

# Environmental Product Declaration

Product-specific information for assessing the environmental impact of a building in accordance with ISO 14025 and EN 15804

**DANO® Bau imprägniert**  
**DANO® Feuer imprägniert**  
**DANO® Massiv imprägniert**  
**DANO® Fix imprägniert**



**FREIHEIT FÜR DEN TROCKENBAU**

**danogips**

## Environmental Product Declaration (EPD) for building materials and building products

In an **E**nvironmental **P**roduct **D**eclaration (EPD) the **l**ife **c**ycle **a**ssessment (LCA) of a product is calculated.

The life cycle of a building product as well as building physics and generally relevant information are presented.

Example:

How much carbon dioxide (CO<sub>2</sub>) did the product emit until it left the factory gate or what was the energy requirement (renewable/non-renewable) for a product during manufacture.

EPDs are mainly used to assess the sustainable use of resources and to evaluate the impact of buildings on the environment.

EPDs are therefore an important source of information for the various building certification systems.

### Transferability of this EPD „Gypsum board - building board“ to Danogips products

The EPD applies according to the scope of application for gypsum boards with the following labeling:

**Type H** according to the EN 520

The characteristic values of this EPD apply to the following DANO® products:

- **DANO®** Bau imprägniert H2/GKBi
- **DANO®** Feuer imprägniert DFH2/GKFi
- **DANO®** Massiv Leicht imprägniert H2/GKBi
- **DANO®** Massiv imprägniert DFH2/GKFi
- **DANO®** Fix imprägniert H2/GKBi

# ENVIRONMENTAL PRODUCT DECLARATION

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

Owner of the Declaration	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-20210163-IBE1-EN
Issue date	01 November 2021
Valid until	31 October 2026

## IMPREGNATED PLASTERBOARD Bundesverband der Gipsindustrie e.V.

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



## 1. General information

Bundesverband der Gipsindustrie e.V.	IMPREGNATED PLASTERBOARD
<b>Programme holder</b> IBU – Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin Germany	<b>Holder of the Declaration</b> Bundesverband der Gipsindustrie e.V. Kochstrasse 6-7 10969 Berlin
<b>Declaration number</b> EPD-BVG-20210163-IBE1-EN	<b>Declared product/unit</b> Impregnated plasterboard in accordance with /DIN EN 520/ and /DIN 18180/, 1 m <sup>2</sup> (10 kg)
<b>This Declaration is based on the product category rules:</b> Gypsum plasterboards, 30.11.2017 (PCR checked and approved by the independent Expert Council (SVR))	<b>Scope:</b> 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.
<b>Issue date</b> 01 November 2021	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.
<b>Valid until</b> 31 October 2026	<b>Verification</b> 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 14025:2010</i>  <input type="checkbox"/> internally <input checked="" type="checkbox"/> 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 m<sup>2</sup> impregnated 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 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 subsurface 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.

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/>.

## Technical construction data

Designation	Value	Unit
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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.

### 2.4 Delivery status

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

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

### 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 on large conveyor systems.

Special cardboard board liner and gypsum additives, e.g. silicone or wax, are used as measures for reducing water absorption.

The quantity of basic materials used for an average analysis comprises around 93% gypsum, 3.5% recycled paper (for cardboard) 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.

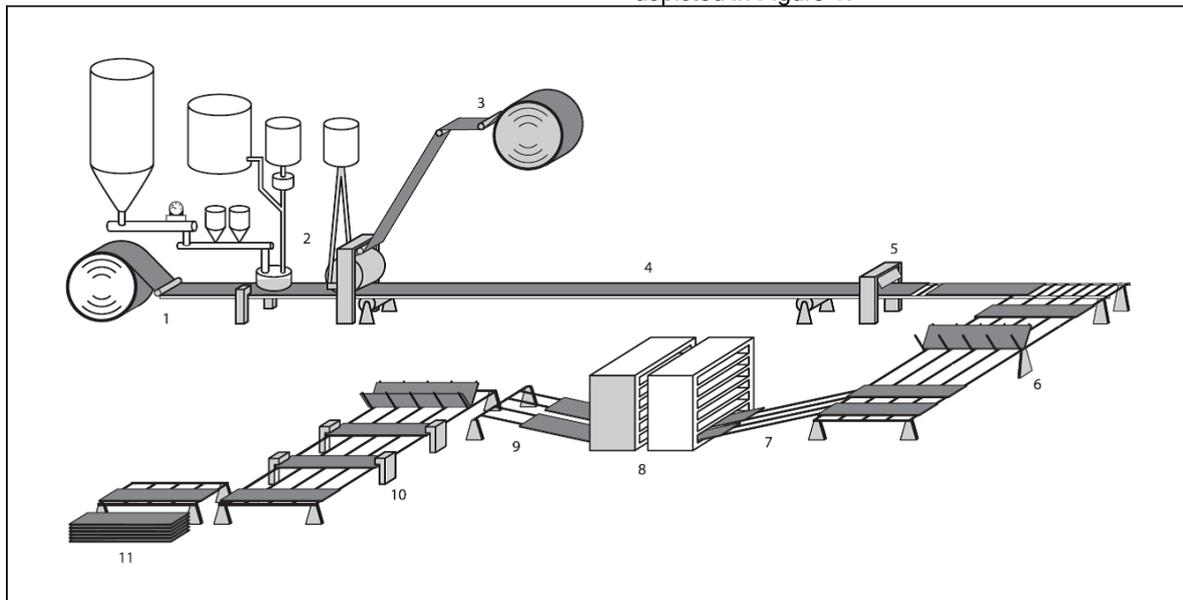


Fig. 1: Plasterboard manufacturing process in accordance with the /Gypsum Data Book/

- 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 in the forming station as the cardboard 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)
- Panel 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 leaflets 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 "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 03.11.2011, amounts to > 50 years for walls, for example, in accordance with code number 342.411 "Nichttragende Innenwände – Ständersysteme" (Non-load-bearing interior walls – Stud systems).

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

**Fire protection**

Designation	Value
Building material class	-

Burning droplets	-
Smoke gas development	-

**Water**

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

In the case of reduced water absorption, a distinction is made between the water absorption classes in accordance with the following table as per /DIN EN 520/:

Water absorption classes	Surface water absorption (g/m <sup>2</sup> )	Total water absorption (%)
H1	180	≤ 5
H2	220	≤ 10
H3	300	≤ 25

**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. 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 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> impregnated plasterboard in accordance with /DIN EN 520/ and /DIN 18180/ with a weight per unit area of 10 kg/m<sup>2</sup>.

#### Declared unit

Designation	Value	Unit
Declared unit	1	m <sup>2</sup>
Layer thickness	0.015	m
Weight per unit area	10	kg/m <sup>2</sup>
Conversion factor [mass/declared unit]	10	-

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 concerns installation at the construction site, including disposal of any packaging, taking consideration of framework conditions inherent in Europe.

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.

have been drawn up in accordance with *EN 15804* and the building context and/or product-specific characteristics are taken into consideration.

**3.9 Comparability**

As a general rule, EPD data can only be compared or evaluated when all of the data records to be compared

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 layer of the plasterboard. A carbon content of approx. 0.43 kg per kg of cardboard 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. If packaging is considered in the LCA, it must be disposed of within Module A5. This is not the case in this EPD, as the products are supplied without packaging.

**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 II:	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 transport distances and disposal costs:

**Scenario 1** includes the assumption of a 100% recycling scenario with steps **C2/ 1, 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 **C2/2** 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 m<sup>2</sup> = 10 kg impregnated plasterboard**

Core indicator	Unit	A1-A3	A4	A5	C1	C2/1	C2/2	C3/1	C3/2	C4/1	C4/2	D/1	D/2
GWP total	[kg CO <sub>2</sub> equiv.]	1.30E+0	1.26E-1	1.01E-3	0.00E+0	6.29E-2	6.29E-2	6.92E-1	0.00E+0	0.00E+0	7.23E-1	-3.73E-2	0.00E+0
GWP fossil	[kg CO <sub>2</sub> equiv.]	1.85E+0	1.20E-1	1.01E-3	0.00E+0	6.01E-2	6.01E-2	6.91E-1	0.00E+0	0.00E+0	7.22E-1	-3.72E-2	0.00E+0
GWP biogenic	[kg CO <sub>2</sub> equiv.]	-5.48E-1	5.53E-3	3.35E-6	0.00E+0	2.77E-3	2.77E-3	5.21E-2	0.00E+0	0.00E+0	5.17E-2	1.38E-4	0.00E+0
GWP luluc	[kg CO <sub>2</sub> equiv.]	3.12E-3	2.85E-6	1.46E-6	0.00E+0	1.42E-6	1.42E-6	1.75E-4	0.00E+0	0.00E+0	4.37E-4	-2.70E-4	0.00E+0
ODP	[kg CFC11 equiv.]	1.66E-10	1.26E-17	2.21E-17	0.00E+0	6.32E-18	6.32E-18	2.66E-15	0.00E+0	0.00E+0	5.62E-16	-7.17E-17	0.00E+0
AP	[mol H <sup>+</sup> equiv.]	3.02E-3	1.13E-4	2.22E-6	0.00E+0	5.64E-5	5.64E-5	2.67E-4	0.00E+0	0.00E+0	1.09E-3	-1.37E-4	0.00E+0
EP freshwater	[kg PO4 equiv.]	1.13E-5	2.56E-8	2.69E-9	0.00E+0	1.28E-8	1.28E-8	3.23E-7	0.00E+0	0.00E+0	2.60E-7	-1.27E-7	0.00E+0
EP marine	[kg N equiv.]	9.62E-4	3.42E-5	4.93E-7	0.00E+0	1.71E-5	1.71E-5	5.92E-5	0.00E+0	0.00E+0	2.80E-4	-5.74E-5	0.00E+0
EP terrestrial	[mol N equiv.]	1.01E-2	3.83E-4	5.18E-6	0.00E+0	1.92E-4	1.92E-4	6.22E-4	0.00E+0	0.00E+0	3.08E-3	-6.55E-4	0.00E+0
POCP	[kg NMVOC equiv.]	2.62E-3	1.00E-4	1.35E-6	0.00E+0	5.00E-5	5.00E-5	1.62E-4	0.00E+0	0.00E+0	8.48E-4	-1.46E-4	0.00E+0
ADPE	[kg Sb equiv.]	1.97E-6	3.59E-9	2.91E-10	0.00E+0	1.79E-9	1.79E-9	3.50E-8	0.00E+0	0.00E+0	1.36E-8	-3.61E-9	0.00E+0
ADPF	[MJ]	2.83E+1	1.70E+0	1.77E-2	0.00E+0	8.48E-1	8.48E-1	2.12E+0	0.00E+0	0.00E+0	1.99E+0	-5.11E-1	0.00E+0
WDP	[m <sup>3</sup> world equiv., extracted]	1.65E-1	2.34E-4	2.19E-4	0.00E+0	1.17E-4	1.17E-4	2.63E-2	0.00E+0	0.00E+0	1.59E-2	-2.23E-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 impregnated plasterboard**

Indicator	Unit	A1-A3	A4	A5	C1	C2/1	C2/2	C3/1	C3/2	C4/1	C4/2	D/1	D/2
PERE	[MJ]	3.99E+0	5.35E-3	7.84E-3	0.00E+0	2.68E-3	2.68E-3	9.41E-1	0.00E+0	0.00E+0	2.61E-1	-5.29E-2	0.00E+0
PERM	[MJ]	4.90E+0	0.00E+0	0.00E+0									
PERT	[MJ]	8.89E+0	5.35E-3	7.84E-3	0.00E+0	2.68E-3	2.68E-3	9.41E-1	0.00E+0	0.00E+0	2.61E-1	-5.29E-2	0.00E+0
PENRE	[MJ]	2.83E+1	1.70E+0	1.77E-2	0.00E+0	8.49E-1	8.49E-1	2.12E+0	0.00E+0	0.00E+0	1.99E+0	-5.13E-1	0.00E+0
PENRM	[MJ]	0.00E+0	0.00E+0										
PENRT	[MJ]	2.83E+1	1.70E+0	1.77E-2	0.00E+0	8.49E-1	8.49E-1	2.12E+0	0.00E+0	0.00E+0	1.99E+0	-5.13E-1	0.00E+0
SM	[kg]	5.30E+0	0.00E+0	0.00E+0									
RSF	[MJ]	0.00E+0	0.00E+0										
NRSF	[MJ]	0.00E+0	0.00E+0										
FW	[m <sup>3</sup> ]	6.71E-3	9.60E-6	9.07E-6	0.00E+0	4.80E-6	4.80E-6	1.09E-3	0.00E+0	0.00E+0	5.02E-4	-7.29E-5	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 m<sup>2</sup> = 10 kg impregnated plasterboard**

Indicator	Unit	A1-A3	A4	A5	C1	C2/1	C2/2	C3/1	C3/2	C4/1	C4/2	D/1	D/2
HWD	[kg]	1.25E-6	1.65E-10	7.32E-12	0.00E+0	8.24E-11	8.24E-11	8.79E-10	0.00E+0	0.00E+0	3.03E-8	-2.59E-8	0.00E+0
NHWD	[kg]	3.98E-2	1.74E-4	1.26E-5	0.00E+0	8.68E-5	8.68E-5	1.51E-3	0.00E+0	0.00E+0	1.00E+1	-1.09E-4	0.00E+0
RWD	[kg]	3.49E-4	1.82E-6	2.69E-6	0.00E+0	9.11E-7	9.11E-7	3.22E-4	0.00E+0	0.00E+0	2.26E-5	-9.13E-6	0.00E+0

CRU	[kg]	0.00E+0											
MFR	[kg]	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	4.70E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
MER	[kg]	0.00E+0											
EEE	[MJ]	0.00E+0											
EET	[MJ]	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 m<sup>2</sup> = 10 kg impregnated plasterboard**

Indicator	Unit	A1-A3	A4	A5	C1	C2/1	C2/2	C3/1	C3/2	C4/1	C4/2	D/1	D/2
PM	[Disease incidences]	7.35E-8	6.12E-10	1.86E-11	0.00E+0	3.06E-10	3.06E-10	2.24E-9	0.00E+0	0.00E+0	1.35E-8	-6.24E-8	0.00E+0
IRP	[kBq U235 equiv.]	4.37E-2	2.61E-4	4.41E-4	0.00E+0	1.30E-4	1.30E-4	5.29E-2	0.00E+0	0.00E+0	2.32E-3	-1.67E-3	0.00E+0
ETP-fw	[CTUe]	1.71E+1	1.20E+0	7.57E-3	0.00E+0	6.01E-1	6.01E-1	9.08E-1	0.00E+0	0.00E+0	1.14E+0	-3.60E-1	0.00E+0
HTP-c	[CTUh]	7.22E-10	2.26E-11	2.09E-13	0.00E+0	1.13E-11	1.13E-11	2.51E-11	0.00E+0	0.00E+0	1.68E-10	-7.78E-12	0.00E+0
HTP-nc	[CTUh]	6.69E-8	9.67E-10	7.70E-12	0.00E+0	4.84E-10	4.84E-10	9.24E-10	0.00E+0	0.00E+0	1.86E-8	-4.36E-10	0.00E+0
SQP	[-]	1.04E+1	4.36E-3	5.63E-3	0.00E+0	2.18E-3	2.18E-3	6.76E-1	0.00E+0	0.00E+0	4.15E-1	-1.61E-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 for the IRP indicator

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 ADPE, ADPF, WDF, ETP-fw, HTP-c, HTP-nc, SQP. 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 (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** =  $\sum Ci/LCii < 1$

## 8. References

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/BBSR service life/

BBSR table "Service lives of components for LCA in accordance with BNB"

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**LCA tool**

**PCR**

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