ENVIRONMENTAL PRODUCT DECLARATION

following *ISO 14025* and *EN 15804+A2*

Declaration owner	Schröder Bauzentrum GmbH, Garding & CO. KG
Editor	Institut Bauen und Umwelt e.V. (IBU)
Program operator	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-SBZ-20240384-IBC1-DE
Date of issue	December 17, 2024
Valid until	December 16, 2029

DeFries Reused Bricks

Schröder Bauzentrum GmbH, Garding & CO. KG

Institut Bauen und Umwelt e.V.

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1. General information

Schröder Bauzentrum GmbH, Garding & CO. KG

Program operator

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number

EPD-SBZ-20240384-IBC1-DE

This declaration is based on the following product category rules (PCR):

Brick, August 01, 2021
(PCR tested and approved by the independent expert council (SVR))

Date of issue

December 17, 2024

Valid until

December 16, 2029

Dipl.-Ing. Hans Peters
(Chairperson of the Institut Bauen und Umwelt e.V.)

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(General Manager of the Institut Bauen und Umwelt e.V.)

DeFries Reused Bricks

Declaration owner

Schröder Bauzentrum GmbH, Garding & CO. KG
Süderstraße 53
25836 Garding
Germany

Declared product / unit

1 m³ DeFries Reused Bricks

Scope of application:

This product declaration applies to 1 m³ of reused solid bricks that is recycled in a plant in Germany. This declaration is an average EPD, keeping in mind that the bricks considered differ in their bulk density. On average, the bulk density is 1,801 kg/m³.
The owner of the declaration is liable for the correctness of the underlying information and records of evidence; IBU excludes any liability with regard to manufacturer's information, life cycle assessment data and records of evidence.

This EPD was created in compliance with the requirements of EN 15804+A2; for simplicity reasons this standard is referred to as *EN 15804* in the following.

Verification

The European Standard EN 15804 serves as a core PCR
Independent verification of the declaration and information in accordance with ISO 14025:2011
☐ internal ☒ external

Dr. Eva Schmincke,
(Independent verifier)

2. Product

2.1 Product description/ definition

The DeFries bricks in question are reused products that were handmade decades ago and have now been salvaged and reworked by hand. The various stones correspond to the state of the art, but were made at a time when there were no precise product specifications such as DIN standards. Historic bricks can be used to create classic facades. Each consignment is unique. Processing is carried out in accordance with general processing guidelines. The distribution of the product within the EU/EFTA (except for Switzerland) is subject to *Regulation (EU) No. 305/2011 (CPR)*. This product requires a Declaration of Performance issued in accordance with *DIN EN 771- 1:2015-11* Specification for Masonry Units – Part 1: Clay Masonry Units and CE marking.
The use of the bricks is governed by the respective national regulations, namely in Germany:
- *DIN 20000-401*
- the list of samples included in the technical building regulation MVV TB
- the general building-supervisory approval issued to the respective manufacturer by the German Institute of Structural Engineering [*Deutsche Institut für Bautechnik*]
- the general type approval issued to the respective manufacturer by the German Institute of Structural Engineering
- the external and internal monitoring of products for which the respective manufacturer has been issued the general building approval

2.2 Use

Facing bricks are used for exposed brickwork as well as facing brickwork and are manufactured as solid or perforated bricks. Facing bricks are mainly used in façade design and generally remain visible on the building. Facing bricks are available in various textures and colors. As they are exposed to the weather they have to be frost-resistant. One of the uses of masonry bricks is the construction of walls (masonry).
Clinker bricks are particularly densely fired bricks the surface of which has been sintered. Sintering describes the process of submitting the bricks to high firing temperature during clinker production which gives the visible surfaces a glassy, dense character. Clinker bricks are frost-resistant and are therefore used for plinths, chimneys, paths and squares, among other things.

2.3 Technical Data

The properties listed below apply to all bricks recycled by DeFries and represent a mean value of the facing bricks. There may be deviations between the batches bricks which is due to their origin.

Structural data

Designation	Value	Unit
Compressive strength according to DIN EN 772-1 (for backing (HMZ) and facing bricks VMZ))	21.5	N/mm^2
Raw density according to DIN EN 772-13 (for HMZ and VMZ)	1801	kg/m^3
Water absorption according to DIN EN 772-21, DIN EN 10545-3 ((for HMZ and VMZ)	11	M.-%
Active soluble salts acc: to DIN EN 772-5 (for VMZ)	Class S2	-

Performance values of the product in accordance with

- DIN 20000-401
- the list of samples included in the technical building regulation MVV TB
- the general building-supervisory approval issued to the respective manufacturer by the German Institute of Structural Engineering
- the general type approval issued to the respective manufacturer by the German Institute of Structural Engineering
- External and internal monitoring of products that have the general building approval of the respective manufacturer

2.4 Delivery condition

In accordance with *DIN EN 772-16,* the bricks have the following average dimensions:

- Length: 196 mm
- Width: 92 mm
- Height: 50 mm

2.5 Base materials/auxiliary materials

The facing bricks consist of the basic materials clay/loam (roughly 85%) and sand (roughly 8%) as well as aggregates already included.

Clay/loam:
Natural earths of different mineralogical composition (aluminum oxide Al_2O_3, silicon oxide SiO_2, iron(III) oxide (Fe_2O_3)).

Other natural clay components:
Clays/loams contain geologically deposited natural components in varying proportions, such as coloring iron oxides. Moreover, clays/loams can also contain lime and dolomite.

Sand and broken bricks: In the case of very fine-grained clays these are added as leaning agents to compensate for the natural fluctuations in the mineralogical composition of the raw clay.

The product or at least one sub-product contains substances included in the *ECHA-list* of Substances of Very High Concern (SVHC) mass percent of more than 0.1: no

The product or at least one sub-product contains further CMR-substances of category 1A or 1B not included in the *List of Candidates*, mass percent of more than 0.1 in at least one sub-product: no

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

No other aids, additives or additives are added to the product.

2.6 Manufacture

DeFries bricks are reused products that were handmade decades ago and have now been salvaged and reworked by hand. In this framework they are cleaned by means of a compressed air chisel hammer or a brush in order to remove mortar residues. There are no further manufacturing processes.

2.7 Environment and health protection during production

Health protection during the production:
The rules and standards of the employers' liability insurance associations apply; no special measures are needed to protect the employees' health.

Water/soil:
There is no contamination of water and soil.

Air:
The recycling process does not entail any air pollution.

Noise:
Due to noise protection measures, the measured values (at the workplace and in the outdoor area) are far below the required limit values.

2.8 Product processing/construction process

The facing bricks are connected to each other by standard masonry mortar complying to *DIN EN 998-2* in accordance with *DIN EN 1996- 2*.

2.9 Packaging

The bricks are wrapped in polyethylene film. This film is assumed to be thermally disposed of at the end of its life cycle.

2.10 State of use

As described under 'Basic materials', bricks mainly consist of clay, loam and sand. In their state of use the brick constituents are bound as solids (ceramic bond).
When used as intended, they are indefinitely durable, vermin-resistant, rot-resistant, fouling-resistant, and acid- and alkaline resistant.

2.11 Environmental and health issues during use

Masonry bricks do not emit any substances that are harmful to the environment or health.

2.12 Reference service life

When installed according to the state of art the reference service life is 150 years (*TBE PCR document*). Buildings constructed with masonry bricks can be operated for just as long.

2.13 Exceptional impacts

Fire

In the event of fire, no gases or vapors are generated that have a visually obstructing or toxic effect. The facing bricks meet the requirements of fire class A1 in accordance with *DIN 4102* and *DIN EN 13501-1* 'non-combustible'.

Fire protection

Designation	Value
Building material class	A1
Burning dripping	
Flue gas development	

Water

When exposed to water (e.g. driving rain, flooding), no substances that are hazardous to water can be washed out due to the solid ceramic bond.

Mechanical destruction

There are no known risks to the environment or living organisms from unforeseen mechanical destruction.

2.14 Post-utilization phase

At the end of their life cycle reused DeFries bricks can be ground and reused in the manufacture of new bricks. It is also potentially possible to reprocess the bricks at the end of their life cycle and reuse them directly.

2.15 Disposal

At the end of their life cycle, ceramic products and ceramic building materials such as bricks, tiles or stoneware can be recycled or, if necessary, deposited in an inert landfill. The waste code according to the European Waste Catalogue (EWC) is 10 12 08.
Such disposal is not intended for the reused DeFries bricks.

2.16 Further information

Optional information, indication of the source of further information, e.g. website, source of safety data sheet.

3. LCA: Calculation rules

3.1 Declared unit

This declaration refers to one cubic meter of reused bricks with an average bulk density of 1,801 kg/m³. The bulk density was determined in 2022 using a random sample of ten brick batches. The bulk density of all samples ranged from 1,726 kg/m³ to 1,892 kg/m².

Declared unit and Mass Reference

Designation	Value	Unit
Declared unit	1	m^3
Bulk density	1801	kg/m^3
Conversion factor	1801	-

The reused DeFries bricks in question were handmade decades ago and have now been salvaged and reworked by hand. The various stones correspond to the state of the art, but were made at a time when there were no precise product specifications such as DIN standards.

3.2 System delimitation

This is a cradle-to-gate type EPD with options. The life cycle assessment takes into account raw material extraction, raw material transportation and product manufacture, including the packaging materials (modules A1-A3). The transportation of the product to the construction site (module A4) and the construction process - including the handling of packaging materials (module A5) - are also taken into consideration. At the end of service life, the dismantling of the product (module C1) and the transportation of the bricks for treatment (module C2) in preparation for further recycling (module C3) of the bricks or their disposal in a landfill (module C4) is included. In this EPD, the bricks are either completely recycled (scenario 1) or completely deposited in a landfill (scenario 2). Module D depicts credits resulting from thermal recycling of packaging materials.

3.3 Estimates and assumptions

It is assumed that the bricks are sourced from old buildings in a standardized dismantling process.

Thus, according to *PCR Part A - Annex Reuse*, there is no impact caused by brick production within module A1. The declared impacts relate entirely to the transportation to the processing site, the purchase of electrical energy to be used to operate the pneumatic chipping hammer and the provision of the packaging film. With regard to exploitation at the end of the life cycle, it is assumed that the packaging film is incinerated and used to generate energy.

3.4 Cutoff rules

All operational data collected were taken into account. This includes the transportation to the processing site in Garding, the use of electrical energy to operate the pneumatic chipping hammer, the amount of packaging film used and any material losses. In this way, material and energy flows with a share of less than 1% are also taken into account.

3.5 Background data

The background data used for the calculation of the LCA were obtained from the *Ecoinvent Version 3.9.1* database using the EN 15804 add-on. The software used is *OpenLCA, version 2.0.4.*

3.6 Data quality

The product system was modeled based on operational data of 2023 supplied by the company Schröder Bauzentrum GmbH, Garding & Co. KG. In 2022, physical properties such as the bulk density in accordance with *DIN EN 772-13* or the compressive strength in accordance with *DIN EN 772-1* were determined on the basis of ten random samples.
All other data originate from the *Ecoinvent Version 3.9.1* background database was published in 2023.
The product system was fully mapped and linked to the geographically most fitting data sets in the background database.
Data quality assessment of the inventory data in the primary system according to the PEF table:

- Survey – measured / calculated and internally verified, plausibility check by reviewer (quality level 2): The data were collected and checked by DeFries. The physical properties of the bricks were additionally attested in an opinion report by an external expert.
- Temporal representativeness – The data refer to an annual administrative period ending no more than two years prior to the date of publication of the EPD (quality level 2). The data were collected over a twelve-month period between 2023 and 2024.
- Technical representativeness - The elementary flows and activity data correspond exactly to the technology of the newly developed dataset (quality level 1): Due to the low-level use of technology and the large proportion of manual work, only generic datasets need to be used with regard to transportation, recycling and the electricity mix. These can be classified as good.
- Geographical representativeness - The activity data and elementary flows correspond in part to the geographical location where the process for the newly developed data set takes place or is modeled (quality level 2). The data sets used are always related to Germany or Europe. Individual deviations are limited to data sets from Switzerland, with the geographical proximity to Germany being considered sufficient.

3.7 Period under review

The data collection was carried out in 2023 over a period of twelve months. Within this period the mean value of the material and energy flows mapped for individual batches was calculated to be used in this declaration.

3.8 Geographical representativeness

The country or region where the declared product system is manufactured and, where applicable, used and treated at the end of its service life: Germany

3.9 Allocation

The production does not generate any by-products, so no allocation had to be made in the model. Any loss of material that may occur during the construction (A5) can be recycled if necessary. However, no credits are awarded for this in Module D since 100% of the bricks already consist of secondary material. Module D merely reflects the energy recovery of the packaging film.

3.10 Comparability

As a matter principle, a comparison or evaluation of EPD data is only possible if all the data sets to be compared have been created in accordance with *EN 15804* and the building context and the product-specific performance characteristics are taken into account.
The background database used is *Ecoinvent Version 3.9.1*.
The underlying system model of the database is the Cutoff Unit Process Model including the EN 15804 Add-On.

4. LCA: Scenarios and further technical data

Characteristic product properties of biogenic carbon

The bricks themselves and the associated packaging film do not contain any biogenic carbon.

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg CO_2

The declared modules are based on the following technical data which can also be used for the development of specific scenarios in the context of a building assessment if modules are not declared (MND).

Transport to the construction site (A4)

Designation	Value	Unit
Liters of fuel	2.28	l/100km
Transportation distance	100	km
Use of loading capacity (including empty runs)	61	%
Gross density of the transported products	1,801	kg/m^3
Volume utilization factor	-	-

The above fuel consumption applies per transported ton. The use of loading capacity is calculated based on the average loading capacity in tons and the total weight of the vehicle. Both values are derived from the corresponding transport data in the Ecoinvent database.

Incorporation in the building (A5)

Designation	Value	Unit
Output substances as a result of on-site waste treatment	1.47	kg
Loss of material	See description below	

Loss of material during the construction process depends on the building itself and is therefore not included in this life cycle assessment. Losses in a specific building can be determined by multiplying the LCA results by a loss factor. For example, a loss of 10% of the material can be calculated by multiplying the results by a loss factor of 1.1.

When declaring a **reference service life** in compliance with the applicable ISO standards it is necessary to indicate the assumptions and conditions of use underlying the determined RSL. Furthermore, it must be stated that the declared RSL only remains valid under the indicated reference conditions of use. The same applies to a life cycle declared by the manufacturer.

Relevant information on reference conditions of use does not need to be declared for a service life based on the BNB table.

Reference service life

Designation	Value	Unit
Reference service life (acc. to ISO 15686-1, -2, -7 and -8)	150	a

End of life cycle (C1-C4)

In this EPD, two different scenarios are assumed. In scenario 1, all of the bricks are recycled. Scenario 2 describes the effects of depositing all of the bricks in a landfill. The two scenarios can be combined to model a specific end-of-life scenario. According to Tiles & Bricks Europe, the usual ratio in Europe is 70% recycling and 30% landfill.

Designation	Value	Unit
Recycling (Scenario 1)	1801	kg
Landfilling (Scenario 2)	1801	kg

Reuse/recovery/recycling potential (D), relevant scenario information

The credits are earned for the incineration of the packaging film and the resulting supersession of the incineration of natural gas. Credits are awarded for recycling, after deducting the amount of secondary material already contained in the product. Since this is 100%, no further credits are awarded for the recycling of the bricks.

Designation	Value	Unit
Incineration of PE packaging film	1.47	kg
Calorific value PE film	12.2	kWh/kg

5. LCA: Results

The tables below show the results of the impact assessment for one cubic meter of a reused brick with a density of 1,801 kg/m³ in terms of environmental impact, input of resources, waste streams and additional impact categories. The results can be converted to a mass-based unit by dividing the results by the specific density (for results per kg) and, if necessary, then multiplying by 1,000 (for results in t).

The results are based on the characterization factors of the original EN 15804 impact assessment method Environmental Footprint 3.1 developed by the European Commission. They merely constitute statements of a relative nature and should not be relied on to draw conclusions regarding the endpoints of individual impact categories or the transgression of thresholds.

INDICATION OF SYSTEM DELIMITATIONS (X = INCLUDED IN LCA; MND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

Production stage			Stage of construction of the building		Utilization stage							Disposal stage				Credits and impacts outside the system delimitation
Supply of raw materials	Transport	Manufacture	Transport from the manufacturer to the place of use	Assembly	Use/Application	Maintenance	Repair	Replacement	Renewal	Energy used to operate the building	Water used for the operation of the building	Dismantling / Demolition	Transport	Waste treatment	Removal	Reuse, recovery or recycling potential
A1	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
X	X	X	X	X	MND	MND	MNR	MNR	MNR	MND	MND	X	X	X	X	X

LCA RESULTS- ENVIRONMENTAL IMPACT in accordance with EN 15804+A2: 1 m³ Reused- DeFries Brick

Indicator	Unit	A1-A3	A4	A5	C1	C2	C2/1	C3	C3/1	C4	C4/1	D	D/1
GWP-total	kg CO_2-Äq.	3.99E+01	2.19E+01	4.4E+00	5.82E-01	1.87E+01	1.87E+01	6.42E+00	0	0	2.37E+01	-3.14E+00	-3.14E+00
GWP-fossil	kg CO_2-Äq.	4E+01	2.18E+01	4.,4E+00	5.82E-01	1.87E+01	1.87E+01	6.42E+00	0	0	2.36E+01	-2.,98E+00	-2.98E+00
GWP-biogenic	kg CO_2-Äq.	-4.46E-02	1.61E-02	2.07E-04	2.53E-04	1.38E-02	1.38E-02	1.39E-03	0	0	3.88E-02	-1.52E-01	-1.52E-01
GWP-luluc	kg CO_2-Äq.	2.04E-02	1.03E-02	9.53E-06	7.34E-05	8.8E-03	8.8E-03	7.22E-04	0	0	6.25E-03	-2.72E-03	-2.72E-03
ODP	kg CFC11-Äq.	7.99E-07	4.77E-07	2.05E-09	1.22E-08	4.09E-07	4.09E-07	1.02E-07	0	0	6.08E-07	-8.3E-08	-8.3E-08
AP	mol H^+-Äq.	1.46E-01	7.35E-02	4.87E-04	5.14E-03	6.29E-02	6.29E-02	5.95E-02	0	0	1.58E-01	-5.65E-03	-5.65E-03
EP-freshwater	kg P-Äq.	3.79E-03	1.55E-03	4.3E-06	2.72E-05	1.33E-03	1.33E-03	1.97E-04	0	0	1.2E-03	-2.28E-03	-2.28E-03
EP-marine	kg N-Äq.	4.93E-02	2.54E-02	2.42E-04	2.39E-03	2.18E-02	2.18E-02	2.76E-02	0	0	6.93E-02	-1.58E-03	-1.58E-03
EP-terrestrial	mol N-Äq.	5.21E-01	2.69E-01	2.56E-03	2.59E-02	2.3E-01	2.3E-01	3E-01	0	0	7.47E-01	-1.34E-02	-1.34E-02
POCP	kg NMVOC-Äq.	2.16E-01	1.14E-01	6.94E-04	7.81E-03	9.8E-02	9.8E-02	8.87E-02	0	0	2.59E-01	-5.24E-03	-5.24E-03
ADPE	kg Sb-Äq.	1.12E-04	6.03E-05	9.75E-08	2.64E-07	5.17E-05	5.17E-05	2.3E-06	0	0	3.61E-05	-1.79E-05	-1.79E-05
ADPF	MJ	6.4E+02	3.21E+02	1.95E-01	7.6E+00	2.75E+02	2.75E+02	8.46E+01	0	0	4.46E+02	-4.59E+01	-4.59E+01
WDP	m^3 Welt-Äq. entzogen	5.74E+00	1.65E+00	3.26E-02	2.71E-02	1.42E+00	1.42E+00	2.09E-01	0	0	1.96E+00	-4.14E-01	-4.14E-01

GWP = Global warming potential; ODP = Ozone depletion potential; AP = Acidification potential of soil and water; EP = Eutrophication potential; POCP = Photochemical ozone creation potential; ADPE = Abiotic depletion potential – non-fossil resources (ADP – substances); ADPF = Abiotic resource depletion potential – fossil fuels (ADP – fossil energy sources); WDP = water deprivation potential (user).

LCA RESULTS – INDICATORS DESCRIBING THE USE OF RESSOURCES in accordance with EN 15804+A2: 1 m³ DeFries Reuse-Brick

Indicator	Unit	A1-A3	A4	A5	C1	C2	C2/1	C3	C3/1	C4	C4/1	D	D/1
PERE	MJ	1.3E+01	4.67E+00	1.15E-02	6.83E-02	4E+00	4E+00	4.78E-01	0	0	9.33E+00	-6.79E+00	-6.79E+00
PERM	MJ	0	0	0	0	0	0	0	0	0	0	0	0
PERT	MJ	1.3E+01	4.67E+00	1.15E-02	6.83E-02	4E+00	4E+00	4.78E-01	0	0	9.33E+00	-6.79E+00	-6.79E+00
PENRE	MJ	5.95E+02	2.94E+02	1.87E-01	6.93E+00	2.52E+02	2.52E+02	1.41E+02	6.46E+01	0	4.08E+02	-4.45E+01	-4.45E+01
PENRM	MJ	1.1E+02	2.74E+01	8.06E-03	6.69E-01	2.35E+01	2.35E+01	-5.69E+01	-6.46E+01	0	3.88E+01	-1.31E+00	-1.31E+00
PENRT	MJ	7.05E+02	3.21E+02	1.95E-01	7.6E+00	2.75E+02	2.75E+02	8.46E+01	0	0	4.46E+02	-4.59E+01	-4.59E+01
SM	kg	1.8E+03	1.82E-01	7.17E-04	5.92E-03	1.56E-01	1.56E-01	3.77E-02	0	0	1.83E-01	-1.65E-01	-1.65E-01
RSF	MJ	1.05E-01	3.8E-02	8.72E-05	5.78E-04	3.26E-02	3.26E-02	2.58E-03	0	0	6.01E-02	-3.65E-01	-3.65E-01
NRSF	MJ	4.51E-01	1.27E-01	3.07E-04	2.14E-03	1.09E-01	1.09E-01	1.32E-02	0	0	1.36E-01	-3.22E-01	-3.22E-01
FW	m^3	1.15E-01	4.29E-02	7.76E-04	4.22E-04	3.68E-02	3.68E-02	4.53E-03	0	0	3.22E-01	-1.27E-02	-1.27E-02

PERE = Primary energy renewable, energy carrier; PERM = Primary energy renewable, material utilization; PERT = Primary energy renewable, total use; PENRE = Primary energy non renewable as energy carrier; PENRM = Primary energy non-renewable, Material utilization; PENRT = Primary energy, non-renewable, total use; SM = Use of secondary material; RSF = Renewable secondary fuels; NRSF = Non-renewable secondary fuels; FW = Net use of freshwater resources

LCA RESULTS – WASTE CATEGORIES AND OUTPUT FLOWS in accordance with EN 15804+A2:
1 m³ DeFries Reuse-Brick

Indicator	Unit	A1-A3	A4	A5	C1	C2	C2/1	C3	C3/1	C4	C4/1	D	D/1
HWD	kg	6.16E-01	3.02E-01	1.94E-02	1.01E-02	2.58E-01	2.58E-01	7.03E-02	0	0	3.08E-01	-2.91E-02	-2.91E-02
NHWD	kg	9.15E+01	2.77E+01	3.12E-02	6.17E-03	2.37E+01	2.37E+01	5.21E-02	0	0	3.61E+03	-1.35E-01	-1.35E-01
RWD	kg	2.78E-04	9.73E-05	1.97E-07	1.5E-06	8.34E-05	8.34E-05	9.2E-06	0	0	1.13E-04	-1.1E-04	-1.1E-04
CRU	kg	0	0	0	0	0	0	0	0	0	0	0	0
MFR	kg	3.01E+02	2.76E-01	7.51E-04	6.8E-03	2.36E-01	2.36E-01	1.8E+03	0	0	3.32E-01	-1.27E+00	-1.27E+00
MER	kg	0	0	0	0	0	0	1.47E+00	1.47E+00	0	0	0	0
EEE	MJ	0	0	0	0	0	0	3.59E+00	3.59E+00	0	0	0	0
EET	MJ	0	0	0	0	0	0	7.17E+00	7.17E+00	0	0	0	0

HWD = Hazardous waste disposal; NHWD = Non-hazardous waste disposal; RWD = Radio-active waste dispoal CRU = Components for reuse; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy.

LCA RESULTS – Additional impact categories in accordance with EN 15804+A2-optional:
1 m³ Reused DeFries Brick

Indicator	Unit	A1-A3	A4	A5	C1	C2	C2/1	C3	C3/1	C4	C4/1	D	D/1
PM	Cases o illness	6.4E-06	2.21E-06	3.92E-09	1.45E-07	1.89E-06	1.89E-06	1.51E-05	0	0	1.74E-05	-2.83E-08	-2.83E-08
IR	kBq U235-Äq.	1.12E+00	4.03E-01	7.87E-04	6.23E-03	3.45E-01	3.45E-01	3.99E-02	0	0	4.79E-01	-3.7E-01	-3.7E-01
ETP-fw	CTUe	2.61E+02	1.54E+02	8.28E-01	3.21E+00	1.32E+02	1.32E+02	4.02E+01	0	0	1.99E+02	-7.35E+00	-7.35E+00
HTP-c	CTUh	1.66E-08	9.49E-09	5.25E-10	2.81E-10	8.13E-09	8.13E-09	1.97E-09	0	0	9.44E-09	-8.21E-10	-8.21E-10
HTP-nc	CTUh	3.99E-07	2.31E-07	3.55E-09	1.47E-09	1.98E-07	1.98E-07	1.38E-08	0	0	1.39E-07	-2.83E-08	-2.83E-08
SQP	SQP	5.29E+02	3.24E+02	6.3E-02	5.16E-01	2.78E+02	2.78E+02	5.64E+00	0	0	6.18E+02	-6.04E+00	-6.04E+00

PM = Potential occurrence of diseases due to particulate matter emissions; IR = Potential impact from humans being exposed to U235; ETP-fw = Potential toxicity comparison unit for ecosystems; HTP-c = Comparison unit for potential toxicity for humans (carcinogenic effect); HTP-nc = Comparison unit for potential toxicity for humans (non-carcinogenic effect); SQP = Potential soil quality index

Restrictive note 1 – applies to the indicator 'Potential effect of human exposure to U235'.

This impact category mainly deals with the possible impact of low-dose ionizing radiation on human health in the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents and occupational exposure, nor the disposal of radioactive waste in underground facilities. Potential ionizing radiation from soil, radon and some building materials is also not measured by this indicator.

Restrictive note 2 – applies to the indicators: 'Potential for depletion of abiotic resources - non-fossil resources', 'Potential for depletion of abiotic resources - fossil fuels', 'Water depletion potential (user)', 'Comparison unit for potential toxicity for ecosystems', ' Comparison unit for potential toxicity for humans - carcinogenic effect', ' Comparison unit for potential toxicity for humans - non-carcinogenic effect', 'Potential soil quality index'.

The results of this environmental impact indicator must be used with caution, because the uncertainties in these results are high or there is only limited experience with the indicator.

6. LCA: Interpretation

The results of the LCA are mainly dominated by the transportation of the bricks to the production site, from the production site to the construction site and from the construction site to disposal. This is due to the fact that the raw material is completely reused and that hardly any environmental impact in its production, as described in PCR Part A - Annex Reuse. With the exception of the environmental impact category PM, transportation in life cycle modules A2, A4 and C2 of all environmental impact categories accounts for a moderate share of the total impact of 74%.
As the effects of transportation depend on the mass that is actually transported, the extent to which the material density affects the results was analyzed. The results listed in Chapter 5 apply to a bulk density of 1,801 kg/m³.

The possible densities of the bricks range between 1,726 kg/m³ and 1,892 kg/m³. In addition to the transport processes the bulk density also has an impact on the mass to be recycled at the end of the life cycle. Using the lowest bulk density for the bricks as a basis and thereby reducing their mass all environmental impact categories are reduced by 3.7% and all result categories by 4.0%. At the highest possible density of 1,892 kg/m³ the mass of the bricks and the results within the environmental impact categories increase by an average of 4.5%. In this case, the results for all categories increase by an average of 4.2%.

Thus, an almost linear change in the results as a function of the bulk density of the bricks can be observed.

7. Evidence

The physical properties of the masonry brick presented in this EPD have been taken from test certificate no. 43 419 issued by the state-approved testing laboratory *Keramisch-Technologisches Baustofflaboratorium Hamburg e.V*.
According to the Federal Office for Radiation Protection, the nuclide content of bricks amounts to up to 1,300 Bq/kg for K-40, up to 63 Bq/kg for Ra-226 and up to 98 Bq/kg for Th-228 (BfS). Thus, the values all fall below the average values for natural radioactivity of these radionuclides in soils in Germany, so that the building materials can be classified as safe.

8. Literature References

Standards

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DIN 20000-401:2017-01, Application of building products in structures - Part 401: Rules for the application of clay masonry units according to DIN EN 771-1:2015-11.
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DIN EN 772-16:2011-07, Methods of test for masonry units - Part 16: Determination of dimensions.
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DIN 13501-1
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DIN EN 772-13
DIN EN 772-13:200-09, Methods of test for masonry units - Part 13: Determination of net and gross dry density of masonry units (except for natural stone).
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Institut für Bauen und Umwelt e.V.: PCR guidance texts for building-related products and services from the program for environmental product declarations of the Institut für Bauen und Umwelt e.V. (IBU) - Part B: Requirements for the EPD for bricks.
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Keramisch-Technologisches Baustofflaboratorium Hamburg e.V.: Test certificate no. 43 419, Reinbek, 2022
PEF
Zampori et al.: Suggestions for updating the Product Environmental Footprint (PEF) method, 2019
TBE PCR Document
Tiles & Bricks Europe: Internal Guidance Document On TBE PCR For Clay Construction Products, 2020
ECHA Candidate List
List of substances of very high concern for authorization published in accordance with Article 59(10) of the REACH Regulation, available online at:
https://echa.europa.eu/de/candidate-list-table (last accessed December 2024).
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Software / Database

Software
Greendelta: OpenLCA Version 2.0.4, Berlin, 2023, https://www.openlca.org
Database
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The completeness and correctness of the above translation of a scan presented to me
from the German into the English language is hereby certified.
Münster, January 21, 2025
Gertrud Hurck, certified translator, appointed by the President of
the Higher Regional Court of Hamm for the English and French language.