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-20230401-IBO1-DE
Date of issue	12/03/2024
Valid until	11/03/2029

Plastering Mortar - Reinforcement Plaster

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-20230401-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

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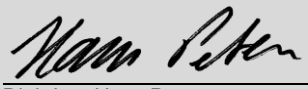

Dipl.-Ing. Hans Peters
(Chairman of the IBU – Institut Bauen und Umwelt e.V.)

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

Plastering Mortar - Reinforcement Plaster

Owner of declaration

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

Declared product / Declared unit

1 kg plastering mortar in the form of mineral factory-made mortar, product group reinforcement plaster with > 1600 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 plastering mortar - reinforcement plaster 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.

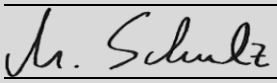
The EPD was drawn up in accordance with EN 15804+A2. The standard will simply be referred to as *EN 15804* herein.

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 factory-made mortar types, according to the type of use: masonry mortar, plastering mortar, and screed mortar.
Mineral plastering mortars are blends of one or more inorganic binding agents, aggregates, water and accessory / auxiliary agents as needed to produce external rendering or internal plastering. Plastering mortars are applied to walls and ceilings in one or several layers as required. In addition to the aesthetic design of the surface, they are used as outdoor plasters to stave off the effects of the weather and as internal plastering to provide an even base for paints and wallpaper. For reinforced concrete ceilings and stairs, plasters are also used as fire protection and, by adding porous aggregates, also as thermal insulation. Based on the technical data, the base and auxiliary materials used and the practical application, plastering mortars are classified into the product groups normal plaster/finishing plaster, normal plaster/finishing plaster with special properties, lightweight plaster, reinforcement plaster, and thermal insulation plaster high in light aggregates. The making available on the market of reinforcement plaster within the EU/EFTA (excluding Switzerland) is subject to the provisions of Regulation (EU) No 305/2011 (CPR). Reinforcement plaster requires a declaration of performance based on *DIN EN 998-1 Specification for mortar for masonry – Part 1: Masonry mortar* and the CE label.
Usage of the product is subject to the applicable national regulations.

2.2 Application

Factory-made plastering mortars for use as rendering or skim on walls, ceilings, pillars and separating walls of structural shells as per applicable standards, or on similar plaster substrates (e.g., existing buildings).
Reinforcement plaster in the form of single-layer plaster to produce indoor and outdoor plasters on difficult plaster substrates.

2.3 Technical data

Structural data

Designation	Value	Unit
Compressive strength acc. to EN 1015-11	1.5 - 7.5	N/mm²
Thermal conductivity acc. to EN 1745 lambda10,dry,mat / P = 50%	≤ 0.61	W/(mK)
Thermal conductivity acc. to EN 1745 lambda10,dry,mat / P = 90%	≤ 0.66	W/(mK)
Sound absorption level (if appropriate)	-	%
Water vapour permeability acc. to EN 1015-19	15/35	-
Dry bulk density acc. to EN 1015-10	≤ 1600	kg/m³
Capillary water absorption acc. to EN 1015-18	n/a	kg/(m²min0.5)

Performance values of reinforcement plaster corresponding to the declaration of performance for the Essential Characteristics acc. to *DIN EN 998-1 Specification for mortar for masonry – Part 1: Masonry mortar*.
Initial shear strength, bond strength, and flexural strength are irrelevant.

2.4 Delivery condition

Mineral plastering mortar - reinforcement plaster are made and delivered as 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 plastering mortar mainly consist of widely available mineral raw materials. There is no lack of resources.

Designation	Value	Unit
Aggregate	30-40	m%
Fine aggregate	20-25	m%
Lightweight aggregate	≤ 10	m%
Artificial lightweight aggregate		m%
Cement	≤ 30	m%
Hydrated lime [$Ca(OH_2$]		m%

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

The following auxiliary materials can be added as needed:

- Plastic dispersion: < 4.00 m%
- Water retaining agents: < 0.30 m%
- Air entraining agents: < 0.05 m%
- Thickeners: < 0.06 m%
- Inorganic pigments: < 0.20 m%
- Fibres: < 0.25 m%
- Hydrophobizers: < 0.45 m%

Aggregates: Natural sands as natural raw materials containing natural secondary and trace minerals in addition to the primary minerals quartz (SiO2) 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 lightweight aggregates: Organic, expanded polystyrene (EPS in ball or particle form (recycled) produced via foaming, used to reduce the dry bulk density. **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 reinforcement plaster.

Water retaining agents: Cellulose ethers, made from pulp, prevents rapid water loss from the wet mortar.
Air-entraining agents: Detergents used to reduce the surface tension of water and create air voids. These reduce the wet mortar's bulk density, improve processability, and reduce the tendency to form shrinkage or tension cracks.
Thickeners: Cellulose or starch ethers, made from pulp or native starch, improve stability, i.e. have a thickening effect, but do not retain water.
Inorganic pigments: Natural or synthetic, powdered dyes produced by mechanical treatment of the respective minerals such as chalk, clay, etc.
Fibres: Fibres made of natural or synthetic polymers (e.g., PAN, PP, PE) or inorganic chemical fibres (e.g., glass fibre) are used to absorb tensile forces in the solidified mortar.
Hydrophobizers: Water-soluble sodium oleates or zinc stearates used to reduce capillary water absorption by the hardened mortar.

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 plastering 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.

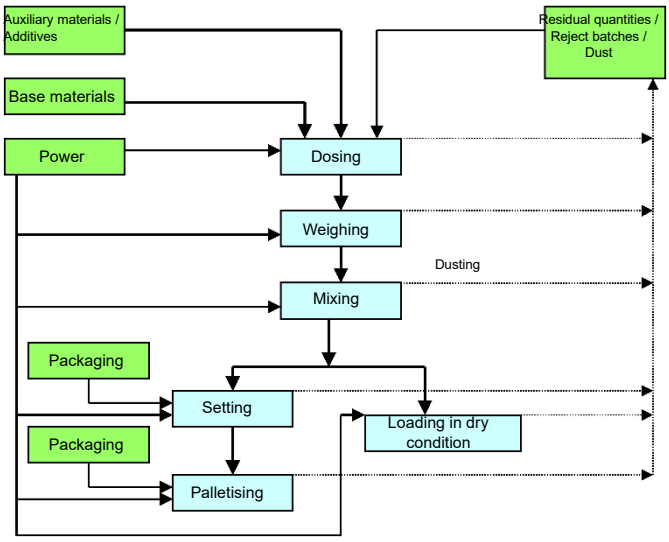


Fig. 1: Manufacturing process (green: input; blue: uniform process)

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 plastering mortar is processed mechanically. They are either automatically removed from the silo using a dry conveyor or from individual containers and mixed, conveyed and applied using a plastering machine. Silo mixing pumps can be employed. Reinforcement plaster can also be mixed manually. The finished plastering mortars are levelled and (if appropriate) textured on site using suitable tools. 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.

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.
Plastering mortar made of mineral factory-made mortars must be safeguarded against permanent exposure to the elements e.g. by proper connection of the façade base (*SAF*).
The crack resistance of mineral factory-made mortar-based plastering mortar can be increased by providing anti-cracking reinforcement in the plaster zone which is subject to tensile forces (*DIN EN 13914- 1, -2, DIN 18550-1, -2*).

2.11 Environment and health during use

The stable calcium-silicate-hydrate (CSH) bonding and solid structure formed when fully cured on the substrate 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 plastering 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, plastering mortars on walls and ceilings using mineral factory-made mortars have a service life of 40 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 was established via testing.

Reinforcement plaster is frequently used in thermal insulation composite systems with general regulatory approvals. The required fire protection tests are always performed on the whole system. As a rule, the fire behaviour of reinforcement plaster is equivalent or better than the approved system.
It was found that, regardless of product group, plastering mortars made of mineral factory-made mortars have a positive effect on the requisite minimum wall thickness in ‘hot’ design (structural validation using diminished load-bearing capacities under fire temperature conditions).

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 plastering 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 coated with reinforcement plaster generally ends with the service life of the building in which it is installed. The coated masonry cannot be reused or continue to be used after dismantling.
As a general rule, components made from mineral plastering 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 plastering 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 plastering 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.

2.16 Additional information

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

3. LCA: calculation rules

3.1 Declared unit

This declaration covers the manufacture of 1 kilogram of typical plastering mortar of the reinforcement plaster product group. Only dry mortars are covered.

Declared unit

Designation	Value	Unit
Declared unit	1	kg
Bulk density	≤ 1600	kg/m³
Yield	0.80-0.95	l/kg

When performing the life cycle assessment, that product in the product group reinforcement plaster 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 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 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 accounted for 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	0.0036	l/100km
Transport distance	100	km
Utilisation (including empty runs)	50 - 85	%
Bulk density of transported product	1600	kg/m³

Installation in building (A5)

Designation	Value	Unit
Auxiliary material	-	kg
Water consumption	0.0003	m^3
Other resources	-	kg
Power consumption	0.00045	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 CO2 absorption and the practical total maximum CO2 absorption potential for plastering mortar was calculated following the method for concrete pursuant to EN 16757, taking account of the mortar structure, the usual plaster thicknesses, and surface exposure, with a maximum carbonation level of 100%. Assuming that the final application of the plastering mortar for this sample EPD is described in sufficient detail or that the parameters for calculating the degree of carbonation can be determined, the simplified method for determining the carbonation according to EN 16757 does not need to be applied.

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	1.12	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	ismantling/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 plastering mortar - reinforcement plaster

Indicator	Unit	A1-A3	A4	A5	B1	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	4.06E-01	1.12E-02	4.76E-02	-1.47E-01	3E-04	6.12E-03	0	1.63E-02	-1.84E-02
GWP-fossil	kg CO_2 eq.	4.44E-01	1.12E-02	3.98E-03	-1.47E-01	3E-04	6.09E-03	0	1.67E-02	-1.82E-02
GWP-biogenic	kg CO_2 eq.	-3.93E-02	4.59E-06	4.36E-02	0	-1.27E-06	2.51E-06	0	-4.95E-04	-1.3E-04
GWP-luluc	kg CO_2 eq.	1.59E-04	4.16E-05	1.71E-07	0	1.17E-06	2.27E-05	0	3.09E-05	-3.14E-06
ODP	kg CFC11 eq.	1.48E-12	1.59E-15	7.02E-15	0	6.21E-17	8.69E-16	0	3.97E-14	-1.83E-13
AP	mol H+ eq.	6.78E-04	1.07E-05	9.16E-06	0	4.05E-06	5.84E-06	0	1.18E-04	-1.83E-05
EP-freshwater	kg P eq.	1.95E-06	2.31E-08	5.03E-09	0	6.04E-10	1.26E-08	0	2.84E-08	-3.77E-08
EP-marine	kg N eq.	2.29E-04	3.6E-06	2.58E-06	0	1.84E-06	1.96E-06	0	3.03E-05	-6.59E-06
EP-terrestrial	mol N eq.	2.64E-03	4.3E-05	4.33E-05	0	2.03E-05	2.35E-05	0	3.33E-04	-7.03E-05
POCP	kg NMVOC eq.	5.83E-04	9.38E-06	6.74E-06	0	5.51E-06	5.12E-06	0	9.21E-05	-1.72E-05
ADPE	kg Sb eq.	5.85E-07	1.15E-09	1.72E-10	0	3.04E-11	6.29E-10	0	1.72E-09	-8.1E-09
ADPF	MJ	4.52E+00	1.48E-01	1.27E-02	0	4.02E-03	8.09E-02	0	2.19E-01	-2.64E-01
WDP	m^3 world eq. deprived	6.34E-03	4.4E-05	5.3E-03	0	1.3E-06	2.4E-05	0	1.83E-03	-2.22E-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 plastering mortar - reinforcement plaster

Indicator	Unit	A1-A3	A4	A5	B1	C1	C2	C3	C4	D
PERE	MJ	9.59E-01	8.81E-03	3.77E-01	0	2.64E-04	4.81E-03	0	3.3E-02	-8.54E-02
PERM	MJ	3.27E-01	0	-3.27E-01	0	0	0	0	0	0
PERT	MJ	1.29E+00	8.81E-03	5E-02	0	2.64E-04	4.81E-03	0	3.3E-02	-8.54E-02
PENRE	MJ	4.47E+00	1.48E-01	5.79E-02	0	4.02E-03	8.1E-02	0	2.19E-01	-2.64E-01
PENRM	MJ	4.2E-02	0	-4.2E-02	0	0	0	0	0	0
PENRT	MJ	4.52E+00	1.48E-01	1.59E-02	0	4.02E-03	8.1E-02	0	2.19E-01	-2.64E-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	1.09E-03	7.68E-06	4.15E-04	0	2.05E-07	4.19E-06	0	5.55E-05	-3.55E-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 plastering mortar - reinforcement plaster

Indicator	Unit	A1-A3	A4	A5	B1	C1	C2	C3	C4	D
HWD	kg	1.04E-09	6.86E-13	1.3E-12	0	1.75E-14	3.74E-13	0	1.13E-11	-4.65E-11
NHWD	kg	9.56E-03	2.35E-05	4.57E-04	0	6.54E-07	1.28E-05	0	1.12E+00	-1.55E-04
RWD	kg	8.73E-05	1.49E-07	4.64E-07	0	5.05E-09	8.15E-08	0	2.4E-06	-9.43E-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	5.96E-02	0	0	0	0	0	0
EET	MJ	0	0	1.4E-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 plastering mortar - reinforcement plaster

Indicator	Unit	A1-A3	A4	A5	B1	C1	C2	C3	C4	D
PM	Cases of illness	1.55E-08	6.32E-11	5.03E-11	0	2.16E-10	3.45E-11	0	1.46E-09	-1.38E-10
IR	kBq U235 eq.	8.64E-03	1.45E-05	4.36E-05	0	5.14E-07	7.92E-06	0	2.61E-04	-9.35E-04
ETP-fw	CTUe	3.22E+00	1.18E-01	6.17E-03	0	3.08E-03	6.41E-02	0	1.23E-01	-4.33E-02
HTP-c	CTUh	7.74E-11	2.33E-12	3.47E-13	0	6.17E-14	1.27E-12	0	1.87E-11	-3.18E-12
HTP-nc	CTUh	7.24E-09	1.17E-10	1.46E-11	0	4.64E-12	6.36E-11	0	2.07E-09	-1.3E-10
SQP	SQP	7.87E+00	4.66E-02	3.51E-03	0	1.2E-03	2.54E-02	0	4.76E-02	-5.79E-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 account for about 80 - 100% of the environmental impact, mainly due to the use of cement, expanding gas, and dispersion powder (cumulatively > 90% 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 (except ADPE and ODP) about 0 - 15% of the environmental impact.
In the usage phase, about 30% of the GWP caused is reintegrated via carbonation (= CO2 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 emission 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		Reinforcement plaster	
AgBB summary of results		3 days [µg/m³]	28 days [µg/m³]
		Measured values	Measured values
[A]	TVOC (C6-C16)	**< 250**	**< 50**
[B]	Σ SVOC (C16-C22)	**< 5**	**< 2**
[C]	R (dimensionless)	**< 1.2**	**< 0.2**
[D]	Σ VOC w/o NIK	**< 20**	**< 5**
[E]	Σ carcinogens	**< 2**	**< 1**
[F]	VVOC (< C6)	**< 250**	**< 40**

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 across all products. 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.

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