

# ENVIRONMENTAL PRODUCT DECLARATION

in accordance with ISO 14025 and EN 15804+A2

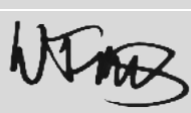

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## GYPSUM PLASTERBOARD IN ACCORDANCE WITH DIN EN 520 AND DIN 18180 **Bundesverband der Gipsindustrie e.V.**

[www.ibu-epd.com](http://www.ibu-epd.com) / <https://epd-online.com>



## 1. General information

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| <p><b>Bundesverband der Gipsindustrie e.V.</b></p> <hr/> <p><b>Programme holder</b><br/>IBU – Institut Bauen und Umwelt e.V.<br/>Panoramastr. 1<br/>10178 Berlin<br/>Germany</p> <hr/> <p><b>Declaration number</b><br/>EPD-BVG-20210344-IBE1-EN</p> <hr/> <p><b>This Declaration is based on the product category rules:</b><br/>Plasterboards, 01.2019<br/>(PCR checked and approved by the Expert Council (SVR))</p> <hr/> <p><b>Issue date</b><br/>04 April 2022</p> <hr/> <p><b>Valid until</b><br/>03 April 2027</p> | <p><b>GYPSUM PLASTERBOARD<br/>IN ACCORDANCE WITH DIN EN 520<br/>AND DIN 18180</b></p> <hr/> <p><b>Holder of the Declaration</b><br/>Bundesverband der Gipsindustrie e.V.<br/>Kochstrasse 6-7<br/>10969 Berlin</p> <hr/> <p><b>Declared product/unit</b><br/>Gypsum plasterboards in accordance with <i>DIN EN 520</i> and <i>DIN 18180</i><br/>1 m<sup>2</sup> (10 kg)</p> <hr/> <p><b>Scope:</b><br/>The EPD applies for all member companies of the Bundesverband der Gipsindustrie e.V. in accordance with the current list of members on <a href="https://www.gips.de/epd-ansprechpartner/gipsplatten/">https://www.gips.de/epd-ansprechpartner/gipsplatten/</a> for products manufactured in Germany. The LCA takes into account specific information from the manufacturers and suppliers of components for the entire life cycle.</p> <p>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.</p> <p>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.</p> <hr/> <p><b>Verification</b></p> <p>The <i>EN 15804</i> European standard serves as the core PCR.</p> <p>Independent verification of the Declaration and information provided in accordance with <i>ISO 14025:2010</i></p> <p><input type="checkbox"/> internally      <input checked="" type="checkbox"/> externally</p> |
| <p></p> <hr/> <p>Dipl.-Ing. Hans Peters<br/>(Chairman of Institut Bauen und Umwelt e.V.)</p>                                                                                                                                                                                                                                                                                                                                            | <p></p> <hr/> <p>Dr.-Ing. Wolfram Trinius<br/>(Independent verifier)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <p></p> <hr/> <p>Dr Alexander Röder<br/>(Managing Director Institut Bauen und Umwelt e.V.)</p>                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

## 2. Product

### 2.1 Product description / Product definition

The Declaration refers to 1 m<sup>2</sup> plasterboard with a weight per unit area of 10 kg/m<sup>2</sup>.

(EU) Directive No. 305/2011 (CPR) applies for placing the product on the market in the EU/EFTA (with the exception of Switzerland). The products require a Declaration of Performance taking consideration of the DIN EN 520: 2009-12, Gypsum plasterboards – Definitions, requirements and test methods, and CE marking. Use is governed by the respective national regulations.

### 2.2 Application

Plasterboards are directly pasted to the substrate as dry plaster, as panelling for wall and ceiling cladding,

mounting walls and suspended ceilings made of wood or galvanised metal and for manufacturing prefabricated components such as those screwed or nailed in the prefabricated building industry.

It 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/>.

The product's performance values correspond with the Declaration of Performance in terms of its essential properties in accordance with DIN EN 520: 2009-12, Gypsum plasterboards – Definitions, requirements and test methods.

For example, reaction to fire, shear strength, water vapour diffusion resistance, thermal conductivity, hazardous substances, impact resistance or sound absorption can be declared.

Use is governed by the respective national provisions; in Germany, this is the /DIN 18180/ as a national application standard. /DIN 18181/ applies for processing the plasterboards.

As a general rule, /DIN 4103-1/ applies for non-load-bearing interior partition walls, /DIN 4103-4/ applies for wooden stud systems, and /DIN 18183-1/ applies for metal stud systems; /DIN 18168-1/ and /DIN 18168-2/ must be observed for suspended ceilings and ceiling cladding.

## 2.4 Delivery status

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

A distinction is made between the following types:

Plasterboard Type A in accordance with /DIN EN 520/, Type GKB in accordance with /DIN 18180/: Plasterboard referred to as wallboard in accordance with DIN, for all standard applications

Gypsum plasterboard Type D (gypsum plasterboard with defined density) in accordance with /DIN EN 520/: plasterboard with a defined density of at least 800 kg/m<sup>3</sup> for ensuring improved performance in certain applications

Gypsum plasterboard Type I (gypsum plasterboard with increased surface strength) in accordance with

/DIN EN 520/: plasterboard designated for applications with increased surface hardness requirements.

Plasterboard Type P in accordance with /DIN EN 520/, Type GKP in accordance with /DIN 18180/: boards whose visible side are intended for the application of gypsum plaster or glued bonding with other materials such as plasterboards or board-shaped substances

Gypsum plasterboard Type R (gypsum plasterboard with increased strength) in accordance with /DIN EN 520/: these gypsum plasterboards are designated for applications requiring increased longitudinal and horizontal breaking strength.

Impregnated plasterboard and fire-resistant plasterboard (e.g. Types E, F, H) are not a component of this EPD.

## 2.5 Base materials / Ancillary materials

Plasterboards are manufactured in a continuous process from moulding plaster and additives for the gypsum core (incl. starch and foaming agent) as well as high-quality, multi-pressed cardboard board liner on large conveyor systems.

The quantity of basic materials used for an average analysis comprises around 93% gypsum, 3.5% recycled paper (for cardboard board liner) and 3.5% mineral aggregates and construction chemical compounds.

## 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 /ECHA2021/: 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.

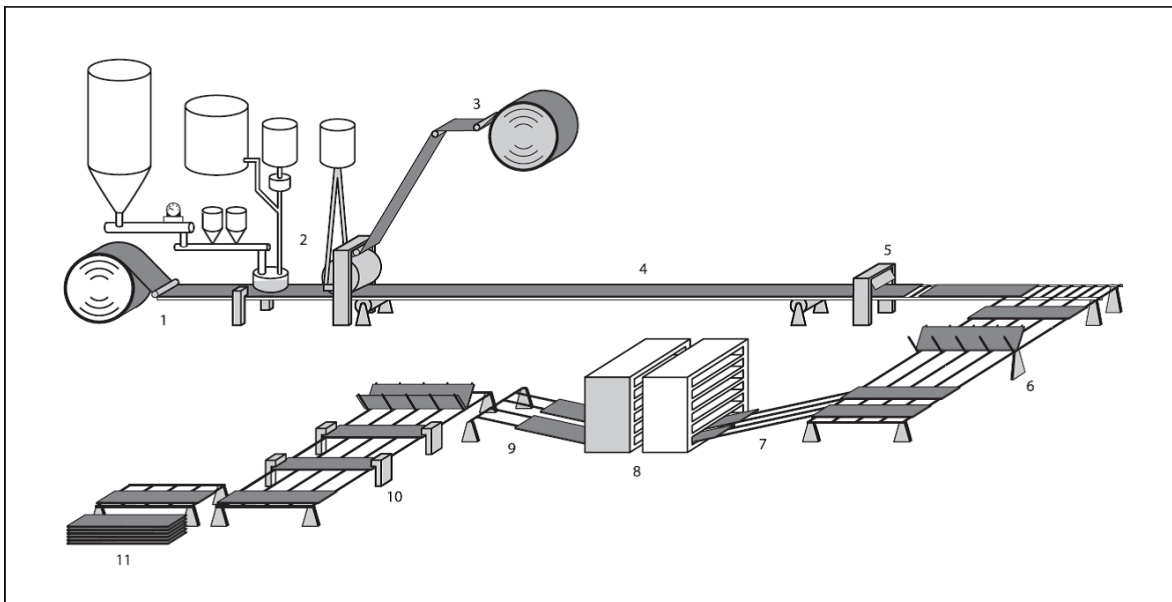


Fig. 1: Plasterboard manufacturing process in accordance with the */Gypsum Data Book/*

- 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 on the forming station as the cardboard 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 */DIN EN 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 */DIN EN 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/m<sup>3</sup> alveolar dust (A-dust) must be observed for calcium sulphate as a time-weighted average in accordance with */TRGS 900/*.

## 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 plasterboards considered here are generally used indoors as an element of interior constructions for wall, ceiling or floor areas.

## 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 were examined by the Institut für Bauphysik */Scherer 2010/*. 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 depend on the respective applications.

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, this 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. The service life complies with the overall useful life of the building. They are not subject to any exterior exposure.

## 2.13 Extraordinary effects

### Fire

Plasterboards offer very good 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 */DIN EN 520/*, plasterboards are usually classified as A2-s1, d0 in terms of their reaction to fire. This classification to */DIN 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 cardboard 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 ensure that any screws or nails are removed by a magnetic separator. Separated cardboard 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](http://www.gips.de)

## 3. LCA: Calculation rules

### 3.1 Declared unit

The declared unit is 1m<sup>2</sup> plasterboard in accordance with */DIN EN 520/* and */DIN 18180/* with a surface weight of 10 kg/m<sup>2</sup>.

#### Declared unit

| Designation   | Value | Unit           |
|---------------|-------|----------------|
| Declared unit | 1     | m <sup>2</sup> |

The results relate to a representative formulation valid for the members of the Bundesverband der Gipsindustrie e.V. with production in Germany, which comprises several thicknesses and weights per unit area, in the form of standardisation to be applied for statistical reports.

### 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 (unpackaged 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

In accordance with the target definition, all relevant input and output flows that occur in connection with the product under consideration were identified and quantified.

All available data from the production process is therefore taken into account in the LCA, i.e. all of the raw materials used, the thermal energy used, and the electricity consumption.

This also takes into account material and energy flows that contribute less than 1% of the mass or energy.

The requirement that a maximum of 5% of the energy and mass input may be neglected is therefore complied with.

### 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.

An R1 factor of greater than 0.6 is assumed for all waste incineration plants.

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 | 0.15  | kg C |

The proportion of biogenic carbon results from the cardboard board liner layer of the plasterboard. A carbon content of approx. 0.43 kg per kg of cardboard board liner is assumed.

Technical information on the application forms the basis for developing specific scenarios within the context of a building evaluation.

#### Transport to construction site (A4)

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

The EPD declares a transport distance of 100 km for A4. This permits easy conversion of specific transport distances at building level.

#### Construction installation process (A5)

Installation in the building includes the electricity consumption for screwing the plasterboards. The actual screws are not included in the calculation.

#### Construction installation process (A5)

| Designation       | Value  | Unit |
|-------------------|--------|------|
| Power consumption | 0.0025 | kWh  |

#### End of Life (C1-C4)

The plasterboards 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 |
|-----------------------------|-------|------|
| For recycling (scenario 1): | 10    | kg   |
| For landfill (scenario 2):  | 10    | kg   |

#### Reuse, recovery and recycling potential (D), relevant scenario information

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 1m<sup>2</sup> 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.

Important:

EP freshwater: This indicator was calculated as "kg P equiv." in accordance with the characterisation model (EUTREND model, Struijs et al., 2009b, as implemented in ReCiPe; <http://eplca.jrc.ec.europa.eu/LCDN/developerEF.xhtml>).

**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 m<sup>2</sup> = 10 kg plasterboard**

| Core indicator | Unit                                     | A1-A3    | A4       | A5       | C1      | C2       | C3/1     | C3/2    | C4/1    | C4/2     | D/1       | D/2     |
|----------------|------------------------------------------|----------|----------|----------|---------|----------|----------|---------|---------|----------|-----------|---------|
| GWP total      | [kg CO2 equiv.]                          | 1.01E+0  | 1.16E-1  | 1.01E-3  | 0.00E+0 | 6.29E-2  | 6.92E-1  | 0.00E+0 | 0.00E+0 | 7.23E-1  | -3.09E-2  | 0.00E+0 |
| GWP fossil     | [kg CO2 equiv.]                          | 1.57E+0  | 1.11E-1  | 1.01E-3  | 0.00E+0 | 6.01E-2  | 6.91E-1  | 0.00E+0 | 0.00E+0 | 7.22E-1  | -3.08E-2  | 0.00E+0 |
| GWP biogenic   | [kg CO2 equiv.]                          | -5.55E-1 | 5.09E-3  | 3.35E-6  | 0.00E+0 | 2.77E-3  | 5.21E-2  | 0.00E+0 | 0.00E+0 | 5.17E-2  | 1.14E-4   | 0.00E+0 |
| GWP luluc      | [kg CO2 equiv.]                          | 3.02E-3  | 2.62E-6  | 1.46E-6  | 0.00E+0 | 1.42E-6  | 1.75E-4  | 0.00E+0 | 0.00E+0 | 4.37E-4  | -2.24E-4  | 0.00E+0 |
| ODP            | [kg CFC11 equiv.]                        | 1.66E-10 | 1.16E-17 | 2.21E-17 | 0.00E+0 | 6.32E-18 | 2.66E-15 | 0.00E+0 | 0.00E+0 | 5.62E-16 | -5.95E-17 | 0.00E+0 |
| AP             | [mol H+ equiv.]                          | 2.56E-3  | 1.04E-4  | 2.22E-6  | 0.00E+0 | 5.64E-5  | 2.67E-4  | 0.00E+0 | 0.00E+0 | 1.09E-3  | -1.14E-4  | 0.00E+0 |
| EP freshwater  | [kg PO4 equiv.]                          | 1.11E-5  | 2.36E-8  | 2.69E-9  | 0.00E+0 | 1.28E-8  | 3.23E-7  | 0.00E+0 | 0.00E+0 | 2.60E-7  | -1.05E-7  | 0.00E+0 |
| EP marine      | [kg N equiv.]                            | 8.37E-4  | 3.15E-5  | 4.93E-7  | 0.00E+0 | 1.71E-5  | 5.92E-5  | 0.00E+0 | 0.00E+0 | 2.80E-4  | -4.77E-5  | 0.00E+0 |
| EP terrestrial | [mol N equiv.]                           | 8.72E-3  | 3.52E-4  | 5.18E-6  | 0.00E+0 | 1.92E-4  | 6.22E-4  | 0.00E+0 | 0.00E+0 | 3.08E-3  | -5.44E-4  | 0.00E+0 |
| POCP           | [kg NMVOC equiv.]                        | 2.21E-3  | 9.20E-5  | 1.35E-6  | 0.00E+0 | 5.00E-5  | 1.62E-4  | 0.00E+0 | 0.00E+0 | 8.48E-4  | -1.21E-4  | 0.00E+0 |
| ADPE           | [kg Sb equiv.]                           | 2.26E-7  | 3.30E-9  | 2.91E-10 | 0.00E+0 | 1.79E-9  | 3.50E-8  | 0.00E+0 | 0.00E+0 | 1.36E-8  | -3.00E-9  | 0.00E+0 |
| ADPF           | [MJ]                                     | 2.43E+1  | 1.56E+0  | 1.77E-2  | 0.00E+0 | 8.48E-1  | 2.12E+0  | 0.00E+0 | 0.00E+0 | 1.99E+0  | -4.24E-1  | 0.00E+0 |
| WDP            | [m <sup>3</sup> world equiv., extracted] | 1.22E-1  | 2.16E-4  | 2.19E-4  | 0.00E+0 | 1.17E-4  | 2.63E-2  | 0.00E+0 | 0.00E+0 | 1.59E-2  | -1.85E-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)

**LCA RESULTS – INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 m<sup>2</sup> = 10 kg plasterboard**

| Indicator | Unit | A1-A3   | A4      | A5      | C1      | C2      | C3/1    | C3/2    | C4/1    | C4/2    | D/1      | D/2     |
|-----------|------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------|---------|
| PERE      | [MJ] | 3.43E+0 | 4.92E-3 | 7.84E-3 | 0.00E+0 | 2.68E-3 | 5.84E+0 | 0.00E+0 | 0.00E+0 | 5.16E+0 | -4.39E-2 | 0.00E+0 |
| PERM      | [MJ] | 4.90E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 0.00E+0 | 4.90E+0 | 0.00E+0 | 0.00E+0 | 4.90E+0 | 0.00E+0  | 0.00E+0 |
| PERT      | [MJ] | 8.33E+0 | 4.92E-3 | 7.84E-3 | 0.00E+0 | 2.68E-3 | 9.41E-1 | 0.00E+0 | 0.00E+0 | 2.61E-1 | -4.39E-2 | 0.00E+0 |
| PENRE     | [MJ] | 2.43E+1 | 1.56E+0 | 1.77E-2 | 0.00E+0 | 8.49E-1 | 2.12E+0 | 0.00E+0 | 0.00E+0 | 1.99E+0 | -4.26E-1 | 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] | 2.43E+1 | 1.56E+0 | 1.77E-2 | 0.00E+0 | 8.49E-1 | 2.12E+0 | 0.00E+0 | 0.00E+0 | 1.99E+0 | -4.26E-1 | 0.00E+0 |

|      |      |         |         |         |         |         |         |         |         |         |          |         |         |
|------|------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------|---------|---------|
| SM   | [kg] | 5.30E+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 | 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 | 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 | 0.00E+0 |
| FW   | [m³] | 6.01E-3 | 8.83E-6 | 9.07E-6 | 0.00E+0 | 4.80E-6 | 1.09E-3 | 0.00E+0 | 0.00E+0 | 5.02E-4 | -6.05E-5 | 0.00E+0 | 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 |  |  |  |  |  |  |  |  |  |  |  |  |
|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|--|

### LCA RESULTS – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 m² = 10 kg plasterboard

| Indicator | Unit | A1-A3   | A4       | A5       | C1      | C2       | C3/1     | C3/2    | C4/1    | C4/2    | D/1      | D/2     |
|-----------|------|---------|----------|----------|---------|----------|----------|---------|---------|---------|----------|---------|
| HWD       | [kg] | 1.23E-6 | 1.52E-10 | 7.32E-12 | 0.00E+0 | 8.24E-11 | 8.79E-10 | 0.00E+0 | 0.00E+0 | 3.03E-8 | -2.15E-8 | 0.00E+0 |
| NHWD      | [kg] | 1.94E-2 | 1.60E-4  | 1.26E-5  | 0.00E+0 | 8.68E-5  | 1.51E-3  | 0.00E+0 | 0.00E+0 | 1.00E+1 | -9.01E-5 | 0.00E+0 |
| RWD       | [kg] | 3.26E-4 | 1.68E-6  | 2.69E-6  | 0.00E+0 | 9.11E-7  | 3.22E-4  | 0.00E+0 | 0.00E+0 | 2.26E-5 | -7.58E-6 | 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  | 3.90E+0  | 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 = 10 kg plasterboard

| Indicator | Unit                 | A1-A3    | A4       | A5       | C1      | C2       | C3/1     | C3/2    | C4/1    | C4/2     | D/1       | D/2     |
|-----------|----------------------|----------|----------|----------|---------|----------|----------|---------|---------|----------|-----------|---------|
| PM        | [Disease incidences] | 7.74E-8  | 5.63E-10 | 1.86E-11 | 0.00E+0 | 3.06E-10 | 2.24E-9  | 0.00E+0 | 0.00E+0 | 1.35E-8  | -5.18E-8  | 0.00E+0 |
| IRP       | [kBq U235 equiv.]    | 4.15E-2  | 2.40E-4  | 4.41E-4  | 0.00E+0 | 1.30E-4  | 5.29E-2  | 0.00E+0 | 0.00E+0 | 2.32E-3  | -1.39E-3  | 0.00E+0 |
| ETP-fw    | [CTUe]               | 1.45E+1  | 1.11E+0  | 7.57E-3  | 0.00E+0 | 6.01E-1  | 9.08E-1  | 0.00E+0 | 0.00E+0 | 1.14E+0  | -2.99E-1  | 0.00E+0 |
| HTP-c     | [CTUh]               | 2.21E-10 | 2.08E-11 | 2.09E-13 | 0.00E+0 | 1.13E-11 | 2.51E-11 | 0.00E+0 | 0.00E+0 | 1.68E-10 | -6.46E-12 | 0.00E+0 |
| HTP-nc    | [CTUh]               | 1.19E-8  | 8.90E-10 | 7.70E-12 | 0.00E+0 | 4.84E-10 | 9.24E-10 | 0.00E+0 | 0.00E+0 | 1.86E-8  | -3.62E-10 | 0.00E+0 |
| SQP       | [-]                  | 7.51E+0  | 4.01E-3  | 5.63E-3  | 0.00E+0 | 2.18E-3  | 6.76E-1  | 0.00E+0 | 0.00E+0 | 4.15E-1  | -1.33E-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 |  |  |  |  |  |  |  |  |  |  |  |  |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|--|

Limitation note 1 – applies to the indicator “Potential impact of exposure to people to U235”: This impact category mainly addresses the potential impact of low-dose ionising radiation on human health in the nuclear fuel cycle. This does not consider impacts attributable to possible nuclear accidents and occupational exposure, nor to the disposal of radioactive waste in underground facilities. Potential ionising radiation from soil, radon and some building materials is also not measured by this indicator.

Limitation note 2 – applies for the indicators: “Potential for Abiotic Resource Depletion – Non-Fossil Resources”, “Potential for Abiotic Resource Depletion – Fossil Fuels”, “Water Depletion Potential (User)”, “Potential Ecosystem Toxicity Comparison Unit”, “Potential Human Toxicity Comparison Unit – Carcinogenic Effect”, “Potential Human Toxicity Comparison Unit – Non-Carcinogenic Effect”, “Potential Soil Quality Index”.

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

## 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), 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

## 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 of the /AgBB/ evaluation scheme are fully met /Scherer 2010/:

**TVOC3** ≤ 10 mg/m<sup>3</sup>

**Carcinogens 3 EU cat. 1 and 2** ≤ 0.01 mg/m<sup>3</sup>

**TVOC28** < 1.0 mg/m<sup>3</sup>

**SVOC28** ≤ 0.1 mg/m<sup>3</sup>

**Carcinogens28 EU cat. 1 and 2** ≤ 0.001 mg/m<sup>3</sup>

**Total VOC28 excl. LCI** ≤ 0.1 mg/m<sup>3</sup>

Total VOC incl. LCI R = Σ Ci/LC*i* < 1

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

## 8. References

### Standards:

/DIN 4103-1/

DIN 4103-1:2014-03, Internal non-loadbearing partitions – Part 1: Requirements and verification

/DIN 4103-4/

DIN 4103-4:1988-11, Internal non-loadbearing partitions; Partitions with timber framing

/DIN 18168-1/

DIN 18168-1:2007-04, Ceiling linings and suspended ceilings with gypsum plasterboards – Part 1: Requirements for construction

/DIN 18168-2/

DIN 18168-2:2008-05, Ceiling linings and suspended ceilings with gypsum plasterboards – Part 2: Verification of the load-carrying capacity of metal sub-constructions and metal suspending rods

/DIN 18180/

DIN 18180:2014-09, Gypsum plasterboards – Types and requirements

/DIN 18181/

DIN 18181:2019-04, Gypsum plasterboards for building construction – Application

/DIN 18183-1/

DIN 18183-1:2018-05, Partitions and wall linings with gypsum boards on metal framing – Part 1: Cladding with gypsum plasterboards

/DIN EN 520/

DIN EN 520:2009-12, Gypsum plasterboards – Definitions, requirements and test methods; German version EN 520:2004+A1:2009

/DIN EN ISO 9001/

DIN EN ISO 9001:2015-11, Quality management systems – Requirements (ISO 9001:2015); German and English version EN ISO 9001:2015

/DIN 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

/ISO 14025/

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

Principles and procedures (ISO 14025:2006); German and English version EN ISO 14025:2011

/DIN EN 15804/

DIN EN 15804:2020-03, Sustainability of construction works – Environmental product declarations – Core rules for the construction products product category; German version EN 15804:2012+A2:2019

/DIN EN ISO 50001/

DIN EN ISO 50001:2018-12, Energy management systems – Requirements with guidance for use (ISO 50001:2018)

### Other literature:

/Waste key/

AVV – Ordinance on the List of Wastes dated 10 December 2001 (Federal Law Gazette No. I, p. 3379), last amended by Article 1 of the Ordinance dated 30 June 2020 (Federal Law Gazette No. I, p. 1533)

/AgBB/

AgBB – Requirements for indoor air quality in buildings: Health-related evaluation of emissions by volatile organic compounds (VOC, VOC and SVOC) from construction products, Committee for Health-Related Evaluation of 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>

/Construction Products Regulation/

Directive (EU) No. 305/2011 of the European Parliament and Council dated 9 March 2011 establishing harmonised conditions for marketing building products and replacing Council Guideline 89/106/EEC; ABI. EU L88/5 dated 4 April 2011

/BBSR service life/

BBSR table "Service lives of components for LCA in accordance with BNB"  
"Sustainable Building Information Portal" of the Federal Ministry of Transport, Building and Urban Affairs: <http://www.nachhaltigesbauen.de/baustoff-undgebaeuedaten/nutzungsdauern-von-bauteilen.html>; last revised 24 February 2017

## */BfS report/*

Natural radioactivity in construction materials and the ensuing radiation exposure, Field of radiation protection and environment  
K. Gehrcke, B. Hoffmann, U. Schkade, V. Schmidt, K. Wichterey; Federal Office for Radiation Protection, Salzgitter, November 2012; <http://nbn-resolving.de/urn:nbn:de:0221-201210099810>

## */Landfill Ordinance/*

Landfill Ordinance dated 27 April 2009 (Federal Law Gazette No. I, p. 900), last amended by Article 3 of the Ordinance dated 9 July 2021 (Federal Law Gazette No. I, p. 2598)

## */ECHA 2021/*

European Chemicals Agency (ECHA)  
Candidate list of Substances of Very High Concern for Authorisation (published in accordance with Article 59(10) of the REACH Regulation); <http://echa.europa.eu/de/candidate-list-table>; last revised 16 April 2021

## */Gypsum Data Book/*

Gypsum Data Book  
Pub.: Bundesverband der Gipsindustrie e.V., Kochstrasse 6-7, 10969 Berlin  
Published on: [www.gips.de](http://www.gips.de) (section: Publications / Books), last revised: May 2013

## */IBU 2021/*

Institut Bauen und Umwelt e.V.: General instructions for the EPD range of Institut Bauen und Umwelt e.V. (IBU), version 2.0, Berlin: Institut Bauen und Umwelt e.V., 2021; [www.ibu-epd.com](http://www.ibu-epd.com)

## */Code of Practice Flooding/*

Removing damage caused by flooding to components made of gypsum or gypsum plaster, BVG Information Service No. 01  
Published on: [www.gips.de](http://www.gips.de) (section: Download, Publications, Information services), last revised: June 2013

## */Scherer 2010/*

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)  
Published on: [www.gips.de](http://www.gips.de) (section: Research association, Projects, 2010). This report has been supplemented by current evidence for the underlying report.

## */TRGS 900/*

TRGS 900 "Occupational exposure limit values" (edition: January 2006; BArBl. volume 1/2006, pp. 41-55; last amended and supplemented: GMBI 2021, p. 580 [No. 25] (dated 23.04.2021))

## */GaBi/*

GaBi 10.0 dataset documentation for the software system and databases, Sphera Solutions GmbH, Leinfelden-Echterdingen, 2020; <http://documentation.gabi-software.com/>

## */LCA tool/*

BV Gips LCA tool, version 1.0; created by Sphera Solutions GmbH

## */PCR, Part A/*

Institut Bauen und Umwelt e.V., Berlin (pub.): Product category rules for building-related products and services, Part A: Calculation rules for the Life Cycle Assessment and requirements on the project report, in accordance with EN 15804+A2:2019, version 1.1.1

## */PCR: Gypsum boards/*

Institut Bauen und Umwelt e.V., Berlin (pub.): Product category rules for building-related products and services, Part B: Requirements on the EPD for gypsum plasterboards, version 1.7



**Publisher**

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