B-EPD ENVIRONMENTAL PRODUCT DECLARATION

ARGEX
Lightweight Expanded Clay Aggregate

AR 8/16 – 340 GEO
used for thermal insulation of 1m² for buildings (roofs, floors and foundations, etc.), applied with a thickness of 11.4 cm that gives a thermal resistance (R-value) of 1 (m²·K/W), with a life span of 100 years.

Issued 16.09.2021
Valid until 16.09.2026

Third party verified
Conform to EN 15804+A2 and NBN/DTD B08-001 and ISO 14025

Modules declared					
A123	A4	A5	B	C	D
☒	☒	☒	☒	☒	☒

[B-EPD n° 21-0134-002.00.00]

OWNER OF THIS ENVIRONMENTAL PRODUCT DECLARATION
ARGEX

EPD PROGRAM OPERATOR
Federal Public Service of Health, Food Chain Safety and Environment
www.b-epd.be

The intended use of this EPD is to communicate scientifically based environmental information for construction products, for the purpose of assessing the environmental performance of buildings. This EPD is only valid when registered on www.b-epd.be. The FPS Public Health cannot be held responsible for the information provided by the owner of the EPD.

PRODUCT DESCRIPTION

PRODUCT NAME

This EPD contains the environmental impact of the ARGEX lightweight expanded clay aggregate reference product **AR 8/16 – 340 GEO**.

PRODUCT DESCRIPTION

Lightweight expanded clay aggregate ARGEX is a granular ceramic material made from clay, and the product is distributed in bulk or bags.

INTENDED USE

This product is used for thermal applications of roofs, floors and foundations, etc.*

* For the full list of thermal insulation applications, please refer to EN 14063-1.

For technical data: see the DoP (following EN 14063-1), and technical sheets (https://www.argex.eu).

FUNCTIONAL UNIT / REFERENCE FLOW

The functional unit is the thermal insulation of 1m² for buildings (roofs, floors and foundations, etc.), using AR 8/16 – 340 GEO, applied with a thickness of 11.4 cm that gives a thermal resistance (R-value) of 1 (m²·K/W), with a life span of 100 years".

The most important part of the product is sold in bulk. The packaging is included for the 1.60% of the final product sold in big bags.

The weight per reference flow is 38.76 kg.
The loose bulk density of the product is 340 kg/m^3.

The environmental assessment is conducted for AR 8/16 GEO with 11.4 cm thickness as reference product, providing a thermal resistance equals to 1 m^{2}K/W. A range of thickness is applicable for this product (0.1 – 2 m). To obtain the impacts related to the different thicknesses, conversion factor should be multiplied by the results presented in this B-EPD. Conversion factor is calculated dividing the actual weight by the reference flow weight (38.76 kg). Table below includes conversion factors for different thicknesses.

Functional	Product Reference	AR 8/16
R = 1 m^{2}K/W thickness = 11.4 cm	Conversion factor	1
	Weight (kg)	38.76
R = 1.75 m^{2}K/W thickness = 20 cm	Conversion factor	1.75
	Weight (kg)	68
R = 2.63 m^{2}K/W thickness = 30 cm	Conversion factor	2.63
	Weight (kg)	102
R = 3.51m^{2}K/W thickness = 40 cm	Conversion factor	3.51
	Weight (kg)	136

INSTALLATION

This EPD includes the impacts of all materials and processes necessary for installing/mounting the product accordingly. A single scenario was defined for this EPD based on the following options:

i. blowing followed by a vibrating plate for levelling and compaction,
ii. blowing followed by a manual levelling.

IMAGES OF THE PRODUCT AND ITS INSTALLATION

Figure 1: Lightweight expanded clay aggregate material

Figure 2: Examples of lightweight expanded clay aggregate in thermal insulation applications

Figure 3: Blowing with vibrating plate levelling-compaction installation

Figure 4: Blowing with manual levelling installation

COMPOSITION AND CONTENT

The main components of the product are:

Components	Composition / content / ingredients	Quantity
Product	*- Clay (on-site ARGEX pit)* *- Iron oxides (Europe)* *- Additives (Europe)*	*- 87%* *- 11 – 12 %* *- 1 – 2 %*
Fixation materials	*- Not applicable for this product*	
Jointing materials	*- Not applicable for this product*	
Treatments	*- Not applicable for this product*	
Packaging	*- PE film* *- PP big bags* *- wooden pallets* *- HDPE (big bags and top sheets)*	*-1.64E-4 kg/ kg final packed product* *-3.21E-3 kg/kg final packed product* *-2.97E-2 kg/kg final packed product* *-3.65E-3 kg/kg final packed product* *Quantities of packaging refer only to packed products*

The product does not contain materials listed in the "Candidate List of Substances of Very High Concern for authorisation".

REFERENCE SERVICE LIFE

Expanded clay ARGEX products are already installed in existing buildings in previous decades (product intrinsic material properties lead to adequate long-term performances). Several buildings maybe find in Europe containing the product from decades ago. Examples are provided in the LCA background report.

The reference service life is estimated at 100 years (installed products are still in use) if the product is installed according to the manufacturers' and suppliers' guidelines. The RSL is based on available average EPDs, expert judgment, EXCA internal guidance for EPDs (2021), and corresponding to the average lifespan of a building.

DESCRIPTION OF GEOGRAPHICAL REPRESENTATIVITY

The EPD is cradle to grave and it is representative for the Belgian market.

DESCRIPTION OF THE PRODUCTION PROCESS AND TECHNOLOGY

The clay is mixed with organic material, dried and expanded to 4-5 times its original volume in a rotary kiln at a temperature of about 1150 °C. The output expanded clay aggregate granules are sieved and blended into different grades of products.

Product stage (A1-3): The extracted clay is transported by conveyor belt to the production plant. Iron oxides and additives (clay substitute) are transported to the production plant by truck and boat. The manufacturing is composed of kneading, grind, compress, kiln and crush processes. Some of the final product is packed. All products are transported to the construction site.

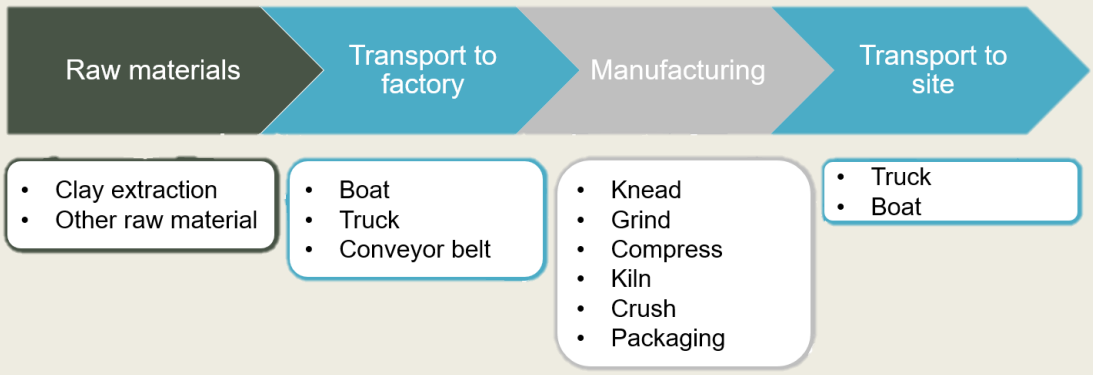

Figure 5: Flowchart illustrating the production process of lightweight expanded clay aggregate

TECHNICAL DATA / PHYSICAL CHARACTERISTICS

Technical property	Standard	Value	Unit
Thickness*	EN 14063-1	11.4	cm
Thermal resistance (R)		1	m^2K/W
Thermal conductivity (λue) **		0.114	W/(m.K)
Loose bulk dry density		340	kg/m^3

* Typical thickness range applied for thermal insulation: 0.1-2 m – see EPBD databank.
** Thermal conductivity declared (and verified) in the EPB database http://www.epbd.be/index.cfm?n01=data&n02=recognized_data
Additional characteristics: see DoP2, in accordance with EN 14063-1, & technical sheets (https://www.argex.eu).

LCA STUDY

DATE OF LCA STUDY

The LCA study cradle to grave is conducted in March 2021. The information contained in this document is provided under the responsibility of ARGEX according to EN 15804 + A2 and additional requirements from NBN/DTD B 08-001.

SOFTWARE

When calculating the environmental impact categories, SimaPro version 9.1.0.7 was used as well as environmental data from the Ecoinvent database, version 3.6.

INFORMATION ON ALLOCATION

No co-product allocation occurs in the product foreground system.
No multi-input allocation occurs in the product system.
The allocations from the background database are kept intact.

During the excavation, the process of refilling the clay pitwith inert waste happens simultaneously. Thus, the energy used to extract the clay is allocated 50/50 to clay (as the product raw material) and landfilling operations.

INFORMATION ON CUT OFF

The company reported the data. Some plausibility and completeness assessments and checks were conducted for some inputs. For a few remaining data, no extended assessment was conducted, therefore accepting data gaps. In all cases, it is assumed that the cut-off criteria of EN 15804 are met.

INFORMATION ON EXCLUDED PROCESSES

Following processes are excluded:

- The effects of capital goods and infrastructural processes have been excluded.
- Flows related to human activities such as employee transport and administration activities are excluded.

INFORMATION ON BIOGENIC CARBON MODELLING

l Lightweight expanded clay aggregate products are mainly made from clay; they don't include any biogenic carbon content.
The biomass used as fuel in the manufacturing contains biogenic content. The biogenic CO_2 capture and emissions are modelled in the same module and therefore neutralised.

For EN 15804+A2 include the following table:

	Biogenic carbon content (kg C / FU)
Biogenic carbon content in the product (at the gate)	-
Biogenic carbon content in accompanying packaging (at the gate)	-

INFORMATION ON CARBON OFFSETTING

Carbon offsetting is not allowed in the EN 15804 and hence not taken into account in the calculations.

ADDITIONAL OR DEVIATING CHARACTERISATION FACTORS
For EN 15804+A2: The characterisation factors from EC-JRC were applied. No additional or deviating characterisation factors were used.

DATA

SPECIFICITY
The data used for the LCA are specific for this product which is manufactured by a single manufacturer in a single production site (ARGEX).

PERIOD OF DATA COLLECTION
Manufacture-specific data have been collected for the year 2020.

INFORMATION ON DATA COLLECTION
No adaptations of the data were found necessary.

DATABASE USED FOR BACKGROUND DATA
Eco-invent version 3.6 was used, released in September 2019.

ENERGY MIX
The Belgian energy mix is considered for the manufacturing and the installation of the product in the building.
Therefore, the Belgian energy mix was used to declare the benefits beyond the system boundaries (for module D).

PRODUCTION SITE

ARGEX – Kruibeeksesteenweg 162, B-2070 Burcht, Belgium.

SYSTEM BOUNDARIES

Product stage			Construction installation stage		Use stage							End of life stage					Beyond the system boundaries
Raw materials	Transport	Manufacturing	Transport	Construction installation stage	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
☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒		☒

X = included in the EPD
MND = module not declared

POTENTIAL ENVIRONMENTAL IMPACTS PER 1 M^2 OF THERMAL INSULATION APPLICATIONS

The results of the LCIA are calculated for AR 8/16 -340 GEO lightweight expanded clay aggregate. The results are provided for **1 m^2 of the lightweight expanded clay aggregate product, with a thickness of 0.114 m, a thermal conductivity λ equals to 0.114 W/(mK) and a R equals to 1 m^2K/W**. The average installed density for the assessed product is 340 kg/m^3.

	Production			Construction process stage		Use stage							End-of-life stage				
	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling
GWP total (kg CO2 equiv/FU)	1.34E-01	2.13E-02	9.95E+00	2.19E-01	1.18E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.78E-02	1.62E-02	0.00E+00	0.00E+00	-9.42E+00
GWP fossil (kg CO2 equiv/FU)	1.33E-01	2.12E-02	9.98E+00	2.19E-01	5.04E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.78E-02	1.62E-02	0.00E+00	0.00E+00	-9.43E+00
GWP biogenic (kg CO2 equiv/FU)	6.98E-04	4.25E-05	-2.76E-02	1.59E-04	6.72E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.67E-06	8.62E-06	0.00E+00	0.00E+00	1.28E-02
GWP luluc (kg CO2 equiv/FU)	1.15E-04	2.43E-05	3.07E-03	6.39E-05	1.09E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.17E-06	5.65E-06	0.00E+00	0.00E+00	-2.98E-03
ODP (kg CFC 11 equiv/FU)	2.86E-08	3.28E-09	3.81E-07	5.14E-08	9.26E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.95E-09	3.67E-09	0.00E+00	0.00E+00	-3.50E-07
AP (mol H+ equiv/FU)	1.01E-03	1.11E-04	3.60E-01	9.19E-04	3.17E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.01E-04	6.60E-05	0.00E+00	0.00E+00	-3.42E-01
EP - freshwater (kg P equiv/FU)	1.33E-06	5.34E-07	4.95E-04	1.67E-06	3.86E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E-07	1.27E-07	0.00E+00	0.00E+00	-4.70E-04
EP - marine (kg N equiv/FU)	4.28E-04	3.21E-05	9.72E-03	2.77E-04	1.27E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.36E-05	1.96E-05	0.00E+00	0.00E+00	-9.44E-03
EP - terrestrial (mol N equiv/FU)	4.73E-03	3.56E-04	1.08E-01	3.06E-03	1.37E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.71E-04	2.17E-04	0.00E+00	0.00E+00	-1.05E-01
POCP (kg NMVOC equiv/FU)	1.29E-03	9.98E-05	4.77E-02	9.83E-04	3.72E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.14E-04	6.63E-05	0.00E+00	0.00E+00	-4.58E-02

ADP Elements (kg Sb equiv/FU)	1.50E-07	2.38E-07	5.47E-06	2.56E-06	4.75E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.51E-08	3.10E-07	0.00E+00	0.00E+00	-1.96E-06
ADP fossil fuels (MJ/FU)	3.04E+00	2.96E-01	5.99E+01	3.40E+00	6.50E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.79E-01	2.44E-01	0.00E+00	0.00E+00	-5.71E+01
WDP (m^3 water eq deprived /FU)	1.81E-02	1.77E-03	5.62E-01	1.11E-02	7.56E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.08E-04	6.78E-04	0.00E+00	0.00E+00	-5.40E-01

GWP total = total Global Warming Potential (Climate Change); GWP-luluc = Global Warming Potential (Climate Change) land use and land use change; ODP = Ozone Depletion Potential; AP = Acidification Potential for Soil and Water; EP = Eutrophication Potential; POCP = Photochemical Ozone Creation; ADPE = Abiotic Depletion Potential – Elements; ADPF = Abiotic Depletion Potential – Fossil Fuels; WDP = water use (Water (user) deprivation potential, deprivation-weighted water consumption)

RESOURCE USE PER 1 M^2 OF THERMAL INSULATION APPLICATIONS

	Production			Construction process		Use stage							End-of-life stage				
	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling
PERE (MJ/FU, net calorific value)	1.66E-01	1.39E-02	2.23E+01	4.28E-02	9.42E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.05E-03	3.44E-03	0.00E+00	0.00E+00	-2.12E+01
PERM (MJ/FU, net calorific value)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERT (MJ/FU, net calorific value)	1.66E-01	1.39E-02	2.23E+01	4.28E-02	9.42E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.05E-03	3.44E-03	0.00E+00	0.00E+00	-2.12E+01
PENRE (MJ/FU, net calorific value)	3.14E+00	3.29E-01	7.18E+01	3.43E+00	6.68E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.78E-01	2.46E-01	0.00E+00	0.00E+00	-6.85E+01
PENRM (MJ/FU, net calorific value)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

PENRT (MJ/FU, net calorific value)	3.14E+00	3.29E-01	7.18E+01	3.43E+00	6.68E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.78E-01	2.46E-01	0.00E+00	0.00E+00	-6.85E+01
SM (kg/FU)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF (MJ/FU, net calorific value)	0.00E+00	0.00E+00	3.30E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF (MJ/FU, net calorific value)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW (m^3 water eq/FU)	5.39E-04	5.92E-05	9.10E-03	2.88E-04	1.42E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.36E-05	1.86E-05	0.00E+00	0.00E+00	-8.86E-03

PERE = use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Net use of fresh water

WASTE CATEGORIES & OUTPUT FLOWS PER 1 M^2 OF THERMAL INSULATION APPLICATIONS

	Production			Construction process stage		Use stage							End-of-life stage				
	A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling
Hazardous waste disposed (kg/FU)	3.96E-06	5.58E-07	2.85E-05	8.25E-06	2.21E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.03E-06	6.38E-07	0.00E+00	0.00E+00	-2.38E-05
Non-hazardous waste disposed (kg/FU)	1.40E-02	1.37E-02	3.46E-01	3.11E-01	3.46E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.48E-03	1.28E-02	0.00E+00	0.00E+00	-2.04E-01
Radioactive waste disposed (kg/FU)	2.62E-05	1.65E-06	3.50E-04	2.32E-05	4.02E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.63E-06	1.66E-06	0.00E+00	0.00E+00	-3.40E-04
Components for reuse (kg/FU)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.68E-03	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	3.68E+01	0.00E+00	0.00E+00
Materials for recycling (kg/FU)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.88E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recovery (kg/FU)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.97E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy heat (MJ/FU)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.61E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy electricity (MJ/FU)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.30E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

IMPACT CATEGORIES ADDITIONAL TO EN 15804 PER 1 M^2 OF THERMAL INSULATION APPLICATIONS

		Production			Construction process		Use stage							End-of-life stage				
		A1 Raw material	A2 Transport	A3 manufacturing	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling
	*PM (disease incidence)*	2.48E-08	1.08E-09	2.23E-06	1.98E-08	4.17E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.99E-09	1.12E-09	0.00E+00	0.00E+00	-2.13E-06
	*IRHH (kg U235 eq/FU)*	2.61E-02	1.31E-03	3.54E-01	1.49E-02	2.61E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.63E-03	1.06E-03	0.00E+00	0.00E+00	-3.50E-01
	*ETF (CTUe/FU)*	1.31E+00	2.96E-01	2.73E+01	2.71E+00	5.97E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.29E-01	1.95E-01	0.00E+00	0.00E+00	-2.51E+01
	*HTCE (CTUh/FU)*	3.54E-11	6.83E-12	2.27E-09	6.68E-11	6.38E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.31E-11	5.48E-12	0.00E+00	0.00E+00	-2.12E-09
	*HTnCE (CTUh/FU)*	8.80E-10	2.31E-10	1.95E-08	3.08E-09	2.04E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.69E-10	2.13E-10	0.00E+00	0.00E+00	-1.70E-08
	*Land Use Related impacts (dimension less)*	6.02E-01	1.58E-01	1.00E+02	3.90E+00	2.64E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.84E-02	1.68E-01	0.00E+00	0.00E+00	-9.31E+01

HTCE = Human Toxicity – cancer effects; HTnCE = Human Toxicity – non cancer effects; ETF = Ecotoxicity – freshwater; (potential comparative toxic unit)
PM = Particulate Matter (Potential incidence of disease due to PM emissions);
IRHH = Ionizing Radiation – human health effects (Potential Human exposure efficiency relative to U235);

Environmental impact categories explained

	*Global Warming Potential*	*The global warming potential of a gas refers to the total contribution to global warming resulting from the emission of one unit of that gas relative to one unit of the reference gas, carbon dioxide, which is assigned a value of 1.* *It is split up in 4:* - *Global Warming Potential total (GWP-total) which is the sum of GWP-fossil, GWP-biogenic and GWP-luluc* - *Global Warming Potential fossil fuels (GWP-fossil) : The global warming potential related to greenhouse gas (GHG) emissions to any media originating from the oxidation and/or reduction of fossil fuels by means of their transformation or degradation (e.g. combustion, digestion, landfilling, etc).* - *Global Warming Potential biogenic (GWP-biogenic) : The global warming potential related to carbon emissions to air (CO2, CO and CH4) originating from the oxidation and/or reduction of aboveground biomass by means of its transformation or degradation (e.g. combustion, digestion, composting, landfilling) and CO2 uptake from the atmosphere through photosynthesis during biomass growth – i.e. corresponding to the carbon content of products, biofuels or above ground plant residues such as litter and dead wood.[1]* - *Global Warming Potential land use and land use change (GWP-luluc): The global warming potential related to carbon uptakes and emissions (CO2, CO and CH4) originating from carbon stock changes caused by land use change and land use. This sub-category includes biogenic carbon exchanges from deforestation, road construction or other soil activities (including soil carbon emissions).*
	*Ozone Depletion*	*Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbonsor halons), Which break down when they reach the stratosphere and then catalytically destroy ozone molecules.*
	*Acidification potential*	*Acid depositions have negative impacts on natural ecosystems and the man-made environment incl. buildings. The main sources for emissions of acidifying substances are agriculture and fossil fuel combustion used for electricity production, heating and transport.*
	*Eutrophication potential*	*The potential to cause over-fertilisation of water and soil, which can result in increased growth of biomass and following adverse effects.* *It is split up in 3:* - *Eutrophication potential – freshwater: The potential to cause over-fertilisation of freshwater, which can result in increased growth of biomass and following adverse effects.* - *Eutrophication potential – marine: The potential to cause over-fertilisation of marine water, which can result in increased growth of biomass and following adverse effects.* - *Eutrophication potential – terrestrial: The potential to cause over-fertilisation of soil, which can result in increased growth of biomass and following adverse effects.*
	*Photochemical ozone creation*	*Chemical reactions brought about by the light energy of the sun creating photochemical smog. The reaction of nitrogen oxides with hydrocarbons in the presence of sunlight to form ozone is an example of a photochemical reaction.*
	*Abiotic depletion potential for non-fossil ressources*	*Consumption of non-renewable resources, thereby lowering their availability for future generations. Expressed in comparison to Antimonium (Sb).* *The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*
	*Abiotic depletion potential for fossil ressources*	*Measure for the depletion of fossil fuels such as oil, natural gas, and coal. The stock of the fossil fuels is formed by the total amount of fossil fuels, expressed in Megajoules (MJ).* *The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*
	*Ecotoxicity for aquatic fresh water*	*The impacts of chemical substances on ecosystems (freshwater).* *The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*

[1] Carbon exchanges from native forests shall be modelled under GWP - luluc (including connected soil emissions, derived products or residues), while their CO2 uptake is excluded.

	*Human toxicity (carcinogenic effects)*	*The impacts of chemical substances on human health via three parts of the environment: air, soil and water.* *The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*
	*Human toxicity (non-carcinogenic effects)*	*The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*
	*Particulate matter*	*Accounts for the adverse health effects on human health caused by emissions of Particulate Matter (PM) and its precursors (NOx, SOx, NH3)*
	*Resource depletion (water)*	*Accounts for water use related to local scarcity of water as freshwater is a scarce resource in some regions, while in others it is not.* *The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*
	*Ionising radiation - human health effects*	*This impact category deals mainly with the eventual impact on human health of low dose ionising radiation of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potential ionising radiation from the soil, from radon and from some construction materials is also not measured by this indicator.*
	*Land use related impacts*	*The indicator is the" soil quality index" which is the result of an aggregation of following four aspects:* - *Biotic production* - *Erosion resistance* - *Mechanical filtration* - *Groundwater* *The aggregation is done based on a JRC model. The four aspects are quantified through the LANCA model for land use.* *The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.*

DETAILS OF THE UNDERLYING SCENARIOS USED TO CALCULATE THE IMPACTS

A1 – RAW MATERIAL SUPPLY

Clay is extracted close to ARGEX plant (1 km). Iron oxides and additives are also part of the final product composition and are considered as waste, without economic value. Hence no environmental impacts are attributed to the waste used as additives in conformity with EN 15804.

A2 – TRANSPORT TO THE MANUFACTURER

Clay is transported by conveyor belt. Iron oxides and additives are transported by truck and boat.

A3 – MANUFACTURING

The manufacturing is composed of kneading, grind, compress, kiln and crush processes. The fuels consumption and theirs emissions in the kiln, as well as electricity and water for the rest of the processes are considered in this module.
1.60% of the final product is packed. All products are transported to the construction site.

A4 – TRANSPORT TO THE BUILDING SITE

Fuel type and consumption of vehicle or vehicle type used for transport	Truck 16-32 tons EURO5
Distance	62.10 km
Capacity utilisation (including empty returns)	Default values from Ecoinvent 3.6
Volume capacity utilisation factor	Default values from Ecoinvent 3.6

Transport scenario is modelled based on the Belgian market. Primary data for the average distances for Belgian sales are provided.

A5 – INSTALLATION IN THE BUILDING

At the construction site, packaging materials are released and treated according to the NBN/DTD B 08-001:2017.

No material losses are identified in the installation phase if the installation procedures are respected.

Installation type	Share	Parameter	Value
Blowing with vibrating plate levelling-compaction	70%	Machine operation, diesel	0.033 hr
		Petrol and combustion emissions	1.279 kg
Blowing with manual levelling	30%	Machine operation, diesel	0.033 hr

B – USE STAGE (EXCLUDING POTENTIAL SAVINGS)

If installed correctly according to the manufacturers' and suppliers' guidelines, normal expanded clay aggregate products need no further maintenance, repair, replacement or refurbishment during the full life span of the product. If the product is applied following the installation instructions, the life span of 100 years is applicable.

C: END OF LIFE

After a service life of 100 years, the building is stripped for recoverable materials and products, and the remaining construction subsequently refurbished. The product can be removed separately from the other parts of the construction. The valuable sorted materials are 95% reused and 5% landfilled according to Belgian Default End of Life scenario for bulk materials.
C1: dismantling considers a crane machine to remove expanded clay aggregates from the deconstruction site. Ecoinvent data used is “Machine operation, diesel, > 18.64 kW, steady-state {GLO} |market for |Cut-off, U” (1 day for 620 m^3);
C2: default from NBN/DTD B 08-001:2017;
C3: -;
C4: 5% of the product for final disposal (NBN/DTD B 08-001:2017).

Module C2 – Transport to waste processing			
Type of vehicle (truck/boat/etc.)	Distance (km)	Capacity utilisation (%)	Assumptions
Transport, freight, lorry 16-32 metric ton, euro5 {RER}|market for transport, freight, lorry 16-32 metric ton, EURO5|Cut-off,U	50 km	85%	Empty return 30%

End-of-life modules – C3 and C4		
Parameter	Unit	Value
Wastes collected separately	kg	38.76
Wastes collected as mixed construction waste	kg	
Waste for reuse	kg	36.82
Waste for recycling	kg	
Waste for energy recovery	kg	
Waste for final disposal	kg	1.94

D – BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARIES

The reuse of normal expanded clay aggregate is considered as benefits beyond system boundary, calculated in module D.

The packaging incineration with energy recovery is also considered as benefits beyond system boundary. Credits are assigned for power and heat outputs using the Belgian grid mix and thermal energy from natural gas. The latter represents cleanest fossil fuel and therefore results in a conservative estimate of avoided burdens. For regional efficiencies and heat-to-power output ratios, 20% is considered for avoided heat from natural gas, and 10% is considered for electricity production.

There are no benefits or loads of allocated co-products in module D.

ADDITIONAL INFORMATION ON RELEASE OF DANGEROUS SUBSTANCES TO INDOOR AIR, SOIL AND WATER DURING THE USE STAGE

INDOOR AIR

Not applicable as this product does not contain any dangerous substances.

SOIL AND WATER

Not applicable as this product does not contain any dangerous substances.

DEMONSTRATION OF VERIFICATION

EN 15804+A2 serves as the core PCR
Independent verification of the environmental declaration and data according to standard EN ISO 14025:2010 Internal ☐ External ☒
Third party verifier: Evert Vermaut Vinçotte Jan Olieslagerslaan 35 B-1800 Vilvoorde evermaut@vincotte.be October 2020

APPLICATION UNIT

The expanded clay aggregates can be used as lightweight fillings and thermal insulation. There is another specific B-EPD for lightweight filling applications. The declared unit used in this B-EPD is $1m^2$ with a thickness of 11.4 cm, which gives a volume of 0.114 m^3, and 38.76 kg, according to the density equals to 340 kg/m^3. The impacts can be scaled according to the weight of employed product. For example:

Weight (kg)	Factor to be applied
38.76	1
77.52	2
100	2.58

ADDITIONAL INFORMATION ON REVERSIBILITY

Reversibility	reversible fixing	loose laying

Simplicity of disassembly	-	*simple - use of dismantling tools required*
Speed of disassembly	-	*speedy disassembly*
Ease of handling (size and weight)	-	*handling requires mechnical devices*
Robustness of material (material resistance to disassembly)	-	*the material resists well during disassembly*

BIBLIOGRAPHY

- ISO 14040:2006: Environmental Management-Life Cycle Assessment-Principles and framework.
- ISO 14044:2006: Environmental Management-Life Cycle Assessment-Requirements and guidelines.
- ISO 14025:2006: Environmental labels and Declarations-Type III Environmental Declarations-Principles and procedures.
- NBN EN 15804+A2:2019
- NBN/DTD B 08-001 (BE-PCR)
- CEN-TC88, 2017, EN16783
- ARGEX Environmental Product Declaration Background Report Expanded Clay Aggregate version 3.8

General information

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EPD program Program operator Publisher of this EPD	**B-EPD** **FPS HEALTH / FOD Volksgezondheid** Galileelaan 5/2 1210 Brussels Belgium www.environmentalproductdeclarations.eu
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Based on the following PCR documents	EN 15804+A2:2019 NBN/DTD B 08-001 and its complement
PCR review conducted by	Federal Public Service of Health and Environment & PCR Review committee
Author(s) of the LCA and EPD	Dr Carolina SZABLEWSKI Dr Naeem ADIBI WeLOOP - info@weloop.org
Identification of the project report	Environmental Product Declaration Background Report Expanded Clay Aggregate V3.8
Verification	External independent verification of the declaration and data according to EN ISO 14025 and relevant PCR documents
Name of the third party verifier Date of verification	Evert Vermaut, Vinçotte 08.07.2021
www.b-epd.be	**www.environmentalproductdeclarations.eu**

Comparing EPDs is not possible unless they are conform to the same PCR and taking into account the building context.
The program operator cannot be held responsible for the information supplied by the owner of the EPD nor LCA practitioner.

LCA practitioner

Building calculator of the regiona authorities

www.totem-building.be

Federal Public Service of Health, Food Chain Safety and Environment

www.b-epd.be

Dieter De Lathauwer
((Signature