg N eq.	0,00249	0,00097	0,00365	0,0017	0,00131	0	1,75E-005	0	3,92E-005	4,58E-005	0,000116	0,000223	-0,000146
EP - terrestrial	mole of N eq.	0,0273	0,0107	0,0402	0,0188	0,0146	0	4,59E-005	0	0,000429	0,000505	0,00128	0,00245	-0,00159
POCP	kg NMVOC eq.	0,00814	0,00196	0,00989	0,00483	0,0032	0	1,94E-005	0	0,000111	0,00011	0,000314	0,000672	-0,000479
ADPE	kg Sb eq.	4,01E-005	8,04E-009	6,16E-006	1,32E-008	5,85E-006	0	3,96E-010	0	2,03E-010	9,6E-010	5,17E-008	5,62E-009	-1,88E-008
ADPF	MJ	207	8,61	8,09	15,5	22,5	0	0,198	0	0,236	1,11	0,95	1,62	-5,45
WDP	m^3 world eq.	0,411	0,00313	0,66	0,00254	0,182	0	0,00156	0	3,95E-005	0,000186	0,00939	0,0133	-0,0164

Caption	GWP = Global warming potential; 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 for 1m² of ceramic tile													
Parameter	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3-B7**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	[MJ]	11,7	0,116	8,39	0,0961	0	0	0,0242	0	0,00152	0,00719	0,0884	0,264	-1,16
PERM*	[MJ]	0	0	0,511	0	-0,511	0	0	0	0	0	0	0	0
PERT	[MJ]	11,7	0,116	8,9	0,0961	4,33	0	0,0242	0	0,00152	0,00719	0,0884	0,264	-1,16
PENRE	[MJ]	207	8,64	7,98	15,6	22,7	0	0,198	0	0,237	1,12	0,953	1,62	-5,45
PENRM*	[MJ]	0	0	0,113	0	-0,113	0	0	0	0	0	0	0	0
PENRT	[MJ]	207	8,64	8,1	15,6	22,6	0	0,198	0	0,237	1,12	0,953	1,62	-5,45
SM	[kg]	0,393	0	0,38	0	0,0503	0	0	0	0	0	0	0	18,3
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]	0,0136	0,000167	0,0171	0,000113	0,00552	0	5,62E-005	0	1,77E-006	8,36E-006	0,000271	0,000409	-0,00106

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

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

Wastes input/output flows for 1m² of ceramic tile														
Parameter	Unit	A1	A2	A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
HWD	[kg]	2,83E-007	4,18E-011	2,96E-009	3,14E-011	1,89E-008	0	1,03E-011	0	4,36E-013	2,06E-012	-2,47E-012	3,52E-011	-2,37E-010
NHWD	[kg]	0,235	0,000916	0,889	0,00154	1,6	0	0,00604	0	2,36E-005	0,000111	0,000251	8,09	-0,765
RWD	[kg]	0,0014	8,54E-005	0,000182	2,5E-005	0,000329	0	4,49E-006	0	3,95E-007	1,86E-006	1,28E-005	1,85E-005	-0,000227
CRU	[kg]	0	0	0	0	0	0	0	0	0	0	0	0	0
MFR	[kg]	0	0	0,0323	0	0,0429	0	0	0	0	0	18,9	0	0
MER	[kg]	0	0	0	0	0,205	0	0	0	0	0	0	0	0

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; EEE = Exported thermal energy

Additional indicators (PM, IR, ETF-fw, HTP-c, HTP-nc and SQP) have been calculated and can only be seen in the /Background Report/.

Disclaimer for EN 15804+A2: additional indicators

(1) Potential Human exposure efficiency relative to U235 (IRP): This impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

(2) The results of the environmental impact indicator: ADP, WDP, ETP-fw, HTP-c, HTP-nc, SQP shall be used with care as the uncertainties on these results are high or as there is limited experience with the indicator.

6. CALCULATION RULES

REFERENCE FLOW:

Name	Value	Unit
Declared unit	1	m^2
Grammage	21,15	kg/m^2
Conversion factor to 1 kg	0.0472	-

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 known inputs and outputs were considered".

DATA QUALITY:

The period of validity of background data from Sphera database is between 2019 and 2024. Most of the information (energy and water consumption, pollutant emissions, atomized dust, 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 verified for each plant involved in this study. Carbon dioxide emissions (related to carbonate oxidation) are collected through ETS (emissions trading system) reporting.
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:

The primary data collected in the study refer to 2024.

ALLOCATION:

Energy and material supplies have been allocated to the product based on annually produced mass of ceramic 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.

VARIABILITY ANALYSIS:

The average EPD covers the thicknesses of ceramic tiles produced by Industrie Ceramiche Piemme SpA that fall within the 8,5-9,5 range. All products considered in the EPD fall within an impact variation of ±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 domestic destination having a capacity of 27 tons (20.5% of tiles sold)	300	km
Truck with European destination having a capacity of 27 tons (48.5% of tiles sold)	1390	km
Transoceanic transport shipment (31% of tiles sold)	6520	km

Installation into the building (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
Detergent	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 show 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

Ceramic tiles are inert, therefore during the use stage, do not emit any pollutants or substances which are harmful to environment and health. For this reasons and according to PCR, evidence are not required because they are not relevant for this product group.

9. OTHER ADDITIONAL ENVIROMENTAL INFORMATION

Carbon content biogenic :

- Packaging: 0.0135 Kg CO2eq. /Kg tile
- Product: 0 Kg/m ^{2}

Additive environmental parameters relating to the minimum environmental criteria of the Ministerial Decree of 23 June 2022 paragraph 2.5.10.1 "Hard flooring"

All the articles produced by Industrie Ceramiche Piemme meet the characteristics and requirements set by the minimum environmental criteria (**CAM**), developed within the national strategy of "**green procurement**", called **GPP** (**Green Public Procurement**).

These criteria are the tool adopted 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 containing "Energy and environmental sustainability criteria" of Legislative Decree 50/2016 "Public contracts code", which made their application mandatory by all contracting authorities.

The ceramic tiles and slabs produced by Industrie Ceramiche Piemme comply with the technical specifications required by the CAM as they respect the following criteria included in Decision (EU) 2021/476, which establishes the criteria for the assignment of the European Union ecological quality label (EU Ecolabel) to hard roofing products.

CRITERIA COMMON TO ALL HARD COVERING PRODUCTS

1.1 - Industrial and construction mineral extraction

Industrie Ceramiche Piemme requires all suppliers of raw materials of extractive origin to have read the authorization for extraction activity, the environmental recovery plan, the environmental impact assessment and a map with the geographical coordinates of the site.

1.2 - Restricted substances

Industrie Ceramiche Piemme produces articles using chemicals or supplied materials that do not contain substances of very high concern, included in the candidate list in accordance with Article 59 of Regulation (EC) No. 1907/2006, in concentrations above 0.10% (weight/weight).

1.3 - VOC emissions - Volatile organic compounds

Ceramic tiles are recognized as an inert material that does not produce harmful emissions.

1.4 - Fitness for use

The articles produced by Industrie Ceramiche Piemme are CE marked in compliance with the technical standard EN 14411. The declarations of performance (DoP) are made in accordance with regulation (EU) n.305/2011. Industrie Ceramiche Piemme adopts a quality management system certified UNI EN ISO 9001.

1.5 - User information

Information on the technical characteristics of Industrie Ceramiche Piemme products, their installation, cleaning and maintenance, are available on the company website.

CRITERIA RELATING TO MATERIALS AND TECHNOLOGIES - 4. CERAMICS

4.1 - Fuel consumption for drying and firing

The specific fuel energy consumption, calculated for the processes of atomization (production of atomized powder), drying (reduction of humidity of the raw pressed support) and firing of the finished product, does not exceed the relevant mandatory limits. See table below.

Requirement		Limit value obligatory	Threshold of excellence	Value respected CERAMICHE PIEMME FLOOR AND MORE	
Fuel consumption	Atomizer	1.8 MJ/kg	1.3 MJ/kg	< 1.3 MJ/kg	Threshold of excellence
	Dryer & Oven	5.5 MJ/kg	4.3 MJ/kg	< 4.3 MJ/kg	Threshold of excellence

(limit values declared for product families)

4.2 - CO_2 emissions

CO_2 emissions associated with the use of fuels and process emissions resulting from the decarbonation of raw materials during drying and firing processes do not exceed the relevant mandatory limits.

See table below.

Requirement		Limit value obligatory	Threshold of excellence	Value respected CERAMICHE PIEMME FLOOR AND MORE	
CO_2 emissions	Atomizer	84 $KgCO_2/t$	54 $KgCO_2/t$	< 54 $KgCO_2/t$	Threshold of excellence
	Dryer & Oven	360 $KgCO_2/t$	290 $KgCO_2/t$	< 290 $KgCO_2/t$	Threshold of excellence

(limit values declared for product families)

4.3 Process water consumption

Compliance with the requirement: the Industrie Ceramiche Piemme SpA production plant has a closed-loop recycling system for wastewater treatment.

4.4 Emissions of pollutants into the air: dust, HF, NOx and SOx

Compliance with the requirement: the specific emissions of dust, HF, NOx in the air associated with the production of ceramic products of Industrie Ceramiche Piemme SpA do not exceed the relevant mandatory limits. See table below.

Requirement		Limit value obligatory	Threshold of excellence	Value respected CERAMICHE PIEMME FLOOR AND MORE	
Emissions into air	Powders (atomizer)	90 mg/kg	no	< 90 mg/kg	Threshold of excellence
	Powders (oven)	50 mg/kg	10 mg/kg	< 10 mg/kg	Threshold of excellence
	HF (oven)	20 mg/kg	6 mg/kg	< 6 mg/kg	Threshold of excellence
	NOX (oven)	250 mg/kg	170 mg/kg	< 250 mg/kg	Mandatory limit
	SOX (oven)	1300 mg/kg	750 mg/kg	< 750 mg/kg	Threshold of excellence

4.5 Wastewater management

Compliance with the requirement: In the Industrie Ceramiche Piemme SpA production plant, process wastewater from production is treated on-site to remove suspended solids and then reintroduced into the production process as part of a zero-liquid discharge system.

4.6 Reuse of process waste

Compliance with the requirement: More than 90% by mass of the process waste generated from the manufacture of ceramic products is incorporated into the on-site production process, off-site ceramic product manufacturing processes, or reused in other manufacturing processes.

4.7 Glazes and inks

Compliance with the requirement: The formulation of glazes (enamels) and inks provides for weight concentrations of less than 0.1% of both Pb and Cd.

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 andframework
EN ISO 14044	EN ISO 14044:2006-10 Environmental management - Life cycle assessment - Requirements andguidelines
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/baustoffundgebaeudedaten/useful lives-of-bauteilen.html; stand 12/2015
US GBC	US Green Building Council, Leed v3, 2009, Whole building life cycle assessment. LEED BD&C v4 (LEED Building Design & Construction).
PD CEN/TR 15941:2010	Sustainability of construction works – Environmental Product Declarations – Methodology for selection and use of generic data
EUROSTAT	EUROSTAT Data browser: Packaging waste by waste management operations
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