

# Environmental Product Declaration (EPD) Environmental and Sanitary Declaration Form (FDES)

## Porcelain Stoneware

In accordance with NF EN 15804 + A1 and its national complement NF EN 15804 / CN

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## Information

This statement (environmental declaration) has been produced by the Technological Center of Ceramics and Glass (from Portuguese “Centro Tecnológico da Cerâmica e do Vidro” - CTCV) at the request of Aleluia Cerâmicas - Vagos. The information contained therein is provided under the responsibility of CTCV and Aleluia Cerâmicas - Vagos (Keratec), in accordance with the NF Standard EN 15804 + A1 and its national complement NF EN 15804 / CN.

Any use, in whole or in part, of the information provided in this document must at least be accompanied by a complete reference to the original Environmental (and Sanitary) Product Declaration (EPD) as well as its producer, who may provide a complete copy.

CEN EN 15804 + A1 serves as the Product Category Definition Rule (CPR).

NOTE: The literal French translation of EPD (Environmental Product Declaration) is DEP (Déclaration Environnementale de Produit). However, in France the term FDES (Fiche de Déclaration Environnementale et Sanitaire) is commonly used, which includes both the Environmental Declaration and health information concerning the product that is the subject of this EPD. The FDES is therefore an EPD supplemented with health information.

## Reading guide

### Display Rules

The following display rules are used:

- Values are expressed according to the following scientific notation:  $0.0123 = 1.23 \times 10^{-2} = 1.23E-02$ ;
- For a null result, the value zero is represented;
- All values are expressed with two significant digits.

### Abbreviations Used

- LCA: Life Cycle Analysis
- CTCV: Technological Center of Ceramics and Glass
- EPD: Environmental Product Declaration
- VUR: reference lifetime
- FDES: Environmental and Health Declaration Form
- LCV/LHV: Lower calorific value

- FU: Functional unit

### Precautions for using EPD for product comparison

EPDs from construction products may not be comparable if they do not comply with the standard NF EN 15804 + A1 and its national complement NF EN 15804 / CN.

NF EN 15804 + A1 defines in point 5.3 - Comparability of EPD for construction products, the conditions under which construction products may be compared based on information provided by the EPD:

“Comparison of the environmental performance of construction products using EPD information shall be based on the product’s use in and its impacts on the building, and shall consider the complete life cycle (all information modules).”

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## 1 General Information

### Name and address of issuer and manufacturer

This statement (environmental declaration) was prepared by the e Technological Center of Ceramics and Glass (CTCV) at the request of Aleluia - Cerâmicas, SA. The information presented here is the responsibility of CTCV and ALELUIA, based on NF EN 15804 + A1 and its national complement NF EN 15804 / CN.

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### 1.1 Manufacturer (s) data and EPD representativeness

EPD is representative of the extruded porcelain stoneware products for floor and wall covering produced by Aleluia - Cerâmica, S.A. at the Vagos site in Aveiro.

### 1.2 EPD type

This EPD is an individual statement and describes the life cycle of ALELUIA extruded porcelain stoneware products “from cradle to gate with options” with the aim of promoting sustainable construction.

### 1.3 Date of publication

September 2018

## 1.4 Verification

This EPD is voluntary and is not subject to verification by third parties and is intended to provide stakeholders with environmental and health information regarding products developed by Aleluia.

## 2 Product Description

### 2.1 Declared Unit

Taking into account the previous considerations and that this EPD covers only the product stage (A1 to A3) and the A4 module (cradle-to-gate with options), the unit used is 1m<sup>2</sup> of porcelain stoneware (including packaging), to calculate performance environmental impact of the product.

### 2.2 Product

Extruded porcelain stoneware produced by ALELUIA, used as a floor and wall covering, both inside and outside (indoors and outdoors) in residential and public areas. This product is waterproof and has a high mechanical resistance. A wide range of aesthetic and dimensional options are available on the market, both in terms of visual effects, texture and color.

ALELUIA manufactures these products in various dimensions, namely with the characteristics shown in Table 1.

Table 1 - Porcelain stoneware products manufactured by Aleluia

<i>Thickness (mm)</i>	<i>Density per m<sup>2</sup> (kg/m<sup>2</sup>)</i>
4,5	10,8
7,0	16,3
8,0	19,2
10,0	24,0
12,0	28,6
14,0	33,6

### 2.3 Use stage - scope / Application.

Porcelain stoneware for the following applications:

- Floor covering
- Wall cladding
- Inner lining
- Exterior coating
- Residential areas and buildings
- Public areas and buildings
- Industrial areas and buildings

## 2.4 Other technical features not included in the functional unit

Characteristic	Standard	Specification - EN 14411 Group Ala - UGL	ALELUIA Specification
Deviation from average (%)	EN ISO 10545-2	± 1,5	± 1
Thickness (%)		± 10	± 10
Rectilinearity (%)		± 0,6	± 0,6
Orthogonality (%)		± 1	± 1
Planarity		± 1,5	± 0,2
Central curvature (%)			
Lateral curvature (%)			
Diagonal Arrow (%)			
Surface Quality (%)		³ 95	³ 95
Water Absorption (%)	EN ISO 10545-3	≤ 0,5	≤ 0,1
Burst module (N / mm²)	EN ISO 10545-4	³ 28	³ 35
Flexural Strength (N)	EN ISO 10545-4	Thickness ³ 7,5 mm ≥ 1300	³ 1300 (1)
		Thickness < 7,5 mm ≥ 600	³ 600 (2)
Resistance to deep abrasion (mm³)	EN ISO 10545-6	≤ 275	≤ 150
Thermal Shock Resistance	EN ISO 10545-9	When required	Resistant
Frost resistance	EN ISO 10545-12	Resistant	Resistant
Chemical resistance	EN ISO 10545-13	Minimum Class B (3) (4)	A (3) LA / HA / HB (4a)
Stain Resistance	EN ISO 10545-14	Available test	Class 3 ou 4 ou 5 (4a)
Slip Resistance	DIN 51130	Available test	Dependente on the Product
	DIN 51097		
	ENV 12633		

- (1) Formats: 15x30; 20x20; 30x30
- (2) Formats: 20x20; 30x30; 40x40; 30x60; 60x60; 30x90
- (3) Household detergents and pool products



- (4) Acids and Bases - To be specified by the Supplier
- (4a) Depending on surface finish and color - Product by Product

## 2.5 Main Product Components and / or Materials

<i>Raw material</i>	<i>Percentage</i>
Water	-
Atomized powder	93,6 %
Clays	5,5 %
Dyes	0,5 %
Glasses	0,3 %
Calcium carbonate	0,1 %
Engobes	0,1 %
<i>Packing</i>	<i>Percentage</i>
Pallets	-
Card boxes	-
Plastic bags	-

## 2.6 Substances on REACH Candidate List (if greater than 0.1% by mass)

The product does not contain any candidate substance from the Reach candidate list of substances of very high concern with more than 0.1% by mass.

## 2.7 Reference lifetime

<i>Parameters</i>	<i>Units/ Values</i>
Reference life	50 years
Declared product properties (of factory) and finishing, etc.	Product characteristics are in accordance with EN 14411. Some references certified by QB UPEC.
Theoretical application parameters (if imposed by the manufacturer), including references to appropriate practice.	Different product models can be installed according to the manufacturers or DTU 52.2 recommendations.
Assumed quality of work when installation complies with manufacturer's instructions	Works must meet the manufacturers or DTU's recommendations mentioned above, if necessary.
Outdoor environment (for outdoor applications) such as bad weather,	Not applicable (no implications)



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pollutants, UV rays and wind exposure, building orientation, shading, temperature	
Indoor environment (for indoor applications) e.g. temperature, humidity, chemical exposure	Not applicable (no implications)
Conditions of use, e.g. frequency of use, mechanical exposure	The product can be used indoors or outdoors.
Maintenance e.g. frequency required, type and quality and replacement of replaceable components	No maintenance required.

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### 3 Life Cycle Stages

This EPD assesses and evaluates the product life cycle “from cradle to gate with options”, comprising modules A1, A2, A3 and A4 defined in NF EN 15804 + A1.

Figure 1 shows the production process of Aleluia.

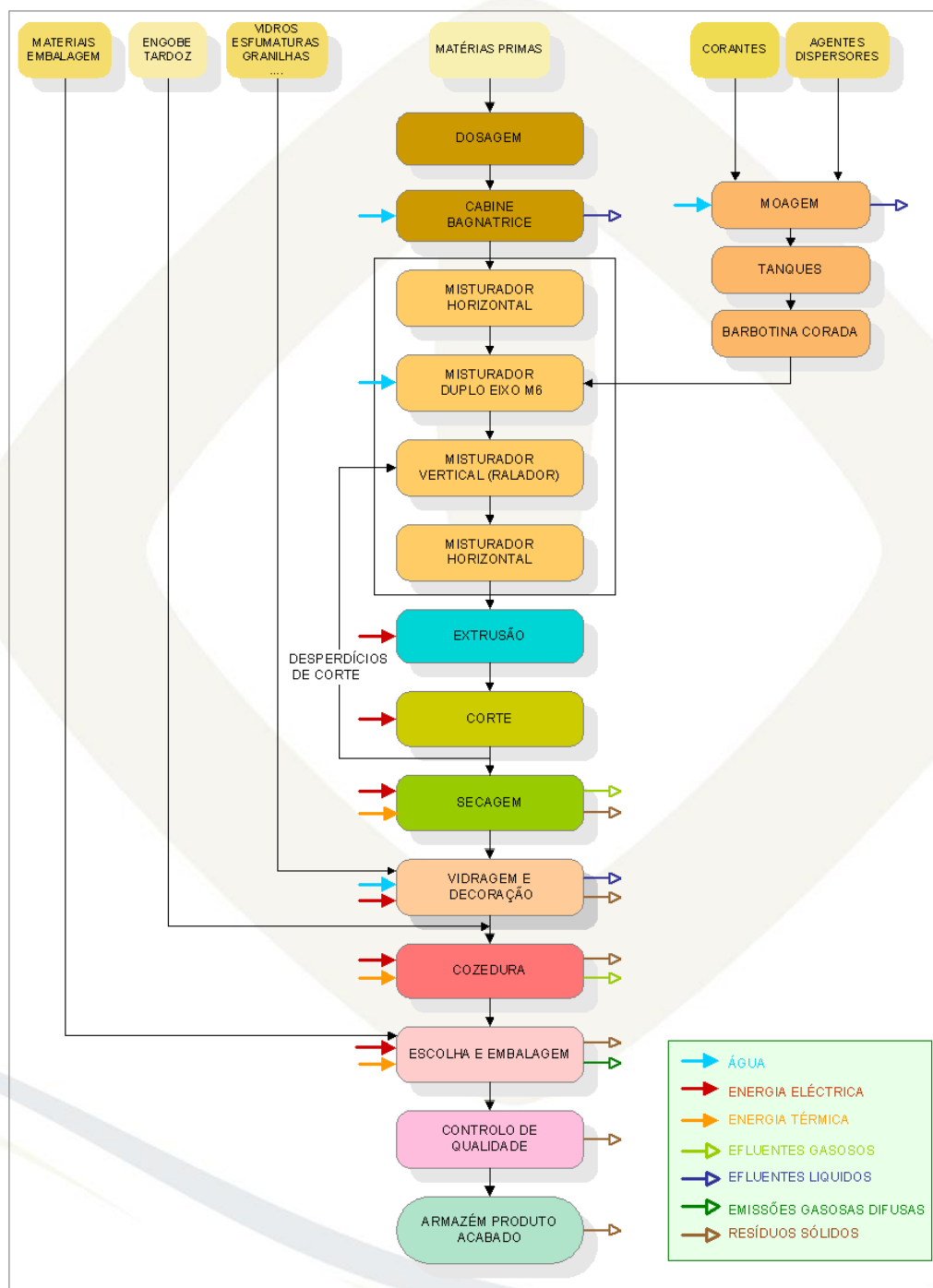


Figure 1 - Aleluia production process

### 3.1 Product stage; A1 - A3

The Vagos unit (Keratec) produces porcelain by extrusion process. Acquires raw materials for the preparation of atomized paste / powder and dye preparation from a Portuguese company. This phase involves the of raw materials preparation, mixing, humidification and coloring. Mixing begins by weighing the paste, which passes through a circular mixer (bagnatrice), where water is added in a controlled way. This process continues in an endless horizontal mixer and continues in a double axis mixer.

Then the mixture of the raw materials is humidified, which can be achieved with water or stained slip. For the final mixing steps, a vertical mixer (grater) is used, which also recycles cutting waste and a horizontal mixer, which controls and adjusts the plasticity of the paste to be used in the extrusion of tiles.

The next step is extrusion and cutting where the paste is compressed using by means of an extruder, the shaping (conformation) of the pieces being achieved using different outlet nozzles (which condition the thickness) and a cutting machine to obtain the desired dimensions. Thereafter, the material is dried in a three-plane horizontal roller dryer. In the continuation of this process, in the glazing line, glazes and other types of decoration are applied with the help of own equipment, such as disc booths and airbrushes.

At a later stage, the monoporous firing phase occurs, which is carried out in a roller oven with pre-set cycles. Following is the choice that is made manually (semi-automatic) and the palletizing.

### 3.2 Construction stage: A4 - A5

The construction phase of the building materials begins with their transportation to the jobsite. This EPD evaluates only the product production stage, integrating steps A1 through A3 and A4. Therefore, the following scenarios of the construction step (modules A5), use stage (B1 to B7) and end of life stage (C1 to C4) are not applicable.

<i>Parameter</i>	<i>Units / Values</i>
Fuel type, vehicle consumption and type of vehicle used for transport	24-ton diesel truck with an average fuel consumption of 38 l / 100 km
Distance to construction site	1500 km
Capacity utilization (including empty returns)	50 %
Density of bulk products	19 kg/m <sup>2</sup>
Volume capacity utilization coefficient	<1

### 3.3 Use step; B1 - B7

The impacts and benefits of this step are excluded from the system boundary, and therefore not assessed.

### 3.4 End of life stage; C1 - C4

The end-of-life stage consists of the following modules: Deconstruction / Demolition (C1), Transport of waste to its processing and end-of-life location (C2), Processing of waste for reuse, recovery and / or recycling (C3 ) and elimination (C4).

The end-of-life phase is the last phase of a material's life cycle but can become the first if after demolition, recycling and reuse of waste is carried out, that is, the valorization of the material considered to be at the end of its life.

The impacts and benefits of this step are excluded from the system boundary and are therefore not evaluated.

### 3.5 Recycling / reuse / recovery potential; Module D

The impacts and benefits of this step are excluded from the system boundary, so they are not evaluated.

## 3.6 Information for calculating the Life Cycle Assessment

### 3.7 PCR used

This environmental declaration statement is based on the standard NF EN 15804 + A1 and its national complement NF EN 15804 / CN.



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### 3.8 System boundaries

This EPD assesses the product life cycle “from cradle to gate with options”, comprising modules A1, A2, A3 and A4 defined in NF EN 15804 + A1.

System boundaries distinguish the separation between the environment and the system (ISO 14040, 2006), and their definition is fundamental in order to be able to identify and calculate mass and energy flows in these boundaries. This study is limited downstream by final product transport (distribution) and upstream limited by the process of extraction, processing and transport of raw materials.

### 3.9 Assignments

The industrial unit of Vagos manufactures various products in extruded porcelain stoneware with different dimensions and shapes but given that the product is the same when exiting the oven, ie by mass the product is the same, there was no need to use assignment or allocation procedures.

### 3.10 Geographic and temporal representativeness

The dataset used to model the production process is, whenever possible, based on specific Portuguese data, since it is produced in this country, or whenever it is not possible, average European data.

The temporal representativeness is based on the data sets used in the Ecoinvent v3.3 database (most recent at the time of the preparation of the EPD), with the update of the Portuguese electric mix to the year 2016. The specific data of the manufacturer refer to average production in 2017.

The data set used to model the upstream production processes and the process itself reflect the physical reality and the technology used. For each process / material used in the process modeling, data sets representative of the technologies used were used.

### 3.11 Variability of results

Not applicable as the product is manufactured in a single industrial unit.

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## 4 Life Cycle Assessment Results

### 4.1 Environmental impacts

Impact category	Parameter	Unit	Result (per m <sup>2</sup> porcelain stoneware)	
			A1-A3	A4
Abiotic Resource Depletion (Elements)	Depletion potential (ADP-elements) for non-fossil abiotic resources	kg de Sb equiv.	3.50E-05	8,17E-09
Depletion of abiotic resources (fossils)	Depletion potential (ADP-fossil fuels) for fossil abiotic resources	MJ, lower calorific value	2.63E+02	6,05E+01
Soil and water acidification	Soil and water acidification potential, AP	kg SO <sub>2</sub> equiv.	6.21E-02	1,06E-02
Ozone layer depletion	Stratospheric ozone layer depletion potential, ODP	kg de CFC 11 equiv.	2.59E-06	7,33E-07
Global warming	Global Warming Potential, GWP	kg de CO <sub>2</sub> equiv.	1.59E+01	3,97E+00
Eutrophication	Eutrophication Potential, EP	kg de (PO <sub>4</sub> ) <sup>3-</sup> equiv.	5.86E-03	1,80E-03
Photochemical ozone formation	Tropospheric ozone formation potential, POCP	kg de Eteno equiv.	3.24E-03	5,07E-04
Water pollution	Water pollution potential	m <sup>3</sup>	1,11E+03	3,14E+02
Air pollution	Air pollution potential	m <sup>3</sup>	4,05E+03	8,17E+01

### 4.2 Resource utilization

Parameter	Unit	Result (per m <sup>2</sup> porcelain stoneware)	
		A1-A3	A4
Use of renewable primary energy, excluding renewable primary energy resources used as raw materials	MJ, lower calorific value	2.33E+01	0.00E+00
Use of renewable primary energy resources used as raw materials	MJ, lower calorific value	6.36E+00	0.00E+00
Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ, lower calorific value	2.97E+01	3,11E-03

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Non-renewable primary energy use excluding non-renewable primary energy resources used as raw materials	MJ, lower calorific value	2.72E+02	0.00E+00
Utilization of non-renewable primary energy resources used as raw materials	MJ, lower calorific value	1.26E+00	0.00E+00
Total use of non-renewable primary energy resources (primary energy and primary energy resources used as raw materials)	MJ, lower calorific value	2.73E+02	3,19E+00
Use of secondary material	kg	0.00E+00	0.00E+00
Use of renewable secondary fuels	MJ, lower calorific value	0.00E+00	0.00E+00
Use of non-renewable secondary fuels	MJ, lower calorific value	0.00E+00	0.00E+00
Net use of freshwater	m <sup>3</sup>	1.26E-02	1,02E-03

#### 4.3 Waste

Parameter	Unit	Result (per m <sup>2</sup> porcelain stoneware)	
		A1-A3	A4
Hazardous waste disposed of	kg	2,47E-03	9,99E-06
Non-hazardous waste disposed of	kg	0,00E+00	0,00E+00
Radioactive waste disposed of *	kg	8,07E-04	4,15E-04

\* The radioactive waste component does not come from the activity of Aleluia (A3). It is a component derived from the upstream activities (A1 and A2), namely the production of electricity.

#### 4.4 Other information

Parameter	Unit	Result (per m <sup>2</sup> porcelain stoneware)	
		A1-A3	A4
Components for reuse	kg	N/A	N/A
Materials for recycling	kg	4.58E-03	N/A
Materials for energy recovery	kg	0,00E+00	N/A
Energy supplied abroad	MJ by energetic vector	N/A	N/A

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## 5 Additional information on the release of hazardous substances into indoor air, soil and water during the use stage.

### 5.1 Indoor Air

Products were analyzed in accordance with ISO 16009-9, ISO 16000-6, ISO 16000-3 to determine the emitted quantities of volatile organic compounds, formaldehyde, acetaldehyde and some CMR substances (carcinogenic, mutagenic and reprotoxic), with a view to classifying the material according to the criteria established by the following French Regulation:

- Ordinance of 19 April 2011 on the labeling of construction products or wall or floor coverings and paints and varnishes in their emissions of volatile pollutants.
- Ordinance of 28 May 2009 on the conditions for placing on the market of building and decoration products containing carcinogenic, mutagenic or reprotoxic substances of category 1 or 2.

The following table shows the concentrations of substances or groups of substances obtained for a specific ventilation rate of 1.25 m<sup>3</sup>h<sup>-1</sup>m<sup>-2</sup>, as well as the concentration limits (in µg / m<sup>3</sup>) for the different classes established by the French Regulation.

		Concentration (µg/m³)				
		Classes				MC.96/11 28 days
Compound	CAS	C	B	A	A+	
Formaldehyde	50-00-0	>120	<120	<60	<10	0,52
Acetaldehyde	75-07-0	>400	<400	<300	<200	n.d.
Toluene	108-88-3	>600	<600	<450	<300	n.d.
Tetrachlorethylene	127-18-4	>500	<500	<350	<250	n.d.
Xylene	1330-20-7	>400	<400	<300	<200	n.d.
1,2,4-trimethylbenzene	95-63-6	>2000	<2000	<1500	<1000	n.d.
1,4-dichlorobenzene	106-46-7	>120	<120	<90	<60	n.d.
Ethylbenzene	100-41-4	>1500	<1500	<1000	<750	n.d.
2-butoxyethanol	111-76-2	>2000	<2000	<1500	<1000	n.d.
Styrene	100-42-5	>500	<500	<350	<250	n.d.
VOCsT		>2000	<2000	<1500	<1000	1,98

n.d. - not detected



The table below shows the concentration limits (in  $\mu\text{g} / \text{m}^3$ ) for CMR substances imposed by the French Regulation and the values obtained from the Aleluia materials for a specific ventilation rate of 1.25 m<sup>3</sup>h<sup>-1</sup>m<sup>-2</sup>.

Compound	CAS	Limite	Concentration ( $\mu\text{g}/\text{m}^3$ )
			MC.96/11 28 dias
Trichlorethylene	79-01-6	<1	n.d.
Benzene	71-43-2	<1	n.d.
bis (2-ethylhexyl) phthalate (DEHP)	117-81-7	<1	n.d.*
Dibutylphthalate (DBP)	84-74-2	<1	n.d.

n.d. - not detect

\* It is considered that this compound is not present in the emissions of the material under study, although it has not been analytically evaluated.

The results allow us to conclude that the material has an A + classification according to the French Regulation and complies with the requirements established by legislation.

## 5.2 Soil and water

The products are placed inside and outside the buildings, so they are in contact with rainwater and runoff water, subsequently infiltrating the water in the water table as well as the wash water, which mixes with the surface water.

In this sense, the products were subjected to leaching tests with the diffusion test, based on the EA NEN 7375: 2004 standard.

Almost all the concentration values are below the equipment's quantitation limits, with only 1 parameter showing measurable values, namely chlorides, which appear above those limits (in only one eluate).



	E1	E2	E3	E4	E5	E6	E7	E8
pH	7,85	7,35	7,63	7,32	7,31	6,36	6,28	6,15
Sulfates	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ
Bromides	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ
Chlorides	< LQ	< LQ	< LQ	< LQ	< LQ	333	< LQ	< LQ
Fluorides	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ
As	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ
Ba	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ
Ca	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ
Cd	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ
Co	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ
Cr	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ
Cu	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ
Phenols	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ
Hg	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ
Mn	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ
Mo	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ
Ni	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ
Pb	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ
Se	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ
Sb	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ
Sn	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ
V	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ
Zn	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ
BTEX	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ
HAP	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ
PCB	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ
Mineral oils	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ	< LQ

LQ - quantification limit



**CTCV**

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**ALELUIA CERÂMICAS**

## **6 Contribution of the product to the quality of the life inside buildings**

- |   |                |
|---|----------------|
| <b>6.1 Product characteristics involved in creating hygrothermal comfort conditions in the building</b> | Not applicable |
| <b>6.2 Product characteristics involved in creating acoustic comfort conditions in the building</b>     | Not applicable |
| <b>6.3 Product characteristics involved in creating visual comfort conditions in the building</b>       | Not applicable |
| <b>6.4 Product characteristics involved in creating olfactory comfort conditions in the building</b>    | Not applicable |

## **7 Additional Information**

This factory has an environmental management system implemented according to EN 14001: 2015.