

ENVIRONMENTAL PRODUCT DECLARATION

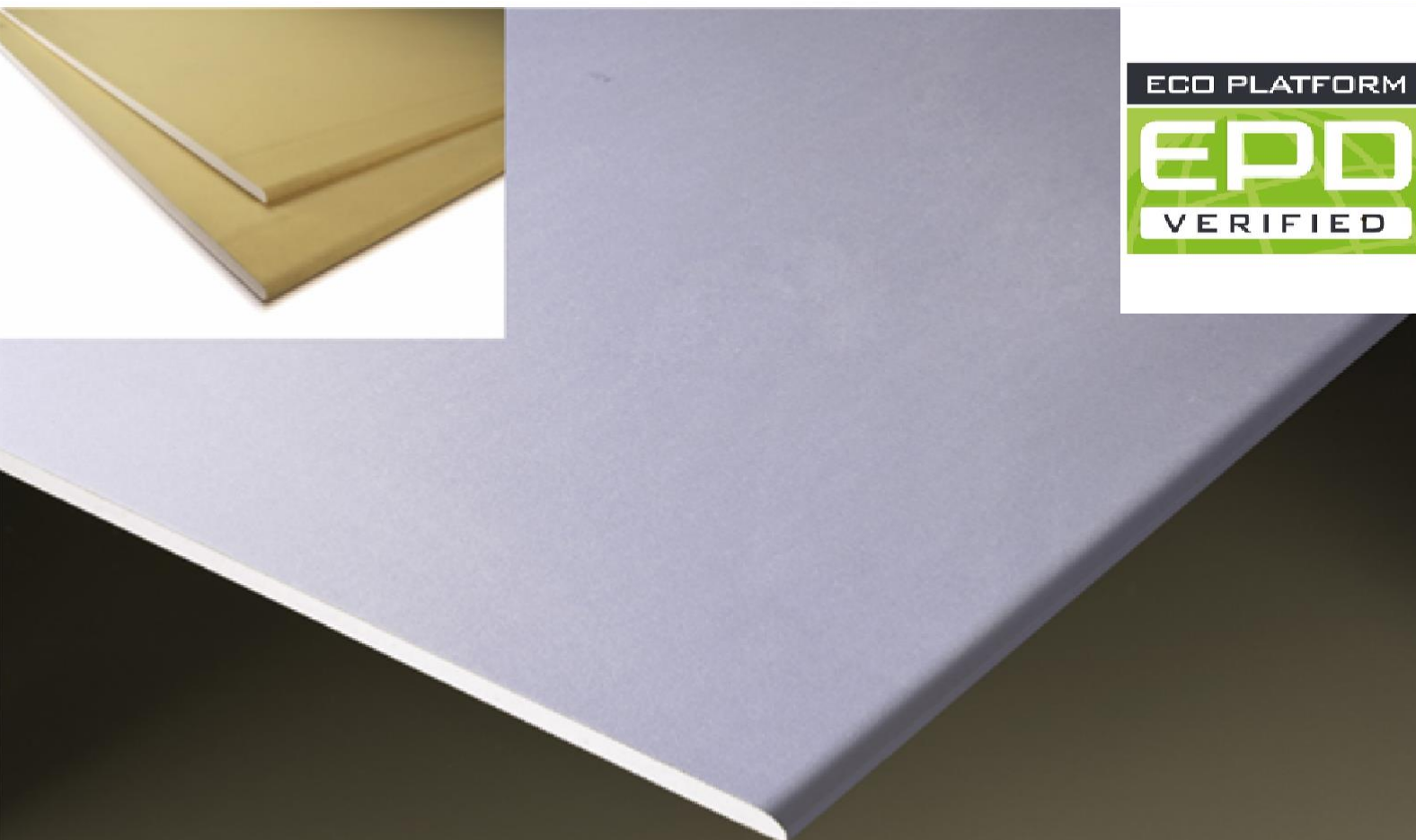
in accordance with *ISO 14025* and *EN 15804+A2*

Declaration holder	Bundesverband der Gipsindustrie e.V.
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-BVG-20220302-IBE1-EN
Issue date	31 January 2023
Valid until	30 January 2028

HARD GYPSUM BOARD

Bundesverband der Gipsindustrie e.V.

www.ibu-epd.com / <https://epd-online.com>



1. General information

Bundesverband der Gipsindustrie e.V.	HARD GYPSUM BOARD
Programme holder IBU – Institut Bauen und Umwelt e.V. Hegelplatz 1 10117 Berlin Germany	Holder of the Declaration Bundesverband der Gipsindustrie e.V. Kochstrasse 6-7 10969 Berlin
Declaration number EPD-BVG-20220302-IBE1-EN	Declared product/unit Hard gypsum board, 1 m ² , Type GKF or GKFI in accordance with <i>DIN 18180</i> , Type DFIR or DFH2IR in accordance with <i>EN 520</i>
This Declaration is based on the product category rules: Plasterboards, 01.2019 (PCR checked and approved by the independent Expert Council (SVR))	Scope: The EPD applies for all member companies of the Bundesverband der Gipsindustrie e.V. in accordance with the current list of members on https://www.gips.de/epd-ansprechpartner/gipsplatten/ for products manufactured in Germany. The LCA takes into account specific information from the manufacturers and suppliers of components for the entire life cycle.
Issue date 31 January 2023	The owner of the Declaration shall be liable for the underlying information and proof; IBU shall not be liable with respect to manufacturer information, life cycle assessment data, or proof. This EPD was drawn up in accordance with the specifications of the <i>EN 15804+A2</i> . This standard is referred to as <i>EN 15804</i> hereinafter.
Valid until 30 January 2028	Verification The <i>EN 15804</i> European standard serves as the core PCR. Independent verification of the Declaration and information provided in accordance with <i>ISO 14025:2011</i> ☐ internally ☒ externally
 Dipl.-Ing. Hans Peters (Chairman of Institut Bauen und Umwelt e.V.)	 Dr.-Ing. Wolfram Trinius (Independent verifier)
 Dr. Alexander Röder (Managing Director Institut Bauen und Umwelt e.V.)	

2. Product

2.1 Product description / Product definition

The Declaration refers to 1 m² hard gypsum board. With a board thickness of 12.5 mm (main sales product), this corresponds to a weight per unit area of approx. 12.8 kg/m². For other board thicknesses, the results of the LCA can be estimated approximately by multiplying by the factor for the weight per unit area used.

Hard gypsum boards are gypsum boards coated on both sides with cardboard board liner, stamped on the back and labelled GKF (not impregnated) or GKFI (impregnated) in accordance with *DIN 18180* or DFIR (not impregnated) or DFH2IR (impregnated) in accordance with *EN 520*.

(EU) Directive No. 305/2011 (CPR) applies for placing the product on the market in the EU/EFTA (with the

exception of Switzerland). The product requires a Declaration of Performance taking consideration of DIN EN 520:2009-12 EN 520:2004+A1:2009 "Gypsum plasterboards – Definitions, requirements and test methods" and/or EN 520:2004+A1:2009-08 "Gypsum plasterboards – Definitions, requirements and test methods", and CE marking. Use is governed by the respective national regulations.

2.2 Application

Plasterboards are bonded directly to the substrate as dry plaster or used as cladding for walls and ceilings, installation walls and suspended ceilings made of wood or galvanised metal, and screwed or nailed for the manufacture of prefabricated components (e.g. prefabricated house construction).

They can be used in buildings for public, private or commercial applications.

2.3 Technical data

Technical information is available in the information supplied by the manufacturers. Due to continuous updating of technical standards or approvals, such information is not listed within the framework of the Environmental Product Declaration.

Details on essential requirements can be taken from the CE mark and/or Declaration of Performance (*Construction Products Regulation*).

The latest technical information can be queried from the manufacturers: <https://www.gips.de/epd-ansprechpartner/gipsplatten/>.

Product performance values in accordance with the Declaration of Performance in terms of essential characteristics in accordance with DIN EN 520:2009-12, EN 520:2004+A1:2009 "Gypsum plasterboards – Definitions, requirements and test methods" and/or EN 520:2004+A1:2009-08 "Gypsum plasterboards – Definitions, requirements and test methods", or ETA.

2.4 Delivery status

Plasterboards can be supplied in various formats taking consideration of various thicknesses and individual requirements.

The available standard dimensions can be retrieved from the manufacturers; special dimensions are also available on request.

Fire-resistant plasterboards (Type F as per EN 520) are plasterboards with an improved cohesive core structure at high temperatures indicated by the red marking.

Impregnated plasterboards (Type H in accordance with EN 520) are plasterboards displaying reduced water absorption. They are classified as water absorption classes H1–[JHH1] H3.

Hard gypsum boards are supplied with or without impregnation as Type GKF or GKFI in accordance with DIN 18180 or DFIR or DFH2IR in accordance with EN 520, depending on the configuration.

2.5 Base materials / Ancillary materials

Hard gypsum boards consist of at least 62% gypsum by weight and are coated with cardboard board liner on both sides (approx. 3% by weight). Between 9% and 30% by weight of mineral fillers and glass fibre rovings are added for reinforcement and increased fire resistance. Less than 5% by weight of additives such as starch, foaming agents and water-repellent agents are added to improve the manufacturing process and the properties of the building material.

Details on SVHC, CMR substances cat. 1A or 1B, and biocides:

The product contains substances from the ECHA candidate list of Substances of Very High Concern (SVHC) (date: 16.04.2021) exceeding 0.1% by mass (ECHA 2021): no

The product contains other CMR substances in categories 1A or 1B which are not on the candidate list exceeding 0.1% by mass in at least one partial product: no

Biocide products were added to this construction product, or it has been treated with biocide products (this then concerns a treated product as defined by the (EU) Regulation on Biocide Products No 528/2012): no

2.6 Manufacture

The manufacturing process comprises the steps depicted in Figure 1.

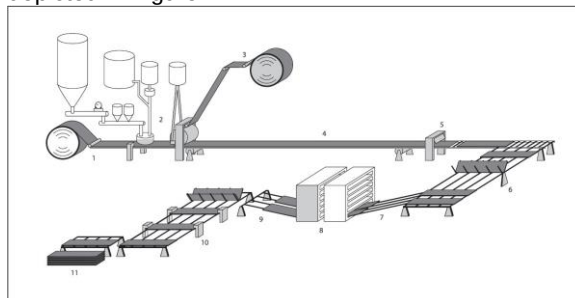


Fig. 1: Plasterboard manufacturing process in accordance with the *Gypsum Data Book*

- Cardboard board liner is fed in facing downwards forming the face side of the board and scored to form the edges (1).
- Addition of gypsum slurry which is spread in the forming station as the board liner is fed in from above (2-3).
- Setting section with shears for cutting (4-5)
- Turning table with input in a multi-rack drier (6-8)
- Board discharge with trimming of transverse edges and bundling
- (9-11)

The manufacturing companies have implemented a quality management system and are certified to ISO 9001.

2.7 Environment and health during manufacturing

Plasterboards are manufactured in plants permitted by emission laws in accordance with the specifications of the Federal Immission Control Act.

The plants have implemented an energy management system in accordance with ISO 50001.

As of an aggregated rated thermal input of > 20 MW, gypsum plants are subordinated to European emissions trading. Below this, compliance with climate protection targets is monitored via German fuel emissions trading.

2.8 Product processing / Installation

Products are processed in accordance with the relevant Codes of Practice of the Bundesverband der Gipsindustrie e.V. and the manufacturers.

During the cutting, sawing or grinding processes for gypsum products, the occupational exposure limit value of 6 mg/m³ alveolar dust (A-dust) must be observed for calcium sulphate as a time-weighted average in accordance with TRGS 900.

The glass fibres used in the hard gypsum boards are so-called continuous filament glass fibres which are manufactured with a defined diameter. Fibres with a diameter of more than 3 micrometres are not respirable. Only such fibres are used in hard gypsum boards; they do not splice even when subjected to

further processing with the result that no "fibre dust" arises as per TRGS 521.

2.9 Packaging

Plasterboards are stored on pallets and delivered without packaging. The wooden pallets used are available as reusable or disposable pallets.

2.10 Condition of use

The useful life of the plasterboards for interior applications reviewed here generally complies with the overall useful life of the building. They are not subject to any exterior exposure.

2.11 Environment and health during use

During the use phase, no hazardous substances are emitted which exceed the limit values of the AgBB evaluation scheme. Plasterboards have been tested by the Institut für Bauphysik (Scherer IBP).

The test result indicates that the plasterboards are not associated with any adverse effects on the interior.

2.12 Reference service life

Reference service lives (RSL) depend on the respective applications. If hard gypsum boards are used as non-accessible building components, the RSL corresponds to the service life of the building (without repair or replacement cycles). If hard gypsum boards are used as replaceable building components, the RSL of 40 years is specified for buildings with an intended service life of over 60 years (ISO 15686-1).

In accordance with the BBSR table "Nutzungsdauern von Bauteilen für Lebenszyklusanalysen nach dem Bewertungssystem Nachhaltiges Bauen (BNB)" (Useful lives of components for LCAs in accordance with the Sustainable Building evaluation system (BNB)), last revised 24.02.2017, the useful life is > 50 years for walls, for example, in accordance with code number 342.411 "Nichttragende Innenwände – Ständersysteme" (Non-load-bearing interior walls – Stud systems) /BBSR service life/.

There are no influences on ageing when the recognised rules of technology are applied.

There are no influences on ageing when the recognised rules of technology are applied.

2.13 Extraordinary effects

Fire

Fire

Plasterboards offer outstanding fire protection with regard to their low density. This is due to the fact that the gypsum core contains approx. 20% crystal water which evaporates when exposed to fire thereby consuming energy by means of conversion. The temperature on the side facing away from the fire remains constant at approx. 110 °C over a longer

period of time depending on the board thickness. The resulting dehydrated gypsum layer offers increased thermal insulation. In accordance with Annex B of EN 520, plasterboards are usually classified as A2-s1, d0 in terms of their reaction to fire. This classification to EN 13501-1 means:

A2 = non-combustible, s1 = no smoke, d0 = no flaming droplets/particles.

Water

All gypsum products must be protected from permanent moisture penetration unless expressly designated by the manufacturer for this purpose. A Code of Practice Flooding is available from the Bundesverband der Gipsindustrie e.V. on remedying damage to components made of gypsum following flooding.

Mechanical destruction

As a general rule, mechanical damage can be compensated for using jointing compound thanks to the ease of repair associated with plasterboards without impairing their functional use. Plasterboards can be easily replaced with new boards in the event of major damage. No environmental consequences are to be anticipated in the event of unforeseen mechanical destruction.

2.14 Reuse phase

Recycling

According to the Commercial Waste Ordinance, gypsum waste must be recycled. After treatment of the boards in special recycling plants for gypsum waste, recycled gypsum can be added to the manufacturing process for new boards following shredding and separation of the board liner.

Alternatively, the reclaimed gypsum can be used in other areas suitable for gypsum (setting regulators for cement, agriculture, fertiliser production).

The recycling plants for gypsum waste also use magnetic separation to separate the screws or nails that are still present after use.

Separated board liner can be used as a secondary fuel or directed to the paper recycling circuit while separated metal is recycled as scrap.

2.15 Disposal

Disposal in accordance with the waste code: 17 08 02 Gypsum-based building materials other than those mentioned in 17 08 01".

Gypsum-based building materials adhere to the disposal conditions from landfill class 1 of the Landfill Ordinance in the case of landfilling.

2.16 Further information

www.gips.de

3. LCA: Calculation rules

3.1 Declared unit

The declared unit is 1 m² of hard gypsum board.

With a board thickness of 12.5 mm (main sales product), this corresponds to a weight per unit area of approx. 12.9 kg/m².

For other board thicknesses, the results of the LCA can be estimated approximately by multiplying by the factor for the weight per unit area used.

Declared unit

Designation	Value	Unit
Declared unit	1	m ²

Conversion factor to 1 kg (12.5 mm thickness)	0.078	-
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3.2 System threshold

EPD type in accordance with *EN 15804*: Cradle to gate, with

- options (A4–A5),
- Modules C1–C4 and
- Module D

(A1–A3 + C + D and additional modules: A4 and A5)

Modules A1–A3 (Product stage) include the production of raw materials taking consideration of framework conditions inherent in Germany and transport thereof, the provision of energy (German electricity mix), and the manufacturing processes required for the production of all components for the plasterboard product. As the plasterboards are generally transported to the construction site on reusable pallets with load-securing straps, no packaging is taken into account.

Module A4 comprises transport to the construction site.

Module A5 includes installation on the construction site. Disposal of any packaging is not required here (unpacked product on reusable pallets).

Module C1 declares the manual deconstruction process.

Module C2 concerns transport to the recycling site.

Module C3 comprises the shredding and preparation of gypsum products.

Module C4 is generally not considered, as the *Commercial Waste Ordinance* provides for plasterboards to be sent for recycling. In this LCA, a landfill scenario is also calculated in order to cover legal exceptions to the *Commercial Waste Ordinance*.

Module D contains potential credits from gypsum recycling.

3.3 Estimates and assumptions

Approximations and estimates for the processes and materials were made in the corresponding modules for modelling the scenarios in the life cycle.

For Module C1, loss-free (100%) manual removal with hand-held tools is assumed. No losses (e.g. collection losses) during deconstruction are taken into account in the calculation of the end-of-life phase.

The entire quantity produced is processed within the recycling process (scenario 1). In a further scenario, a landfill scenario is declared (scenario 2).

3.4 Cut-off criteria

All components for manufacturing the plasterboards as well as all electricity and water required were taken into consideration.

Accordingly, material and energy flows accounting for a share < 1% were also considered.

It can be assumed that the processes ignored would have contributed less than 5% to the impact categories under review.

There is no packaging to be taken into account when supplying the components or manufacturing the plasterboard.

3.5 Underlying data

The data sets used are taken from the *GaBi* databases.

The underlying database is based on the *GaBi* 2021, Service Pack 40/CUP 2020.1 version. The *GaBi* database provides the life cycle inventory data for raw and process materials, transport and energy.

3.6 Data quality

The data quality of the life cycle inventories is assessed based on their precision (measured, calculated, literature values or estimated), completeness (e.g. unreported emissions), consistency (degree of uniformity of the methods used), and representativeness (geographical, temporal, technological).

In order to comply with these aspects and thus ensure reliable results, first-hand industry data was used together with consistent underlying data from the *GaBi* 2021 databases.

3.7 Period under review

The primary data recorded refers to 2020.

3.8 Allocation

The allocation methods used in underlying data (materials and energy) originating from the *GaBi* databases are documented online at <http://www.gabi-software.com>.

All incineration processes are depicted by partial flow analyses of the respective materials.

Environmental loads from combustion processes in the construction, utilisation and disposal stages are allocated to the module in which they arise. Potential benefits from these processes are allocated to Module D.

The potential credits arising from energy substitution are awarded via average German data for electric energy and thermal energy from natural gas.

3.9 Comparability

As a general rule, EPD data can only be compared or evaluated when all of the data records to be compared have been drawn up in accordance with *EN 15804* and the building context and/or product-specific characteristics are taken into consideration.

The *GaBi* ts underlying database was used (SP40).

4. LCA: Scenarios and additional technical information

Characteristic product features
Biogenic carbon

Information describing the biogenic carbon content at the plant gate

Designation	Value	Unit
Biogenic carbon in the product	0.172	kg C
Biogenic carbon in the associated packaging	-	kg C

Transport to construction site (A4)

(truck)

Designation	Value	Unit
Transport distance	100	km
Capacity utilisation (including empty runs)	60	%

Construction installation process (A5)

Designation	Value	Unit
Power consumption	0.0025	kWh

End of Life (C1-C4)

The hard gypsum boards are removed manually and transported by truck to a recycling plant (scenario 1) or to landfill (scenario 2). Module C2 is calculated at 50 km in each case.

Designation	Value	Unit
Gypsum-based construction materials collected separately 170802	10.8	kg
For recycling	10.8	kg
For landfilling	10.8	kg

Reuse, recovery and recycling potential (D), relevant scenario details

Module D contains potential credits for the substitution of natural gypsum from the recycling process (Module C3).

5. LCA: Results

The following table depicts the LCA results for the life cycle of 1m² plasterboards. It should be noted that two scenarios are calculated at the disposal stage for the plasterboards, which start after the same deconstruction stage (C1) for both scenarios and differ in terms of disposal costs:

Scenario 1 includes the assumption of a 100% recycling scenario with steps C2, C3/1 and D/1. In this scenario, no landfilling takes place, so there are no contributions to indicators in C4/1 (disposal), which are listed as zero in the table below.

Scenario 2 includes complete disposal in a landfill with steps C2 and C4/2. No waste treatment is required for landfilling, which is why Module C3/2 has a zero value for all indicators and is listed as such in the table below. Similarly, there are no credits in Module D/2, which is therefore also shown as zero.

DESCRIPTION OF THE SYSTEM THRESHOLDS (X = INCLUDED IN LCA; MND = MODULE NOT DECLARED; MNR = MODULE NOT RELEVANT)

Product stage			Construction process stage		Use stage							End-of-life stage				Benefits and loads beyond the system thresholds
Raw material supply	Transport	Manufacturing	Transport from the manufacturer to the site	Assembly	Use / Application	Maintenance	Repairs	Replacement	Renewal	Operational energy use	Operational water use	Deconstruction / Demolition	Transport	Waste treatment	Landfilling	Reuse, recovery or recycling potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	ND	ND	MNR	MNR	MNR	ND	ND	X	X	X	X	X

LCA RESULTS – ENVIRONMENTAL IMPACTS according to EN 15804+A2: 1 m² hard gypsum board, 12.8 kg

Core indicator	Unit	A1-A3	A4	A5	C1	C2	C3/1	C3/2	C4/1	C4/2	D/1	D/2
GWP total	[kg CO ₂ equiv.]	2.72E+0	2.74E-1	1.43E-3	8.18E-3	8.05E-2	8.07E-1	0.00E+0	0.00E+0	8.47E-1	-1.64E-1	0.00E+0
GWP fossil	[kg CO ₂ equiv.]	3.33E+0	2.62E-1	1.42E-3	8.16E-3	7.69E-2	8.07E-1	0.00E+0	0.00E+0	8.46E-1	-1.64E-1	0.00E+0
GWP biogenic	[kg CO ₂ equiv.]	-6.10E-1	1.21E-2	9.27E-6	1.19E-5	3.54E-3	5.60E-2	0.00E+0	0.00E+0	5.55E-2	6.08E-4	0.00E+0
GWP luluc	[kg CO ₂ equiv.]	3.85E-3	6.21E-6	3.60E-6	1.86E-7	1.82E-6	2.24E-4	0.00E+0	0.00E+0	5.59E-4	-1.19E-3	0.00E+0
ODP	[kg CFC11 equiv.]	1.67E-10	2.76E-17	4.36E-17	8.25E-19	8.08E-18	3.40E-15	0.00E+0	0.00E+0	7.19E-16	-3.16E-16	0.00E+0
AP	[mol H ⁺ equiv.]	4.54E-3	2.46E-4	2.16E-6	3.86E-5	7.22E-5	3.41E-4	0.00E+0	0.00E+0	1.39E-3	-6.06E-4	0.00E+0
EP freshwater	[kg P equiv.]	1.30E-5	5.59E-8	5.88E-9	1.67E-9	1.64E-8	4.13E-7	0.00E+0	0.00E+0	3.33E-7	-5.59E-7	0.00E+0
EP marine	[kg N equiv.]	1.43E-3	7.46E-5	6.62E-7	1.81E-5	2.19E-5	7.58E-5	0.00E+0	0.00E+0	3.58E-4	-2.53E-4	0.00E+0
EP terrestrial	[mol N equiv.]	1.52E-2	8.35E-4	6.92E-6	1.99E-4	2.45E-4	7.96E-4	0.00E+0	0.00E+0	3.94E-3	-2.89E-3	0.00E+0
POCP	[kg NMVOC equiv.]	3.95E-3	2.18E-4	1.66E-6	5.14E-5	6.40E-5	2.08E-4	0.00E+0	0.00E+0	1.09E-3	-6.45E-4	0.00E+0
ADPE	[kg Sb equiv.]	2.11E-6	7.83E-9	5.34E-10	2.34E-10	2.30E-9	4.47E-8	0.00E+0	0.00E+0	1.74E-8	-1.59E-8	0.00E+0
ADPF	[MJ]	5.11E+1	3.70E+0	1.77E-2	1.11E-1	1.09E+0	2.72E+0	0.00E+0	0.00E+0	2.55E+0	-2.25E+0	0.00E+0
WDP	[m ³ world equiv., extracted]	4.35E-1	5.11E-4	3.14E-5	1.53E-5	1.50E-4	3.37E-2	0.00E+0	0.00E+0	2.03E-2	-9.83E-3	0.00E+0

Legend	GWP = Global warming potential; ODP = Ozone depletion potential; AP = Acidification potential of soil and water; EP = Eutrophication potential; POCP = Photochemical ozone creation potential; ADPE = Abiotic depletion potential – non-fossil resources (ADP substances); ADPF = Abiotic depletion potential – fossil fuels (ADP fossil fuels); WDP = Water deprivation potential (users)											
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LCA RESULTS – INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 m² hard gypsum board, 12.8 kg

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3/1	C3/2	C4/1	C4/2	D/1	D/2
PERE	[MJ]	5.36E+0	1.17E-2	1.02E-2	3.50E-4	3.42E-3	6.80E+0	0.00E+0	0.00E+0	5.93E+0	-2.33E-1	0.00E+0
PERM	[MJ]	5.60E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	5.60E+0	0.00E+0	0.00E+0	5.60E+0	0.00E+0	0.00E+0
PERT	[MJ]	1.10E+1	1.17E-2	1.02E-2	3.50E-4	3.42E-3	1.20E+0	0.00E+0	0.00E+0	3.34E-1	-2.33E-1	0.00E+0
PENRE	[MJ]	5.11E+1	3.70E+0	1.77E-2	1.11E-1	1.09E+0	2.72E+0	0.00E+0	0.00E+0	2.55E+0	-2.26E+0	0.00E+0
PENRM	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
PENRT	[MJ]	5.11E+1	3.70E+0	1.77E-2	1.11E-1	1.09E+0	2.72E+0	0.00E+0	0.00E+0	2.55E+0	-2.26E+0	0.00E+0
SM	[kg]	9.16E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
RSF	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
NRSF	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
FW	[m ³]	1.39E-2	2.09E-5	5.51E-6	6.27E-7	6.14E-6	1.39E-3	0.00E+0	0.00E+0	6.42E-4	-3.21E-4	0.00E+0

Legend	PERE = Renewable primary energy as primary energy carrier; PERM = Renewable primary energy resources as material utilisation; PERT = Total use of renewable primary energy resources; PENRE = Non-renewable primary energy as energy carrier; PENRM = Non-renewable primary energy as material utilisation; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary materials; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water
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LCA RESULTS – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 m² hard gypsum board, 12.8 kg

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3/1	C3/2	C4/1	C4/2	D/1	D/2
HWD	[kg]	1.28E-6	3.59E-10	1.19E-11	1.08E-11	1.05E-10	1.13E-9	0.00E+0	0.00E+0	3.88E-8	-1.14E-7	0.00E+0
NHWD	[kg]	5.24E-2	3.79E-4	1.36E-5	1.13E-5	1.11E-4	1.93E-3	0.00E+0	0.00E+0	1.28E+1	-4.79E-4	0.00E+0
RWD	[kg]	5.63E-4	3.98E-6	1.48E-6	1.19E-7	1.17E-6	4.12E-4	0.00E+0	0.00E+0	2.89E-5	-4.02E-5	0.00E+0
CRU	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
MFR	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.07E+1	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
MER	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
EEE	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
EET	[MJ]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
Legend	HWD = Hazardous waste for disposal; NHWD = Non-hazardous waste for disposal; RWD = Radioactive waste for disposal; CRU = Components for reuse; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy											

LCA RESULTS – Additional impact categories acc. to EN 15804+A2 – optional: 1 m² hard gypsum board, 12.8 kg

Indicator	Unit	A1-A3	A4	A5	C1	C2	C3/1	C3/2	C4/1	C4/2	D/1	D/2
PM	[Disease incidences]	1.31E-7	1.33E-9	1.78E-11	4.35E-10	3.91E-10	2.86E-9	0.00E+0	0.00E+0	1.72E-8	-2.75E-7	0.00E+0
IRP	[kBq U235 equiv.]	6.86E-2	5.68E-4	1.33E-4	1.70E-5	1.67E-4	6.77E-2	0.00E+0	0.00E+0	2.97E-3	-7.37E-3	0.00E+0
ETP-fw	[CTUe]	2.10E+1	2.62E+0	6.85E-3	7.86E-2	7.70E-1	1.16E+0	0.00E+0	0.00E+0	1.46E+0	-1.59E+0	0.00E+0
HTP-c	[CTUh]	9.15E-10	4.93E-11	2.46E-13	1.48E-12	1.45E-11	3.21E-11	0.00E+0	0.00E+0	2.16E-10	-3.43E-11	0.00E+0
HTP-nc	[CTUh]	7.59E-8	2.11E-9	9.45E-12	7.61E-11	6.19E-10	1.18E-9	0.00E+0	0.00E+0	2.38E-8	-1.92E-9	0.00E+0
SQP	[-]	1.20E+1	9.51E-3	9.00E-3	2.85E-4	2.79E-3	8.65E-1	0.00E+0	0.00E+0	5.31E-1	-7.08E-1	0.00E+0
Legend	PM = Potential incidence of disease due to particulate matter emissions; IR = Potential effect of human exposure to U235; ETP fw = Potential toxicity comparison unit for ecosystems; HTP c = Potential toxicity comparison unit for humans (carcinogenic effect); HTP nc = Potential toxicity comparison unit for humans (non-carcinogenic effect); SQP = Potential soil quality index											

- : no parameters determined

6. LCA: Interpretation

The juxtaposition of the declared modules shows that the manufacturing phase (A1-A3) dominates the Life Cycle Assessment. Greenhouse gas emissions also play a role in Module C3.

Transport to the construction site (A4) and to recycling or landfill (C2) at the end of life are of minor importance. Module D shows the potential credits from the recycling process.

7. Proof

7.1 Leaching (sulphate + heavy metals)

On analysis according to the *Landfill Ordinance*, the product displays the sulphate concentration in the saturation range which is typical for gypsum (approx. 1500 mg/l in accordance with *DIN 38405-5*), resulting in disposal options only from landfill class I upwards. Gypsum is classified as a listed substance in water hazard class 1 (slightly hazardous for water). Heavy metal content is significantly below the corresponding criteria for landfill class I. Proper disposal in accordance with the parameters which can depend on use, sorting depth during deconstruction, collection (separately or together with other construction waste) and treatment, among others, and must be determined by the responsible waste producer

Designation	Value	Unit
Analysis in accordance with the Landfill Ordinance	DK I or higher	See Landfill Ordinance

7.2 Radioactivity

The product can be used without restriction with overall dose contributions of significantly lower than 0.3 mSv/a, determined on the basis of the index calculation to RP 112 and the radon concentration (BfS report).

7.3 VOC emissions

The requirements in accordance with the AgBB evaluation scheme are complied with in full (*Scherer IBP*):

$$\text{TVOC}_3 \leq 10 \text{ mg/m}^3$$

$$\text{Carcinogens}_3 \text{ EU cat. 1 and 2} \leq 0.01 \text{ mg/m}^3$$

$$\text{TVOC}_{28} < 1.0 \text{ mg/m}^3$$

$$\text{SVOC}_{28} \leq 0.1 \text{ mg/m}^3$$

$$\text{Carcinogens}_3 \text{ EU cat. 1 and 2} \leq 0.001 \text{ mg/m}^3$$

$$\text{Total VOC}_{28} \text{ excl. LCI} \leq 0.1 \text{ mg/m}^3$$

$$\text{Total VOC incl. LCI } R = \sum \text{Ci/LCii} < 1$$

A current test report was attached to the underlying report to demonstrate compliance with the current AgBB scheme.

8. References

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DIN 4103-4

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DIN 18168-1

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DIN 38405-5

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AgBB

Committee for Health-related Evaluation of Construction Products – Requirements for indoor air quality in buildings: Health-related evaluation of emissions by volatile organic compounds (VOC, VOC and SVOC) from construction products
<https://www.umweltbundesamt.de/themen/gesundheit/kommissionen-arbeitsgruppen/ausschuss-zur-gesundheitlichen-bewertung-von-agbb-gesundheitliche-bewertung-der-emissionen-von-fluchtigen-organischen-verbindungen-aus-bauprodukten>

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DIRECTIVE (EU) No. 305/2011 OF THE EUROPEAN PARLIAMENT AND COUNCIL dated 9 March 2011 establishing harmonised conditions for marketing construction products and replacing Council Guideline 89/106/EEC; ABl. EU L88/5 dated 4 April 2011

BBSR service life

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<http://www.nachhaltigesbauen.de/baustoff-undgebaeuedaten/nutzungsdauern-von-bauteilen.html> Stand 24.02.2017.

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Natural radioactivity in construction materials and the ensuing radiation exposure, Field of radiation protection and environment,
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Fraunhofer-Institut für Bauphysik IBP, Holzkirchen

Test report: Cross-sectional study on the emission potential of volatile organic compounds from gypsum components and gypsum products for interior applications (July 2010)

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