ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A1*

Owner of the Declaration	**Xella Baustoffe GmbH**
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-XEL-20180175-IAD1-EN
Issue date	11/03/2019
Valid to	10/03/2024

Silka Calcium Silicate Unit

Xella Baustoffe GmbH

Institut Bauen und Umwelt e.V.

www.ibu-epd.com | https://epd-online.com

silka®

1. General Information

Xella Baustoffe GmbH

Programme holder
IBU – Institut Bauen und Umwelt e.V.
Panoramastr. 1
10178 Berlin
Germany

Declaration number
EPD-XEL-20180175-IAD1-EN

This declaration is based on the product category rules:
Lime sand bricks, 07.2014
(PCR checked and approved by the SVR)

Issue date
11/03/2019

Valid to
10/03/2024

Dipl. Ing. Hans Peters
(chairman of Institut Bauen und Umwelt e.V.)

Dr. Alexander Röder
(Managing Director Institut Bauen und Umwelt e.V.))

Silka Calcium silicate unit

Owner of the declaration
Xella Baustoffe GmbH
Düsseldorfer Landstraße 395
D - 47259 Duisburg

Declared product / declared unit
1 m^3 Silka calcium silicate unit with average bulk density of 1800 kg/m^3.

Scope:
The life cycle assessment is based on the 2013 database and the following German calcium silicate unit-producing plants: Blatzheim, Bocholt, Colbitz, Eisendorf, Griedel, Haltern, Kaltenkirchen, Möllenhagen, Neustadt, Niederlehme, Nievenheim, Nohra, Reinbek, Remsfeld, Ruhlsdorf, Schönbach und Wankum.

The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

The EPD was created according to the specifications of *EN 15804+A1*. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard *EN 15804* serves as the core PCR
Independent verification of the declaration and data according to *ISO 14025:2010*
☐ internally ☒ externally

Patricia Wolf
(Independent verifier appointed by SVR)

2. Product

2.1 Product description/Product definition

The specified products are unreinforced building blocks of varying format made of calcium silicate stone (calcium silicate unit). Calcium silicate units belong to the group of steam-hardened building materials.
For product placement in the EU/EFTA (with the exception of Switzerland), the Regulation (EU) No. /305/2011/ (CPR) is applicable. The product requires a declaration of performance according to the /DIN EN 771-2:2015-11, Calcium silicate masonry units/ and the CE marking.
Use of the product is governed by the respective national regulations, in Germany: /DIN V 20000-402:2017-01/.

2.2 Application

Unreinforced blocks for load-bearing and non-load-bearing masonry walls.

2.3 Technical Data

See performance declaration for the respective product. The following table includes general information.

Structural data

Name	Value	Unit
Gross density	1000 - 2400	kg/m^3
Brick compressive strength class	10 - 60	N/mm^2
Compressive strength according to DIN 20000-402, Tab. 6	12.5 - 75	N/mm^2
Thermal conductivity according to /EN 1745/ P90	0.3 - 1.76	W/(mK)
Water vapour diffusion resistance factor according to DIN 4108-4	5/10 bis 15/25	-
Moisture content at 23 °C, 80% humidity	3 - 6	M.-%

Performance values of the product pursuant to the performance declaration with reference to its essential characteristics according to /DIN EN 771-2:2015-11, Calcium silicate masonry units/

2.4 Delivery status

The manufactured block formats range between 240 mm • 115 mm • 52 mm (length • width • height) and 998 mm • 365 mm • 623 mm.

2.5 Base materials/Ancillary materials

Basic materials

Name	Value	Unit
Sand	50 - 85	M-%
Gravel	0 - 45	M-%
Crushed sand	0 - 15	M-%
Quicklime	4 - 9	M-%
Grey lime	0 - 4	M-%

In addition, 3 - 6 wt% water (relative to solid material) is used.

Sand: The sand used is a natural raw material containing the principal mineral, quartz (SiO2), as well as natural secondary and trace minerals. It is an essential raw material for the hydrothermal reaction during steam curing. Often gravel sand is quarried and used; this is a mixture of gravel and sand. Other natural raw materials are sometimes added to achieve certain product properties. Such materials are coarse and fine-grained components such as gravel of fraction 2-8 mm, limestone chippings, greywacke chippings, basalt chippings or ground quartz or limestone.

Quicklime: Quicklime: Quicklime acc. to. /DIN EN 459-1/ serves as a binder and is manufactured by burning natural limestone and/or dolomite. A distinction is made between fine-ground high-calcium lime and grey lime. Grey lime is produced by burning dolomite.

Water: The presence of water is fundamental for the hydraulic reaction of the binding agents. Continuous process control requires that a defined water content is set during pressing.

The product contains SVHC according to /Candidate List (05/02/2019) of ECHA in excess of 0.1 wt%: no

The product contains further CMR substances of category 1A or 1B not included on the Candidate List, in excess of 0.1 wt%: no

Biocidal products have been added to the present building product or it has been treated with biocidal products (it is thus a treated product within the meaning of Biocidal Products Regulation (EU)/ No. 528/2012): no

2.6 Manufacture

The compound formulas used are adapted to the respective raw material properties and vary within the fluctuation ranges specified under 2.6. Basic materials / auxiliary materials. There are no further additives contained.

The raw materials (sand, quicklime and water) are gravimetrically dosed and thoroughly mixed according to the respective compound formula. The raw material mix is then temporarily stored in a reaction vessel (reactor), where an exothermic reaction takes place. This ensures that the quicklime is completely quenched to form lime hydrate before further processing. From the reactor, the mix is transferred to a further mixer, where it is brought to press moisture by adding water. The compaction and shaping of the raw mass then takes place in mould boxes, into which it is pressed by the calcium silicate presses. The blanks are then stacked on hardening cars by means of an automatic stacking system and transported to the autoclave via a rail-mounted traverser system.

The final properties of the components are established during the subsequent steam curing during 6 - 12 hours at about 200°C and pressure 16 bar in steam pressure boilers, the so-called autoclaves. Here, the raw materials combine to form calcium silicate hydrates. The reaction of the material is complete once it is removed from the autoclave. The steam is utilised for further autoclave cycles after completion of the curing process. As far as technologically feasible, the accumulated condensate is recycled as process water.

2.7 Environment and health during manufacturing

The general statutory regulations and the rules and regulations of the employers' liability insurance associations are applicable. No special measures must be taken to protect the environment or the health of employees.

2.8 Product processing/Installation

The processing of calcium silicate units is carried out by hand. If products weigh over 25 kg, lifting equipment will be necessary. Design elements are usually prefabricated at the calcium silicate unit plant and delivered to the construction site number-coded. Elements may also be supplied in bulk. The blocks are cut with diamond blades using a wet-cutting process. High-speed tools such as angle grinders without water dust suppression or dust extraction are not suitable for processing calcium silicate units due to the release of dust (including fine quartz dust).

The sand-lime blocks are connected to each other and to other standardised building materials using normal or thin-bed mortar in accordance with /DIN EN 998-2/ and /DIN V 18580/ (e.g. thin-bed mortar in accordance with /Approval: Z-17.1-1019/). The calcium silicate unit components can be plastered, coated or painted over. It is also possible to cover them with small-format elements or erect a face masonry layer according to /DIN 1053-1/. KS facing bricks are used as a face masonry layer.

2.9 Packaging

Calcium silicate unit components are stacked on wooden pallets and strapped with steel or plastic straps, shrink-wrapped in recyclable polyethylene (PE) shrink film or supplied loose.

Packaging material and pallets arising on the construction site must be collected separately. The polyethylene shrink foils can be recycled. Non-soiled PE films and re-usable wooden pallets are taken back by the builders merchants (reimbursement of re-usable pallets in a deposit system) and returned to the calcium silicate unit plants by the latter. They also return the used foils to the foil manufacturer for recycling.

2.10 Condition of use

Calcium silicate units are not subject to any further change once the autoclave process is complete.

2.11 Environment and health during use

Calcium silicate units do not emit any harmful substances such as VOC. The natural ionising radiation of calcium silicate unit products is extremely low, so there are no radiological restrictions to the use of this building material (see 7.1 Radioactivity).

2.12 Reference service life

Under normal conditions of use, the service life of calcium silicate unit masonry is ≥ 50 years with reference to the /BBSR table/ “Nutzungsdauer von Bauteilen zur Lebenszyklusanalyse nach BNB".

2.13 Extraordinary effects

Fire

In case of fire, no toxic gases and vapours can be generated. The specified products meet the requirements of building material class A1, "non-combustible" according to /DIN EN 13501-1/.

Fire safety

Name	Value
Building material class	A1
Burning droplets	d0
Smoke gas development	s1

Water

Calcium silicate units show a weak alkaline reaction (pH value approx. 10) when exposed to water (e.g. flooding). No substances that could pose a water hazard are leached out.

Mechanical destruction

Unforeseen mechanical destruction poses no known risks to the environment or to living organisms.

2.14 Re-use phase

Calcium silicate products exceed the service life of the buildings in which they are used. After such buildings have been demolished, the materials can therefore be re-used without restrictions in terms of durability.
So far, calcium silicate units have seldom been re-used.
Calcium silicate unit residues from demolition and dismantling meet the criteria of /LAGA/ Z 0. This means that the material is suitable for unrestricted installation /LAGA Test report 2014/.

2.15 Disposal

Calcium silicate units can be disposed of in Class 0 landfill sites in accordance with /DepV/ [Landfill directive].
Key according to /European waste catalogue/ (EWC): 17 01 01.

2.16 Further information

For further information please refer to the homepage www.silka.de .

3. LCA: Calculation rules

3.1 Declared Unit

The declaration refers to the production of 1 m³ calcium silicate unit with an average bulk density of 1800 kg/m³.

An average was calculated on the basis of the annual production volume in 2013 of all Xella calcium silicate unit plants in Germany.

Declared unit

Name	Value	Unit
Declared unit	1	m^3
Gross density	1800	kg/m^3
Conversion factor to 1 kg	1/1800	-

3.2 System boundary

Type of EPD: Cradle to factory gate
In detail, the following processes were included in the product stage A1-A3 of the production of calcium silicate units.

- Provision processes for auxiliary materials & energy
- Transport of resources and raw materials (quicklime, sand, etc.) to the respective production site
- Manufacturing process in the plant including energy consumption, production of auxiliary materials, disposal of residual materials
- Production of the proportional packaging

Modules A5 and D only show the debits and credits for packaging. Therefore, the modules A5 and D are not completely declared.

3.3 Estimates and assumptions

Datasets are not available in the /GaBi Database/ for all raw materials. The production of grey lime was estimated to be on a par with white lime, as both limes are similar in production and environmental impact. The weight percentage of grey lime in the average product is 0.01 %. The influence on the results is well below 1 %.

3.4 Cut-off criteria

All data from the collection of operating data, i.e. all raw materials used according to the compound formula, the thermal energy used, the internal fuel consumption and the electricity consumption, all direct production waste as well as all available emission measurements were taken into account in the LCA. Conditioning agents constituted an exceptional case, contributing a total of < 0.001 wt% to product manufacture. These were neglected.
Where no primary data was available, assumptions were made about transport expenditure for all inputs and outputs taken into account. Thus material and energy flows with a share of less than 1% were also taken into account. It can be assumed that the sum of neglected processes does not exceed 5% of the impact categories. The machines, equipment and infrastructure required for production were neglected.

3.5 Background data

The software system for Holistic Balancing /GaBi6/ Servicepack 36, developed by thinkstep AG, was used to model the production of calcium silicate units. The consistent data sets contained in the GaBi database are documented in the online /GaBi-Documentation/. The basic data of the GaBi database was used for energy, transport and auxiliary materials. The life cycle assessment was compiled for the reference area Germany. As a result, in addition to the production processes under these boundary conditions, the preliminary stages relevant for Germany, such as the

provision of electricity or energy sources, were also used. The electricity mix for Germany with reference year 2014 was applied.

3.6 Data quality

All background data sets relevant for the production were taken from the database of the software /GaBi6/. Foreground data was provided by Xella Baustoffe GmbH.
The last revision of the background data used took place less than 1 year ago. The production data comprises current industry data from Xella Baustoffe GmbH dating from 2013.
Overall, the quality of the data and also the robustness of the results in terms of averaging can be classified as good.

3.7 Period under review

Data records on the production of calcium silicate units from 2013 form the data basis of this Life Cycle Assessment. The consumed quantities of raw materials, energy and auxiliary and operating materials are factored in as 12-month averages in the plants.

3.8 Allocation

For the production of the specified products, production data from 17 plants was provided, whereby ISO Kimmstein units, calcium silicate lintels and units/elements were in part produced jointly. The proportion of auxiliary products in the total production volume amounts to 1%.
The required raw materials were assigned to each product according to the respective compound formula.
The fuels and packaging materials were allocated specifically for each product according to the volume produced, likewise electricity and diesel consumption. Not directly allocatable raw materials were allocated by weight.

3.9 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account.

The used background database has to be mentioned.

4. LCA: Scenarios and additional technical information

Installation in building (A5)
No costs for installing the product were included, but merely the costs for disposal of the packaging materials. The latter refer to replacement of worn pallets in the deposit-return system, and to the disposal of any used PE foil or strapping materials

Credits (D)
Module D contains the energy gains yielded by the combustion processes from A5 (packaging waste). A waste incineration plant with an R1 value > 0.6 was assumed.

Istallation in building (A5)

Name	Value	Unit
Packaging waste	6,71	kg

5. LCA: Results

The following is a representation of the environmental impacts for 1 m³ calcium silicate units manufactured by Xella Baustoffe GmbH. The modules marked "x" in the overview according to /EN 15804/ are addressed here, those marked "MND" (module not declared) are not taken into consideration.
The following tables show the results of the indicators of impact assessment, resource use, waste and other output flows in relation to the declared unit.

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED; MNR = MODULE NOT RELEVANT)

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	MND	X	MND	MND	MNR	MNR	MNR	MND	MND	MND	MND	MND	MND	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A1: 1 m³ calcium silicate unit

Parameter	Unit	A1-A3	A5	D
Global warming potential	[kg CO_2-Eq.]	2.09E+2	1.23E+1	-4.49E+0
Depletion potential of the stratospheric ozone layer	[kg CFC11-Eq.]	3.61E-11	2.31E-13	-9.84E-12
Acidification potential of land and water	[kg SO_2-Eq.]	1.08E-1	1.14E-3	-7.59E-3
Eutrophication potential	[kg $(PO_4)^{3-}$-Eq.]	2.13E-2	2.38E-4	-8.19E-4
Formation potential of tropospheric ozone photochemical oxidants	[kg ethene-Eq.]	6.11E-3	9.37E-5	-5.93E-4
Abiotic depletion potential for non-fossil resources	[kg Sb-Eq.]	2.29E-4	1.12E-7	-1.28E-6
Abiotic depletion potential for fossil resources	[MJ]	1.34E+3	1.99E+0	-6.18E+1

RESULTS OF THE LCA - RESOURCE USE according to EN 15804+A1: 1 m³ calcium silicate unit

Parameter	Unit	A1-A3	A5	D
Renewable primary energy as energy carrier	[MJ]	1.51E+2	8.42E+1	-1.53E+1
Renewable primary energy resources as material utilization	[MJ]	8.39E+1	-8.39E+1	0.00E+0
Total use of renewable primary energy resources	[MJ]	2.35E+2	3.84E-1	-1.53E+1
Non-renewable primary energy as energy carrier	[MJ]	1.39E+3	2.97E+1	-7.87E+1
Non-renewable primary energy as material utilization	[MJ]	2.73E+1	-2.73E+1	0.00E+0
Total use of non-renewable primary energy resources	[MJ]	1.42E+3	2.39E+0	-7.87E+1
Use of secondary material	[kg]	4.38E-1	0.00E+0	0.00E+0
Use of renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0
Use of non-renewable secondary fuels	[MJ]	0.00E+0	0.00E+0	0.00E+0
Use of net fresh water	[m³]	3.63E-1	2.93E-2	-2.08E-2

RESULTS OF THE LCA – OUTPUT FLOWS AND WASTE CATEGORIES according to EN 15804+A1: 1 m³ calcium silicate unit

Parameter	Unit	A1-A3	A5	D
Hazardous waste disposed	[kg]	8.13E-6	1.49E-9	-3.21E-8
Non-hazardous waste disposed	[kg]	2.50E+1	2.59E-2	-3.38E-2
Radioactive waste disposed	[kg]	3.15E-2	1.59E-4	-6.70E-3
Components for re-use	[kg]	0.00E+0	0.00E+0	0.00E+0
Materials for recycling	[kg]	0.00E+0	4.38E-1	0.00E+0
Materials for energy recovery	[kg]	0.00E+0	6.28E+0	0.00E+0
Exported electrical energy	[MJ]	0.00E+0	1.92E+1	0.00E+0
Exported thermal energy	[MJ]	0.00E+0	3.44E+1	0.00E+0

The impact assessment results only represent relative statements. They do not make any statements about endpoints of impact categories, overstepping of threshold values, safety margins or risks.

6. LCA: Interpretation

The environmental impacts of the production of calcium silicate units are dominated by the environmental burdens in the production of the raw materials and the energy consumption in the production plant. For the main components sand and quicklime, the upstream chains of quicklime production have a significant influence on the results regarding global warming potential, and are also relevant in almost all other impact categories.

7. Requisite evidence

7.1 Radioactivity

Method: Measurement of nuclide content in Bq/kg, determination of activity index I

Summary report: /BfS-SW-14/12/, Salzgitter, November 2012

Result: The evaluation of the samples was carried out according to the /Directive of the European Commission "Radiation Protection 112"/ (Radiological Protection Principles concerning the Natural Radioactivity of Building Materials, 1999). The determined index values I are lower than the exclusion level in all cases. Hence no further controls are required. From a radiological point of view, the natural radioactivity of this building material allows its unrestricted use.

7.2 Leaching behaviour

Monitoring body: LGA Institut für Umweltgeologie und Altlasten GmbH, Nürnberg

Method: Chemical analysis according to /DepV (2009)/ and /LAGA M20/

Report: IUA2014353 Investigation of calcium silicate unit samples with regard to disposal

Result: All criteria for disposal in Class 0 landfill sites in accordance with the Landfill Directive of 27/04/2009, valid in Germany, are fulfilled. The evaluation according to /LAGA M20/ results in a classification in installation class Z0.

8. References

/IBU 2016/
IBU (2016):General EPD Program Guidelines of Institut Bauen und Umwelt e.V. (IBU). Version 1.1, Institut Bauen und Umwelt e.V., Berlin.

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PCR 2013, Part B
Institut Bauen und Umwelt e.V., Berlin (ed.): Product category rules for construction products in the Program for Environmental Product Declarations of Institut Bauen und Umwelt (IBU) Part B: Requirements for the EPD on calcium silicate units v1 6 2014-07, www.bau-umwelt.de

Regulation (EU) No. 305/2011 of the European Parliament and the European Council of 9 March 2011, also EU Construction Products Regulation (CPR)

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DIN V 20000-402: 2017-01; Application of building products in structures - Part 402: Rules for the application of calcium silicate masonry units according to DIN EN 771-2:2015-11

DIN V 106: 2005-10; Calcium silicate units with specific properties

DIN EN 459-1: 2015-07; Building lime - Part 1: Definitions, specifications and conformity criteria; German version EN 459-1:2015

DIN EN 998-2: 017-02; Specification for mortar for masonry - Part 2: Masonry mortar; German version EN 998-2:2016

DIN V 18580: 2007-03; Special masonry mortar

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Useful life of construction elements for Life Cycle Assessments according to the Rating system for sustainable building (BNB) Status as of: 24/02/2017, Information portal Sustainable Building of BMI (Federal Ministry of the Interior)

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DepV (2009): Verordnung über Deponien und Langzeitlager - Deponieverordnung vom 27.04.2009 (BGBl I S. 900) zuletzt geändert durch Art. 7 V vom 26/11/2010

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Measurement report 1813.10:

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