ENVIRONMENTAL PRODUCT DECLARATION

according to *ISO 14025* and *EN 15804+A2*

Owner of declaration	Verband für Dämmsysteme, Putz und Mörtel e.V.
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration no.	EPD-VDP-20230395-IBO1-DE
Date of issue	12/03/2024
Valid until	11/03/2029

Masonry Mortar - Thin-Bed Mortar/Mortar with Special Properties

Verband für Dämmsysteme, Putz und Mörtel e.V. (VDPM)

Institut Bauen und Umwelt e.V.

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1. General information

Verband für Dämmsysteme, Putz und Mörtel e.V. (VDPM).

Programme holder

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

Declaration no.

EPD-VDP-20230395-IBO1-DE

This declaration is based on the product category rules:

Mineral factory-made mortar, 01/08/2021
(PCR tested and approved by the Independent Board of Experts (SVR))

Date of issue
12/03/2024

Valid until
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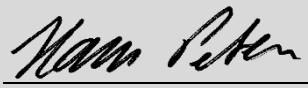


Dipl.-Ing. Hans Peters
(Chairman of the IBU – Institut Bauen und Umwelt e.V.)

Florian Pronold
(Managing director – Institut Bauen und Umwelt e.V.)

Masonry Mortar - Thin-Bed Mortar/Mortar with Special Properties

Owner of declaration

Verband für Dämmsysteme, Putz und Mörtel e.V.
Reinhardtstraße 14
D-10117 Berlin
Germany

Declared product / Declared unit

1 kg masonry mortar in the form of mineral factory-made mortar, product group thin-bed screed/mortar with special properties, with > 1300 kg/m³ dry bulk density.

Scope:

This document is an EPD template with that product of a group selected for the life cycle assessment which carries the highest environmental impact in this group. It exclusively covers masonry mortar - thin-bed mortar/mortar with special properties in the form of mineral factory-made mortar for members of the association (see the association's website). The figures, such as structural or concentration data, reflect the usual, average values for this product group.
The owner of the declaration is liable for the underlying information and supporting documents; any liability of IBU regarding the manufacturer's information, life cycle assessment data, and supporting documents is excluded.

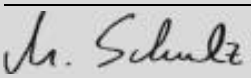
The EPD was drawn up in accordance with EN 15804+A2. The standard will simply be referred to as *EN 15804* herein.

Verification

The European standard EN 15804 is the core PCR.

Independent verification of the declaration and information according to ISO 14025:2011.

☐ internal ☒ external



Matthias Schulz,
(Independent verifier)

2. Product

2.1 Product description/Product definition

Mineral factory-made mortars are a type of mortar containing substances which are mixed at the factory rather than the construction site. It is divided into three
mortar types, according to the type of use: masonry mortar, plastering mortar, and screed mortar.
Mineral masonry mortars are blends of one or more inorganic binding agents, aggregates, water and accessory / auxiliary agents as needed to produce bed joints, butt joints and longitudinal joints, smoothed joints, and for brickwork regrouting. Based on the technical data, the base and auxiliary materials used and the practical application, masonry mortars are classified into the product groups normal masonry mortar, lightweight masonry mortar, facing mortar/mortar with special properties, and thin-bed mortar/mortar with special properties. Distinction is made between factory-made dry mortar, factory-made wet mortar, multi-chamber silo mortar, and factory-made pre-mixed mortar, depending on the manner of production. The making available on the market of thin-bed mortar / mortar with special properties within the EU/EFTA (excluding Switzerland) is subject to the provisions of Regulation (EU) No 305/2011 (CPR). Thin-bed mortar/mortar with special properties requires a declaration of performance based on *DIN EN 998-2 Specification for mortar for masonry Part 2: Masonry mortar* and the CE label.
Usage of the product is subject to the applicable national regulations.

2.2 Application

Factory-made masonry mortar for use in walls, pillars, and separating masonry walls: thin-bed mortar for the construction of masonry for load-bearing and non-load-bearing masonry structures in civil engineering or mortar with special properties for mortar applications of comparable composition not covered by the scope of application of other factory-made mortars (plastering and screed mortars).

2.3 Technical data

Typical structural data

Designation	Value	Unit
Compressive strength acc. to EN 1015-11	min. M10	N/mm²
Initial shear strength acc. to EN 1052-3	≥ 0.20	N/mm²
Thermal conductivity acc. to EN 1745 lambda10,dry,mat / P = 50%	≥ 0,29	W/(mK)
Thermal conductivity acc. to EN 1745 lambda10,dry,mat / P = 90%	≥ 0,32	W/(mK)
Water vapour permeability acc. to EN 1015-19	15/35	-
Dry bulk density acc. to EN 1015-10	≥ 1300	kg/m³

Performance values of thin-bed mortar / mortar with special properties corresponding to the declaration of performance for the Essential Characteristics acc. to *DIN EN 998-2 Specification for mortar for masonry – Part 2: Masonry mortar*.
Water absorption, bond strength, and sound absorption level are irrelevant.

2.4 Delivery condition

Mineral masonry mortars - thin-bed mortars/mortars with special properties are made and delivered in the form of factory-made dry mortar.

Factory-made dry mortar is a mortar consisting of starting materials which are filled at the factory in dry condition and delivered to the construction site, where they are mixed with the required volume of water according to the manufacturer's instructions and conditions to produce ready-to-use mortar. Delivered as bagged material with a weight up to 35 kg per bag or silo material with a weight up to 15 to per silo.

2.5 Base/Accessory materials

Mineral construction materials including mineral factory-made mortar and masonry mortar mainly consist of widely available mineral raw materials. There is no lack of resources.

Designation	Value	Unit
Aggregate	35-40	m%
Fine aggregate	10-15	m%
Lightweight aggregate		m%
Artificial fillers		m%
Cement	45-55	m%
Hydrated lime [$Ca(OH_2$]		m%

The permissible fluctuation range of the engineering data is based on the varying
fractions of base materials. The composition of the masonry mortars is always 100 mass percent.
The following auxiliary materials can be added as needed:

- Plastic dispersion: < 2.00 m%
- Water retaining agents: < 0.50 m%
- Thickeners: < 0.06 m%
- Retarders: < 0.36 m%
- Chromate reducers: < 0.04 m%

Aggregates: Natural sands as natural raw materials containing natural secondary and trace minerals in addition to the primary minerals quartz (SiO_2) and calcite ($CaCO_3$).
Fine aggregates: Limestone meals produced during treatment of the natural sands to produce the aggregates, and ultra fine sands.
Lightweight aggregates: Natural or artificial inorganic lightweight aggregates to reduce dry bulk density. Natural lightweight aggregates are made from natural raw materials by shredding (e.g., pumice, vermiculite). Artificial lightweight aggregates are made by processing, melting and expanding suitable natural raw materials (expanded clay, perlites) or sorted waste glass (expanded glass).
Artificial fillers: Fine meals or sands produced in other manufacturing processes, in part with latent hydraulic or puzzolana characteristics such as mineral coal fly ash.
acc. to *EN 450*, bottom ash, etc.
Cement: Acc. to *EN 197-1*; cement functions as binding agent and is mainly produced from limestone marl or a mixture of limestone and clay. The natural raw materials are baked and ground.
Slaked lime: Acc. to *EN 459*; white hydrated lime serves as binding agent and is produced from natural limestone with subsequent slaking. **Plastic dispersion**: Polymer powders to improve adhesive bonding, elasticity, the mechanical properties etc in thin-bed mortar. **Water retaining agents:** Cellulose ethers, made from pulp, prevents rapid water loss from the wet mortar.

Thickeners: Cellulose or starch ethers, made from pulp or native starch, improve stability, i.e. have a thickening effect, but do not retain water.
Retarders: Calcium complexing or protective colloid forming agent on an inorganic (sodium and potassium phosphates, etc) or organic basis (sugar, fruit acids, etc) which increase the time between the mortar's plastic and solid state.
Chromate reducers: Iron-II sulphate transforms water-soluble, hexavalent chrome fractions contained in the cement into trivalent compounds.

Information on substances of very high concern:

- The product contains substances according to the *ECHA List of 14 June 2023* at levels above 0.1 mass percent: no.
- The product/at least one partial product contains additional, category 1A or 1B, CMR substances not included in the candidate list, at levels above 0.1 mass percent in at least one partial product: no.
- The construction product in question has biocides added or was treated with biocidal products (making it a treated good in the meaning of the Biocidal Products Regulation (EU) No. 528/2012: no.

2.6 Manufacture

The figure shows the manufacturing process. Mineral masonry mortars are produced in mixers according to the following process:

- Fill the reservoirs / weighing vessels,
- Feed the charge materials/mix into the mixer,
- Mix,
- Transport the finished product,
- Packaging,
- Loading and delivery of the finished product.

The raw materials – sand, binding agents, lightweight aggregates, auxiliary materials and aggregates (see base materials) – are stored in silos at the production plant. Raw materials are dispensed from the silos by gravimetry as formulated, and intensely mixed.
In the next step, the mix is packaged and delivered in the form of factory-made dry mortar in containers or silos in dry condition.

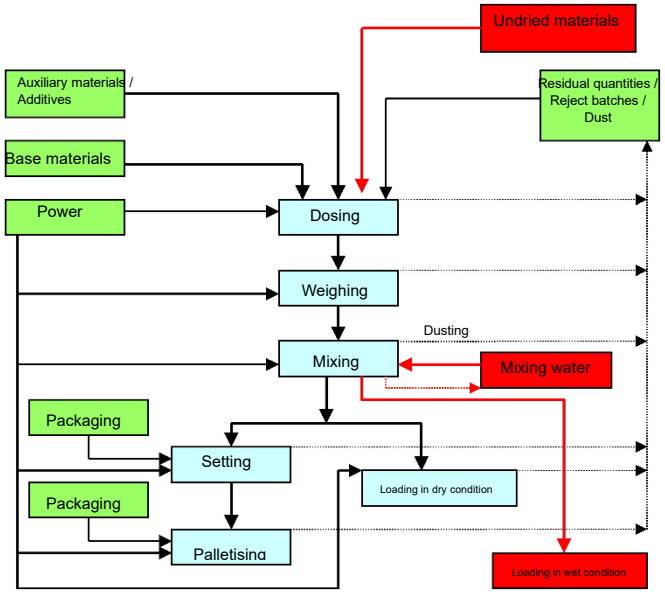


Fig. 1: Manufacturing process (green: input; red: input of different varieties; blue: uniform process)

2.7 Environment and health during production

According to the state of technology, 100% of the dry waste is fed back into the production cycle. Any dust developing during production at the factory is sent to a central filter system by a dedicated extraction unit, taking account of the maximum allowable concentrations. The segregated fine dust is fed back into the production cycle. Under the quality management system in place, all reject batches that may be produced are detected immediately by the automated process monitoring system and routed via dedicated return material silos back into the production cycles, i.e., in minuscule fractions. The same approach is employed for product residues which are sent back in low quantities in silos or bags to the production plant.
Process exhaust air is dedusted down to a level significantly below the statutory threshold values of the maximum allowable concentrations (MAC).

Noise:
Noise level measurements have shown that all values determined inside

and outside the production site are significantly below the levels required by the technical standards, thanks to the soundproofing measures in place.

2.8 Product processing/Installation

As a rule, mineral masonry mortar is mixed mechanically. Masonry mortars in the form of factory-made dry mortar are mixed using a horizontal mixer with automated water dosing (dispensed from silo or container) and lifted onto the scaffold with a crane and suitable bucket. Thin-bed mortars/mortars with special properties can be removed automatically with a dry conveyor from the silo or manually from single containers and mixed, transported and applied with a mixer. Silo mixing pumps can be employed.
After mixing and transport on site, the masonry mortar is manually processed with the corresponding brickwork using appropriate tools.
Masonry mortar used for jointing is processed manually (normal and lightweight masonry mortar) or suitable application and spreading tools (facing mortar, thin-bed mortar). The guidelines of the professional associations and relevant safety data sheets for the construction products apply.
The binding agents cement and limestone contained in the mineral factory-made mortars render the water-mixed wet mortar highly alkaline. Prolonged exposure may cause severe skin damage due to the alkalinity so that contact with the eyes and skin must be avoided by using personal protective equipment (*EC safety data sheet*). No particular steps need to be taken to protect the environment. Unchecked dust emissions must be avoided. Mineral factory-made mortar must not be allowed to enter into sewers, surface water, or ground water.
When selecting the necessary processing aggregates, it must be ensured that these do not adversely affect the environmental compatibility properties of the construction products.

2.9 Packaging

Bagged material consisting of a paper bag with plastic liner, bags stored on pallets, pallet sealed in plastic film, silo material in steel silos.

Re-use options for packaging: to be sorted as appropriate. Clean polyethylene (PE) film (ensure sorting by type) and reusable wood pallets are accepted back by building materials distributors (reusable pallets against refund under the deposit-refund system), which return it to the mortar plants to be fed back into the production cycle. The film is sent to the film manufacturers to be recycled.

2.10 Condition in use

The products described above are resistant to rotting and ageing when used normally and as intended.

2.11 Environment and health during use

The stable calcium-silicate-hydrate (CSH) bonding and solid structure formed in the brickwork when fully cured preclude any emissions. When used normally
and as intended,
health impairments are precluded.
There are no known hazards to water, air and soil as long as the products are used as intended. The natural ionising radiation emitted by the masonry mortars produced from mineral factory-made mortars is extremely low and considered safe.

2.12 Reference service life

A reference service life (RSL) acc. to *ISO 15686-1, -2, -7* and -8 is not declared. When used as intended and properly installed, masonry walls made with factory-made mortar have a service life of 50 years or more (*BBSR*), based on experience.

2.13 Exceptional influences fire

Fire behaviour category A1

Since the fraction of finely distributed organic components exceeds 1%,
the fire behaviour category A1 is generally established via testing.
Additional labelling is provided on a product-specific basis on containers in the form of CE labels/declarations of performance.

Fire protection

Designation	Value
Construction material category	A1
Burning drops	
Flue gas formation	

Water

Mineral factory-made mortars, in the form of masonry mortar, are structurally stable and not subject to deformation when exposed to water and drying.

Mechanical destruction

No information required.

2.14 End-of-life phase

The service life of brickwork made with masonry mortar - thin-bed mortar/mortar with special properties generally ends with the service life of the building in which it is installed. The masonry cannot be reused or continue to be used after dismantling.
As a general rule, components made from masonry mortar can be simply dismantled. When dismantling a building, they do not need to be treated as hazardous waste, but should be sorted according to type as far as possible. Mineral masonry mortars can be introduced into the normal construction materials recycling process.
They are reused in most cases in the form of recycled aggregates in civil engineering applications.

2.15 Disposal

Mortar forms part of the mineral construction waste fraction. About 78% of the construction waste is recycled (*BBS*).
Depositability of hardened mineral masonry mortars acc. to dump category I under the Dump Ordinance (*DepV*) is guaranteed.
The EAK waste code according the Waste Index Ordinance (*AVV*) is 170101 / 101314.

2.16 Additional information

Additional information is available at the following URL: www.vdpm.info.

3. LCA: calculation rules

3.1 Declared unit

Based on the technical data, the base and auxiliary materials used and the practical application, masonry mortars are classified into the product groups normal masonry mortar, lightweight masonry mortar, facing mortar/mortar with special properties, and thin-bed mortar/mortar with special properties.

This declaration covers the manufacture of 1 kilogram of typical masonry mortar of the product group thin-bed mortars/mortars with special properties. Only dry mortars are covered.

Declared unit

Designation	Value	Unit
Declared unit	1	kg
Bulk density	≥ 1300	kg/m³
Yield	0.75-0.85	l/kg

When assessing the life cycle, that product in the product group thin-bed mortars/mortars with special properties is selected that has the highest environmental impact in this group.
contribute more than 1% to the primary energy demand. Taken together, the disregarded input flows do not exceed 5% of the energy and

3.2 System boundary

The life cycle assessment of the tested products spans the phases from mortar, including raw material, production and provision of energy carriers up to the packaged product (module A1-A3), installation of the product incl. transport to the construction site (module A4-A5), the usage phase (module B1), and disposal of the mortar (module C1-C4). For silo materials, expenditures are factored in on a pro-rate basis for transport and manufacture of the silo. Credits for packaging, including energy recovery (module D), are also included in the life cycle assessment.

3.3 Estimates and assumptions

Estimates for individual formulation components were made based on the manufacturer's data where no specific *Gabi* processes were available.

3.4 Cut-off rules

On the input side, all material flows were factored in which enter the system and exceed 1% of the total mass or Germany as reference territory, meaning that the precursors relevant to Germany, such as the provision of power or energy

mass input.
The manufacture of the equipment, plants and other infrastructure needed to produce the products in question were not included in the life cycle assessment.

3.5 Background data

The LCA For Experts *LCA FE* (previously GaBi) software, version 10.6.1.35, by Sphera GmbH was used to model the life cycle of the declared product, The underlying database is Sphera Managed LCA Content, CUP version 2022.2.

3.6 Data quality

Representative products were used for this EPD template; the product with the highest environmental impact was declared product group representative in the life cycle assessment.
The *Sphera Software LCA-FE* provided appropriate background datasets with the associated databases MLC for all relevant precursors. Requirements on data quality and background data correspond to *PCR Part A*. The technological background of the recorded data reflects the physical reality for the declared product group. The datasets are complete and correspond with the system boundaries and the input / output exclusion criteria.
The data used was last revised less than 8 years ago.

3.7 Period under consideration

The period under consideration is one annual production, based on 2023. Life cycles were assessed for carriers, were used in addition to the production processes under these underlying conditions.

3.8 Geographic representative status

Country or region in which the declared product system is manufactured and possibly used and subjected to end-of-life treatment: Germany

3.9 Allocation

The documentation of the Sphera MLC (previously GaBi) datasets of the contain details of the allocation within the background data. Material and energy consumptions were allocated for the declared product by the affiliate companies of the VDPM. The data provided are unpublished, internal indicators.
Incineration of the packaging and production waste and disposal of the production waste is accounted for in a multi-input allocation with credits assigned for power and thermal energy under the simple credit approach. Packaging disposal credits are credited in module D.

3.10 Comparability

On the whole, EPD data can be compared or evaluated only if all datasets to be compared were generated acc. to *EN 15804* and the building context and product-specific performance characteristics are taken into consideration. The *Sphera LCA FE* Sphera Managed LCA Content, CUP version 2022.2 database was used for modelling.

4. LCA: scenarios and additional technical information

Characteristic product properties biogenic carbon

Information describing the biogenic carbon content at the factory gate

Designation	Value	Unit
Biogenic carbon contained in product	-	kg C
Biogenic carbon contained in packaging	0.01	kg C

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

The following technical information are used as the basis of the declared modules or can be used to derive specific scenarios under a building assessment.

Transport to construction site (A4)

Designation	Value	Unit
Litres of fuel	0.0037	l/100km
Transport distance	100	km
Utilisation (including empty runs)	50-85	%
Bulk density of transported product	1300	kg/m³

Installation in building (A5)

Designation	Value	Unit
Auxiliary material	-	kg
Water consumption	0.0005	m³
Other resources	-	kg
Power consumption	0.00008	kWh
Other energy carriers	-	MJ
Wastage	-	kg
Output materials resulting from on-site waste processing	-	kg
Airborne dust	-	kg
Airborne VOC	-	kg

Usage (B1)

Also see chapter 2.12: Reference service life. In the usage phase, the carbonation-related CO_2 integration is considered. The CO_2 released by limestone ($CaCO_3$) deacidification during limestone and cement production bound again by reacting with the binding agents lime and cement, thus increasing strength. In the factory-made mortar life cycle assessment, the resultant, maximum theoretical CO_2 absorption for fully carbonated masonry mortar was calculated following *EN 16757*, and the practical total maximum CO_2 absorption potential was calculated with due regard to the limited degree of exposure inside the brickwork.

End of life (C1-C4)

Designation	Value	Unit
Waste type collected separately Waste type	-	kg
Collected as mixed construction waste	-	kg
To reuse	-	kg
To recycling	-	kg
To energy recovery	-	kg
To landfill	1.2	kg

Reuse, recuperation and recycling potential (D), relevant scenario data

Designation	Value	Unit
Recycling silo (packaging)	**100**	**%**
Incineration wood pallets (packaging)	**100**	**%**
Incineration paper (packaging)	**100**	**%**
Incineration PE film (packaging)	**100**	**%**

5. LCA: Results

**SPECIFICATION OF SYSTEM BOUNDARIES (X = INCLUDED IN LIFE CYCLE ASSESSMENT; MND = MODULE OR INDICATOR NOT DECLARED;
MNR = MODULE NOT RELEVANT)**

Production stage			Building construction stage		Usage stage							Disposal stage				Credits and burdens outside the system boundaries
Raw materials supply	Transport	Manufacture	Transport from manufacturer to site of use	Installation	Usage/Application	Maintenance	Repair	Replacement	Renewal	Energy consumption for operation of	Water consumption for operation of	Dismantling/Demolition	Transport	Waste treatment	Disposal	Reuse, recuperation 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	X	MND	MNR	MNR	MNR	MND	MND	X	X	X	X	X

RESULTS OF THE LIFE CYCLE ASSESSMENT – ENVIRONMENTAL IMPACT acc. to EN 15804+A2: 1 kg masonry mortar - thin-bed mortar / mortar with special properties

Indicator	Unit	A1-A3	A4	A5	B1	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	4.84E-01	1.13E-02	6.15E-02	-1.84E-01	3.22E-04	6.55E-03	0	1.74E-02	-2.26E-02
GWP-fossil	kg CO_2 eq.	5.27E-01	1.12E-02	7.04E-03	-1.84E-01	3.22E-04	6.53E-03	0	1.79E-02	-2.24E-02
GWP-biogenic	kg CO_2 eq.	-4.29E-02	4.62E-06	5.45E-02	0	-1.36E-06	2.68E-06	0	-5.3E-04	-1.62E-04
GWP-luluc	kg CO_2 eq.	1.09E-04	4.18E-05	3.97E-07	0	1.25E-06	2.43E-05	0	3.31E-05	-3.82E-06
ODP	kg CFC11 eq.	1.39E-12	1.6E-15	1.34E-14	0	6.65E-17	9.31E-16	0	4.26E-14	-2.29E-13
AP	mol H+ eq.	5.14E-04	1.08E-05	1.38E-05	0	4.34E-06	6.25E-06	0	1.27E-04	-2.18E-05
EP-freshwater	kg P eq.	6.37E-07	2.32E-08	6.77E-09	0	6.47E-10	1.35E-08	0	3.04E-08	-4.68E-08
EP-marine	kg N eq.	1.61E-04	3.62E-06	4.01E-06	0	1.98E-06	2.1E-06	0	3.25E-05	-7.97E-06
EP-terrestrial	mol N eq.	1.74E-03	4.33E-05	6.27E-05	0	2.17E-05	2.52E-05	0	3.57E-04	-8.51E-05
POCP	kg NMVOC eq.	4.98E-04	9.44E-06	1.06E-05	0	5.91E-06	5.48E-06	0	9.87E-05	-2.07E-05
ADPE	kg Sb eq.	3.83E-08	1.16E-09	3.15E-10	0	3.25E-11	6.74E-10	0	1.85E-09	-5.44E-09
ADPF	MJ	3.46E+00	1.49E-01	4.64E-02	0	4.3E-03	8.67E-02	0	2.35E-01	-3.26E-01
WDP	m^3 world eq. deprived	1.16E-02	4.42E-05	6.67E-03	0	1.4E-06	2.57E-05	0	1.96E-03	-2.72E-04

GWP = global warming potential; ODP = atmospheric ozone layer depletion potential; AP = soil and water acidification potential; EP = eutrophication potential; POCP = tropospheric ozone formation potential; ADPE = abiotic resource scarcity potential – non-fossil resources (ADP – substances); ADPF = abiotic resource scarcity potential – fossil fuels (ADP – fossil energy carriers); WDP = water deprivation potential (user)

RESULTS OF THE LIFE CYCLE ASSESSMENT – RESOURCE UTILISATION INDICATORS acc. to EN 15804+A2: 1 kg masonry mortar - thin-bed mortar/mortar with special properties

Indicator	Unit	A1-A3	A4	A5	B1	C1	C2	C3	C4	D
PERE	MJ	8.82E-01	8.86E-03	4.72E-01	0	2.83E-04	5.15E-03	0	3.53E-02	-1.06E-01
PERM	MJ	4.09E-01	0	-4.09E-01	0	0	0	0	0	0
PERT	MJ	1.29E+00	8.86E-03	6.3E-02	0	2.83E-04	5.15E-03	0	3.53E-02	-1.06E-01
PENRE	MJ	3.4E+00	1.49E-01	1.03E-01	0	4.31E-03	8.68E-02	0	2.35E-01	-3.26E-01
PENRM	MJ	5.3E-02	0	-5.3E-02	0	0	0	0	0	0
PENRT	MJ	3.46E+00	1.49E-01	5E-02	0	4.31E-03	8.68E-02	0	2.35E-01	-3.26E-01
SM	kg	0	0	0	0	0	0	0	0	0
RSF	MJ	0	0	0	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0	0	0	0
FW	m^3	8.24E-04	7.73E-06	5.49E-04	0	2.2E-07	4.49E-06	0	5.95E-05	-4.39E-05

PERE = renewable primary energy as energy carrier; PERM = renewable energy for material utilisation; PERT = total renewable primary energy; PENRE = non-renewable primary energy as energy carrier; PENRM = non-renewable primary energy for material utilisation; PENRT = total non-renewable primary energy; SM = use of secondary materials; RSF = renewable secondary fuels; NRSF = non-renewable secondary fuels; FW = net utilisation of sweet water resources

RESULTS OF THE LIFE CYCLE ASSESSMENT – WASTE CATEGORIES AND OUTPUT FLOWS acc. to EN 15804+A2: 1 kg masonry mortar - thin-bed mortar/mortar with special properties

Indicator	Unit	A1-A3	A4	A5	B1	C1	C2	C3	C4	D
HWD	kg	9.95E-10	6.9E-13	3.49E-12	0	1.88E-14	4.01E-13	0	1.21E-11	-5.73E-11
NHWD	kg	9.78E-03	2.36E-05	5.87E-04	0	7.01E-07	1.37E-05	0	1.2E+00	-1.87E-04
RWD	kg	8.21E-05	1.5E-07	3.43E-06	0	5.41E-09	8.73E-08	0	2.57E-06	-1.17E-05
CRU	kg	0	0	0	0	0	0	0	0	0

MFR	kg	0	0	0	0	0	0	0	0	0
MER	kg	0	0	0	0	0	0	0	0	0
EEE	MJ	0	0	7.46E-02	0	0	0	0	0	0
EET	MJ	0	0	1.74E-01	0	0	0	0	0	0

HWD = hazardous waste sent to landfill; NHWD = disposed. non-hazardous waste; RWD = disposed radioactive waste; CRU = components for reuse; MFR = materials for recycling; MER = materials for energy recovery; EEE = exported energy – electric; EET = exported energy – thermal

RESULTS OF THE LIFE CYCLE ASSESSMENT – additional effect categories acc. to EN 15804+A2-optional: 1 kg masonry mortar - thin-bed mortar/mortar with special properties

Indicator	Unit	A1-A3	A4	A5	B1	C1	C2	C3	C4	D
PM	Cases of illness	1.72E-08	6.36E-11	8.55E-11	0	2.32E-10	3.7E-11	0	1.56E-09	-1.59E-10
IR	kBq U235 eq.	8.15E-03	1.46E-05	2.75E-04	0	5.5E-07	8.49E-06	0	2.8E-04	-1.17E-03
ETP-fw	CTUe	1.32E+00	1.18E-01	1.5E-02	0	3.3E-03	6.87E-02	0	1.31E-01	-5.32E-02
HTP-c	CTUh	5.08E-11	2.35E-12	5.77E-13	0	6.61E-14	1.36E-12	0	2.01E-11	-3.42E-12
HTP-nc	CTUh	3.75E-09	1.17E-10	2.8E-11	0	4.97E-12	6.82E-11	0	2.22E-09	-1.55E-10
SQP	SQP	9.08E+00	4.69E-02	4.65E-03	0	1.29E-03	2.72E-02	0	5.1E-02	-7.22E-02

PM = potential occurrence of disease caused by particulate emissions; IR = potential effect through human exposition to U235; ETP-fw = potential toxicity reference unit for ecosystems; HTP-c = potential toxicity reference unit for humans (carcinogenic effect); HTP-nc = potential toxicity reference unit for humans (non-carcinogenic effect); SQP = potential soil quality index

Qualifier 1 – applies to the indicator “potential effect through human exposition to U235”

This effect category mainly covers the potential impact of low-dosage ionising radiation on human health in the nuclear fuel cycle. It does not account for effects caused by possible nuclear accidents and occupational exposition nor for the disposal of radioactive waste in subterranean installations. This indicator also does not cover the potential ionising radiation emitted by the ground, radon, and certain construction materials.

Qualifier 2 – applies to the indicators: “abiotic resource scarcity potential – non-fossil resources”, “abiotic resource scarcity potential – fossil fuels”, “water deprivation potential (user)”, “potential toxicity reference unit for ecosystems”, “potential toxicity reference unit for humans – carcinogenic effect”, “potential toxicity reference unit for humans – non-carcinogenic effect”, and “potential soil quality index”.

Diligence must be applied when using the results of the environmental impact indicator because they are fraught with high uncertainties or experience with the indicator is limited.

6. LCA: Interpretation

The life cycle assessment results are substantially dominated across all effect categories by the life cycle phases provision of raw materials and transport (A1-A2), manufacture (especially of the packaging in A3), and disposal on landfill (C4). Taken together, about 85 - 100% (except WDP) of the environmental impact is due to these life cycle phases.
The sum of the utilised raw materials (except WDP) and their transport accounts for about 75 - 95% of the environmental impact, mainly due to the use of cement, methyl cellulose, and dispersion powder (cumulatively > 95% in A1). Raw material transport is of secondary significance (< 10% from sum of A1-A2). Product transport to the construction site (A4) is of secondary significance (< 10%).
WDP in A5 is chiefly caused by the thermal recycling of the packaging material.
End-of-life landfill disposal (C4) contributes about 0 - 40% of the environmental impact.
In the usage phase, about 30% of the GWP caused is reintegrated via carbonation (= CO_2 integration).

7. Verification

7.1 Leaching:

There are currently no European or national assessment or emission scenarios for a scenario involving components exposed to moisture,meaning a technical verification analogous to indoor areas (*AgBB* schema) is impractical.

7.2 VOC emissions*:*

Measuring point: Fraunhofer Institute for Structural Physics (IBP), Division Holzkirchen, D-83626 Valley

Measuring method: Determination of the emissions of volatile organic compounds from construction products and items of furniture acc. to *ISO 16000-9 and -11* in a 0.2 m³ test chamber (t0 = 7 days) and evaluation acc. to the AgBB schema. Measurement of different products for indoor and outdoor applications.

Test report: Summary record 005/2008/281 of 20/03/2008

Results:

Sample name	Thin-Bed Mortar/Mortar with Special Properties	
AgBB summary of results	3 days [µg/m³] Measured values	28 days [µg/m³] Measured values
[A] TVOC (C6-C16)	**< 200**	**< 50**
[B] Σ SVOC (C16-C22)	**< 5**	**< 5**
[C] R (dimensionless)	**< 3.0**	**< 0.6**
[D] Σ VOC w/o NIK	**< 10**	**< 10**
[E] Σ carcinogens	**< 2**	**< 1**
[F] VVOC (< C6)	**< 200**	**< 50**

7.3 Radioactivity:

Measuring point: Fraunhofer Institute for Structural Physics (IBP), Division Holzkirchen, D-83626 Valley

Measuring method: Determination of the content of radioactive nuclides 226Ra, 232Th and 40K by measuring the activity concentrations $C_{nuclide}$ by alpha spectrometry (delayed coincidence method using LSC) and/or gamma spectrometry.

Test report: Inspection report dated 12/12/2006 on construction product radioactivity

Result: The activity concentration indices I calculated from the measured activity concentrations $C_{nuclide}$ were below the recommended threshold value I = 2 for all products tested. The proposed threshold value I = 0.5 for construction products used in high volumes was never reached either. When correlating I to the dosage criterion under the Radiation Protection 112 guidance of the European Commission, all of the aforementioned products remained below the recommended threshold value for the annual radiation dose of 0.3 mSv/a.

8. List of references

PCR Part A
Product Category Rules for Building-Related Products and Services, Part A: Calculation Rules for the Life Cycle Assessment and Requirements on the Project Report according to EN 15804+A2:2019. Version 1.3, 2022-08. Institut Bauen und Umwelt e.V.

PCR: Mineralische Werkmörtel
Produktkategorie-Regeln für gebäudebezogene Produkte und Dienstleistungen, Teil B: Anforderungen an die EPD für Mineralische Werkmörtel, Institut Bauen und Umwelt e. V., version 3, 2023-07.

Allgemeine Anleitung zum IBU-EPD-Programm
Die Erstellung von Umwelt-Produktdeklarationen. Version 2.1, 2022-10. Institut Bauen und Umwelt e.V. (ed.) at https://ibu-epd.com/ (June 2023).

Sphera LCA FE (previously GaBi)
Sphera LCA For Experts (previously GaBi Software System) with associated databases Managed LCA Content MLC (previously GaBi databases), Sphera Solutions GmbH. CUP version: 2022.2. University of Stuttgart, Leinfelden Echterdingen, MLC Data Documentation at https://sphera.com/product-sustainability-gabi-data-search/ (June 2023).

Standards

EN 197-1
DIN EN 197-1:2011-11, Cement – Part 1: Composition, specifications and conformity criteria for common cements.

EN 450-1
DIN EN 450-1:2012-10, Fly ash for concrete – Part 1: Definition, specifications and conformity criteria.

EN 459-1
DIN EN 459-1:2015-07, Building lime – Part 1: Definitions, specifications and conformity criteria.

EN 998-2
DIN EN 998-2:2017-02, Specification for mortar for masonry – Part 2: Masonry mortar.

EN 1015-10
DIN EN 1015-10:2007-05, Methods of test for mortar for masonry – Part 10: Determination of dry bulk density of hardened mortar.

EN 1015-11
DIN EN 1015-11:2020-01, Methods of test for mortar for masonry – Part 11: Determination of flexural and compressive strength of hardened mortar.

EN 1015-19
DIN EN 1015-19:2005-01, Methods of test for mortar for masonry – Part 19: Determination of water vapour permeability of hardened rendering and plastering mortars.

EN 1052-3
DIN EN 1052-3:2007-06, Methods of test for masonry – Part 3: Determination of initial shear strength.

EN 1745
DIN EN 1745:2020-10 Masonry and masonry products – Methods for determining design thermal values.

EN 1996-1-1
DIN EN 1996-1-1:2013-02, Eurocode 6: Design of masonry structures – Part 1-1: General rules for reinforced and unreinforced masonry structures.

EN 1996-1-1/NA
DIN EN 1996-1-1/NA:2019-12, National Annex – Nationally determined parameters – Eurocode 6: Design of masonry structures – Part 1-1: General rules for reinforced and unreinforced masonry structures.

EN 1996-2
DIN EN 1996-2:2010-12, Design of masonry structures – Part 2: Design considerations, selection of materials and execution of masonry.

EN 1996-2
DIN EN 1996-2/NA:2012-01, National Annex – Nationally determined parameters – Eurocode 6: Design of masonry structures – Part 2: Design considerations, selection of materials and execution of masonry.

EN 1996-2/NA/A1
DIN EN 1996-2/NA/A1:2021-06, National Annex – Nationally determined parameters – Eurocode 6: Design of masonry structures – Part 2: Design considerations, selection of materials and execution of masonry. Amendment 1.

EN 1996-3
DIN EN 1996-3:2010-12, Eurocode 6: Design of masonry structures – Part 3: Simplified calculation methods for unreinforced masonry structures.

EN 1996-3/NA
DIN EN 1-3/NA:2019-12, National Annex – Nationally determined parameters – Eurocode 6: Design of masonry structures – Part 3: Simplified calculation methods for unreinforced masonry structures.

EN 13501-1
DIN EN 13501-1:2019-05, Fire classification of construction products and building elements – Part 1: Classification using data from reaction to fire tests.

EN 15804
DIN EN 15804:2022-03, Sustainability of construction works – Environmental product declarations – Fundamental rules for the product category construction products.

EN 15942
DIN EN 15942:2022-04, Sustainability of construction works – Environmental product declarations – Communication format business-to-business.

EN 16516
DIN EN 16516:2020-10, Construction products: Assessment of release of dangerous substances – Determination of emissions of into indoor air.

EN 16757
DIN EN 16757:2023-03, Sustainability of construction works – Environmental product declarations – Product category rules for concrete and concrete elements.

ISO 14025
DIN EN ISO 14025:2011-10, Environmental labels and declarations – Type III environmental declarations – Principles and procedures.

ISO 14040
DIN EN ISO 14040:2021-02, Environmental management – Life cycle assessment – Principles and framework.

ISO 14044
DIN EN ISO 14044:2021-02, Environmental management – Life cycle assessment - Requirements and guidelines.

ISO 15686-1
ISO 15686-1:2011-05, Buildings and constructed assets – Service life planning – Part 1: General principles and framework.

ISO 15686-2
ISO 15686-2:2012-05, Buildings and constructed assets – Service life planning – Part 2: Service life prediction procedures.

ISO 15686-3
ISO 15686-3:2002-08, Buildings and constructed assets – Service life planning – Part 1: Performance audits and reviews.

ISO 15686-4
ISO 15686-4:2014-01, Building Construction – Service Life Planning – Part 4: Service Life Planning using Building Information Modelling.

ISO 15686-5
ISO 15686-5:2017-07, Buildings and constructed assets – Service life planning – Part 5: Life-cycle costing.

ISO 15686-7
ISO 15686-7:2017-04, Buildings and constructed assets – Service life planning – Part 7: Performance evaluation for feedback of service life data from practice.

ISO 15686-8
ISO 15686-8:2008-06, Buildings and constructed assets – Service-life planning – Part 8: Reference service life and service-life estimation.

ISO/TS 15686-9
ISO/TS 15686-9:2008-12, Building and constructed assets – Service life
planning – Part 9: Guidance on assessment of service-life data.

ISO 15686-10
ISO 15686-10:2010-06, Buildings and constructed assets – Service-life planning – Part 10: When to assess functional performance.

ISO/TR 15686-11
ISO/TR 15686-11:2014-08, Buildings and constructed assets – Service life planning – Part 11: Terminology.

ISO 16000-9
DIN EN ISO 16000-9:2008-04,
Indoor air - Part 9: Determination of the emission of volatile organic compounds from building products and furnishing – Emission test chamber method.

ISO 16000-11
DIN EN ISO 16000-11:2006-06,
Indoor air – Part 11: Determination of the emission of volatile organic compounds from samples of building products and furnishing. Sampling, storage of samples and preparation of test specimens.

Further reading

AgBB
Ausschuss zur gesundheitlichen Bewertung von Bauprodukten (AgBB): Anforderungen an die Innenraumluftqualität in Gebäuden: Gesundheitliche Bewertung der Emissionen von flüchtigen organischen Verbindungen (VVOC, VOC und SVOC) aus Bauprodukten. As at June 2021.

AVV
Waste Index Ordinance of 10 December 2001 (Federal Gazette of Laws and Ordinances I p. 3379) last amended by article 1 of the Ordinance of 30 June 2020 (Federal Gazette of Laws and Ordinances I p. 1533).

BBS
Bundesverband Baustoffe – Steine und Erden (bbs) e.V. u.a. (ed.: Mineralische Bauabfälle – Monitoring 2018. Bericht zum Aufkommen und zum Verbleib mineralischer Bauabfälle im Jahr 2018. Berlin, 2021.

BBSR
BBSR – Bundesinstitut für Bau-, Stadt- und Raumforschung: Nutzungsdauern von Bauteilen für Lebenszyklusanalysen nach Bewertungssystem Nachhaltiges Bauen (BNB), as at 24/02/2017.

DepV
Landfill Ordinance of 27 April 2009 (Federal Gazette of Laws and Ordinances I p. 900) last amended by article 3 of the Ordinance of 9 July 2021 (Federal Gazette of Laws and Ordinances I p. 2598).

EAK Waste Code
Ordinance Implementing the European Waste Catalogue (EAK Ordinance – EAKV) of 13 September 1996 (Federal Gazette of Laws and Ordinances I p. 1428) Federal Gazette of Laws and Ordinances III/FNA 2129–27–2–6, amended by art. 8 of the Ordinance Implementing the European Waste Catalogue of 10/12/2001 (Federal Gazette of Laws and Ordinances I p. 3379).

ECHA List
European Chemicals Agency (ECHA): Candidate List of substances of very high concern for Authorisation, published according to article 59 para. 10 of the REACH Regulation (14/06/2023).

EC Safety Data Sheet
Available on the website of the relevant VDPM affiliate company.

Industrieverband Werktrockenmörtel e.V. (WTM) internal study 'Ökologische Aspekte von Werktrockenmörtel', as at January 2000 (unpublished).

Commission Decision 94/611/EC
Decision of the Commission of 9 September 1994 implementing Article 20 of Directive 89/106/EEC on construction products (94/611/EC).

Life Cycle Assessment
Vergleichende Ökobilanz: Mauerwerk mit mineralischem Mörtel und Mauerwerk mit PU-Schaum-Verklebung nach ISO 14040 und ISO 14044; performed on behalf of VDPM (previously IWM); IBP Fraunhofer Institut für Bauphysik, Stuttgart/Holzkirchen 2008.

Radiation Protection 112
European Commission: Radiation Protection 112 “Radiological Protection Principles Concerning the Natural Radioactivity of Building Materials”, Luxembourg: Publications Office of the European Union, 2000.

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