LAMINAM S.P.A

ENVIRONMENTAL PRODUCT DECLARATION

Product Name:
CERAMIC TILES – LAMINAM 2; LAMINAM 2+

Site Plant:
Via Ghiarola Nuova 258, Fiorano Modenese (MO), Italy

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

Program Operator	EPDItaly
Publisher	EPDItaly

Declaration number	*LAM_2MM_2025*
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1. GENERAL INFORMATION

EPD OWNER

Company name	LAMINAM S.p.A
Legal head office	Via Ghiarola Nuova ,258 41042, Fiorano Modenese (MO), Italy
Contacts for information on the EPD	**Serena Pierini (Quality Supervisor), Giulia Ferri (Quality Specialist)** **info@laminam.com**

PROGRAM OPERATOR

EPDITALY (www.epditaly.it)	via Gaetano De Castillia n° 10 - 20124 Milano, Italia

INFORMATION ON THE EPD

Product name	CERAMIC TILES – LAMINAM 2; LAMINAM 2+
Plant involved in the declaration	Via Ghiarola Nuova 258, Fiorano Modenese (MO), Italy
Functional Unit	1 m^2
Application area	Ceramic tiles for indoor and outdoor flooring and cladding, suitable for residential and commercial use.
EPD Type	Average EPD ***generated by a qualified TOOL***
CPC Code	37370

VERIFICATION INFORMATION

Product Category Rules (PCR)	EN 15804:2012+A2:2019 is the framework reference for PCRs. PCR ICMQ-001/15 rev3.2
EPDItaly regulation	Regulation EPDItaly v.6
Project Report	Background report for LCA tool for Confindustria Ceramica, 27/11/2023 iReport 2 - 2+ mm_25092026
Indipendent check	Independent verification of the declaration and data, according to EN ISO 14025:2010. Internal □ External ☑ Third party verifier: ICMQ S.p.A, Via Gaetano De Castillia, n°10 - 20124 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	LAMINAM S.p.A relieves 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 manufacturer's information, data and results of the life cycle assessment.

ADDITIONAL INFORMATION

Technical support	Sphera https://www.sphera.com

2. THE COMPANY

The story of Laminam is made up of an unwavering pursuit of absolute quality and perseverance in the desire to innovate, which has taken it further, always, beyond national boundaries. Our architectural surfaces are proving increasingly popular in Europe and in all other continents, where excellence Made in Italy traditionally matches high-quality finishes with impeccable aesthetic taste. Some of the most interesting markets include Europe, Russia and the Far East.

However, Laminam also has a significant presence on the American continent and is also rousing interest in the Middle East. Consequently, the brand has boosted its exposure abroad, also from a corporate perspective. The parent company, Laminam S.p.A., has been supplemented with subsidiary companies that are controlled directly or in partnership with local commercial players: LaminamRUS, Laminam USA, Laminam Canada, Laminam UK, Laminam Germany, Laminam France, Laminam China, Laminam Japan, Laminam Israel and the latest to be established: Laminam Australia.

The company headquarters firmly remain in Italy, in Fiorano Modenese. Again, in Italy are two of the three production plants and the Research & Development laboratories. This is to emphasize the brand's strong national component and its desire for Italian know-how to become known. Over the coming years, the objective is to increase the international reach in terms of sales, production and logistics, to make its range of products more accessible to the global market, providing speedy and on-time deliveries and responses. It should be noted that Laminam works at international level, relying on solid partnerships with first-level distributors who are able to convey the distinguishing values of Laminam to the market, with respect to other surface materials. Laminam's strength lies in valuing partnerships, providing considerable support for all market players, in addition to superior product quality.

Shaping tomorrow's world

Surfaces inspired by nature, which go beyond nature. Laminam produces ceramic slabs which challenge the traditional uses of this material, creating large sized minimum thickness surfaces, which are used in exterior architecture, interior design and furnishings. The aim is to redefine and play spaces so that they become an expression of our personality and give rise to places to live and work and feel at ease with ourselves and with others. From the onset, we revolutionized the ceramic world thanks to a pioneering vision and to the introduction of ever more innovative products in terms of thicknesses and sizes. What's more, IN-SIDE technology has enabled us to take a leap forward, achieving for the first time ever body and surface continuity. The end result is a product which accompanies elegance with structure and beauty. Our company grows continually thanks also to the development of solid partnerships and a mutually beneficial exchange of know-how and ideas with those who, like us, nurture the ambition of shaping tomorrow's world.

The ceramic specialists

Laminam works with an ancient material, ceramic, which has reinterpreted by creating its surfaces, combining its natural qualities with a new application connotation. This is a constantly evolving process, which allows us to study ever new application possibilities in international architecture and in state-of-the-art contexts, through increasingly precious and sophisticated furnishing finishes. From tradition to production, Laminam has deployed innovation not just in terms of technology, but also aesthetic styling, constantly raising the market standards with our surfaces, without ever forgetting our focus on sustainability and safety.

Technology and Innovation

At the heart of the Laminam philosophy lies an unwavering propensity for innovation and the pursuit of uniqueness. We dedicate intensive research activity for each and every product.

Laminam's tireless technological research opens to never-before-seen levels of innovation, a genuine turning point in how we live: twO by Laminam, surfaces just 2mm thick. The twO by Laminam project represents a strategic initiative of technological innovation begun in 2023, aimed at developing solutions with a high level of originality and industrial applicability. Right from the initial phases, the project was oriented towards the generation of long-term value, through investments in research, development and industrial property protection. The patent protection pathway started in support of the innovation developed represents a key element in the company strategy of safeguarding its know-how and strengthening its competitiveness in the reference markets. During the course of 2025, technological development and consolidation activities continued, allowing the robustness of the solution to be confirmed, with its full integration into the corporate production processes. The industrial application of innovation helps improve operational efficiency and the diffusion of ever-more advanced and sustainable production models. In keeping with a vision oriented towards responsible growth and exploitation of fixed assets, the extension of patent protection to the European level was also set in motion, in support of the strategy of international development and creation of economic, technological and competitive value over time. twO by Laminam is the thinnest material ever created in the ceramics sector, a totally innovative and sustainable product which retains the same technical performance and aesthetics as the other thicknesses, while at the same time guaranteeing a significantly reduced environmental impact.

Certification of Laminam Company:

Product Certification

LEED & BREEAM

Vietnam Quality Mark

CCC

MOCA

QB15

QB UPEC

KOSHER

DGNB

SQM Saudi Quality Mark

CE

ITB

ISPM 15

UKCA

ESL-24-11745
ESL-24-11746
Civil Defence/COC

Kuwait Conformity Assurance

0474/2026
IMO-MED

CAM

NSF

System Certification

ISO 9001

ISO 14001
ISO 14064-1

ISO 20400

CTPAT

Production Plants

The Group's headquarters are located in Fiorano Modenese, in the province of Modena. Laminam has three manufacturing plants (two in Italy and one in Russia), Research & Development and Technology laboratories in both countries. In addition, the company has sales subsidiaries in the USA, Canada, UK, France, Germany, Poland, Israel, China, Japan and Australia, several showrooms and a network of distributors worldwide.

The Laminam location subject to this EPD verification is:

- Laminam S.p.A - Via Ghiarola Nuova 258, Fiorano Modenese (MO)

Company contact

For more information on Laminam's activities or in relation to this environmental product declaration, you can contact:

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Alternatively, you can consult the website: www.laminam.com

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), and 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 and 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, so 1 m^2 of tile surface is the net of material losses.
Module **B2** covers cleaning activities which only require water and detergent; no energy is needed for cleaning. The water used for cleaning as part of maintenance will be included in module B2, not in modules B6 and B7. Additionally, the treatment process for the cleaning water will also be accounted for in module B2.

Modules **C1** and **C2** concern the process of demolition and deconstruction of the tiles from the building. The module considers an excavator (with its fuel consumption) and the transportation of the discarded tile to a recycling or disposal process.
For further operation (**C3** and **C4**), one EoL scenario for the ceramic tiles is considered 100% landfill.
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. Typically, this is classified as either A5 or C3. However, since no incineration scenario is available for C3, this study will only consider scenario A5. Resulting credits for thermal and electrical energy are then declared in module D.

PRODUCTION			INSTALLATION		USE STAGE							END-OF-LIFE				NEXT PRODUCT SYSTEM
Raw material supply	Transport to manufacturer	Manufacturing	Transport to building site	Installation into building	Use / application	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction / demolition	Transport to EoL	Waste processing	Disposal	Reuse, recovery or 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

Modules B1, B3, B4, B5, B6 and B7 can be considered to have no impact (negligible); ceramic tiles are intrinsically inert and therefore do not have environmental impacts during their use to be addressed in module B1 "Use/application". The environmental impacts generated during the B1 phase are therefore negligible. The ceramic tile is a long-lasting product, the repair is not expected to apply to ceramic tiles, and the impacts in module B3 can, therefore, be neglected. Moreover, tiles require neither replacement nor refurbishment during the use phase, and therefore, no impacts should be declared in modules B4 and B5. Likewise, tiles require no energy and water use once they are installed in a building, so modules B6 and B7 also have no impacts.
Impacts and aspects related to waste are considered in the module in which the waste occurs.

EPD TYPE:

Average EPD.
Average EPD relative to average products. The environmental performances declared in this EPD refer to 2 average products, each of which is representative of a specific Laminam product family. The product families considered are:

- 2 mm thick slabs
- 2+ mm thick reinforced slabs

The average product for each family is obtained by averaging the compositions of all Laminam products belonging to that particular family. The average is weighted with respect to the production volumes of each product in reference to the year 2025.

PRODUCT NAME:

CERAMIC TILES – LAMINAM 2; LAMINAM 2+

DECLARED UNIT and REFERENCE FLOW:

The functional unit for this study is 1 m^2 of an average installed ceramic tile produced by LAMINAM S.p.A covering walls and floors, following the normative constraints in terms of installation for 50 years (BNB (2011)).

GEOGRAPHICAL VALIDITY:

Performance was calculated with reference to the company sites (Italy). The reference market is worldwide.

REFERENCE SERVICE LIFE (RSL):

A reference life according to ISO 15686 (2011) is not reported. For this study, the service life is 50 years (NF EN 15804+A2/CN (2022)). 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.

DATABASE:

Managed LCA Content (version 2023.2)

SOFTWARE:

LCA tool creator for Ceramic Tile V6 [(27/11/2023) - DB version 2023.2]

4. DETAILED PRODUCT DESCRIPTION

PRODUCT DESCRIPTION:

The products covered by this EPD are porcelain stoneware ceramic slabs, produced in Italy in the Laminam plants in Fiorano Modenese. The slabs, and their respective environmental performance, are grouped into product families according to the thickness and / or particular characteristics of the slab. This EPD refers to 2 product families:

1. 2 mm thick slabs
2. 2+ mm thick reinforced slabs

Laminam 2

Laminam 2 is the standard slab, in its original form as it leaves the kiln, without being trimmed to a standard working size. Laminam 2 surfaces are made from a combination of clay, sand, feldspar, and inorganic ceramic pigments. These materials are ground, pressed into shape using an innovative press-forming process, and sintered at 1250°C in a hybrid kiln. The material can be supplied in its raw form as it leaves the kiln (untrimmed) or in a standard squared working size.

Usable Surface Area: 1000x3000 mm (39.4''x118.1'')*

Nominal Thickness: 2.2 mm (1/16'')

Uses of Laminam 2
Primarily used for surface cladding in the design sector.

**Untrimmed end product*

Laminam 2+

Laminam 2+ is the basic slab reinforced with fiberglass mesh on the underside, secured with a specific adhesive.

Laminam 2+ surfaces are made from the same materials as Laminam 2. They are produced by a wet grinding process, pressed into shape, and sintered at 1250°C. The surface is reinforced with an inert material (fiberglass mesh) applied to the underside and can be supplied in its raw form or trimmed to a standard size.

Usable Surface Area: 1000x3000 mm (39.4''x118.1'')

Nominal Thickness: 2.6 mm (1/8'')

Uses of Laminam 2+
Ideal for indoor and outdoor cladding in the construction sector, and for surface cladding in the furniture sector.

One surface, a multitude of technical features

Easy to clean and maintain
Laminam is simple, fast and easy to clean and has no special maintenance requirements as time passes by. Generally speaking, all you need to clean the surface is warm water and a neutral detergent.

Hygienic surface
Laminam surfaces are ideal for application in places where maximum hygiene is needed.

Suitable for contact with foodstuffs
Laboratory tests have proven that Laminam is totally compatible with foodstuffs, as it does not release elements in solution.

Resistant to mould and fungi
Laminam doesn't allow mould, bacteria or fungi to grow.

Impervious surface
Laminam surface porosity is average 0.1% and it does not absorb water.

Resistant to freeze-thaw
Laminam is frost resistant and suitable for any weather condition, thanks to its low average water absorption (0.1%)

Dimensional stability
Laminam is not subject to dimensional variations of any significance, as it has a low coefficient of thermal expansion.

Suitable for indoor and outdoor applications
Laminam can be used both for interior and exterior décor. Weathering exposure does not damage or alter surfaces.

Resistant to heat and high temperatures
Laminam does not contain any organic materials therefore it is resistant to fire and high temperatures.
In the event of fire, it does not release smoke or toxic substances. Used as a kitchen countertop, it is suitable for direct contact with hot surfaces, such as pots and pans.

Resistant to staining**
Laminam is not affected by prolonged contact with products commonly found in the kitchen that can cause staining, such as wine, coffee, olive oil or lemon juice and its color or shine will not be affected permanently.

Resistant to detergents and cleaning products**
Laminam is not affected by prolonged contact with normal household detergents, including products to eliminate grease or lime scale. It is extremely easy to clean while maintaining the characteristics of the surface unaltered.

Resistant to chemicals, acids, alkalis and solvents**
Laminam is not affected by organic and inorganic solvents, chemicals and disinfectants. The only chemical that can damage ceramics is hydrofluoric acid.

Resistant to thermal shock
Sudden changes in outdoor temperature will not damage Laminam.

Resistant to humidity
The ceramic surface of Laminam is not affected by long-term humidity.

Resistant to UV rays, no alteration to colors
Laminam surface is not affected by exposure to UV light and will preserve its original good looks throughout its lifetime.

Resistant to deflection
Laminam has a high modulus of rupture.

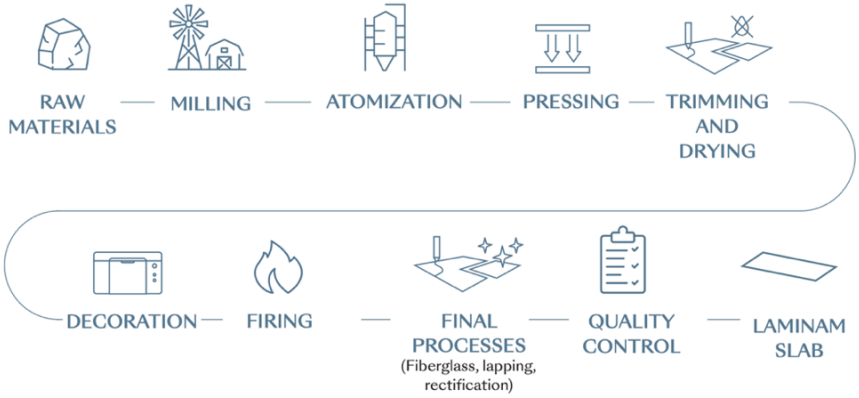
Resistant to scratches and abrasions**
Laminam is resistant to scratching and deep abrasion. Its properties do not change even if it is subjected to intensive use and frequent cleaning.

Graffiti proof
Laminam is the first graffiti proof ceramic surface. It is easy to clean and even the strongest paints can be easily removed.

MANUFACTURING PROCESS DESCRIPTION:

The production of LAMINAM S.p.A 's porcelain stoneware tiles is structured in sequential phases that ensure the high quality of the finished product and the efficiency of the processes, in accordance with the principles of Life Cycle Thinking (LCT).

The production process for the creation of a Laminam slab is characterized by innovative, highly automated and digitalized methods and technologies which increase its energy efficiency and safety while reducing its environmental impact. A Laminam slab is made from natural raw materials: clays, sands and feldspars which, after being subjected to quality controls, are treated and milled. Afterwards, inorganic and eco-compatible colors are added to the milled raw materials to pigment the base, after which they are mixed and subjected to the spray drying process that considerably reduces humidity. The granulated material obtained in this way, unlike the traditional technique that involves the use of molds, is spread on a mobile tape and subjected to uniform pressure with the freedom to expand. In this way any internal tension is released, obtaining a perfectly regular surface. The slabs thus obtained are sent to the trimming unit which removes the rough and jagged edge and to a dryer to reduce residual moisture. Subsequently, the slabs are decorated using sophisticated digital inkjet equipment which makes it possible to obtain a chromatic and grain size variability which makes the range of obtainable decorations almost unlimited. Finally, the slabs are preheated and fired in the kiln at temperatures over 1200 degrees centigrade. Upon leaving the kiln, the slabs are subjected to a computer integrity that allows defective slabs to be discarded. In some cases, at the customer's request or for safety reasons related to the future use of the slab (e.g. for external facades), the slabs are reinforced by pasting a fiberglass that increases their mechanical properties. Afterwards they can be lapped using special industrial sanding machines and the use of special abrasive scales obtaining a polishing that makes the slab similar to marble and rectified if a custom-made product is required. At the end of the production process, the material is subjected to quality control which divides it into first, second choice and scrap.



HEALTH AND SAFETY OF WORKERS:

Laminam is committed to promoting responsible and informed health and safety behavior, adopting the highest standards and fully complying with national and international regulations, both within the organization and along the entire value chain.

Laminam's HSE (Health, Safety and Environment) model is based on a collaborative approach and continuous feedback, implemented through:

• Periodic meetings with management, the Supervisory Board and Workers' Health and Safety Representatives, dedicated both to environmental and safety topics, and to sharing feedback received during day-to-day activities;

• Internal and external audits, including along the supply chain, to incentivize feedback and clearly define the paths and priorities to take on as a corporate system;

• Engaging consultants with highly qualified skills;

• An HSE system which guarantees equal levels of knowledge, training and information to all employees, regardless of contract type. The reporting program for "near misses" also continues, that is unexpected events which could have caused accidents or injuries, but which did not actually cause negative consequences.

This process allows us to identify potential risks in a timely manner and to strengthen preventive measures.

In 2025, a total of 2,146 hours of safety training was provided to Italian employees (+9% YOY), with 244 participants.

Laminam for the Health of its employers activate in 22 The LAMINAM CARES project that continued in 2025; the project involves a structured set of Company Welfare initiatives and activities for health safeguarding and prevention.

Over the course of the year, Laminam Cares supported the usual voluntary flue vaccination project, and supported the participation of employees in regional screen programs. The Company indeed is a member of the Emilia-Romagna

Region's "Aziende che promuovono la salute" (companies which promote health) project, providing paid leave to facilitate access to preventive care initiatives. In 2025, employees were offered blood tests, an osteopath visit, and further preventive services, taking place entirely within the company during working hours. A total of 270 Laminam S.p.A. employees participated in the screening. In recent years, our Company Welfare project has proven to be a key pillar in improving the well-being of our employees, helping to create a more inclusive, balanced and motivating work environment.

The Company's continuous growth and the evolution of its employees' needs today drive us to renew our approach, introducing concrete and flexible solutions. Active listening has identified priority needs such as parenting support, mental wellbeing, work-life balance, sustainable mobility, and personal growth paths.

ENVIRONMENTAL PROTECTION:

Laminam incorporates environmental protection in its industrial model through an approach oriented towards continuous improvement of the process performance and progressive reduction of the environmental impacts.

The technological and organizational choices adopted over time reflect an industrial development vision which considers sustainability to be a structural element, with a particular focus on efficient use of resources and preventing impacts.

Many aspects of Laminam's production process and the characteristics of its ceramic slabs can be associated with a circular economy model aimed at minimizing consumption of raw materials, energy, and water, as well as the production of waste. The organization of the production flows allows for recovery and internal reuse of the materials, encouraging more efficient management of resources and contributing to an increase in the product's useful lifespan. Laminam slabs are recyclable and, thanks to the reduction in weight and thickness compared to traditional ceramic products, they require lower quantities of raw materials and less energy for the firing and transport phases. The adoption of digital decoration represents a further improvement factor for environmental performance, allowing for a decrease in consumption of water and auxiliary materials, and a reduction in the production of process waste.

Management of environmental aspects is coordinated by the HSE (Health, Safety and Environment) department, which works in an integrated manner with the production functions, while the Energy Manager plays a key role in planning and monitoring of energy consumption, in managing sources and carrying forward energy efficiency and GHG emissions reduction projects. The Italian sites operate under an Integrated Environmental Authorization (Autorizzazione Integrata Ambientale – AIA) regime, which organically regulates the main environmental matrices, including atmospheric emissions, the noise impact, waste management, water balance, and energy balance. The AIA ensures application of the principles of integrated prevention and reduction of pollution, promoting the adoption of technical solutions designed to limit emissions and improve the overall efficiency of the processes. Monitoring of environmental performance is supported by structured monitoring solutions which include continuous monitoring of emissions parameters, monitoring of energy consumption – with a particular focus on optimizing efficiency – and management of water resources, aimed both at reducing withdrawal and reuse of process water within the production cycle. Waste management is designed to prioritize reuse and recovery of materials, including through transfer to qualified third parties, from a standpoint of maximum exploitation of resources along the value chain. Rounding off the operational monitoring activities, Laminam has, over time, developed biomonitoring activities programs and studies on vegetation designed to improve knowledge of the ecological status of the areas in which it operates and strengthening a preventive approach to managing impacts.
Together, these actions delineate an integrated environmental management system, aimed at reductions in impacts, efficient use of resources, and the consolidation of a production model consistent with principles of sustainability.

In 2021 Laminam S.p.A. obtained ISO 14001 certification for its Italian plants in Borgo Val di Taro and Fiorano. The certification guarantees the presence of a management system aimed at monitoring the Company's environmental impact, alongside a constant search for sustainable improvement of processes.

TECHNICAL DATA:

The products meet the requirements defined by European standard EN 14411 and International standard ISO 13006, according to the criteria established by the test methods ISO 10545 - International Organization for Standardization Specifications for Ceramic Tile reported below. Porcelain stoneware slabs Group BIa according to UNI EN 14411 Annex G / ISO 13006 Annex G.

Technical Property	AVERAGE VALUE	
	LAMINAM 2	LAMINAM 2+
Length and Width Rectified Product (ISO 10545-2)	Max ± 0,5 mm deviation on the side	

Technical Property	AVERAGE VALUE	
	LAMINAM 2	LAMINAM 2+
Length and Width Full-Size Product (Laminam)	Minimum size guaranteed (reference in product data sheet)	
Surface quality (ISO 10545-2)	Minimum 95% of the tiles tested must be free from visible defects	
Water absorption (ISO 10545-3)	E ≤ 0.1 % Bla	
Modulus of Rupture (ISO 10545-4)	50 N/mm² (samples 200x300 mm)	
Breaking Strength (ISO 10545-4)	-	
Resistance to Deep Abrasion (ISO 10545-6)	≤ 175 mm³	
Linear Thermal Expansion Coefficient (ISO 10545-8)	$6.6 * 10^{-6}$ °C^{-1}	
Resistance to Thermal Shock (ISO 10545-9)	Compliant	
Frost Resistance (ISO 10545-12)	Compliant	
Weight (Laminam)	4.8 Kg/m²	5.1 Kg/m²
Reaction to Fire (EN 13501)	A1	A2, S1-d0
Resistance to Household Chemicals and Swimming Pool Salts (ISO 10545-13)	A	
Resistance to Low Concentrations of Acids and Alkalis (ISO 10545-13)	Min HB	
Resistance to High Concentrations of Acids and Alkalis (ISO 10545-13)	Min LB	
Stain Resistance (ISO 10545-14)	Min class 4	
Release of Lead and Cadmium (ISO 10545-15)	Lead: < 0,05 mg/l Cadmium: < 0,010 mg/l	--- (*) mg/dm² --- (*) mg/dm²

CONTENT INFORMATION

Following is the main information about the product contents such as the main raw materials, installation, relevant effects during use, and relationship with the environment and health during use.

The main raw materials used in the production of Laminam ceramic slabs are clays, sands and feldspars of certified origin, natural substances that are carefully selected to ensure a homogeneous composition. To these materials are added inorganic coloring pigments and eco-compatible glazes (not containing dangerous substances according to the European REACH Regulation) during the decoration phase.

Depending on the type, Laminam slabs contain up to 40% pre-consumer recycled material (i.e. reused industrial waste) as certified by LEED and BREEAM certification in compliance with ISO 14021. In addition, because they are made from natural raw materials, the slabs can be easily milled and recycled in other production cycles.

Main raw materials used for the ceramic tile:

- Clay = 30-33%
- Feldspar = 60-63 %
- Sand 4-10%
- Presence of inorganic pigment in a quantity less than 5%

Regarding the product Laminam 2+, the following components must be added to the previous raw materials:

- glue (0,2%)
- glass fiber mesh (0,2%)

These components form an additional layer, glued into the back of the ceramic slab.

Biogenic carbon content:

Indicator	Unit	Value
Biog. C in packaging	[kg]	5,26E-02
Biog. C in product	[kg]	0,00E+00
Caption	**Biog. C in packaging** = Biogenic carbon content in packaging; **Biog. C in product** = Biogenic carbon content in product	

PRODUCT INSTALLATION

Tiles are fixed to the walls 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

Interaction with Fire

Slab without fibreglass: in accordance with standard EN 13501-1:2007+A1:2009, ceramic tiles can be classified in fire resistance class A1, as they are non-flammable. It has been demonstrated that the ceramic tile coating in case of fire reduces the heat input to them and therefore the risk of collapse.

Slab with fiberglass mesh glued in the back, after testing according to EN 13501, have shown the belonging of material to class A2-s1, d0.

Interaction with Water

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

ENVIRONMENT AND HEALTH DURING USE

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

For the end user, the product is safe after installation for its intended use and does not pose health risk under proper conditions of use and maintenance. Stable chemical compounds are formed during the firing process; therefore, ceramic tiles are not considered hazardous to health.

3. 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.

Environmental Impact Indicators for 1m^2 of ceramic tiles														
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3-B7**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-total	kg CO_2 eq.	4,22E+00	3,18E-01	1,42E+00	2,20E-01	3,25E+00	0,00E+00	7,30E-03	0,00E+00	7,09E-03	3,29E-02	1,95E-02	4,96E-02	-2,02E-01
GWP-fossil	kg CO_2 eq.	4,20E+00	3,05E-01	2,40E+00	2,14E-01	1,78E+00	0,00E+00	4,68E-03	0,00E+00	6,78E-03	3,15E-02	1,95E-02	4,93E-02	-2,01E-01
GWP-biogenic	kg CO_2 eq.	1,24E-02	1,22E-02	-9,81E-01	6,08E-03	1,47E+00	0,00E+00	2,62E-03	0,00E+00	3,10E-04	1,44E-03	-2,02E-04	1,38E-04	-9,81E-04
GWP-luluc	kg CO_2 eq.	5,15E-04	1,80E-05	8,64E-04	9,81E-06	9,90E-04	0,00E+00	9,72E-07	0,00E+00	4,25E-07	2,01E-06	1,50E-04	1,55E-04	-6,09E-05
ODP	kg CFC-11 eq.	3,11E-11	7,98E-14	2,63E-11	2,14E-14	7,55E-12	0,00E+00	2,59E-14	0,00E+00	7,99E-16	3,77E-15	3,33E-14	1,27E-13	-1,60E-12
AP	mole of H^+ eq.	1,70E-02	2,14E-03	3,34E-03	3,01E-03	3,48E-03	0,00E+00	9,78E-06	0,00E+00	3,40E-05	4,72E-05	1,04E-04	3,55E-04	-3,11E-04
EP-freshwater	kg P eq.	5,87E-06	7,77E-08	3,51E-06	5,09E-08	9,54E-06	0,00E+00	3,29E-06	0,00E+00	1,64E-09	7,73E-09	6,77E-08	1,01E-07	-4,50E-07
EP-marine	kg N eq.	2,08E-03	7,21E-04	1,58E-03	7,24E-04	1,06E-03	0,00E+00	1,49E-05	0,00E+00	1,61E-05	1,89E-05	4,76E-05	9,17E-05	-9,67E-05
EP-terrestrial	mole of N eq.	2,35E-02	7,95E-03	1,73E-02	7,94E-03	1,19E-02	0,00E+00	2,86E-05	0,00E+00	1,77E-04	2,08E-04	5,26E-04	1,01E-03	-1,04E-03
POCP	kg NMVOC eq.	7,43E-03	1,69E-03	4,60E-03	2,06E-03	2,62E-03	0,00E+00	9,62E-06	0,00E+00	4,55E-05	4,51E-05	1,29E-04	2,77E-04	-2,96E-04
ADPE	kg Sb eq.	2,38E-05	3,88E-09	3,66E-05	2,40E-09	6,77E-06	0,00E+00	2,16E-10	0,00E+00	8,37E-11	3,95E-10	2,13E-08	2,31E-09	-1,50E-08
ADPF	MJ	1,01E+02	4,40E+00	7,78E+00	2,92E+00	1,50E+01	0,00E+00	8,33E-02	0,00E+00	9,71E-02	4,59E-01	3,91E-01	6,66E-01	-4,05E+00
WDP	m^3 world eq.	4,30E-01	1,10E-03	3,79E-01	4,58E-04	1,71E-01	0,00E+00	1,05E-03	0,00E+00	1,63E-05	7,68E-05	3,87E-03	5,49E-03	-1,66E-02
Caption	**GWP (tot, fossil, bio and luluc)** = Global Warming Potential total, fossil, biogenic and land use and land use change; **ODP** = Ozone Depletion Potential; **AP** = Acidification Potential; **EP (fresh, marine and terrestrial)** = Eutrophication Potential freshwater, marine and terrestrial; **POCP** = Photochemical Ozone Creation Potential; **ADPE** = Abiotic Depletion Potential (elements, non-fossil resources); **ADPF** = Abiotic Depletion Potential (fossil resources); **WDP** = Water Depletion Potential.													

Resource Use Indicators for 1 m² of ceramic tiles														
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3-B7**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	[MJ]	1,27E+01	4,08E-02	1,75E+01	1,68E-02	0,00E+00	0,00E+00	1,57E-02	0,00E+00	6,27E-04	2,96E-03	3,64E-02	1,09E-01	-1,03E+00
PERM	[MJ]	0,00E+00	0,00E+00	1,93E+00	0,00E+00	-1,93E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PERT	[MJ]	1,27E+01	4,08E-02	1,94E+01	1,68E-02	5,03E+00	0,00E+00	1,57E-02	0,00E+00	6,27E-04	2,96E-03	3,64E-02	1,09E-01	-1,03E+00
PENRE	[MJ]	1,01E+02	4,42E+00	7,45E+00	2,93E+00	1,54E+01	0,00E+00	8,33E-02	0,00E+00	9,75E-02	4,60E-01	3,92E-01	6,67E-01	-4,05E+00
PENRM	[MJ]	0,00E+00	0,00E+00	3,34E-01	0,00E+00	-3,34E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
PENRT	[MJ]	1,01E+02	4,42E+00	7,78E+00	2,93E+00	1,51E+01	0,00E+00	8,33E-02	0,00E+00	9,75E-02	4,60E-01	3,92E-01	6,67E-01	-4,05E+00
SM	[kg]	0,00E+00	0,00E+00	9,54E-02	0,00E+00	6,20E-03	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	7,55E+00
RSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
NRSF	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
FW	[kg]	1,71E-02	5,49E-05	1,08E-02	2,02E-05	5,46E-03	0,00E+00	3,38E-05	0,00E+00	7,29E-07	3,44E-06	1,12E-04	1,68E-04	-8,78E-04
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													

Waste input/output flows for 1 m^2 of ceramic tiles														
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3-B7**	**C1**	**C2**	**C3**	**C4**	**D**
HWD	[kg]	4,35E-08	1,44E-11	2,57E-08	6,70E-12	4,81E-09	0,00E+00	2,67E-12	0,00E+00	1,79E-13	8,48E-13	-1,02E-12	1,45E-11	-1,88E-10
NHWD	[kg]	5,45E-01	4,49E-04	4,69E-01	2,83E-04	5,91E-01	0,00E+00	5,29E-03	0,00E+00	9,71E-06	4,58E-05	1,03E-04	3,33E+00	-3,16E-01
RWD	[kg]	1,60E-03	2,28E-05	6,56E-04	4,39E-06	3,57E-04	0,00E+00	3,28E-06	0,00E+00	1,62E-07	7,67E-07	5,26E-06	7,60E-06	-2,41E-04
CRU	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
MFR	[kg]	0,00E+00	0,00E+00	1,22E-01	0,00E+00	2,35E-02	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	7,77E+00	0,00E+00	0,00E+00
MER	[kg]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	2,63E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EEE	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	7,37E-01	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
EET	[MJ]	0,00E+00	0,00E+00	0,00E+00	0,00E+00	1,10E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00	0,00E+00
Caption	**HWD** = Hazardous waste disposed; **NHWD** = Non-hazardous waste disposed; **RWD** = Radioactive waste disposed; **CRU** = Components for re-use; **MFR** = Materials for recycling; **MER** = Materials for energy recovery; **EEE** = Exported electrical energy; **EET** = Exported thermal energy.													

Additional environmental impact indicators for 1 m² of ceramic tiles														
Indicator	**Unit**	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3-B7**	**C1**	**C2**	**C3**	**C4**	**D**
PM	[Disease incidences]	2,65E-07	2,66E-08	1,58E-07	5,10E-08	9,22E-08	0,00E+00	1,01E-10	0,00E+00	3,86E-10	6,44E-10	1,97E-09	4,36E-09	-6,58E-09
IR	[kBq U235 eq.]	2,19E-01	3,41E-03	2,62E-02	6,42E-04	3,87E-02	0,00E+00	5,11E-04	0,00E+00	2,40E-05	1,13E-04	8,46E-04	8,78E-04	-3,89E-02
ETF-fw	[CTUe]	2,32E+01	3,10E+00	3,55E+00	2,09E+00	5,14E+00	0,00E+00	1,58E-01	0,00E+00	7,00E-02	3,30E-01	2,61E-01	3,60E-01	-9,87E-01
HTP-c	[CTUh]	2,34E-09	5,73E-11	8,21E-10	3,83E-11	4,54E-10	0,00E+00	1,59E-11	0,00E+00	1,29E-12	6,07E-12	5,74E-12	5,59E-11	-7,83E-11
HTP-nc	[CTUh]	1,90E-07	1,84E-09	6,26E-08	1,23E-09	4,33E-08	0,00E+00	1,53E-09	0,00E+00	4,15E-11	1,96E-10	2,09E-10	5,91E-09	-5,02E-09
SQP	[Pt]	1,16E+01	3,94E-02	1,54E+02	1,53E-02	2,35E+01	0,00E+00	1,15E-02	0,00E+00	6,07E-04	2,87E-03	1,05E-01	1,62E-01	-7,42E-01
Caption	**PM** = Particulate matter emissions; **IR** = Ionising radiation, human health; **ETF**= Eco-toxicity (freshwater); **HTP-c** = Human toxicity, cancer effects; **HTP-nc** = Human toxicity, non-cancer effects; **SQP** = Soil quality potential/Land use-related impacts													

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

The functional unit for this study is 1 m^2 of an average installed ceramic tile produced by LAMINAM S.p.A, covering walls and floors in accordance with the normative constraints in terms of installation for 50 year (BNB (2011)).

Packaging material for transport to the installation site (plastic, paper-cardboard, wood, and wax) and additional material for the installation (adhesive mortar) have been considered. Material losses of 6,5% during the installation process (A5 phase) have been considered, so 1 m^2 of tile surface is the net of material losses.

REFERENCE FLOW:

Average data:

Name	Value	Unit
Declared unit	1	m^2
Grammage	5,1	kg/m^2
Conversion factor to 1 kg	0,2	-

Specific data:

Porcelain stoneware slabs	Reference flows (kg/m^2)
Thickness 2 mm	4,8
Thickness 2+ mm	5,1

ASSUMPTIONS:

Where it is not possible to know the precise composition of materials in the supply chain (due to commercial or industrial confidential suppliers' reasons or due to missing datasets), these are approximated with LCIs of similar materials, estimated by the combination of available datasets or reconstructed with literature data. In most cases, a conservative approach has been adopted, overestimating burdens to prove irrelevance. In other cases, proxy data were selected based on scientific experience, to improve the accuracy of the model.

Some materials, like colorants, glaze compounds, inks, and frits, have been used based on composition (instead, for instance, of the single composition of a single colorant) using primary data in terms of absolute quantity and relative percentage of single chemical compound. For these kinds of materials, belonging to the same family (colorant, serigraphy, etc.) where a technical datasheet is not available, the same composition of the other materials of that family compound has been assumed.

Chemical additives have been modelled using compositions available in technical data sheets (in certain safety data sheets).

Quantities of auxiliary materials and packaging of input materials have been estimated according to waste produced by the company of the working group (e.g., lubricating oil, paper/cardboard, wood, plastic packaging, etc). The exact chemical composition of detergent components used for cleaning ceramic tiles depends on user behaviour and the selected supplier. The following assumptions are applied in the current study concerning the composition of detergents:

- Detergents for ordinary cleaning in a water solution are mixed as reported below according to Müller, F. |. (2003):
    - 5% anionic surfactant component: alcohol ethoxy sulfate,
    - 10% non-ionic surfactant component: fatty acid derivate.

For those processes that take place in Italy, electricity Italian residual grid mix was used, instead for those processes for which the place is unknown electricity RER residual grid mix was used.

Below are the emission factors considered for the energy related to production:

- EElectricity (Residual, IT) = 0,562 kg CO_2 eq./kWh
- Electricity (Residual, EU) = 0,416 kg CO_2 eq./kWh
- Thermal Energy from Natural gas = 0,072 kg CO_2 eq./MJ

CUT-OFF CRITERIA:

No cut-offs have been made in the study.

DATA QUALITY:

Geographical, temporal and technological representativeness of primary data:

- **Geographical**: All primary data are collected specifically for the countries/regions studied. Some secondary data represent the German industrial framework or an average European situation. The most important secondary processes for this study, thermal and electrical energy, specifically represent Italian geographical conditions. Processes for which the manufacturing location is unknown (e.g. grinding of some raw materials) use the generic EU28 electricity grid process.
  When country- or region-specific data are not available, surrogate data are used. Geographical representativeness is considered good.
- **Temporal**: All primary data are collected for the year 2025. All secondary data come from the LCA for Expert 2023.2 databases and are representative of the years 2018-2022. Temporal representativeness is good.
- **Technological**: All primary and secondary data are modelled to be specific to the technologies or technology mixes studied. When technology-specific data is not available, surrogate data is used. Technological representativeness is considered good.

PERIOD UNDER REVIEW:

The primary data collected in the study refers to the year 2025.

ALLOCATION:

For all refinery products, the allocation in terms of mass and net calorific value was applied. Two allocation rules are applied:

1. The raw material consumption (crude oil) of the respective steps, which is required for the production of a product or intermediate, is allocated according to the energy (mass of the product * calorific value of the product);
2. The energy consumption (thermal energy, steam, electricity) of a process, e.g. atmospheric distillation, which is required by a product or intermediate, is allocated to the product according to the share of the step's throughput (mass allocation).

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 environmental costs of transporting the packaged product from the production site to the construction site in Italy and Europe are allocated to Module A4. Having no specific information about the distances of the product's distribution, it was decided to follow what is indicated in NF EN 15804+A2/CN (2022). The transportation settings are:

Distribution	Dataset	Distance [km]
National (Italy) – 42,76 % of tiles sold	Truck-trailer, Euro 6 A-C, 34 - 40t gross weight / 27t payload capacity (with a consumption of 2,11E-03 kg diesel/kg)	300
Intracontinental (Europe) – 44,12 % of tiles sold		1390
International – 13,12 % of tiles sold	Bulk commodity carrier, average, deep sea (with a consumption of 1,37E-04 kg HFO/kg)	6520

Installation to the building (A5):

The installation stage options were based on average data from different manufacturers of ceramic tiles in Europe to define which kind and the amounts of materials used EN 17160:2019. For this study, it is assumed that the tiles are installed using 6 kg of cementitious adhesive per 1m^2 of tile, on a worst-case scenario approach. The three options indicated in the EN 17160:2019 were compared based on the total score using the EF3.0 methodology. What emerged is that option 3 (cementitious adhesive) is 10% more impactful than option 2 (mortar, dispersion adhesive and polysulfide) and 70% more impactful than option 1 (mortar and water).
During the installation, there is an average tile scrap production of 6,5%, which is considered in module A5, as well as all the impacts generated by the production of the scrap. For the treatment of packaging waste, the most updated European average scenarios (Eurostat 2020) are used:

Disposal scenarios for packaging materials			
Material	**Recycling (%)**	**Energy recovery (%)**	**Landfill (%)**
Plastic	37,6	38,2	24,2
Paper and board	81,5	9,1	9,4
Wood	31,9	38,9	39,2
Glue-wax*	-	-	100

* Since there are no specific Eurostat statistics for glue or wax packaging, it was decided to consider an end-of-life of 100% landfill, using a conservative approach.

Maintenance (B2):

Over the use modules (B1-B7), only the maintenance module (B2) is considered to generate environmental impacts. During the ceramic tile life cycle, the product has to be regularly cleaned, 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. Thus, the consumption of water and disinfectant chemicals has been taken into account. This scenario is modelled based on EN 17160:2019. The scenario is made as follows:

Name	Value	Unit
Detergent	0,13	ml/m^2
Water	0,2	l/m^2
Cleaning times in 1 year according to periodicity	26	Done once every two weeks
RSL	50	years
Electricity	-	kWh

End-of-life:

The EoL phase starts with the demolition process used for representing the C1 module, where the building deconstruction takes place. This process considers 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. After the demolition stage, ceramic tiles can be crushed and then used in several applications different from ceramic tiles production:

- Road construction in filled embankment;
- Concrete aggregates;
- Aggregates that can be integrated as partial substitutes for natural aggregate in hot mix asphalt;
- Aggregates which can be used in the construction of landfills;

After the demolition, ceramic tiles are transported to the end-of-life processing; this is the C2 module, and it is considered an average distance of 30 km.

The product's end-of-life scenario includes:

- 70% of the product sent for recycling;
- 30% of the product sent to landfill.

The worst-case scenario (landfilling) is modelled by the landfill process where admixtures end their life cycle and no credit allocated to module D is considered. The dataset used for the landfill considers 100 years of deposit.

Benefits and loads beyond the product system boundary:

Module D comprises credits from the recycling of packaging and energy credits from the thermal recovery of packaging. For the treatment of packaging waste, the most updated European average scenarios are used (Eurostat 2020):

Material	Recycle (%)	Incineration with energy recovery (%)	Landfill
Plastic	37,6	38,2	24,2
Paper and cardboard	81,5	9,1	9,4
Wood	31,9	38,9	39,2
Wax	-	-	100

End of life

Laminam products are defined as inert. They do not release any hazardous substance, so it is feasible to reuse them at the end of their life. They can be used as backfill material for construction sites and as filler for roadways, thus reducing the need for quarry gravel.

8. ENVIRONMENT AND HEALTH DURING USE

Volatile Organic Compounds (VOC)

Ceramic slabs have been recognized as inert materials free of harmful emissions. For Laminam materials with fibre, tests are available according to UNI EN ISO 16.000, the current European reference for VOC emissions, carried out at the laboratory 'Catas' whose results confirm that our materials do not emit VOC (Volatile Organic Compounds).

9. REFERENCES

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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
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