Type III Environmental Product Declaration No. 634/2024

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H+H Calcium Silicates

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Basic information

This declaration is the Type III Environmental Product Declaration (EPD) based on EN 15804+A2 and verified according to ISO 14025 by an external auditor. It contains the information on the impacts of the declared construction materials on the environment and their aspects verified by the independent body according to ISO 14025. Basically, comparison or evaluation of EPD data is possible only if all the compared data were created according to EN 15804+A2.

Life cycle analysis (LCA): A1-A3, C1-C4 and D modules in accordance with EN 15804
(Cradle-to-Gate with options)
The year of preparing the EPD: 2024
Product standard: EN 771-2:2011+A1:2015
Service Life: 150 years for standard product
PCR: ITB-PCR A (PCR based on EN 15804+A2)
Declared unit: 1 kg
Reasons for performing LCA: B2B
Representativeness: Polish, European, 2022

MANUFACTURER

Fig. 1. The view from the street of H+H Polska Sp. z o. o. in Warsaw

H+H Polska Sp. z o. o. belongs to the H+H International A/S Group, a leading manufacturer of "white wall materials" in Europe, listed on the Copenhagen Stock Exchange. It has been operating on the Polish market since 2006. It produces and supplies a complete range of products made of autoclaved aerated concrete, and since 2018 also calcium silicate elements. The success of H+H Polska is the result of the joint work of nearly 600 people employed in 11 production plants. It is measured by customer trust, attention to the highest standards of service, occupational safety and environmental protection, as well as the quality of products intended for energy-efficient construction that provide users with thermal and acoustic comfort and structural safety. The company owes its strong position on the Polish market to its transparent strategy and solid product offer, and numerous investments ensure the company's continuous development.

PRODUCTS DESCRIPTION AND APPLICATION

Calcium silicate is a building material that is a mixture of natural ingredients, i.e. quicklime, sand and water. It stands out from other materials of this type mainly due to its low construction costs and the lack of environmentally harmful and radioactive compounds. It is worth adding that after the silicate has been used, it can be ground again and later used in the production of new products, which is a huge advantage. It can also be stored in the ground without fear of soil contamination. The material is used in residential and commercial construction. Calcium silicate is produced under the influence of water vapor. When hardened, it behaves well under the influence of various external factors. Production is carried out in accordance with the product standard EN 771-4:2011+A1:2015.

The list of products manufactured from silicates and covered by this EPD is presented in table no. 1

Table 1. Types, dimensions and properties of produced silicates blocks

Product designation	***Density***	***Length***	***Width***	***Height***	***Resistance [MPa]***	***Finish***	***Color***	***Thermal conductivity coefficient [W/(mK)]***
H+H Calcium Silicate 15-1400	*1210 - 1400*	*250*	*80, 120, 150, 180, 240, 250*	*220*	*15,0*	*Smooth element*	*White*	*0.46*
H+H Calcium Silicate 15-1600	*1410 - 1600*	*250*	*65, 80,120,150, 180, 240, 250*	*220*	*15,0*	*Smooth element*	*White*	*0.61*
H+H Calcium Silicate 15-1800	*1610 - 1800*	*250*	*120*	*65*	*15,0*	*Smooth element*	*White*	*0.81*
		115	*240*	*220*				
H+H Calcium Silicate 20-1400	*1210 - 1400*	*250*	*180, 240, 250*	*220*	*20,0*	*Smooth element*	*White*	*0.46*
H+H Calcium Silicate 20-1600	*1410 - 1600*	*250*	*180, 240, 250*	*220*	*20,0*	*Smooth element*	*White*	*0.61*
		500	*250*	*140*				
	1610 - 1800	*115*	*240*	*220*	*20,0*	*Smooth element*	*White*	*0.81*
		120	*250*					

H+H Calcium Silicate 20-1800		*250*	*120*	*65*				
			240, 250	*98*				
			120, 180, 240, 250	*220*				
H+H Calcium Silicate 20-2000	*1810 - 2000*	*250*	*180, 240*	*98*	*20,0*	*Smooth element*	*White*	*1.05*
			180, 240	*220*				
		180	*250*					
H+H Calcium Silicate 25-1600	*1610 - 1800*	*250*	*240, 250*	*220*	*25,0*	*Smooth element*	*White*	*0.61*
H+H Calcium Silicate 25-1800	*1610 - 1800*	*250*	*180, 240, 250*	*220*	*25,0*	*Smooth element*	*White*	*0.81*
H+H Calcium Silicate 25-2000	*1810 - 2000*	*250*	*180, 240*	*220*	*25,0*	*Smooth element*	*White*	*1.05*
		180	*250*					
H+H Calcium Silicate 30-2000	*1810 - 2000*	*250*	*180*	*220*	*30,0*	*Smooth element*	*White*	*1,05*
		180	*250*					
H+H Calcium Silicate 25-2200	*2010 - 2200*	*250*	*180*	*220*	*25,0*	*Smooth element*	*White*	*1.37*
		180	*250*					
H+H Calcium Silicate 30-2200	*2010 - 2200*	*250*	*180*	*220*	*30,0*	*Smooth element*	*White*	*1.37*
		180	*250*					

LIFE CYCLE ASSESSMENT (LCA) – general rules applied

Declared unit

Declared unit is 1 m^3 of siliacte product with a dry (averaged) density of 1800 kg/m^3. To calculate/converte the impact on a specific product with a specific density, the results from the table should be divided by factor 1800 and multiplied by the product density value in kg/m^3.

Allocation

The allocation rules used for this EPD are based on general ITB PCR A. Production is a line process executed by of H+H Polska Sp. z o. o. in 5 plants:

- Plant Jedlanka located in Jedlanka 2, 21-450, Stoczek Łukowski;
- Plant Klucze located in Osada 17A, 32-310, Klucze;
- Plant Kruki located in ul. Nowowiejska 33, 07-415, Olszewo-Borki;
- Plant Leżajsk located in ul. Fabryczna 5, 37-300, Leżajsk;
- Plant Przysieczyn in Przysieczyn 6, 62-100, Wągrowiec.

Allocation was done on product mass basis. All impacts from raw materials extraction and processing are allocated in module A1 of the LCA. Impacts from the global line production of H+H Polska Sp. z o. o. were inventoried and 100% were allocated to Calcium silicates. Water and energy consumption, associated emissions and generated wastes are allocated to module A3. Packaging materials were takien into consideration. The calculations were performed separately for each plant, then the results were averaged on a weighted average basis.

System limits

Type of the EPD is: cradle to gate - with options. The following life cycle stages were considered. Production stage including: A1 - Raw material extraction and processing, A2 - Transport to the manufacturer and A3 - Manufacturing, A4 - Transport to Site, A5 – installation, End-of-life stage: C1-Deconstruction, C2 - Transport to waste processing, C3 - Waste processing, C4 - Disposal (landfill).

This includes provision of all materials, products and energy, packaging processing and its transport, as well as waste processing up to the end-of waste state or disposal of final residues. EPD includes D module - declaration of all benefits and loads beyond product system. Energy and water consumption, emissions as well as information on generated wastes were inventoried and were included. It can be assumed that the total sum of omitted processes does not exceed 5% of all impact categories. In accordance with EN 15804+A2, machines and facilities (capital goods) required for the production as well as transportation of employees were not included in LCA. 99.8% materials submitted for the formulations and production data were taken into consideration. In the assessment, all available data from production have been considered, i.e. all raw materials/elements used as per formulation process, utilized thermal energy for heating, and electric power consumption. Thus, material and energy flows contributing less than 1 % of mass or energy have been considered. It can be assumed that the total sum of neglected processes does not exceed 0.5 % of energy use and mass per modules.

Modules A1 and A2: ***Raw materials supply and transport***

The product includes sand, lime, water and packaging materials mainly from local suppliers. The means of transport are trucks. Polish and European fuel averages were used for calculations. Polish and European standards for average combustion were used for calculations. Data on mode of transport and distances, as reported by suppliers were used for those materials and parts contributing more than 0.1 % of total product mass.

Module A3: ***Production***

The first stage of calcium silicate production is placing lime and sand in a reactor, then water is added to this mixture. Another important step in the silicate production process is lime slaking. The ready mixture of sand, lime and water is shaped - i.e. pressed under high pressure. At the forming stage, the appropriate geometry of blocks is obtained, and it is also a production stage that affects their final compressive strength. The elements prepared in this way are subjected to the autoclaving process. It involves placing the compressed lime-sand mass in autoclaves for several hours (usually 6-8), where it is hardened under the influence of steam. In such conditions, as a result of a series of chemical reactions, the calcium silicate elements are hardened and reach their high level of compressive strength and its high durability, which remains even in contact with changing weather conditions. The final stage of production is packing the finished elements onto pallets, which are then wrapped and transported to the warehouse. A diagram of the production process is shown in Fig. 2.

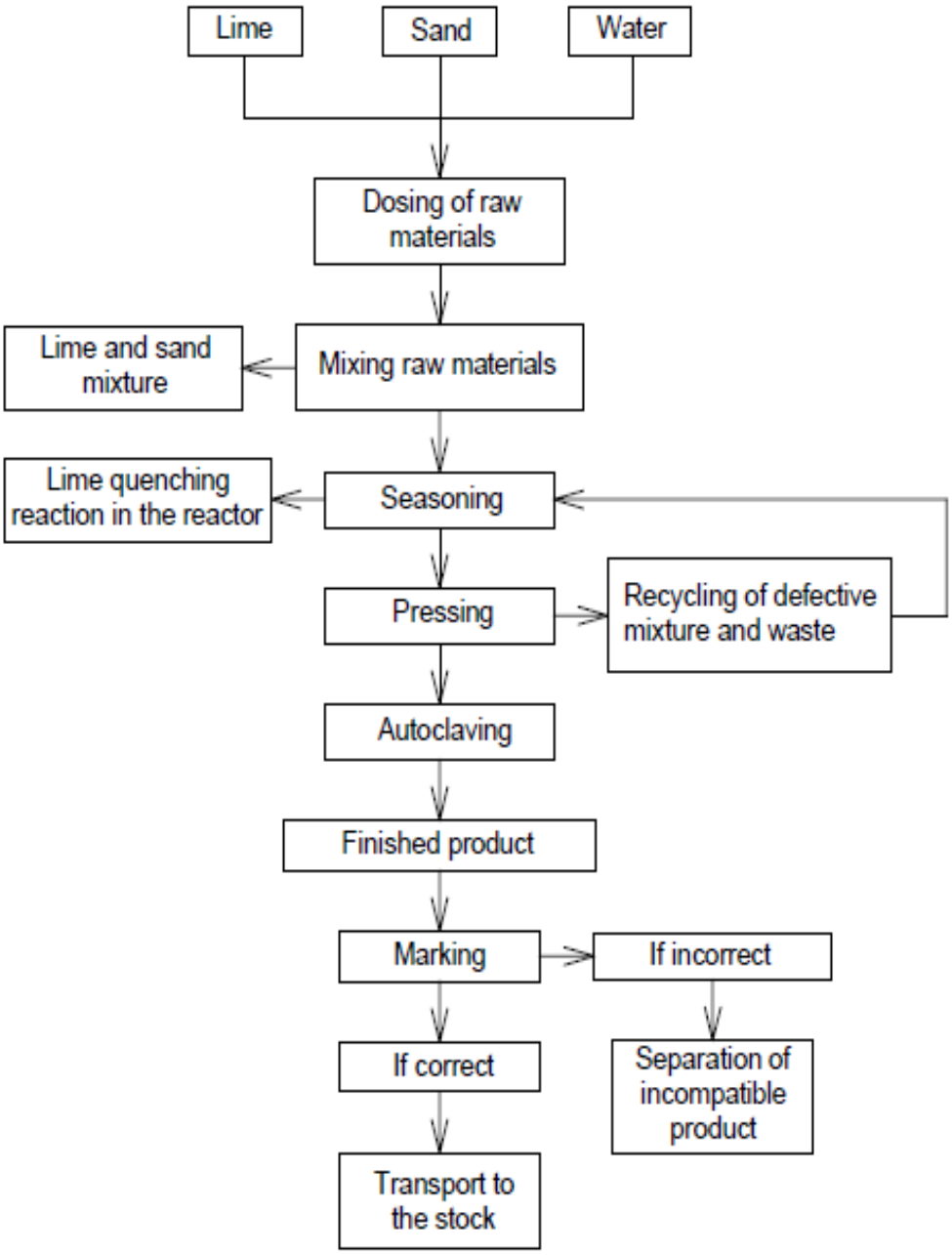

Fig. 2. The scheme of production by H+H Polska Sp. z o. o.

Module A4: ***Transport to a construction site***

The bricks and elements produced are delivered to Polish as well as foreign customers. In the adapted scenario an average distance of 135 km from the factory gate to a recipient is assumed. Means of transport include 16 - 32 t lorry (EURO 5) with fuel consumption of 35 l per 100 km.

Module A5: Installation

The blocks are installed as predefined elements using auxiliary materials or machinery. The calcium silicate products are installed in Europe. A flat amount of construction waste is assumed for all

products equal to 1%. The declared product is thus the inclusion of the construction waste in the product.

Module: B1

For B1 CO2 uptake (minus value) from carbonation has been calculated based on the reactive CaO specifications on each product and the rate of carbonation set to 95%.

Modules *C1-C4 and D: End-of-life (EoL)*

In the adapted scenario, dismantling of calcium silicates (C1) is performed as part of building renovation or demolition processes, where environmental impacts from declared products can be considered as minor (<1%). There are no specific deconstruction methods, applied in Poland, so impact the electric tools and construction machines was assumed. During the demolition process the major amount of the products contribute to the construction and demolition wastes which can be processed on site or in a waste processing plant. It is assumed that 100% of calcium silicates are recovered at the EoL cycle. Recovered material is transported to either to landfill or construction site distant by 100km, on 16-32t lorry (EURO 5) with fuel consumption of 35l per 100 km. In the adapted scenario 90% of the products is recycled and further used as aggregate for road foundation or ballast(credits presented in module D) while remaining 10% is forwarded to landfill in the form of mixed construction and demolition wastes. Environmental burdens declared in module C4 are associated with waste-specific emissions to air, soil and groundwater. Regarding the recycling material of metals, the metal parts in the EoL are declared as end-of-waste status. Electricity at end-of-life (module C) has been modelled. Electricity at end-of-life (module D) has been modelled using an average EU-27 electricity mix as the location where the product reaches end-of-life is unknown.

Table 2. End-of-life scenario for the calcium silicates products

Material	Material recovery	Recycling	Landfilling
Calcium silicates	100 %	90%	10 %

Electricity at end-of-life (module C) has been modelled using an average Polish electricity mix as the location where the product reaches end-of-life is unknown.

Data quality

The values determined to calculate the LCA originate from verified H+H Polska Sp. z o. o. inventory data. The data selected for LCA originate from ITB LCI questionnaires completed by H+H Polska Sp. z o. o. and verified during data audit. No data collected is older than five years and no generic datasets used are older than ten years. The representativeness, completeness, reliability, and consistency is judged as good. Specific (LCI) data quality analysis was a part of the input data verification.

Data collection period

The data for manufacture of the declared products refer to period between 01.01.2022 – 31.12.2022 (1 year). The life cycle assessments were prepared for Poland and Europe as reference area.

Assumptions and estimates

The impacts of calcium silicates were aggregated using average.

Calculation rules

LCA was done in accordance with ITB PCR A document (v1.6).

Databases

The data for the processes come from the following databases: Ecoinvent v.3.10, specific EPDs, ITB-Database. Specific data quality analysis was a part of external audit. Polish electricity mix used (production) is 0.685 kg CO2/kWh (KOBiZE 2023). European electricity mix used is 0.430 kg CO2/kWh for the end of life (Ecoinvent v3.10, RER).

LIFE CYCLE ASSESSMENT (LCA) – Results

Declared unit

The declaration refers to declared unit (DU) – 1 m^3 of calcium silicates produced by H+H Polska Sp. z o. o (density 1800 kg/m^3).

Table 3. System boundaries for the environmental characteristic of the product.

Environmental assessment information (MD – Module Declared, MND – Module Not Declared, INA – Indicator Not Assessed)																
Product stage			Construction process		Use stage							End of life				Benefits and loads beyond the system boundary
Raw material supply	Transport	Manufacturing	Transport to construction site	Construction-installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction 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**
MD	**MD**	**MD**	**MD**	**MD**	**MD**	**MND**	**MND**	**MND**	**MND**	**MND**	**MND**	**MD**	**MD**	**MD**	**MD**	**MD**

Table 4. Life cycle assessment (LCA) results for specific product – environmental impacts (DU: 1 m^3)

Indicator	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Global Warming Potential	eq. kg CO_2	1.31E+02	8.48E+00	7.45E+01	2.14E+02	4.05E+01	2.47E+00	6.17E+00	3.00E+01	2.70E+01	1.92E+00	-1.62E+01
Greenhouse potential - fossil	eq. kg CO_2	1.31E+02	8.45E+00	7.45E+01	2.14E+02	4.04E+01	2.47E+00	6.17E+00	2.99E+01	2.69E+01	1.89E+00	-1.62E+01
Greenhouse potential - biogenic	eq. kg CO_2	9.96E-01	2.89E-02	-2.93E-01	7.32E-01	1.38E-01	6.65E-03	1.66E-02	1.02E-01	9.20E-02	1.91E-02	-9.72E-04
Global warming potential - land use and land use change	eq. kg CO_2	9.54E-03	3.32E-03	7.82E-03	2.07E-02	1.59E-02	3.86E-04	9.64E-04	1.17E-02	1.06E-02	1.92E-03	-7.43E-02
Stratospheric ozone depletion potential	eq. kg CFC 11	1.10E-06	1.96E-06	2.94E-06	6.00E-06	9.35E-06	1.36E-08	3.39E-08	6.92E-06	6.23E-06	5.76E-07	-3.05E-06
Soil and water acidification potential	eq. mol H+	1.83E-01	3.43E-02	7.88E-01	1.01E+00	1.64E-01	2.61E-02	6.52E-02	1.21E-01	1.09E-01	1.60E-02	-6.80E-01
Eutrophication potential - freshwater	eq. kg P	2.55E-03	5.68E-04	4.06E-02	4.37E-02	2.72E-03	4.25E-03	1.06E-02	2.01E-03	1.81E-03	5.50E-04	-2.47E-02
Eutrophication potential - seawater	eq. kg N	5.02E-02	1.04E-02	6.23E-02	1.23E-01	4.95E-02	3.69E-03	9.23E-03	3.67E-02	3.30E-02	5.51E-03	-6.04E-02
Eutrophication potential - terrestrial	eq. mol N	5.65E-01	1.13E-01	6.15E-01	1.29E+00	5.40E-01	3.22E-02	8.05E-02	4.00E-01	3.60E-01	6.00E-02	-8.12E-01
Potential for photochemical ozone synthesis	eq. kg NMVOC	2.91E-01	3.46E-02	4.10E-01	7.35E-01	1.65E-01	9.27E-03	2.32E-02	1.22E-01	1.10E-01	1.74E-02	-1.95E-01
Potential for depletion of abiotic resources - non-fossil resources	eq. kg Sb	1.74E-03	3.00E-05	2.20E-05	1.79E-03	1.43E-04	9.29E-07	2.32E-06	1.06E-04	9.55E-05	6.42E-06	-4.83E-03
Abiotic depletion potential - fossil fuels	MJ	7.34E+02	1.25E+02	8.80E+02	1.74E+03	6.00E+02	3.89E+01	9.74E+01	4.44E+02	4.00E+02	4.38E+01	-5.69E+02
Water deprivation potential	eq. m^3	9.57E+00	5.80E-01	5.25E+00	1.54E+01	2.77E+00	7.44E-01	1.86E+00	2.05E+00	1.85E+00	2.54E-01	-4.22E+01

Table 5. Life cycle assessment (LCA) results for specific product – additional impacts indicators (DU: 1 m^3)

Indicator	Unit	A1-A3	A4-A5	C1-C4	D
Particulate matter	disease incidence	INA	INA	INA	INA
Potential human exposure efficiency relative to U235	eg. kBq U235	INA	INA	INA	INA
Potential comparative toxic unit for ecosystems	CTUe	INA	INA	INA	INA
Potential comparative toxic unit for humans (cancer effects)	CTUh	INA	INA	INA	INA
Potential comparative toxic unit for humans (non-cancer effects)	CTUh	INA	INA	INA	INA
Potential soil quality index	dimensionless	INA	INA	INA	INA

Table 6. Life cycle assessment (LCA) results for specific product - the resource use (DU: 1 m^3)

Indicator	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Consumption of renewable primary energy - excluding renewable primary energy sources used as raw materials	MJ	1.00E+02	1.80E+00	1.97E+01	1.22E+02	8.60E+00	3.20E+00	8.01E+00	6.37E+00	5.73E+00	7.69E-01	-6.54E+01
Consumption of renewable primary energy resources used as raw materials	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
Total consumption of renewable primary energy resources	MJ	1.00E+02	1.80E+00	1.99E+01	1.22E+02	8.60E+00	3.20E+00	8.01E+00	6.37E+00	5.73E+00	7.69E-01	-6.54E+01
Consumption of non-renewable primary energy - excluding renewable primary energy sources used as raw materials	MJ	7.08E+02	1.25E+02	7.89E+02	1.62E+03	6.00E+02	3.89E+01	9.74E+01	4.44E+02	4.00E+02	4.73E+01	-5.70E+02
Consumption of non-renewable primary energy resources used as raw materials	MJ	2.60E+01	0.00E+00	0.00E+00	2.60E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total consumption of non-renewable primary energy resources	MJ	7.34E+02	1.25E+02	8.90E+02	1.75E+03	6.00E+02	3.89E+01	9.74E+01	4.44E+02	4.00E+02	4.73E+01	-5.70E+02
Consumption of secondary materials	kg	2.04E-01	4.21E-02	7.52E-02	3.22E-01	2.01E-01	3.39E-03	8.46E-03	1.49E-01	1.34E-01	0.00E+00	-3.44E-01
Consumption of renew. secondary fuels	MJ	1.76E-01	4.63E-04	4.90E-04	1.77E-01	2.21E-03	1.71E-05	4.27E-05	1.64E-03	1.48E-03	0.00E+00	-2.09E-02
Consumption of non-renewable secondary fuels	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
Net consumption of freshwater	m^3	5.84E-01	1.58E-02	4.05E-01	1.01E+00	7.54E-02	1.12E-01	2.80E-01	5.59E-02	5.03E-02	6.83E-03	-1.03E+00

Table 7. Life cycle assessment (LCA) results for specific product – waste categories (DU: 1 m^3)

Indicator	Unit	A1	A2	A3	A1-A3	A4	A5	C1	C2	C3	C4	D
Hazardous waste	kg	7.35E-01	1.41E-01	6.12E+00	7.00E+00	6.73E-01	3.02E-01	7.55E-01	4.98E-01	4.49E-01	6.89E-05	-3.97E+00
Non-hazardous waste	kg	1.97E+01	2.50E+00	1.90E+02	2.12E+02	1.19E+01	2.03E+01	5.08E+01	8.85E+00	7.96E+00	1.80E+02	-1.11E+02
Radioactive waste	kg	5.37E-04	9.37E-06	5.69E-05	6.04E-04	4.48E-05	5.84E-06	1.46E-05	3.32E-05	2.98E-05	2.66E-04	-1.50E-03
Components for re-use	kg	0.00E+00	0.00E+00	1.69E+01	1.69E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for recycling	kg	7.29E-03	3.88E-04	1.80E+01	1.80E+01	1.86E-03	2.61E-04	6.53E-04	1.37E-03	1.24E-03	0.00E+00	-7.71E-03
Materials for energy recovery	kg	1.74E-05	3.14E-06	7.56E+00	7.56E+00	1.50E-05	4.20E-07	1.05E-06	1.11E-05	1.00E-05	0.00E+00	-7.16E-04
Exported Energy	MJ	5.39E+01	0.00E+00	4.95E-01	5.44E+01	0.00E+00	1.25E-01	3.11E-01	0.00E+00	0.00E+00	0.00E+00	-1.55E+00

Verification

The process of verification of this EPD is in accordance with ISO 14025 and ISO 21930. After verification, this EPD is valid for a 5-year-period. EPD does not have to be recalculated after 5 years, if the underlying data have not changed significantly.

The basis for LCA analysis was EN 15804 and ITB PCR A
Independent verification corresponding to ISO 14025 (subclause 8.1.3.) ☒ external ☐ internal
External verification of EPD: PhD. Eng. Halina Prejzner LCI audit and verification: Filip Poznański, M.Sc. Eng. LCA, LCI audit and input data verification: Michał Piasecki, PhD., D.Sc., Eng.

Note 1: The declaration owner has the sole ownership, liability, and responsibility for the for the information provided and contained in EPD. Declarations of construction products may not be comparable if they do not comply with EN 15804+A2. For further information about comparability, see EN 15804+A2 and ISO 14025.

Note 2: Note: ITB is a public Research Organization and Notified Body (EC Reg. no 1488) to the European Commission and to other Member States of the European Union designated for the tasks concerning the assessment of building products' performance. ITB acts as the independent, third-party verification organization (ISO 17025/17065/17029). ITB-EPD program is recognized and registered member of The European Platform - Association of EPD program operators and ITB-EPD declarations are registered and stored in the international ECO-PORTAL.

Normative references

- ITB PCR A General Product Category Rules for Construction Products (2023)
- *EN 771-2:2011+A1:2015* Specification for masonry units - Part 2: Calcium silicate masonry units
- ISO 14025:2006, Environmental labels and declarations – Type III environmental declarations – Principles and procedures
- ISO 21930:2017 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services
- ISO 14044:2006 Environmental management – Life cycle assessment – Requirements and guidelines
- ISO 15686-1:2011 Buildings and constructed assets – Service life planning – Part 1: General principles and framework
- ISO 15686-8:2008 Buildings and constructed assets – Service life planning – Part 8: Reference service life and service-life estimation
- EN 15804:2012+A2:2019 Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products
- ISO 14067:2018 Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification
- PN-EN 15942:2012 Sustainability of construction works – Environmental product declarations – Communication format business-to-business
- EN 459-1:2015 Building lime - Definitions, specifications and conformity criteria
- https://ecoinvent.org/

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CERTIFICATE № 634/2024
of TYPE III ENVIRONMENTAL DECLARATION

Products:

H+H Calcium Silicates

Manufacturer:

H+H Polska Sp. z o.o.

Kupiecka 6, 03-046 Warszawa, Poland

confirms the correctness of the data included in the development of
Type III Environmental Declaration and accordance with the requirements of the standard

EN 15804+A2

Sustainability of construction works.
Environmental product declarations.
Core rules for the product category of construction products.

This certificate, issued on 10th May 2024 is valid for 5 years
or until amendment of mentioned Environmental Declaration

Head of the Thermal Physic, Acoustics and Environment Department
Agnieszka Winkler-Skalna, PhD

INSTYTUT TECHNIKI BUDOWLANEJ

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Warsaw, May 2024