kerama-marazzi.com

KERAMA MARAZZI

ENVIRONMENTAL PRODUCT DECLARATION

CERAMIC TILES EN 14411:2016

GLAZED AND UNGLAZED CERAMIC TILES OF MEDIUM SIZE

EPD®

Based on PCR 2012:01
Construction products and construction services, Version 2.32, 2020-07-01
(EN 15804:A1) and SUB PCR Bricks, blocks, tiles, flagstone of clay and siliceous earths (construction product)

Programme: The International EPD® System
www.environdec.com
EPD registered through the fully aligned regional programme/hub:
EPD Russia, www.epdrussia.org
Programme operator:
EPD International AB
Regional hub: EPD Russia
EPD registration number: S-P-01479
Publication date: 2020/10/20
Valid until: 2025/10/19

CONTENTS

1 GENERAL INFORMATION

Programme

The International EPD® System
EPD International AB
Box 210 60
SE-100 31 Stockholm, Sweden
www.environdec.com
info@environdec.com

Manufacturer & owner

KERAMA MARAZZI LLC
Orel city, Italyanskaya St., 5,
302024, Russian Federation
www.kerama-marazzi.com

The EPD owner has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804.

Product category rules (PCR)	**Construction products and construction services, 2012:01, Version 2.32, 2020-07-01, UN CPC 3731**
PCR review was conducted by	**The Technical Committee of the International EPD® System** **Review chair: Massimo Marino** **Contact via: info@environdec.com**
Independent third-party verification of the declaration and data, according to ISO 14025:2006:	☐ **EPD process certification** ☑ **EPD verification**
Declaration issued	**2020/10/20**
Valid until	**2025/10/19**
Third party verifier	**Certiquality S.r.l.** **Via Gaetano Giardino, 4, 20123, Milan Headquarter** **Number of accreditation: 003H rev15** **www.certiquality.it**
Procedure for follow-up of data during EPD validity involves third party verifier	☑ **Yes** ☐ **No**
LCA prepared by	**EcoStandard Group** **Perevedenovskij per., 13/16, 105082, Moscow** **www.ecostandardgroup.ru** **LCA expert: Alina Vigovskaya** **vigovskaya.a@ecostandard.ru**

2 COMPANY

Manufacturer & owner of the EPD

KERAMA MARAZZI LLC
Orel city, Italyanskaya st., 5,
302024, Russian Federation
www.kerama-marazzi.com
+7 495 795-00-45

Further information regarding the project report of the LCA study for ceramic tiles manufactured by KERAMA MARAZZI LLC might be requested. To access this data, please contact the manufacturer.

Name and location of production site

Production in Orel
Orel city, Italyanskaya st., 5,
302024, Russian Federation

Production in Malino
Moscow region, Stupinskij region,
Rabochy p. Malino,
the main way of the railway
«Bekasovo-Voskresensk» 336 km,
estate 3, building 1, POB 571,
142850, Russian Federation

Description of the organization

KERAMA MARAZZI is a leading manufacturer of ceramic decorative and finishing materials with a well-developed mono-brand retail network in Russia and abroad. The history of the company dates back to 1988, when the modern ceramic industry was in its infancy.

KERAMA MARAZZI is an example of long-standing and fruitful relations between Italy and Russia. The company represents Italian solutions and creative approach to designing ceramic items that are popular throughout the world and Russia's enormous potential, production capacity, and personnel. The high quality of KERAMA MARAZZI products, their compliance with Russian and international standards, norms and technical requirements are confirmed with appropriate certificates, technical approvals, and expert reports.

In 2013, Italian Institute CERTIQUALITY (Milan) issued the CERTIQUALITY-UNI EN 14411 certificate and the KEYMARK 023 conformity mark for KERAMA MARAZZI products. As part of the certification, the control over compliance with production technologies (including elements of ISO 9001 quality management system) was evaluated at the enterprises in Orel and in Malino, Moscow region.

The CERTIQUALITY-UNI EN 14411:2016 certificate and the KEYMARK 023 conformity mark confirm the high quality of KERAMA MARAZZI products, their full compliance with the unified European standards and technical characteristics, as well as their safety for humans and the environment.

The technical certificate (TS) issued by the Ministry of regional development of the Russian Federation confirms the suitability of KERAMA MARAZZI products, including large — format stoneware tiles, for facing the exterior walls of buildings and structures for various purposes, including in the structures of hinged facade systems for «visible» (klyammers) and hidden (collet anchors) method of fixing tiles, on the territory of Russia.

LEED, Leadership in Energy and Environmental Design: several series of KERAMA MARAZZI porcelain gres contain at least 10% of recycled material, complying with DT 55 ED 02 100915, certified by Certiquality with certificate N P2181.

KERAMA MARAZZI is a member of Green Building Council Russia that supports the develepment of constrution process aspects from ecologic design to energy-saving technologies imlementation.

KERAMA MARAZZI is certified with GOST R Certificate that confirms the quality of the products manufactured and compliance with standards applied for and the requirements of Russian Federation.

Products of KERAMA MARAZZI are VOC free according the UNI EN ISO 1600-9:2006.

The high standards

The high standards of KERAMA MARAZZI production are achieved by taking special care of each stage of the production flow: from the extration of the finest clays from our quarries to the selection of raw material components from the top sites worldwide. Throughout the manufacturing process control, our specialists carefully monitor the purity of compounds, ensure adequate conditions for the processing of semi-products.

To guarantee its ceramics glazing characteristics, KERAMA MARAZZI has been also manufacturing frit in-house since 1992, ensuring a direct quality control of the supply chain and obtain the highest-purity semi-product, thus manufacturing a glaze of superb quality.

KERAMA MARAZZI products fully comply with both Russian and European standards, granting a strict Factory Production Control throughout a daily system of check-points at all phases, audited regularly by independent third parts, such as Centro Ceramico and Test center «Opytnoye» of the Moscow regional public institution «Regional certification center» «Opytnoye», according with requirements of the normatives, and our strict in-house standards, for which the production is certified.

3 PRODUCT INFORMATION

Product name

The products are produced according to European standard EN 14411:2016 Ceramic tiles – Definition, classification, characteristics, assessment and verification of constancy of performance and marking.

UN CPC code

3731

Geographical scope

Russia, Europe and Asia

Product description

The EPD describes the environmental information based on a life cycle assessment of the tiles: BIa type (glazed and unglazed), BIII type. The stoneware tiles (BIa, glazed and unglazed) are produced at the production sites in Orel and Malino (Moscow region). The ceramic tile (BIII, glazed) is produced only at the production site in Orel.

The intended use of the product is surface covering. The versatility of the ceramic tile allows the installation in different environments such as homes, offices, shops, restaurants, hospitals, and etc., both indoor and outdoor, for walls and floors cladding. BIII type tiles are, in particular, intended for the tiling of interior walls, which are not exposed to climatic effects. This type of tiles is suitable for tiling walls in kitchens, bathrooms, and other premises.

The table below introduces the weight values for different types of ceramic tiles. For further information, please, request the manufacturer's technical data sheet on the model required.

Type of ceramic tile	Weight per 1 m², kg
Production in Orel	
BIa (glazed)	20.16
BIa (unglazed)	20.16
BIII (glazed)	13.74
Production in Malino	
BIa (glazed)	22.75
BIa (unglazed)	22.75

Product components

None of the end-product components are included in the Candidate List of substances of very high concern for authorization.

The table below shows the component composition by product group (EN 14411:2016)

	BIa		BIII	
RAW MATERIALS				
Clay	**44%**		Clay	**68%**
Feldspar	**43%**		Limestone	**16%**
Kaolin	**8%**		Feldspar	**8%**
Quartz sand	**5%**		Sand	**8%**
GLAZE COMPONENTS				
Clay			Clay	
Quartz			Quartz	
Feldspar			Feldspar	
Kaolin			Kaolin	
Frit			Frit	
GENERAL ADDITIVES				
Dispersing agent			Dispersing agent	
Diluents			Diluents	
Binding material			Binding material	
Coloring materials			Coloring materials	

Zirconium silicate gives glaze its white colour

Mineral components increase whiteness

Finished glaze, high density solution as its consistency

Feldspar, the main component or frit production

Frit is melted at 1450 °C

Produced glass-like granules are used to make glaze

TECHNICAL DATA BIa TYPE

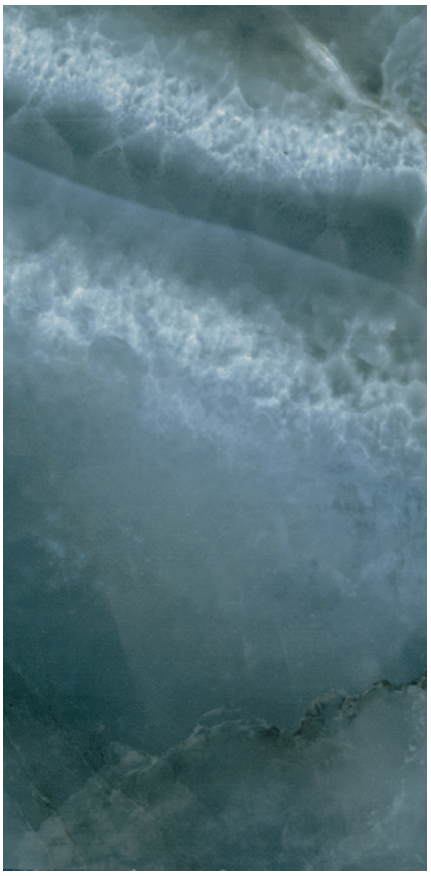
Technical features	Testing method	Measurement unit	Average actual values	Normative values	Reference standard
Water absorption	ISO 10545-3 GOST 27180	%	0.08	Eb ≤ 0.5	EN 14411:2016 Bla TC 23.31.10-012-04693313-2017
Breaking strength	ISO 10545-4 GOST 27180	N	> 1800 > 1300	min 1300 for thickness of the tile ≥ 7.5 mm min 700 for thickness of the tile < 7.5 mm	EN 14411:2016 Bla
Modulus of rupture	ISO 10545-4 GOST 27180	N/mm²	≥ 45–N ≥ 15 cm ≥ 40–7cm ≤ N < 15 cm	≥ 35	EN 14411:2016 Bla TC 23.31.10-012-04693313-2017
Resistance to deep abrasion (UGL)	ISO 10545-6	mm³	≤ 145	≤ 175	EN 14411:2016 Bla TC 23.31.10-012-04693313-2017
Wear resistance of the surface (degree of wear resistance PEI) (GL)	ISO 10545-7	class	by catalog	1–4	EN 14411:2016 Bla TC 23.31.10-012-04693313-2017
Thermal expansion coefficient	ISO 10545-8 GOST 27180	x10-6 °C-1	≤ 9	value declared	EN 14411:2016 Bla
Thermal shock resistance	ISO 10545-9		satisfy	passed ISO 10545-1	EN 14411:2016 Bla
Frost resistance	ISO 10545-12 GOST 27180	cycles	150	passed ISO 10545-1 ≥ 150	EN 14411:2016 Bla TC 23.31.10-012-04693313-2017
Resistance to chemicals for household use and swimming pool salts	ISO 10545-13	class	A	min B	EN 14411:2016 Bla
Resistance to low concentration acids and bases	ISO 10545-13	class	LA	value declared	EN 14411:2016 Bla
Stain resistance	ISO 10545-14	class	satisfy	min 3 (GL) value declared (UGL)	EN 14411:2016 Bla
Friction coefficient	B.C.R.		μ > 0.4	μ > 0.4	D.D. Nº236 14/6/89
Skid resistance	RAMP		by catalog	R9–R13 ABC	DIN 51130 DIN 51097
Anti-slip properties	DIN 51130	Request for the manufacturer's technical sheet according to the model			
Impact resistance	ISO 10545-5	Complies			

TECHNICAL DATA BIII TYPE

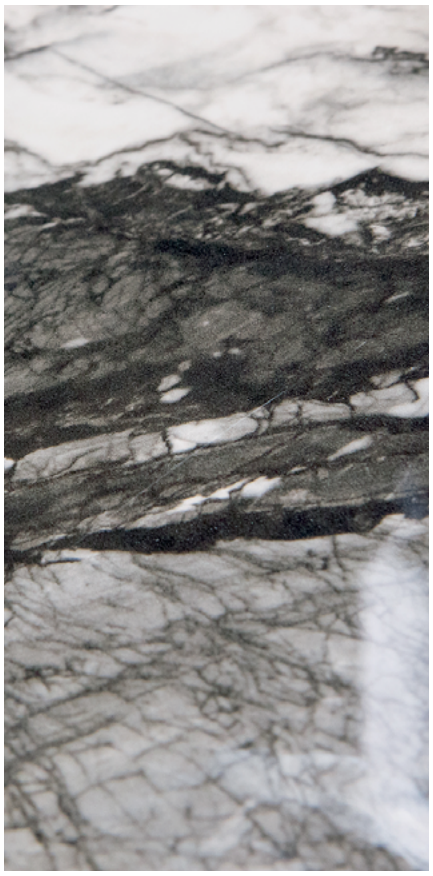
Technical features	Testing method	Measurement unit	Average actual values	Normative values	Reference standard
Water absorption	ISO 10545-3 GOST 27180	%	15.7	Eb > 10% less than 24%	EN 14411:2016 BIII GOST 6141-91
Breaking strength	ISO 10545-4 GOST 27180	N	> 630	min 600 for thickness of the tile ≥ 7.5 mm min 200 for thickness of the tile < 7.5 mm	EN 14411:2016 BIII
Modulus of rupture	ISO 10545-4 GOST 27180	N/mm²	≥ 20	min 12 for thickness of the tile ≥ 7.5 mm min 15 for thickness of the tile < 7.5 mm more than 15	EN 14411:2016 BIII GOST 6141-91
Thermal shock resistance	ISO 10545-9		satisfy	passed ISO 10545-9	EN 14411:2016 BIII
Crazing resistance	ISO 10545-11 ГОСТ 27180		resist	passed ISO 10545-11 resistant to GOST 27180	EN 14411:2016 BIII GOST 6141-91
Resistance to chemicals for household use and swimming pool salts	ISO 10545-13 GOST 27180	class	A resist	min B resistant to solution No. 3	EN 14411:2016 BIII GOST 6141-91
Stain resistance	ISO 10545-14	class	satisfy	min 3 (GL)	EN 14411:2016 BIII
Anti-slip properties	DIN 51130	Request for the manufacturer's technical sheet according to the model			
Impact resistance	ISO 10545-5	Complies			

TECHNICAL DATA BIa TYPE

matt



glossy



glossy

TECHNICAL DATA BIII TYPE

matt

matt

glossy

4 LIFE CYCLE ASSESSMENT CONSIDERATIONS

Functional unit

The functional unit is: 1 m² covering of a surface for 50 years with ceramic tiles (water absorption groups BIa, BIII).

Reference service life

The reference service life (RSL) of the product is the same as that of the building where it is installed. Ceramic tile is a durable product that does not require replacement. RSL of 50 years is considered in this study.

Time representativeness

The inventory for LCA study is based on 2019 production figures for ceramic tiles manufactured at the production plants in Orel and Malino, Moscow region.

System boundary

This Life Cycle Assessment is «Cradle-to-grave». The LCA takes into consideration the following Life Cycle stages: A1, A2, A3, A4, A5, B2, B3, B4, B5, C1, C2, C3, C4.

PRODUCT STAGE	A1 — Raw material supply	X
	A2 — Raw material transport	X
	A3 — Manufacturing	X
	• Raw materials preparation milling • Spray dryring • Forming • Drying • Glazing and decoration • Firing • Sorting • Packaging and storage	
CONSTRUCTION PROCESS STAGE	A4 — Transport to the building	X
	A5 — Construction, installation	X
USE STAGE	B1 — Use	**NR**
	B2 — Maintenance	X
	B3 — Repair	X
	B4 — Replacement	X
	B5 — Refurbishment	X
	B6 — Operational energy use	**NR**
	B7 — Operational water use	**NR**
END-OF-LIFE	C1 — Deconstruction, demolition	X
	C2 — Transport	X
	C3 — Waste processing	X
	C4 — Disposal	X
Benefits and loads beyond the system boundaries	D — Reuse, Recovery, Re-cycling potential	**MND**

X — Included in LCA **NR** — Not relevant **MND** — Module not declared

Life cycle description

A1—A2
PRODUCT STAGE
RAW MATERIALS SUPPLY & TRANSPORT

BIa type

The primary materials for the BIa type tiles are clay, feldspar, kaolin, quartz sand and a thin layer of decorative materials (for glazed tiles). Basic raw materials are extracted in Russia, Ukraine and Turkey. These materials are transported by railway, road, and from Turkey the raw materials are delivered, partly, by sea.

BIII type

The primary materials for the BIII type tiles are clay, limestone, sand, feldspar, and a thin layer of decorative materials. All basic raw materials are extracted in Russia. These materials are transported to the factory by trucks.

The decorative materials, used in the production of ceramic tiles BIa and BIII types for glazing are quartz, kaolin, feldspar, glaze, frit, zircon, clay, alumina, calcium carbonate, pigments, and additives such as suspending agents, deflocculants, and binders.

For A2 stage the transportation of main packaging materials is considered. The main packaging materials are: corrugated box, wooden pallet, cardboard lining, packing tape, and polyethylene film.

Also for A2 stage the internal transportation is included, introduced by the amount of diesel fuel consumption.

A3
PRODUCT STAGE
RAW MATERIALS MANUFACTURING

Ceramic tiles of BIa type, Orel, Malino

The first stage of production is the preparation of spray-dried granules.
Raw materials mixed according to the technological card are delivered to the batch mill. Water is dosed into the mill. Alubit balls are used as grinding bodies. After the mill the slip with certain parameters is pumped to the flow tanks, from where it is then delivered to atomizer, which operates on natural gas. The spray-dried granules after atomizer are delivered to storage (for 24–36 hours) using a conveyor belt or pneumatic transport.

The second stage is pressing. The spray-dried granules are pressed on hydraulic press. After pressing, the product is sent to the horizontal roller dryers for drying. As a result of the drying process most of the water contained in the newly pressed tile is removed.

After pressing and drying, the tile is sent to the glazing area. Tiles from the glazing line are delivered to the storage warehouse from where they go to industrial furnace. The maximum temperature in the firing zone reaches 1220 °C.

Sorted stoneware tiles are automatically packed in boxes by grades and calibers. The pallet is provided with a packing list, tied with a tape, covered with a polyethylene bag and passes through a shrink oven, after which it is sent to the temporary storage site of end-products, and then to the existing warehouse.

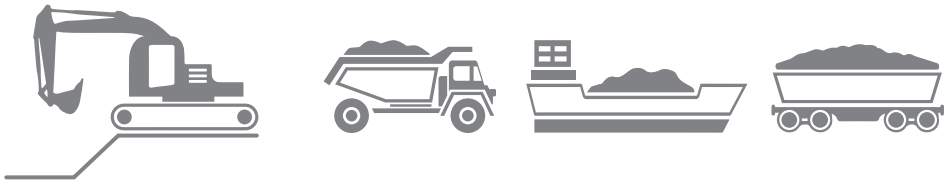
Ceramic tiles of BIII type, Orel

A distinctive feature of the production of ceramic tiles BIII type is double firing. The second furnace is designed for firing the glaze coating of wall facing tiles.

The production of this type of tiles can be hereby divided into four sections: section of presses, section of furnace, glazing section, sorting (cutting).

TECHNICAL DATA BIa TYPE

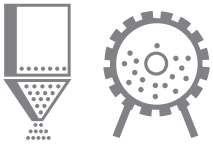
→ 1 Quarry



→ 2 Clay receiving tank

→ 3 Clay storage building

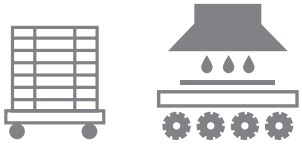
→ 4 Mixing & Atomization



→ 5 Press

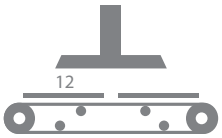
→ 6 Dryer

→ 7 Glazing



→ 8 Kiln

→ 9 Sorting

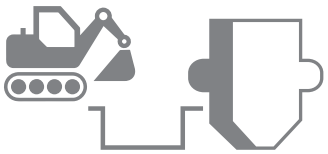


→ 10 Packaging

TECHNICAL DATA BIII TYPE

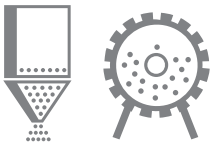
→ 1 Quarry

→ 2 Clay receiving tank



→ 3 Clay storage building

→ 4 Mixing & Atomization



→ 5 Press

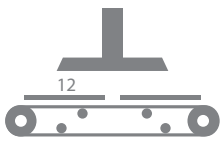
→ 6 Dryer

→ 7 Kiln

→ 8 Glazing

→ 9 Kiln

→ 10 Sorting



→ 11 Packaging

A4
CONSTRUCTION PROCESS STAGE
TRANSPORT TO THE CONSTRUCTION SITE

BIa type production in Orel

85% Russia | **8%** Rest of the world | **5%** Europe | **2%** Scandinavia

BIII type production in Orel

83% Russia | **8%** Rest of the world | **7%** Europe | **2%** Scandinavia

BIa type production in Malino

86% Russia | **7%** Rest of the world | **5%** Europe | **2%** Scandinavia

For road transport, a freight >32 metric ton, EURO6, is considered.
For transportation of products by sea, a container ship is considered.

A5
CONSTRUCTION PROCESS STAGE
CONSTRUCTION INSTALLATION

For the treatment of packaging waste the following scenario is used: cardboard and wood packaging waste goes to the sorting point for further recycling; plastics packaging waste goes to the landfill. The distance between the construction site and the sorting point is assumed to be 30 km. The distance between the construction site and the landfill is assumed to be 50 km. It is considered a 3% (in mass) wastage of the product during the installation.

In this study it is considered that the tiles are installed using cement mortar.

BIa	Cement mortar	3.5 kg/m²
	Water	0.0008 m³/m²
BIII	Cement mortar	2.5 kg/m²
	Water	0.0006 m³/m²

B1
USE STAGE
USE

Use stage concerns emissions into environment.
B1 module is not relevant for this product.

B2
USE STAGE
MAINTENANCE

Ceramic covering products shall be cleaned regularly, depending on the type of building: residential, commercial, healthcare. Therefore, the consumption of water and detergent has been considered. The values declared refer to a time period of 50 years.

Residential use scenario: 0,0002 liter of detergent and 0,1 liter of water are used to wash 1 m^2 of ceramic tiles once a week for flooring and every three months for wall coverings. This scenario is based on self-declaration of KERAMA MARAZZI — the manufacturer of ceramic tiles

B3–B5
USE STAGE
REPAIR
REPLACEMENT
REFURBISHMENT

Ceramic tiles require no repairing, replacement or refurbishment during the use stage and therefore no impacts are declared in B3–B5 modules.

B6–B7
USE STAGE
OPERATIONAL ENERGY USE
OPERATIONAL WATER USE

Operational energy use and operational water use are not relevant for this product.

C1
END OF LIFE STAGE
DECONSTRUCTION / DEMOLITION

Deconstruction or demolition at the end of RSL is usually conducted with a selective deconstruction/demolition.

The environmental impacts associated with the product during demolition are very low and therefore can be neglected.

C2
END OF LIFE STAGE
TRANSPORT

The product wastes are transported to the landfill in a truck (16-32 metric ton) according to EURO 4 standard. The assumed average distance from the container to the landfill is 50 km. A truck return trip (100% empty returns) is also included.

C3
END OF LIFE STAGE
WASTE PROCESSING

100% of demolished material is sent to the landfill. The environmental impacts generated during the C3 stage are very low and therefore can be neglected.

C4
END OF LIFE STAGE
DISPOSAL

After domestic usage, 100% of demolished material is treated at the controlled landfill.

5 RESULTS OF THE LIFE CYCLE ASSESSMENT

The LCA was developed with the LCA software OpenLCA and the latest version of the ecoinvent database: ecoinvent 3.6 (Cut-Off System Model). The characterization factors used are the factors included within the standard EN 15804:2012+A1:2013. This EPD includes the results of BIa and BIII types separately for glazed and unglazed tiles, for two production sites (Orel and Malino, Moscow region).

Environmental impact for 1 m² of Ceramic tiles, produced in Orel

BIa TYPE GLAZED

Parameter	Unit	A1–A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Abiotic depletion	kg Sb eq	3.07E-04	3.77E-05	1.79E-05	NR	1.50E-04	0	0	0	NR	NR	0	4.60E-06	0	2.27E-06	MND
Abiotic depletion (fossil fuels)	MJ	1.50E+02	3.08E+01	1.02E+01	NR	1.33E+01	0	0	0	NR	NR	0	2.54E+00	0	4.88E+00	MND
Acidification	kg SO_2 eq	3.57E-02	4.26E-03	3.46E-03	NR	8.21E-03	0	0	0	NR	NR	0	6.76E-04	0	1.38E-03	MND
Eutrophication	kg $(PO_4)^3$ eq	1.27E-02	7.49E-04	1.21E-03	NR	2.65E-03	0	0	0	NR	NR	0	1.61E-04	0	4.52E-04	MND
Global warming (GWP100a)	kg CO_2 eq	1.02E+01	2.09E+00	1.16E+00	NR	1.31E+00	0	0	0	NR	NR	0	1.72E-01	0	2.10E-01	MND
Ozone layer depletion (ODP)	kg CFC-11 eq	9.77E-07	3.87E-07	8.60E-08	NR	2.08E-07	0	0	0	NR	NR	0	3.02E-08	0	5.27E-08	MND
Photochemical oxidation	kg C_2H_4 eq	2.05E-03	2.18E-04	1.75E-04	NR	4.10E-04	0	0	0	NR	NR	0	2.35E-05	0	5.70E-05	MND

BIa TYPE UNGLAZED

Parameter	Unit	A1–A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Abiotic depletion	kg Sb eq	8.60E-05	3.77E-05	1.12E-05	NR	1.50E-04	0	0	0	NR	NR	0	4.60E-06	0	2.27E-06	MND
Abiotic depletion (fossil fuels)	MJ	1.43E+02	3.08E+01	9.98E+00	NR	1.33E+01	0	0	0	NR	NR	0	2.54E+00	0	4.88E+00	MND
Acidification	kg SO_2 eq	3.17E-02	4.26E-03	3.34E-03	NR	8.21E-03	0	0	0	NR	NR	0	6.76E-04	0	1.38E-03	MND
Eutrophication	kg $(PO_4)^3$ eq	1.15E-02	7.49E-04	1.17E-03	NR	2.65E-03	0	0	0	NR	NR	0	1.61E-04	0	4.52E-04	MND
Global warming (GWP100a)	kg CO_2 eq	9.56E+00	2.09E+00	1.14E+00	NR	1.31E+00	0	0	0	NR	NR	0	1.72E-01	0	2.10E-01	MND
Ozone layer depletion (ODP)	kg CFC-11 eq	9.02E-07	3.87E-07	8.37E-08	NR	2.08E-07	0	0	0	NR	NR	0	3.02E-08	0	5.27E-08	MND
Photochemical oxidation	kg C_2H_4 eq	1.86E-03	2.18E-04	1.70E-04	NR	4.10E-04	0	0	0	NR	NR	0	2.35E-05	0	5.70E-05	MND

BIII TYPE GLAZED

Parameter	Unit	A1–A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Abiotic depletion	kg Sb eq	5.59E-04	2.97E-05	2.31E-05	NR	1.17E-05	0	0	0	NR	NR	0	3.13E-06	0	1.55E-06	MND
Abiotic depletion (fossil fuels)	MJ	1.17E+02	2.42E+01	7.64E+00	NR	1.04E+00	0	0	0	NR	NR	0	1.73E+00	0	3.33E+00	MND
Acidification	kg SO_2 eq	2.84E-02	3.32E-03	2.57E-03	NR	6.40E-04	0	0	0	NR	NR	0	4.60E-04	0	9.38E-04	MND
Eutrophication	kg $(PO_4)^3$ eq	9.49E-03	5.86E-04	8.86E-04	NR	2.10E-04	0	0	0	NR	NR	0	1.09E-04	0	3.08E-04	MND
Global warming (GWP100a)	kg CO_2 eq	8.07E+00	1.65E+00	8.61E-01	NR	1.02E-01	0	0	0	NR	NR	0	1.17E-01	0	1.43E-01	MND
Ozone layer depletion (ODP)	kg CFC-11 eq	7.87E-07	3.05E-07	6.52E-08	NR	1.62E-08	0	0	0	NR	NR	0	2.06E-08	0	3.59E-08	MND
Photochemical oxidation	kg C_2H_4 eq	1.47E-03	1.71E-04	1.26E-04	NR	3.19E-05	0	0	0	NR	NR	0	1.60E-05	0	3.88E-05	MND

Environmental impact for 1 m² of Ceramic tiles, produced in Malino

BIa TYPE GLAZED

Parameter	Unit	A1–A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Abiotic depletion	kg Sb eq	2.52E-04	3.99E-05	1.63E-05	NR	1.50E-04	0	0	0	NR	NR	0	5.19E-06	0	2.56E-06	MND
Abiotic depletion (fossil fuels)	MJ	1.96E+02	3.25E+01	1.16E+01	NR	1.33E+01	0	0	0	NR	NR	0	2.87E+00	0	5.51E+00	MND
Acidification	kg SO_2 eq	5.37E-02	4.46E-03	4.01E-03	NR	8.21E-03	0	0	0	NR	NR	0	7.62E-04	0	1.55E-03	MND
Eutrophication	kg $(PO_4)^3$ eq	1.88E-02	7.87E-04	1.32E-03	NR	2.65E-03	0	0	0	NR	NR	0	1.81E-04	0	5.10E-04	MND
Global warming (GWP100a)	kg CO_2 eq	1.40E+01	2.21E+00	1.28E+00	NR	1.31E+00	0	0	0	NR	NR	0	1.94E-01	0	2.37E-01	MND
Ozone layer depletion (ODP)	kg CFC-11 eq	1.33E-06	4.09E-07	9.74E-08	NR	2.08E-07	0	0	0	NR	NR	0	3.41E-08	0	5.94E-08	MND
Photochemical oxidation	kg C_2H_4 eq	2.46E-03	2.30E-04	1.88E-04	NR	4.10E-04	0	0	0	NR	NR	0	2.65E-05	0	6.43E-05	MND

BIa TYPE UNGLAZED

Parameter	Unit	A1–A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Abiotic depletion	kg Sb eq	1.17E-04	3.99E-05	1.22E-05	NR	1.50E-04	0	0	0	NR	NR	0	5.19E-06	0	2.56E-06	MND
Abiotic depletion (fossil fuels)	MJ	1.89E+02	3.25E+01	1.14E+01	NR	1.33E+01	0	0	0	NR	NR	0	2.87E+00	0	5.51E+00	MND
Acidification	kg SO_2 eq	4.95E-02	4.46E-03	3.89E-03	NR	8.21E-03	0	0	0	NR	NR	0	7.62E-04	0	1.55E-03	MND
Eutrophication	kg $(PO_4)^3$ eq	1.75E-02	7.87E-04	1.29E-03	NR	2.65E-03	0	0	0	NR	NR	0	1.81E-04	0	5.10E-04	MND
Global warming (GWP100a)	kg CO_2 eq	1.34E+01	2.21E+00	1.26E+00	NR	1.31E+00	0	0	0	NR	NR	0	1.94E-01	0	2.37E-01	MND
Ozone layer depletion (ODP)	kg CFC-11 eq	1.26E-06	4.09E-07	9.53E-08	NR	2.08E-07	0	0	0	NR	NR	0	3.41E-08	0	5.94E-08	MND
Photochemical oxidation	kg C_2H_4 eq	2.26E-03	2.30E-04	1.82E-04	NR	4.10E-04	0	0	0	NR	NR	0	2.65E-05	0	6.43E-05	MND

Resource use for 1 m² of Ceramic tiles, produced in Orel

BIa TYPE GLAZED

Parameter	Unit	A1–A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Renewable primary energy as energy source	MJ	1.38E+01	2.38E-01	1.56E+00	NR	1.24E+00	0	0	0	NR	NR	0	2.88E-02	0	8.16E-02	MND
Renewable primary energy as the use of material	MJ	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Total use of renewable energy resources	MJ	1.38E+01	2.38E-01	1.56E+00	NR	1.24E+00	0	0	0	NR	NR	0	2.88E-02	0	8.16E-02	MND
Non-renewable primary energy as energy source	MJ	1.80E+02	3.33E+01	1.22E+01	NR	1.59E+01	0	0	0	NR	NR	0	2.73E+00	0	5.30E+00	MND
Non-renewable primary energy as the use of material	MJ	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Total use of non-renewable energy resources	MJ	1.80E+02	3.33E+01	1.22E+01	NR	1.59E+01	0	0	0	NR	NR	0	2.73E+00	0	5.30E+00	MND
Use of secondary material	kg	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Use of renewable secondary fuel	MJ	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Use of non-renewable secondary fuel	MJ	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Net use of fresh water	m³	1.48E-01	1.34E-03	9.41E-03	NR	2.84E-01	0	0	0	NR	NR	0	2.85E-04	0	5.24E-03	MND

BIa TYPE UNGLAZED

Parameter	Unit	A1–A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Renewable primary energy as energy source	MJ	1.33E+01	2.38E-01	1.55E+00	NR	1.24E+00	0	0	0	NR	NR	0	2.88E-02	0	8.16E-02	MND
Renewable primary energy as the use of material	MJ	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Total use of renewable energy resources	MJ	1.33E+01	2.38E-01	1.55E+00	NR	1.24E+00	0	0	0	NR	NR	0	2.88E-02	0	8.16E-02	MND
Non-renewable primary energy as energy source	MJ	1.73E+02	3.33E+01	1.20E+01	NR	1.59E+01	0	0	0	NR	NR	0	2.73E+00	0	5.30E+00	MND
Non-renewable primary energy as the use of material	MJ	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Total use of non-renewable energy resources	MJ	1.73E+02	3.33E+01	1.20E+01	NR	1.59E+01	0	0	0	NR	NR	0	2.73E+00	0	5.30E+00	MND
Use of secondary material	kg	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Use of renewable secondary fuel	MJ	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Use of non-renewable secondary fuel	MJ	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Net use of fresh water	m³	1.36E-01	1.34E-03	9.04E-03	NR	2.84E-01	0	0	0	NR	NR	0	2.85E-04	0	5.24E-03	MND

BIII TYPE GLAZED

Parameter	Unit	A1–A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Renewable primary energy as energy source	MJ	1.11E+01	1.86E-01	1.15E+00	NR	9.62E-02	0	0	0	NR	NR	0	1.96E-02	0	5.56E-02	MND
Renewable primary energy as the use of material	MJ	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Total use of renewable energy resources	MJ	1.11E+01	1.86E-01	1.15E+00	NR	9.62E-02	0	0	0	NR	NR	0	1.96E-02	0	5.56E-02	MND
Non-renewable primary energy as energy source	MJ	1.39E+02	2.60E+01	9.13E+00	NR	1.24E+00	0	0	0	NR	NR	0	1.86E+00	0	3.61E+00	MND
Non-renewable primary energy as the use of material	MJ	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Total use of non-renewable energy resources	MJ	1.39E+02	2.60E+01	9.13E+00	NR	1.24E+00	0	0	0	NR	NR	0	1.86E+00	0	3.61E+00	MND
Use of secondary material	kg	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Use of renewable secondary fuel	MJ	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Use of non-renewable secondary fuel	MJ	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Net use of fresh water	m^3	9.67E-02	1.05E-03	6.48E-03	NR	2.21E-02	0	0	0	NR	NR	0	1.94E-04	0	3.57E-03	MND

Resource use for 1 m² of Ceramic tiles, produced in Malino

BIa TYPE GLAZED

Parameter	Unit	A1–A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Renewable primary energy as energy source	MJ	1.74E+01	2.49E-01	1.67E+00	NR	1.24E+00	0	0	0	NR	NR	0	3.25E-02	0	9.21E-02	MND
Renewable primary energy as the use of material	MJ	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Total use of renewable energy resources	MJ	1.74E+01	2.49E-01	1.67E+00	NR	1.24E+00	0	0	0	NR	NR	0	3.25E-02	0	9.21E-02	MND
Non-renewable primary energy as energy source	MJ	2.36E+02	3.48E+01	1.40E+01	NR	1.59E+01	0	0	0	NR	NR	0	3.09E+00	0	5.98E+00	MND
Non-renewable primary energy as the use of material	MJ	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Total use of non-renewable energy resources	MJ	2.36E+02	3.48E+01	1.40E+01	NR	1.59E+01	0	0	0	NR	NR	0	3.09E+00	0	5.98E+00	MND
Use of secondary material	kg	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Use of renewable secondary fuel	MJ	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Use of non-renewable secondary fuel	MJ	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Net use of fresh water	m³	1.67E-01	1.40E-03	9.99E-03	NR	2.84E-01	0	0	0	NR	NR	0	3.21E-04	0	5.92E-03	MND

BIa TYPE UNGLAZED

Parameter	Unit	A1–A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Renewable primary energy as energy source	MJ	1.65E+01	2.49E-01	1.64E+00	NR	1.24E+00	0	0	0	NR	NR	0	3.25E-02	0	9.21E-02	MND
Renewable primary energy as the use of material	MJ	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Total use of renewable energy resources	MJ	1.65E+01	2.49E-01	1.64E+00	NR	1.24E+00	0	0	0	NR	NR	0	3.25E-02	0	9.21E-02	MND
Non-renewable primary energy as energy source	MJ	2.29E+02	3.48E+01	1.38E+01	NR	1.59E+01	0	0	0	NR	NR	0	3.09E+00	0	5.98E+00	MND
Non-renewable primary energy as the use of material	MJ	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Total use of non-renewable energy resources	MJ	2.29E+02	3.48E+01	1.38E+01	NR	1.59E+01	0	0	0	NR	NR	0	3.09E+00	0	5.98E+00	MND
Use of secondary material	kg	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Use of renewable secondary fuel	MJ	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Use of non-renewable secondary fuel	MJ	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Net use of fresh water	m³	1.54E-01	1.40E-03	9.61E-03	NR	2.84E-01	0	0	0	NR	NR	0	3.21E-04	0	5.92E-03	MND

Output flows and waste categories for 1 m² of Ceramic tiles, produced in Orel

BIa TYPE GLAZED

Parameter	Unit	A1–A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Hazardous waste disposed	kg	3.22E-04	8.80E-05	2.21E-05	NR	3.03E-05	0	0	0	NR	NR	0	6.79E-06	0	7.65E-06	MND
Non-hazardous waste disposed	kg	2.53E+00	2.71E-02	8.07E-01	NR	2.39E-01	0	0	0	NR	NR	0	1.22E-01	0	2.02E+01	MND
Radioactive waste disposed	kg	3.07E-04	2.18E-04	4.82E-05	NR	4.56E-05	0	0	0	NR	NR	0	1.69E-05	0	2.99E-05	MND
Components for re-use	kg	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Materials for recycling	kg	4.62E-02	0	1.15E+00	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Materials for energy recovery	kg	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Exported energy	MJ	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND

BIa TYPE UNGLAZED

Parameter	Unit	A1–A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Hazardous waste disposed	kg	3.03E-04	8.80E-05	2.15E-05	NR	3.03E-05	0	0	0	NR	NR	0	6.79E-06	0	7.65E-06	MND
Non-hazardous waste disposed	kg	2.41E+00	2.71E-02	8.03E-01	NR	2.39E-01	0	0	0	NR	NR	0	1.22E-01	0	2.02E+01	MND
Radioactive waste disposed	kg	2.87E-04	2.18E-04	4.76E-05	NR	4.56E-05	0	0	0	NR	NR	0	1.69E-05	0	2.99E-05	MND
Components for re-use	kg	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Materials for recycling	kg	4.62E-02	0	1.15E+00	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Materials for energy recovery	kg	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Exported energy	MJ	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND

BIII TYPE GLAZED

Parameter	Unit	A1–A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Hazardous waste disposed	kg	2.52E-04	6.94E-05	1.67E-05	NR	2.36E-06	0	0	0	NR	NR	0	4.63E-06	0	5.22E-06	MND
Non-hazardous waste disposed	kg	9.78E-01	2.13E-02	5.34E-01	NR	1.86E-02	0	0	0	NR	NR	0	8.29E-02	0	1.38E+01	MND
Radioactive waste disposed	kg	2.19E-04	1.71E-04	3.50E-05	NR	3.55E-06	0	0	0	NR	NR	0	1.15E-05	0	2.04E-05	MND
Components for re-use	kg	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Materials for recycling	kg	4.62E-02	0	1.07E+00	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Materials for energy recovery	kg	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Exported energy	MJ	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND

Output flows and waste categories for 1 m² of Ceramic tiles, produced in Malino

BIa TYPE GLAZED

Parameter	Unit	A1–A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Hazardous waste disposed	kg	3.22E-04	8.80E-05	2.21E-05	NR	3.03E-05	0	0	0	NR	NR	0	6.79E-06	0	7.65E-06	MND
Non-hazardous waste disposed	kg	2.53E+00	2.71E-02	8.07E-01	NR	2.39E-01	0	0	0	NR	NR	0	1.22E-01	0	2.02E+01	MND
Radioactive waste disposed	kg	3.07E-04	2.18E-04	4.82E-05	NR	4.56E-05	0	0	0	NR	NR	0	1.69E-05	0	2.99E-05	MND
Components for re-use	kg	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Materials for recycling	kg	4.62E-02	0	1.15E+00	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Materials for energy recovery	kg	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Exported energy	MJ	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND

BIa TYPE UNGLAZED

Parameter	Unit	A1–A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Hazardous waste disposed	kg	3.03E-04	8.80E-05	2.15E-05	NR	3.03E-05	0	0	0	NR	NR	0	6.79E-06	0	7.65E-06	MND
Non-hazardous waste disposed	kg	2.41E+00	2.71E-02	8.03E-01	NR	2.39E-01	0	0	0	NR	NR	0	1.22E-01	0	2.02E+01	MND
Radioactive waste disposed	kg	2.87E-04	2.18E-04	4.76E-05	NR	4.56E-05	0	0	0	NR	NR	0	1.69E-05	0	2.99E-05	MND
Components for re-use	kg	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Materials for recycling	kg	4.62E-02	0	1.15E+00	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Materials for energy recovery	kg	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND
Exported energy	MJ	0	0	0	NR	0	0	0	0	NR	NR	0	0	0	0	MND

6 ADDITIONAL ENVIRONMENTAL INFORMATION

Indoor air emissions

In the ceramic tile manufacturing process, tiles are subjected to a thermal process above 1000 °C. At these high temperatures, any organic compound decomposes, and in the end there is an inert product free of any volatile organic compounds that might be released in the use stage.

Release to soil and water

Ceramic tiles release no compounds into the soil or water during their use stage because a completely inert product is involved that undergoes no physical, chemical, or biological transformations, is neither soluble nor combustible, and does not react physically or chemically or in any other way, is not biodegradable, and does not adversely affect other materials with which it enters into contact such that it might produce environmental pollution or harm human health. It is a non-leaching product, so that it does not endanger the quality of surface water or groundwater.

7 LCA INTERPRETATION

The following charts show the LCA results of each type of Ceramic tile.
The individual columns represent the impact categories in the following order:

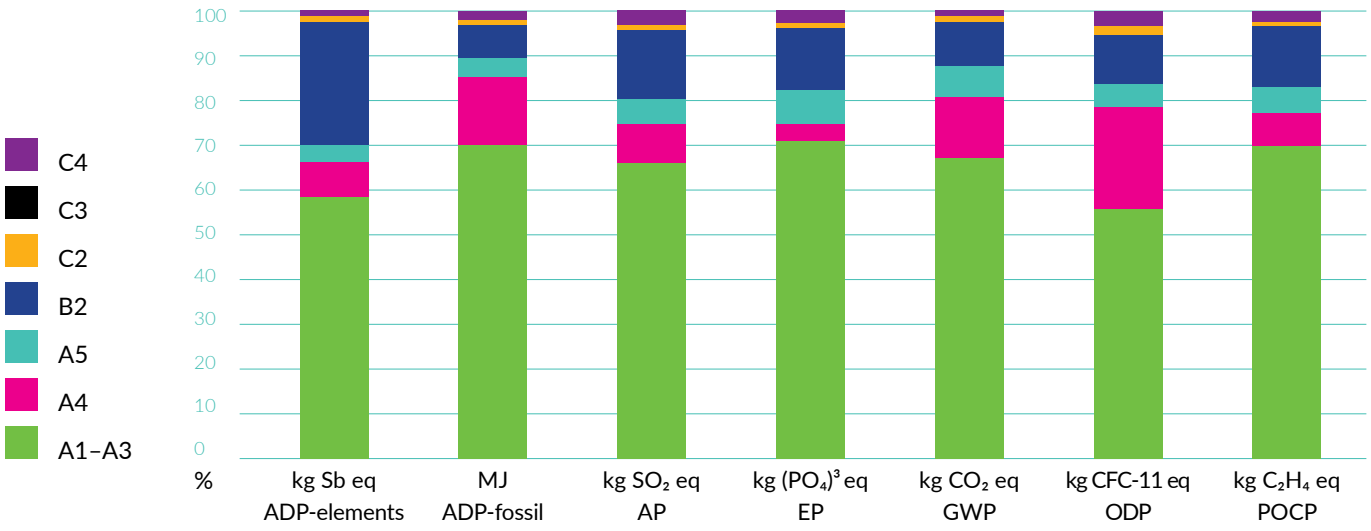
ADP-elements	Abiotic Depletion Potential-non fossil resources
ADP-fossil	Abiotic Depletion Potential-fossil resources
AP	Acidification Potential
EP	Eutrophication Potential
GWP	Global Warming Potential
ODP	Ozone layer Depletion Potential
POCP	Photochemical Ozone Creation Potential

A1–A3 is a module of the life cycle with the greatest environmental impact.
The A4 and B2 modules have another important impact, which occurs throughout the whole reference life. Overall most of the impact categories are dominated by energy processes and raw materials consumption for ceramic mixture.

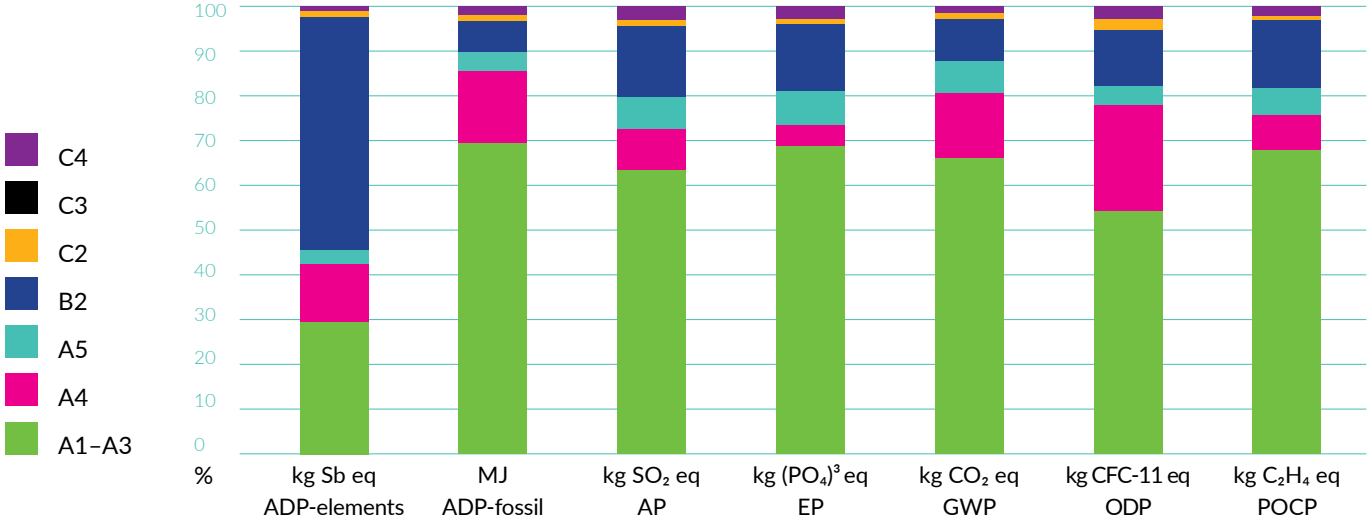
Production in Orel

The figures below show how impacts are distributed between the phases considered in this EPD:

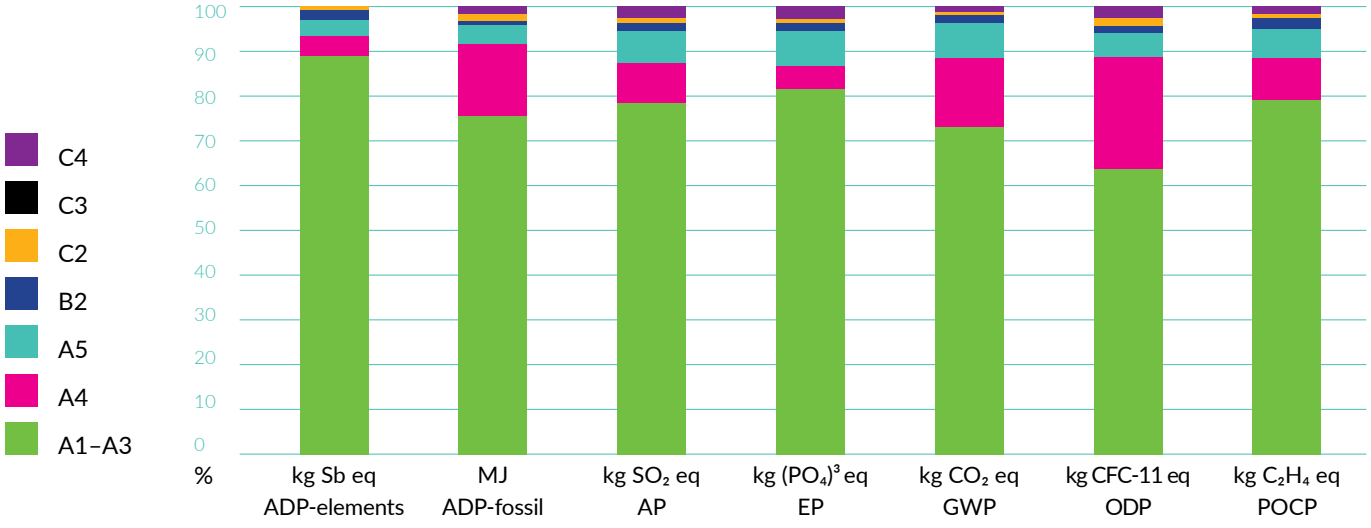
BIa TYPE GLAZED



BIa TYPE UNGLAZED

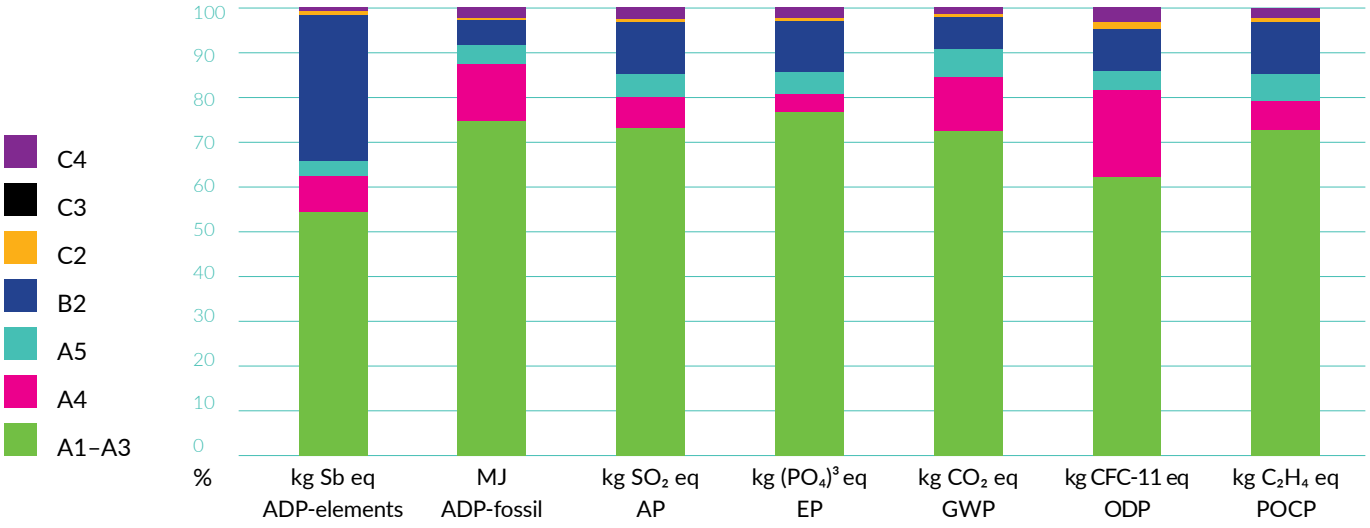


BIII TYPE

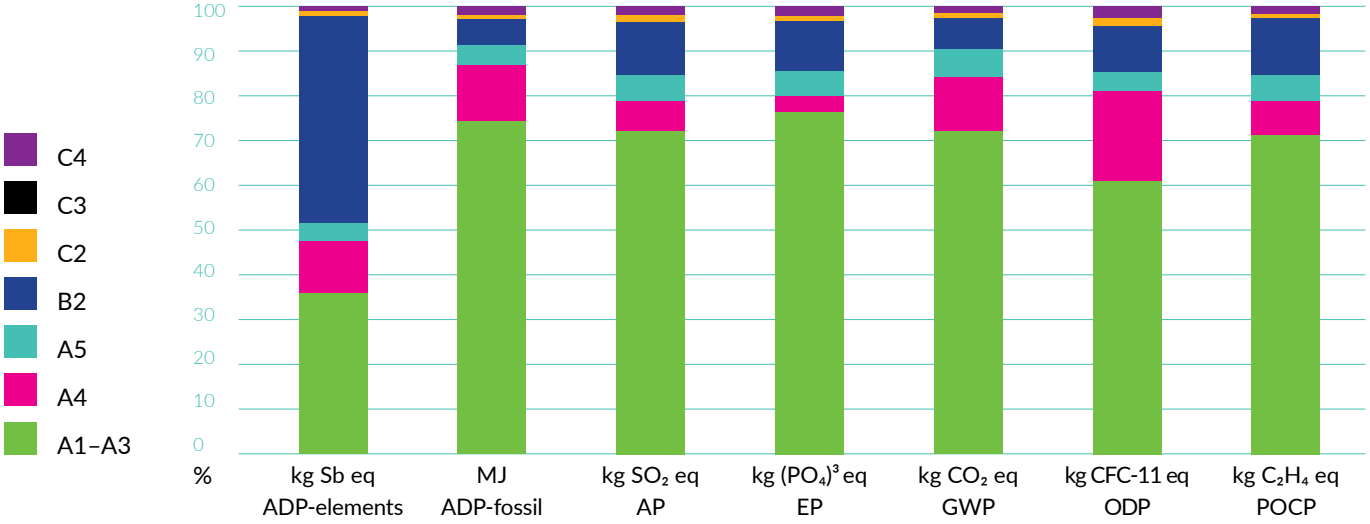


Production in Malino

BIa TYPE GLAZED



BIa TYPE UNGLAZED



8 REFERENCES

ISO 14025:2010
Labels and declarations | Type III environmental declarations | Principles and procedures

EN 15804:2012+A1:2013
Sustainability of construction works | Environmental product declarations |
Core rules for the product category of construction products.

EN 14411:2016
Ceramic tiles. Definitions, classification, characteristics, evaluation of conformity and marking

ISO 14040:2006
Environmental management | Life cycle assessment | Principles and framework

ISO 14044:2006
Environmental management | Life cycle assessment | Requirements and guidelines

The International EPD® System. PCR 2012:01
Construction products and construction services, Version 2.32

The International EPD® System
SUB-PCR Bricks, blocks, tiles, flagstone of clay and siliceous earths (construction product)

The International EPD® System
General Programme Instruction v. 2.5 for the International EPD® System

OpenLCA Software System www.openlca.org

Ecoinvent database www.ecoinvent.org

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