

# 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-20230403-IBO1-DE
Date of issue	12/03/2024
Valid until	11/03/2029

**Masonry Mortar - Normal Masonry Mortar**  
**Verband für Dämmsysteme, Putz und Mörtel**  
**e.V. (VDPM)**

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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-20230403-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

11/03/2029



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(Chairman of the IBU – Institut Bauen und Umwelt e.V.)



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### Masonry Mortar - Normal Masonry Mortar

#### 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 normal masonry mortar, with > 1500 kg/m<sup>3</sup> 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 - normal masonry mortar 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 at the construction site. It is divided into three factory-made 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 normal masonry mortar within the EU/EFTA (excluding Switzerland) is subject to the provisions of Regulation (EU) No 305/2011 (CPR). Normal masonry mortar 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 walls made of masonry: normal masonry mortar for producing masonry, for load-bearing and non-load-bearing masonry structures in civil engineering.

### 2.3 Technical data

#### Structural data

Designation	Value	Unit
Compressive strength acc. to EN 1015-11	≥ 2.5	N/mm <sup>2</sup>
Initial shear strength acc. to EN 1052-3	≥ 0,15	N/mm <sup>2</sup>
Thermal conductivity acc. to EN 1745 lambda <sub>10,dry,mat</sub> / P = 50%	≥ 0.53	W/(mK)
Thermal conductivity acc. to EN 1745 lambda <sub>10,dry,mat</sub> / P = 90%	≥ 0.58	W/(mK)
Water vapour permeability acc. to EN 1015-19	15/35	-
Dry bulk density acc. to EN 1015-10	≥ 1500	kg/m <sup>3</sup>

Performance values of normal masonry mortar 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 are made and delivered as factory-made dry mortar, factory-made wet mortar, multi-chamber silo mortar or factory-made pre-mixed mortar.

**Delivery condition 1: 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 waters 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.

**Delivery condition 2: Factory-made wet mortar** consisting of starting materials which are filled at the factory, mixed with the required volume of water, and delivered wet to the construction site where it is used according to the manufacturer's instructions and conditions. Delivered by truck mixer, up to 10 to per vehicle.

**Delivery condition 3:** With multi-chamber silo mortar, starting materials are delivered to the construction site separately in a silo and are subsequently mixed with the required volume of water to produce ready-to-use mortar. Delivery up to 15 to per silo.

**Delivery condition 4:** Pre-mixed factory-made mortar consists of base materials put together and mixed at the factory. It is delivered to the construction site for addition of other components as directed or delivered (e.g., cement) by the factory. 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	80-85	m%
Fine aggregate	5-10	m%
Lightweight aggregate		m%
Artificial fillers		m%
Cement	10-15	m%
Hydrated lime [Ca(OH) <sub>2</sub> ]		m%

The permissible fluctuation range of the engineering data is based on the varying fractions of the base materials. The composition of the masonry mortars is always 100 mass percent.

In addition, 100 - 250 l water per m<sup>3</sup> of wet mortar are used for normal masonry mortars delivered as factory-made wet mortar. The following auxiliary materials can be added as needed:

- Retarders: < 0.36 m%
- Chromate reducers: < 0.14 m%

**Aggregates:** Natural sands as natural raw materials containing natural secondary and trace minerals in addition to the primary minerals quartz (SiO<sub>2</sub>) and calcite (CaCO<sub>3</sub>).

**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 pozzolana characteristics such as mineral coal fly ash as per *DIN 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.

**Water:** The presence of water is essential for processing, setting and curing and to obtain the product characteristics. In the case of factory-made dry mortar, water is added at the construction site.

**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

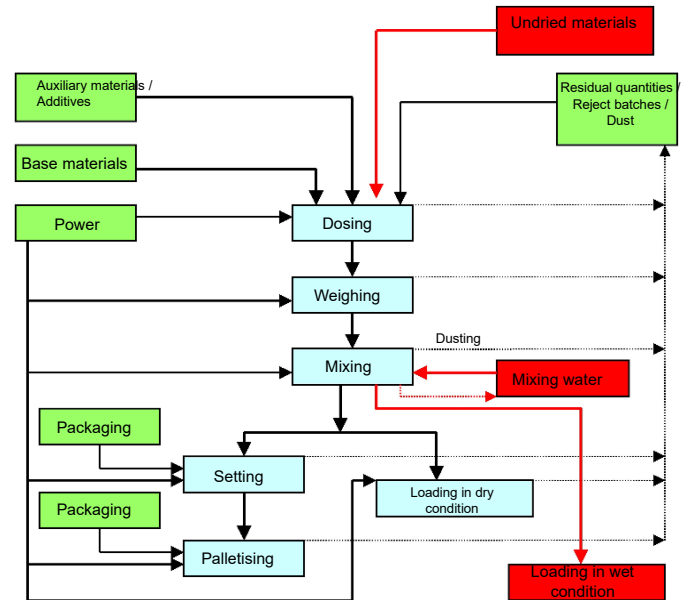
The figure shows the manufacturing process. Mineral masonry mortars are produced in mixers according to the following process:

- 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 shipped either in dry condition (factory-made dry mortar) in containers or silos, or mixed with water (factory-made wet mortar).

The base materials can be factory-filled separately and without mixing into special silos and can be mixed on site by adding water, producing ready-to-use mortar. It is also possible to pre-mix certain base materials, deliver this mixture, add further components at the construction site, and mix with water to produce ready-to-use mortar.



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

**2.7 Environment and health during production** All of the dry waste is fed back to the production cycle. According to the state of technology. Any dust developing during production at the factory is sent to a central filter system by a dedicated extraction unit. The segregated fine dust is fed back into the production cycle.

For

**Delivery condition 1: Factory-made dry mortar,**

**Delivery condition 3: Multi-chamber silo mortar,**

**Delivery condition 4: Factory-made pre-mixed mortar:**

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).

For

**Delivery condition 2: Factory-made wet mortar**

Some of the process water is fed back into the production cycle via the process water cycle. Surplus water, e.g. from the truck mixer drum cleaning process, is fed back into the production cycle as recycled water. Pre-filtered solids are continuously fed back into the production cycle.

## 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.

**Delivery condition 1: Factory-made dry mortar,  
Delivery condition 3: Multi-chamber silo mortar,  
Delivery condition 4: Factory-made pre-mixed mortar:**

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. This way of mixing is also applied to multi-chamber silo mortar and pre-mixed mortar.

**Delivery condition 2: Factory-made wet mortar**

the delivered factory-made wet mortar is transported to the installation site by a crane (bucket) or a suitable mixing and feed pump.

In the next step, 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, screed layers using mineral 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

The guidelines offer the following options to establish the fire behaviour:

**Option 1:** Normal masonry mortars are always classed into fire behaviour category A1 according to *Commission Decision 94/611/EG* without testing, i.e. "no contribution to fire" because the fraction of finely distributed organic components does not exceed 1%. **Option 2:** Since the fraction of finely distributed organic components exceeds 1%, the fire behaviour category A1 was established via testing.

Additional labelling is provided on a product-specific basis on containers with CE labels / declaration 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 a masonry structure made with masonry mortar - normal masonry mortar 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 mineral 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](http://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 normal masonry mortar. Both wet and dry mortar is covered. To ensure comparability, the declared unit will be 1 kg dry mass also for wet mortar products.

#### Declared unit

Designation	Value	Unit
Declared unit	1	kg
Bulk density	≥ 1500	kg/m <sup>3</sup>
Yield	0.60-0.65	l/kg

When performing the life cycle assessment, that product in the product group normal masonry mortar is selected that has the highest environmental impact in this group.

#### 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 which contribute more than 1% to the primary energy requirements. Taken together, the disregarded input flows do not exceed 5% of the energy and 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 as representative of a group 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 Germany as reference territory, meaning that the precursors relevant to Germany, such as the provision of power or energy 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<sub>2</sub>.

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	0.0024	l/100km
Transport distance	100	km
Utilisation (including empty runs)	50 - 85	%
Bulk density of transported product	1500	kg/m <sup>3</sup>

### Installation in building (A5)

Designation	Value	Unit
Auxiliary material	-	kg
Water consumption	0.00015	m <sup>3</sup>
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<sub>2</sub> integration is considered. The CO<sub>2</sub> released by limestone (CaCO<sub>3</sub>) 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<sub>2</sub> absorption for fully carbonated masonry mortar was calculated following *EN 16757*, and the practical total maximum CO<sub>2</sub> 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	1.04	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 building	Water consumption for operation of building	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 - normal masonry mortar

Indicator	Unit	A1-A3	A4	A5	B6	C1	C2	C3	C4	D
GWP-total	kg CO <sub>2</sub> eq.	9.24E-02	1.15E-02	3.18E-02	-3.29E-02	2.8E-04	5.69E-03	0	1.51E-02	-1.22E-02
GWP-fossil	kg CO <sub>2</sub> eq.	1.13E-01	1.14E-02	2.61E-03	-3.29E-02	2.8E-04	5.67E-03	0	1.56E-02	-1.21E-02
GWP-biogenic	kg CO <sub>2</sub> eq.	-2.09E-02	4.71E-06	2.92E-02	0	-1.18E-06	2.33E-06	0	-4.61E-04	-8.72E-05
GWP-luluc	kg CO <sub>2</sub> eq.	6.17E-05	4.26E-05	1.06E-07	0	1.09E-06	2.11E-05	0	2.87E-05	-2.08E-06
ODP	kg CFC11 eq.	2.53E-13	1.63E-15	4.5E-15	0	5.78E-17	8.09E-16	0	3.7E-14	-1.23E-13
AP	mol H <sup>+</sup> eq.	1.27E-04	1.1E-05	6.05E-06	0	3.77E-06	5.43E-06	0	1.1E-04	-1.2E-05
EP-freshwater	kg P eq.	2E-07	2.36E-08	2.18E-09	0	5.63E-10	1.17E-08	0	2.65E-08	-2.52E-08
EP-marine	kg N eq.	4E-05	3.69E-06	1.7E-06	0	1.72E-06	1.83E-06	0	2.82E-05	-4.34E-06
EP-terrestrial	mol N eq.	4.35E-04	4.41E-05	2.88E-05	0	1.89E-05	2.19E-05	0	3.1E-04	-4.64E-05
POCP	kg NMVOC eq.	1.15E-04	9.62E-06	4.45E-06	0	5.13E-06	4.77E-06	0	8.57E-05	-1.13E-05
ADPE	kg Sb eq.	1.15E-07	1.18E-09	1.1E-10	0	2.83E-11	5.86E-10	0	1.6E-09	-4.17E-09
ADPF	MJ	6.73E-01	1.52E-01	7.62E-03	0	3.74E-03	7.53E-02	0	2.04E-01	-1.76E-01
WDP	m <sup>3</sup> world eq. deprived	1.46E-03	4.51E-05	3.41E-03	0	1.21E-06	2.23E-05	0	1.7E-03	-1.47E-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 - normal masonry mortar

Indicator	Unit	A1-A3	A4	A5	B1	C1	C2	C3	C4	D
PERE	MJ	1.79E-01	9.03E-03	2.53E-01	0	2.46E-04	4.48E-03	0	3.07E-02	-5.71E-02
PERM	MJ	3.27E-01	0	-3.27E-01	0	0	0	0	0	0
PERT	MJ	5.06E-01	9.03E-03	-7.4E-02	0	2.46E-04	4.48E-03	0	3.07E-02	-5.71E-02
PENRE	MJ	6.44E-01	1.52E-01	3.79E-02	0	3.74E-03	7.54E-02	0	2.04E-01	-1.76E-01
PENRM	MJ	4.2E-02	0	-4.2E-02	0	0	0	0	0	0
PENRT	MJ	6.86E-01	1.52E-01	-4.1E-03	0	3.74E-03	7.54E-02	0	2.04E-01	-1.76E-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 <sup>3</sup>	1.6E-04	7.88E-06	1.78E-04	0	1.91E-07	3.9E-06	0	5.17E-05	-2.36E-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 - normal masonry mortar

Indicator	Unit	A1-A3	A4	A5	B1	C1	C2	C3	C4	D
HWD	kg	4.13E-10	7.03E-13	8.1E-13	0	1.63E-14	3.49E-13	0	1.05E-11	-3.09E-11
NHWD	kg	3.24E-02	2.41E-05	2.75E-04	0	6.09E-07	1.19E-05	0	1.04E+00	-1.02E-04
RWD	kg	2E-05	1.53E-07	2.44E-07	0	4.7E-09	7.59E-08	0	2.23E-06	-6.31E-06
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	4E-02	0	0	0	0	0	0
EET	MJ	0	0	9.35E-02	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 - normal masonry mortar

Indicator	Unit	A1-A3	A4	A5	B1	C1	C2	C3	C4	D
PM	Cases of illness	5.83E-09	6.48E-11	3.27E-11	0	2.01E-10	3.21E-11	0	1.36E-09	-8.9E-11
IR	kBq U235 eq.	1.96E-03	1.49E-05	2.39E-05	0	4.78E-07	7.38E-06	0	2.43E-04	-6.26E-04
ETP-fw	CTUe	3.82E-01	1.21E-01	3.49E-03	0	2.87E-03	5.97E-02	0	1.14E-01	-2.88E-02
HTP-c	CTUh	1.2E-11	2.39E-12	2.19E-13	0	5.74E-14	1.19E-12	0	1.74E-11	-1.98E-12
HTP-nc	CTUh	8.64E-10	1.19E-10	8.6E-12	0	4.32E-12	5.92E-11	0	1.93E-09	-8.51E-11
SQP	SQP	3.81E+00	4.78E-02	2.31E-03	0	1.12E-03	2.37E-02	0	4.43E-02	-3.87E-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, transport, manufacture (A1-A3), and disposal on landfill (C4). Taken together, about 65 - 95% (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 account for about 25 - 95% of the environmental impact, mainly due to the use of cement and retarder (cumulatively > 80% in A1). Raw material transport is of secondary significance (< 10% from sum of A1-A2).

**Test report:** Summary record 005/2008/281 of 20/03/2008  
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 1 - 40% of the environmental impact.

In the usage phase, about 20% of the GWP caused is reintegrated via carbonation (= CO<sub>2</sub> integration).

## 7. Verification

### 7.1 Leaching:

No European or national assessment criteria and/or emission scenarios are available 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 m<sup>3</sup> test chamber (t<sub>0</sub> = 7 days) and evaluation acc. to the AgBB schema. Measurement of different products for indoor and outdoor applications.

**Measuring method:** Determination of the content of radioactive nuclides <sup>226</sup>Ra, <sup>232</sup>Th and <sup>40</sup>K by measuring the activity concentrations C<sub>nuclide</sub> by alpha spectrometry (delayed coincidence method using LSC) and/or gamma spectrometry.

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

### Results:

Sample name	Normal masonry mortar (NM)	
	3 days [µg/m <sup>3</sup> ] Measured values	28 days [µg/m <sup>3</sup> ] Measured values
[A] TVOC (C6-C16)	< 100	< 100
[B] Σ SVOC (C16-C22)	< 5	< 5
[C] R (dimensionless)	< 0.2	< 0.1
[D] Σ VOC w/o NIK	< 20	< 10
[E] Σ carcinogens	< 4	< 1
[F] VVOC (< C6)	< 30	< 30

### 7.3 Radioactivity

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

**Result:** The activity concentration indices I calculated from the measured activity concentrations C<sub>nuclide</sub> 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

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#### 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/NA

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

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#### 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**

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#### **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**

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#### **ISO 14040**

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#### **ISO 14044**

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

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#### **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**

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#### **ISO 15686-10**

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#### **ISO/TR 15686-11**

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#### **ISO 16000-9**

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#### **ISO 16000-11**

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#### **Further reading**

##### **AgBB**

Ausschuss zur gesundheitlichen Bewertung von Bauprodukten (AgBB): Anforderungen an die Innenraumluftqualität in Gebäuden: Gesundheitliche Bewertung der Emissionen von flüchtigen organischen Verbindungen (VVO, 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**

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### **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**

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### **EC Safety Data Sheet**

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### **Commission Decision 94/611/EC**

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### **Life Cycle Assessment**

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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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