# **Environmental Product Declaration according to ISO 14025 and EN 15804**

Product specific values for the calculation of the environmetal impact of a building



**RiStuck**\*

The Original. For space to live.

# **ENVIRONMENTAL PRODUCT DECLARATION**

as per /ISO 14025/ and /EN 15804/

Owner of the Declaration	Bundesverband der Gipsindustrie e.V.
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Program holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-BVG-SGR-20140071-IAG1-EN
Issue date	21.08.2018
Valid to	12.11.2020

# RiStuck Saint-Gobain Rigips GmbH



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









# . General Information

#### Bundesverband der Gipsindustrie e.V.

#### Programme holder

IBU - Institut Bauen und Umwelt e.V. Panoramastr. 1 10178 Berlin Deutschland

#### Declaration number EPD-BVG-SGR-20140071-IAG1-EN

# This Declaration is based on the Product

Category Rules: Mineral factory-made mortar, 07.2014 (PCR tested and approved by the SVR)

#### Issue date

21.08.2018

# Valid to

12.11.2020

Wermanes

Prof. Dr.-Ing. Horst J. Bossenmayer (President of Institut Bauen und Umwelt e.V.)

Mann

Dr. Burkhart Lehmann (Managing Director IBU)

### 2. Product

#### 2.1 Product description

Gypsum binder in accordance with /DIN EN 13279-1/ is the base product for industrial manufacturing of various gypsum plasters but also for all prefabricated elements made of gypsum. It is extracted through calcination of calcium sulphate dihydrate (CaSO<sub>4</sub> 2 H<sub>2</sub>O) and comprises calcium sulphate in its various hydrate phases, e.g. hemi-hydrate (CaSO<sub>4</sub>  $\frac{1}{2}$  H<sub>2</sub>O) and anhydrite (CaSO<sub>4</sub>).

Gypsum binder is a bindable material ground to powder whose curing process is triggered by addition of water. This can be carried out at the construction site (gypsum plaster, gypsum filler and gypsum-based adhesive) or in the plant within the framework of board production.

Gypsum binder forms the basis for manufacturing gypsum plaster (for automatic or manual plastering), gypsum filler material and gypsum-based adhesives as well as for model plaster, stucco and fixing plaster.

# STUCCO

#### Owner of the Declaration

Bundesverband der Gipsindustrie e.V. Kochstraße 6/7 10969 Berlin

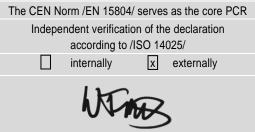
#### Declared product / Declared unit

1 kg gypsum binder for powder products in accordance with /DIN EN 13279-1/

#### Gültigkeitsbereich:

The EPD applies for all member companies of the Bundesverband der Gipsindustrie e.V. in accordance with the current list of members on www.gips.de and for products manufactured in Germany. The Life Cycle Analysis considers specific information provided by manufacturers and suppliers of components exclusively for the cradle-to-gate product stage. This document is translated from the German Environmental Product Declaration into English. It is based on the German original version EPD-BVG-20140071-IAG1-DE. The verifier has no influence on the quality of the translation. The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

#### Verification



Dr.-Ing. Wolfram Trinius, (Independent verifier appointed by SVR)

#### 2.2 Application

Gypsum binders can be manufactured for various applications which are indicated by the respective name in accordance with European standards or traditional, possibly deviating, names combined with applications indicated by the manufacturer only. An overview is provided by the Gypsum Data Book issued by the Bundesverband der Gipsindustrie e.V. /Gypsum Data Book/ and the IGB Stucco Manual /IGB/ published by the building plaster industrial group of the Bundesverband der Gipsindustrie e.V.

#### 2.3 Technical data

The technical data is based on the following standards:

 Definitions and requirements on gypsum binders and gypsum plasters in accordance with /DIN EN 13279-1/



 /DIN EN 13963/ also applies for materials for filling plasterboard joints (filler, fine filler and jointing compound)

Additional technical data refer to application of the products at the construction site. This technical construction data, which refers to the down-stream processing after the plant gate, result from following the manufacturer's processing instructions at the construction site. As this LCA only considers the production stage, these properties are not listed here for systematic reasons.

If necessary, more information is available in the standards, the Gypsum Data Book issued by the Bundesverband der Gipsindustrie e.V. /Gypsum Data Book/ and information supplied by the manufacturer.

#### 2.4 Placing on the market / Application rules

Directive (EU) No. 305/2011 dated 9 March 2011 /Construction Products Regulation/ applies for placing on the market in the EU/EFTA. The products require a Declaration of Performance considering the

information on gypsum plaster in accordance with /EN -13279-1:2008: Gypsum binders and gypsum plasters - Part 1: Definitions and requirements/ and CE marking.

/DIN EN 13963/ also applies for filler, fine filler and jointing compound.

Use is governed by the respective national regulations. Applications should be in line with manufacturer's recommendations.

#### 2.5 Delivery status

The product is delivered as powder. The product can be procured in various pack sizes, e.g. in sacks or loose from silos depending on the manufacturers' respective offers.

The list of manufacturers is available on website of the Bundesverband Gips: <u>www.gips.de</u>.

#### 2.6 Base materials / Auxiliaries

As a general rule, gypsum binder comprises calcium sulphate of various hydrate stages, whereby the binding and processing characteristics are based on their respective combinations and possibly the addition of retarders and water retention agents.

A distinction can generally be made between products containing non-hazardous substances and alkaline gypsum products.

Gypsum binders with added lime hydrate of 1% to 10% by weight bear the CLP label eye damage / eye irritation category 1 with the GHS05 pictogram, the signal word "Danger" and the H318 hazard statement "Causes serious eye damage".

A safety data sheet is available for all products from the respective manufacturer or from the data base GISBAU of the employers' liability insurance association of the building industry BG Bau.

#### 2.7 Manufacture

During the manufacturing process, raw gypsum is burned as gypsum binder where it is available as hemihydrate, anhydrite III and anhydrite II gypsum phases. Gypsum plaster is also admixed with powdered limestone, sand or perlite, and additives such as binding retarders or cellulose derivatives which are added in dry form to the calcined calcium sulphates.

#### 2.8 Environment and health during manufacturing

Gypsum products are manufactured in the "Installations for burning gypsum" which are outlined in the 4th Federal Immission Control Ordinance in the Annex to installations subject to approval. The immission control requirements comprise the guidelines outlined in the Federal Immission Control Act and the technical requirements on air as outlined in the "TA Luft". Plants of the gypsum industry are only subject to emissions trading if the cumulated rated thermal input is  $\geq$  20 MW. This threshold value is only achieved by larger plants and/or joint production of several gypsum products. The plants implemented an Energy Management System in accordance with /DIN EN ISO 50001/.

#### 2.9 Product processing / Installation

The subsurface must fulfill the following requirements for the professional manufacture of plaster surfaces:

- Even surface in accordance with the requirements of /DIN 18202/
- Load-bearing, solid and sufficiently inherently stable
- Dry, non-water-repellent and evenly absorbent
- Free of dust, soiling and harmful
  efflorescence
- Frost-free and/or tempered above +5 °C
- Free of sintered layers and release agent residue

Where concrete is used as a plaster base, residual moisture must not exceed 3% by weight. Moisture release by concrete must be finished in the surface zone. Freshly-plastered rooms must be protected from frost.

Other key information is represented by the absorptivity of the plaster base, material requirements and yield, water values when sprinkling the product into water, plaster layer and thickness, processing times, drying out as well as the requisite quality levels of surfaces and details on suitable coatings.

Plaster finishing spatulas (abbreviated as C7) in accordance with /DIN EN 13279-1/ are primarily used for flat coatings on smooth solid subsurfaces (plaster surfaces, plane stone masonry, smooth-formed concrete, prefabricated concrete parts) or on gypsum or gypsum fibreboard for subsequent surface treatment. Apart from full-surface coatings, textured designs are also possible. Depending on the product, plaster can be applied and processed manually or by machine. Layers have a thickness of 0.1 mm to 3 mm. Filler, fine filler and jointing compound are regulated according to /DIN EN 13963/ and are primarily used for filling plasterboard joints in accordance with /DIN EN 520/ as well as for fibre-reinforced plasterboard.

#### 2.10 Packaging

Powder gypsum products must be protected from moisture absorption during transport and storage. Where possible, material delivered in sacks should be stored in enclosed spaces and on wooden gratings. The storage times specified – usually three to six months – must be observed. Gypsum products can usually still be processed after these times, whereby



the information provided by the manufacturer concerning processing times no longer applies.

#### 2.11 Condition of use

The product is intended for use as a construction product in interior areas and/or serves as an industrial interim product for the manufacture of other gypsum products.

#### 2.12 Environment and health during use

All requirements of the AgBB test scheme (version 2008) are are fully met /Scherer 2010/.

All listed the criteria are significantly fallen short of. The products do not have any negative impact on the quality of indoor air.

#### 2.13 Reference service life

Reference Service Lives depend on the respective applications. The Reference Service Lives result from the application areas in accordance with the BSSR "Nutzungsdauern von Bauteilen für

Lebenszyklusanalysen nach dem Bewertungssystem Nachhaltiges Bauen (BNB) (Useful life of components for the LCA according to the Sustainable Building assessment system)" table, last revised 03.11.2011 /BBSR Service Life/ as follows:

- for standard interior plasters (code 345.211, stucco, lime-gypsum plaster and much more) ≥ 50 years (the same applies for plaster profiles (code 345.221) and plaster bases (code 345.222) which may be used in combination with gypsum products
- for filling compounds, adhesive binders and adhesives made of gypsum in stud wall systems (code 342.411) or partitions made of gypsum plasterboards (code 342.511) ≥ 50 years

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

#### 2.14 Extraordinary effects

#### Fire

The product is allocated to class A1 according to DIN EN 13501 (no contribution to fire load) provided that it contains less than 1% by weight or volume of organic substances (the higher value applies).

#### 3. LCA: Calculation rules

#### 3.1 Declared unit

This declaration refers to 1 kg material in the respective delivery form (powder product, not mixed with water).

Material requirements and yield are indicated in the product information or can be obtained from the manufacturer.

#### **Declared unit**

Description	Value	Unit
Declared unit: Powder product	1	kg
<b>NA</b> ( 1 <b>1</b> 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	01	2 1

Material requirements comprise between 8 kg/m<sup>2</sup> and 11 kg/m<sup>2</sup> for 10 mm plaster thickness on subsurfaces which are solidly filled and of normal absorbency.

According to /DIN EN 13501-1/, this also satisfies the additional requirements concerning "no smoke gas development" (s1) and "no burning droplets/drips" (d0).

#### Water

The product is intended for interior applications only. Permanent penetration of the product with water must be avoided as recrystallisation and structural changes can arise due to the water solubility of gypsum. In the event of any temporary moisture penetration at a later stage, strength diminishes. But the original values are achieved again after drying. This is why application in domestic kitchens and bathrooms with only occasional and temporary exposure to moisture does not present any problems.

A leaflet /Flooding Leaflet/ is available from the Bundesverband der Gipsindustrie (gypsum plaster industry) on how to repair damage caused by flooding.

#### **Mechanical destruction**

Mechanical stress does not occur during the service life of the building. As gypsum construction materials are used in interior applications, unforeseen destruction does not have any negative impact on the environment.

#### 2.15 Re-use phase

Waste processing (recycling or disposal) depends on the respective substrate due to the low material thickness displayed by the component. The actual material is suitable for disposal on landfills from landfill class DK I in accordance with the Landfill Ordinance. Recycling options can be restricted by sulphate content caused by gypsum in the eluate.

#### 2.16 Disposal

The waste code for the unused material is 10 13 06 "Particulates and dust (with the exception of 10 13 12 and 10 13 13)" in category 10 13 "Waste from the manufacture of cement, unhydrated lime, gypsum and products made from these materials" or 17 08 02 "Construction products based on gypsum with the exception of those included in 17 08 01" in category 17 08 "Construction materials based on gypsum".

Neither represents hazardous waste.

After processing, the waste code must be selected depending on the respective substrate.

2.17 Further information <u>www.gips.de</u>

#### 3.2 System boundary

Type of EPD: cradle to gate

Modules A1-A3 include the production of raw materials and transport thereof, the provision of energy and the manufacturing processes required for production.

#### 3.3 Estimates and assumptions

Packaging material for powder products to be delivered were taken into account. As a general rule, the products can be delivered in bags; larger volumes can also be supplied loose in silos or tank trucks. Assumptions were made regarding packaging and transportation for all materials required for manufacturing and packaging of the product. In the case of product packaging, average values concerning



various paper sack volumes were considered (see section 5) and an LCA comparison was made with the unpacked product (see section 6).

#### 3.4 Cut-off criteria

All components for manufacturing as well as all electricity and water required were considered. Accordingly, material and energy flows with a share of less than 1 % were also considered.

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

#### 3.5 Background data

"GaBi 5" – the software system for comprehensive analysis /GaBi 5 2012/ developed by PE INTERNATIONAL AG – was used for modelling the production of all components.

The Life Cycle Assessment was modelled for Germany as a reference area. This means that apart from the production processes within the system boundaries, the up-stream processes of relevance for Germany such as provision of electricity or energy carriers were taken into account, too. The power mix for Germany 2008 is applied.

#### 3.6 Data quality

All background data sets of relevance were taken from the GaBi 5 software data base.

#### 3.7 Period under review

The data used by PE INTERNATIONAL AG complies with the current level of knowledge at the time of modelling the LCA in early 2013.

#### 3.8 Allocation

Allocations were used in the background data for modelling the requisite components, e.g. for the provision of electricity. An allocation was avoided for the provision of FGD gypsum which is sometimes used for the production of calcium sulphate beta hemihydrate.

#### 3.9 Comparability

As a general rule, a comparison or evaluation of EPD data is only possible when all of the data sets to be compared have been recorded in accordance with /EN 15804/ and the building context and/or product-specific performance characteristics are taken into consideration.

#### 4. LCA: Scenarios and additional technical information

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

No scenarios are developed within the framework of this cradle-to-gate declaration.



# 5. LCA: Results

Product stage  Construction process stage  Use stage  End of-life stage  Berefits and back beyond the system boundary    Identify and other integration of the stage  Image: Stage integration of the system boundary    A1  A2  A3  A4  A5  B1  B2  B3  B4  B5  B6  B7  C1  C2  C3  C4  D    X  X  MND  MND  MND  MND  MND  MND  MND  MND    CAR BESULTS - ENVIRONMENTAL IMPACT: 1 kg stuccoo  Image: Stage integration of the stage integr	SYST	SYSTEM BOUNDARIES (X = INCLUDED IN THE LCA; MND = MODULE NOT DECLARED)																
A1      A2      A3      A4      A5      B1      B2      B3      B4      B5      B6      B7      C1      C2      C3      C4      D        X      X      X      MND      MAD      MAD	Product stade														loads beyond the			
X      X      X      MND	Raw material supply	Transport	Manufacture	Transport from manufacturer to site	Assembly	Use / Application	Maintenance	Repairs	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction	Transport	Waste treatment	Landfilling	Re-use, recovery or recycling potential	
LCA RESULTS - ENVIRONMENTAL IMPACT: 1 kg stucco        Parameter      Unit      A1-A3        Global warming potential      [kg CO <sub>2</sub> -Eq.]      0.11        Ozone depletion potential      [kg CC <sub>2</sub> -Eq.]      0.11        Acidification potential of sol and water      [kg CPC <sub>1</sub> * equv]      1.13E-11        Eutrification potential of sol and water      [kg QPC <sub>2</sub> * equv]      2.01E-5        Photochemical zone creation potential      [kg gPb ene equiv.]      1.56E-5        Abiotic depletion potential fossil resources      [kg gPb ene equiv.]      1.66        ICA RESULTS - USE OF RESOURCES: 1 kg stucco      Imit      A1-A3        Renewable primary energy as energy carrier      [MJ]      0.14        Renewable primary energy as energy carrier      [MJ]      0.14        Non-renewable primary energy as energy carrier      [MJ]      0.00        Total use of renewable primary energy as energy carrier      [MJ]      0.00        Non-renewable primary energy as energy carrier      [MJ]      0.66        Use of secondary material      [kg]      0.66        Renewable primary energy as energy carrier      [MJ]      0.00        Non-renewable primary energy sources      [MJ]	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	
Parameter      Unit      A1-A3        Global warming potential      [kg CO-Eq.]      0.11        Ozone depletion potential      [kg CFC11 equiv.]      1.13E-11        Acidification potential of soil and water      [kg CPC]      1.51E-4        Eutrification potential      [kg (POA)*equiv.]      2.01E-5        Photochemical zone creation potential      [kg (POA)*equiv.]      1.56E-5        Abiotic depletion potential non-fossil resources      [kg Sb equiv.]      1.89E-5        Abiotic depletion potential institutes      [MJ]      1.66        ICA RESULTS – USE OF RESOURCES: 1 kg stucco      Image: State S					MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	
Global warming potential    [kg CO2-Eg.]    0.11      Ozore depletion potential    [kg CC11    1.13E-11      equiv.]    1.51E-4    1.51E-4      Eutrification potential    [kg (PO4) <sup>2</sup> equiv]    2.01E-5      Photochemical ozone creation potential    [kg (PO4) <sup>2</sup> equiv]    2.01E-5      Abiotic depletion potential on fossil resources    [kg S be quiv.]    1.58E-5      Abiotic depletion potential on fossil resources    [kg S be quiv.]    1.66      LCA RESULTS – USE OF RESOURCES: 1 kg stucco    1.66    1.66      Value of renewable primary energy as energy carrier    [MJ]    0.00      Total use of renewable primary energy as energy carrier    [MJ]    0.00      Total use of non-renewable primary energy as material utilisation    [MJ]    0.00      Total use of non-renewable primary energy as material utilisation    [MJ]    0.00      Total use of non-renewable primary energy as material utilisation    [MJ]    0.00      Non-renewable primary energy as material utilisation    [MJ]    0.00      Non-renewable primary energy as material utilisation    [MJ]    0.00      Non-renewable primary energy as nergy carrier    [MJ]    0.00      Non-renewable primary energy	LCA	RESU	LTS –	ENVI	RONM	ENTA	L IMP/	ACT:	1 kg st	ucco								
Ozore depletion potential      Ikg CFC11 equiv.]      1.13E-11        Acidification potential of soil and water      Ikg SO_FEQ.]      1.51E-4        Eutification potential      [kg (POu) <sup>2</sup> equiv]      2.01E-5        Photochemical czone creation potential      [kg Sb equiv.]      1.56E-5        Abotic depletion potential non-fossil resources      [kg Sb equiv.]      1.89E-5        Abotic depletion potential fossil fuels      [MJ]      1.66        LCA RESULTS – USE OF RESOURCES: 1 kg stucco      1.66        Variant energy as energy carrier      [MJ]      0.14        Renewable primary energy as material utilisation      [MJ]      0.00        Total use of renewable primary energy as energy carrier      [MJ]      0.14        Non-renewable primary energy as material utilisation      [MJ]      0.00        Total use of non-renewable primary energy as energy carrier      [MJ]      0.00        Use of secondary materials      [kg]      0.66        Renewable secondary material utilisation      [MJ]      0.00        Total use of non-renewable primary energy as energy carrier      [MJ]      0.00        Use of secondary material utilisation      [MJ]      0.00        Non-renewable				Param	eter				Unit	A1-A3								
Acidification potential of soil and water      [kg SO_Eq.]      1.13E-11        Acidification potential      [kg SO_Eq.]      1.51E-4        Eutrification potential      [kg (PO_a)* equiv)      2.01E-5        Photochemical ozone creation potential      [kg SD_equiv.]      1.56E-5        Abiotic depletion potential non-fossil resources      [kg SD equiv.]      1.86E-5        Abiotic depletion potential fossil fuels      [MJ]      1.66        LCA RESULTS – USE OF RESOURCES: 1 kg stucco      MI      A1-A3        Renewable primary energy as energy carrier      [MJ]      0.14        Non-renewable primary energy as energy carrier      [MJ]      0.14        Non-renewable primary energy as energy carrier      [MJ]      0.14        Non-renewable primary energy as material ullisation      [MJ]      0.00        Total use of renewable primary energy sources      [MJ]      1.66        Non-renewable primary energy sources      [MJ]      0.00        Non-renewable primary energy sourc										q.] 0.11								
Addification potential of soil and water    [kg (PQ <sub>4</sub> ) <sup>2</sup> equiv]    1.51E-4      Eutrification potential    [kg (PQ <sub>4</sub> ) <sup>2</sup> equiv]    2.01E-5      Photochemical ozone creation potential    [kg ethene equiv.]    1.56E-5      Abiotic depletion potential non-fossil resources    [kg Sb equiv.]    1.89E-5      Abiotic depletion potential fossil fuels    [MJ]    1.66      LCA RESULTS – USE OF RESOURCES: 1 kg stucco    1.66      Renewable primary energy as energy carrier    [MJ]    0.14      Renewable primary energy as anterial utilisation    [MJ]    0.14      Non-renewable primary energy as material utilisation    [MJ]    0.00      Total use of non-renewable primary energy sources    [MJ]    0.00      WI    0.66    [MJ]    0.00      Non-renewable primary energy sources    [MJ]    0.00      Non-renewable primary energy sources    [MJ]    0.00      Non-renewable primary energy sources    [MJ]    0.00			Ozoi	ne depleti	on potent	ial				1 1.13E-11								
Eutification potential    [kg (POu) <sup>3</sup> equiv]    2.01E-5      Photochemical ozone creation potential and observes    [kg Sb equiv]    1.56E-5      Abiotic depletion potential norsoll resources    [kg Sb equiv]    1.89E-5      Abiotic depletion potential fossil fuels    [MJ]    1.66      LCA RESULTS – USE OF RESOURCES: 1 kg stucco      Maint in the image of		Acidification potential of soil and water						kg SO <sub>2</sub> -Eo	Eq.] 1.51E-4									
Abiotic depletion potential non-fossil resources    [kg Sb equiv.]    1.89E-5      Abiotic depletion potential fossil fuels    [MJ]    1.66      LCA RESULTS – USE OF RESOURCES: 1 kg stucco    Parameter    Unit    A1-A3      Renewable primary energy as energy carrier    [MJ]    0.14      Renewable primary energy as material utilisation    [MJ]    0.00      Total use of renewable primary energy sources    [MJ]    0.14      Non-renewable primary energy as material utilisation    [MJ]    0.14      Non-renewable primary energy as material utilisation    [MJ]    0.14      Non-renewable primary energy sources    [MJ]    0.14      Non-renewable primary energy sources    [MJ]    0.66      WI    1.66    0.00      Total use of non-renewable primary energy sources    [MJ]    0.00      Non-renewable primary energy sources    [MJ]    0.00      WI    1.66    0.00      Non-renewable primary energy sources    [MJ]    0.00      Non-renewable primary energy sources    [MJ]    0.00      Non-renewable secondary fuels    [MJ]    0.00      Non-renewable secondary fuels    [MJ]    0.00			Eu	utrification	potential			[k	$(PO_4)^3$ ec	2.01E-5								
Abiotic depletion potential fossil fuels    [MJ]    1.66      LCA RESULTS - USE OF RESOURCES: 1 kg stucco      Renewable primary energy as energy carrier    [MJ]    0.14      Renewable primary energy as material utilisation    [MJ]    0.14      Renewable primary energy as material utilisation    [MJ]    0.14      Non-renewable primary energy as material utilisation    [MJ]    0.14      Non-renewable primary energy as material utilisation    [MJ]    1.66      Non-renewable primary energy as material utilisation    [MJ]    0.00      Total use of non-renewable primary energy sources    [MJ]    0.00      Use of secondary fuels    [MJ]    0.00      Use of secondary fuels    [MJ]    0.00      Non-renewable secondary fuels    [M]    0.00      Non-renewable secondary fuels <td>-</td> <td>Ph</td> <td>otochem</td> <td>ical ozone</td> <td>e creation</td> <td>potential</td> <td></td> <td></td> <td></td> <td colspan="8"></td>	-	Ph	otochem	ical ozone	e creation	potential												
LCA RESULTS - USE OF RESOURCES: 1 kg stucco        Parameter      Unit      A1-A3        Renewable primary energy as material utilisation      [MJ]      0.14        Renewable primary energy as material utilisation      [MJ]      0.00        Total use of renewable primary energy as energy carrier      [MJ]      0.14        Non-renewable primary energy as energy carrier      [MJ]      0.14        Non-renewable primary energy as material utilisation      [MJ]      0.00        Total use of non-renewable primary energy sources      [MJ]      0.00        Total use of non-renewable primary energy sources      [MJ]      0.00        Total use of non-renewable primary energy sources      [MJ]      0.00        Non-renewable secondary fuels      [MJ]      0.00        Non-reazerdous waste for landfilling </td <td colspan="4">Abiotic depletion potential non-fossil resources</td> <td></td> <td></td> <td colspan="8"></td>	Abiotic depletion potential non-fossil resources																	
Parameter      Unit      A1-A3        Renewable primary energy as energy carrier      [MJ]      0.14        Renewable primary energy as material utilisation      [MJ]      0.00        Total use of renewable primary energy sources      [MJ]      0.14        Non-renewable primary energy as energy carrier      [MJ]      0.14        Non-renewable primary energy as material utilisation      [MJ]      0.00        Total use of non-renewable primary energy sources      [MJ]      0.00        Total use of secondary materials      [kg]      0.66        Use of secondary fuels      [MJ]      0.00        Non-renewable secondary fuels      [MJ]      0.00        Non-reacedus waste for lanotilling      [kg]      0.00        Non-reacardous waste for lanotilling      [kg]	LCA I						CES:	1 kg	<u> </u>									
Renewable primary energy as material utilisation    [MJ]    0.00      Total use of renewable primary energy sources    [MJ]    0.14      Non-renewable primary energy as meterial utilisation    [MJ]    1.66      Non-renewable primary energy as material utilisation    [MJ]    0.00      Total use of non-renewable primary energy sources    [MJ]    1.66      Use of secondary materials    [kg]    0.66      Renewable secondary fuels    [MJ]    0.00      Non-renewable secondary fuels    [MJ]    0.00      Net use of fresh water    [m³]    0.00      Vet use of fresh water    [m³]    0.00      Non-hazardous waste for landfilling    [kg]    0.00      Non-hazardous waste for disposal    [kg]    3.38E-5							Unit											
Renewable primary energy as material utilisation    [MJ]    0.00      Total use of renewable primary energy sources    [MJ]    0.14      Non-renewable primary energy as meterial utilisation    [MJ]    1.66      Non-renewable primary energy as material utilisation    [MJ]    0.00      Total use of non-renewable primary energy sources    [MJ]    1.66      Use of secondary materials    [kg]    0.66      Renewable secondary fuels    [MJ]    0.00      Non-renewable secondary fuels    [MJ]    0.00      Net use of fresh water    [m³]    0.00      Vet use of fresh water    [m³]    0.00      Non-hazardous waste for landfilling    [kg]    0.00      Non-hazardous waste for disposal    [kg]    3.38E-5	Renewable primary energy as energy carrier						[MJ]	0.14										
Non-renewable primary energy as energy carrier    [MJ]    1.66      Non-renewable primary energy as material utilisation    [MJ]    0.00      Total use of non-renewable primary energy sources    [MJ]    1.66      Use of secondary materials    [kg]    0.66      Renewable secondary fuels    [MJ]    0.00      Non-renewable secondary fuels    [MJ]    0.00      Net use of fresh water    [m <sup>2</sup> ]    0.00      LCA RESULTS – OUTPUT FLOWS AND WASTE CATEGORIES: 1 kg stucco       Parameter    Unit    A1-A3      Hazardous waste for landfilling    [kg]    0.00      Non-hazardous waste for disposal    [kg]    0.00      Radioactive waste for disposal    [kg]    0.00      Radioactive waste for disposal    [kg]    IND      Materials for ne-use    [kg]    IND      Materials for energy recovery    [kg]    IND      Exported	Renewable primary energy as material utilisation																	
Non-renewable primary energy as material utilisation    [MJ]    0.00      Total use of non-renewable primary energy sources    [MJ]    1.66      Use of secondary materials    [kg]    0.66      Renewable secondary fuels    [MJ]    0.00      Non-renewable secondary fuels    [MJ]    0.00      Nother secondary fuels    [MJ]    0.00      Non-renewable secondary fuels    [MJ]    0.00      Nother secondary fuels    [MJ]    0.00      Net use of fresh water    [m³]    0.00      LCA RESULTS - OUTPUT FLOWS AND WASTE CATEGORIES: 1 kg stucco    100      Hazardous waste for landfilling    [kg]    0.00      Non-hazardous waste for disposal    [kg]    0.00      Non-hazardous waste for disposal    [kg]    0.00      Radioactive waste for disposal    [kg]    ND      Materials for re-use    [kg]    IND      Materials for ene	Total use of renewable primary energy sources																	
Total use of non-renewable primary energy sources    [MJ]    1.66      Use of secondary materials    [Kg]    0.66      Renewable secondary fuels    [MJ]    0.00      Non-renewable secondary fuels    [MJ]    0.00      Non-renewable secondary fuels    [MJ]    0.00      Non-renewable secondary fuels    [MJ]    0.00      Not-renewable secondary fuels    [MJ]    0.00      Net use of fresh water    [m³]    0.00 <b>LCA RESULTS – OUTPUT FLOWS AND WASTE CATEGORIES: 1 kg stucco Hazardous waste for landfilling</b> Hazardous waste for landfilling    [kg]    0.00      Non-hazardous waste for disposal    [kg]    0.00      Radioactive waste for disposal    [kg]    0.00      Radioactive waste for disposal    [kg]    ND      Materials for re-use    [kg]    IND      Materials for re-grupt (kg]    IND    IND      Exported electrical energy    [MJ]    IND	Non-renewable primary energy as energy carrier																	
Use of secondary materials    [kg]    0.66      Renewable secondary fuels    [MJ]    0.00      Non-renewable secondary fuels    [MJ]    0.00      Net use of fresh water    [m³]    0.00      LCA RESULTS – OUTPUT FLOWS AND WASTE CATEGORIES: 1 kg stucco      Parameter    Unit    A1-A3      Hazardous waste for landfilling    [kg]    0.00      Non-hazardous waste for disposal    [kg]    0.00      Radioactive waste for disposal    [kg]    0.00      Radioactive waste for disposal    [kg]    0.00      Materials for re-use    [kg]    IND      Materials for energy recovery    [kg]    IND      Exported electrical energy    [MJ]    IND	Non-renewable primary energy as material utilisation																	
Non-renewable secondary fuels    [MJ]    0.00      Net use of fresh water    [m³]    0.00      LCA RESULTS - OUTPUT FLOWS AND WASTE CATEGORIES: 1 kg stucco      Parameter    Unit    A1-A3      Hazardous waste for landfilling    [kg]    0.00      Non-hazardous waste for disposal    [kg]    0.00      Radioactive waste for disposal    [kg]    0.00      Radioactive waste for disposal    [kg]    1ND      Materials for ne-use    [kg]    IND      Materials for energy recovery    [kg]    IND      Exported electrical energy    [MJ]    IND																		
Net use of fresh water      [m³]      0.00        LCA RESULTS - OUTPUT FLOWS AND WASTE CATEGORIES: 1 kg stucco        Parameter      Unit      A1-A3        Hazardous waste for landfilling      [kg]      0.00        Non-hazardous waste for disposal      [kg]      0.00        Radioactive waste for disposal      [kg]      3.38E-5        Components for re-use      [kg]      IND        Materials for recycling      [kg]      IND        Materials for energy recovery      [kg]      IND        Exported electrical energy      [MJ]      IND										0.00								
LCA RESULTS – OUTPUT FLOWS AND WASTE CATEGORIES: 1 kg stucco      Parameter    Unit    A1-A3      Hazardous waste for landfilling    [kg]    0.00      Non-hazardous waste for disposal    [kg]    0.00      Radioactive waste for disposal    [kg]    3.38E-5      Components for re-use    [kg]    IND      Materials for recycling    [kg]    IND      Materials for energy recovery    [kg]    IND      Exported electrical energy    [MJ]    IND																		
ParameterUnitA1-A3Hazardous waste for landfilling[kg]0.00Non-hazardous waste for disposal[kg]0.00Radioactive waste for disposal[kg]3.38E-5Components for re-use[kg]INDMaterials for recycling[kg]INDMaterials for energy recovery[kg]INDExported electrical energy[MJ]IND	LCA																	
Non-hazardous waste for disposal  [kg]  0.00    Radioactive waste for disposal  [kg]  3.38E-5    Components for re-use  [kg]  IND    Materials for nergy recovery  [kg]  IND    Materials for energy recovery  [kg]  IND    Exported electrical energy  [MJ]  IND																		
Non-hazardous waste for disposal  [kg]  0.00    Radioactive waste for disposal  [kg]  3.38E-5    Components for re-use  [kg]  IND    Materials for nergy recovery  [kg]  IND    Materials for energy recovery  [kg]  IND    Exported electrical energy  [MJ]  IND		Hazardous waste for landfilling					[ka]	0.00										
Components for re-use  [kg]  IND    Materials for recycling  [kg]  IND    Materials for energy recovery  [kg]  IND    Exported electrical energy  [MJ]  IND	Non-hazardous waste for disposal						0.00											
Materials for recycling  [kg]  IND    Materials for energy recovery  [kg]  IND    Exported electrical energy  [MJ]  IND						[kg]												
Materials for energy recovery  [kg]  IND    Exported electrical energy  [MJ]  IND																		
Exported electrical energy [MJ] IND																		

# 6. LCA: Interpretation

In calculating the LCA, a generic national raw material mix for gypsum is applied for the upstream chain in order to comply with the various levels of availability in the individual plants and the interchangeability and/or combination possibilities offered by raw gypsum. Gypsum can be procured as a raw material from nature or as a by-product from desulphurisation of coal-fired power stations (FGD gypsum). While all material and energy flows are considered for natural gypsum, the cut-off limit for FGD gypsum is represented by the material and energy flows associated with the manufacture of FGD gypsum following desulphurisation (e.g. electricity consumption of the belt filter but not the use of limestone in the flue gas scrubber or the disposal of FGD waste water). Delivery to the gypsum plant is initially followed by the production of calcium sulphate- $\beta$ -semi-hydrate (stucco) by burning the raw gypsum (calcination) below 180 °C.

This stucco is supplied without blending with additives and aggregates.

Production significantly dominates the LCA impact categories due to the calcination of the raw gypsum associated with the consumption of fossil energy sources; this is responsible for approximately 60% of the GWP.

There is no scarcity of resources in terms of the gypsum raw material used or the additives and aggregates used.

More than 99% of the ADPE is dominated by the use of natural gypsum for which the sulphur content of the earth's crust is applied as a criterion for calculating the Sb equivalent. As the LCA has been modelled from the cradle to the factory gate, no credits are considered for possible recycling of gypsum at the end of life. Unpacked products do not display any serious differences from packaged products in the impact



categories (all differences < 10%) but packaging requires around 50% more primary energy (PERE and

### 7. Requisite evidence

#### 7.1 Leaching

On analysis according to the Landfilling 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, and must be determined by the responsible waste producer. PERT) than for the unpacked product.

#### 7.2 Radioactivity

The product can be used without restriction with overall dose contributions 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 test scheme, version 2008, are satisfied with regard to all test criteria /Scherer 2010/: **TVOC**<sub>3</sub>  $\leq$  10 mg/m<sup>3</sup> **Carcinogens**<sub>3</sub> **EU cat. 1 and 2**  $\leq$  0.01 mg/m<sup>3</sup> **TVOC**<sub>28</sub> < 1.0 mg/m<sup>3</sup> **SVOC**<sub>28</sub>  $\leq$  0.1 mg/m<sup>3</sup> **Carcinogens**<sub>28</sub> **EU cat. 1 and 2**  $\leq$  0.001 mg/m<sup>3</sup> **Total VOC**<sub>28</sub> excl. LCI  $\leq$  0.1 mg/m<sup>3</sup> **Total VOC** incl. LCI R =  $\Sigma$  Ci/LCIi < 1

#### 8. References

**Institut Bauen und Umwelt e.V.**, Berlin (pub.): Drawing up Environmental Product Declarations (EPDs);

**General Principles** for the EPD range of Institut Bauen und Umwelt e.V. (IBU), 2013-04

#### **Product Category Rules for Building Products, Part** A: Calculation rules for the Life Cycle Assessment and

requirements on the background report, 2013-04

#### ISO 14025

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

#### EN 15804

EN 15804:2012-04+A1 2013, Sustainability of construction works - Environmental product declarations – Core rules for the product category of construction products.

/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 4.4.2011

#### /BBSR Reference Service Life/

 $\mathsf{BBSR}$  table "Service lives of components for LCA in accordance with  $\mathsf{BNB}"$ 

"Sustainable Building Information Portal" by the Federal Ministry of Transport, Building and Urban Affairs:

http://www.nachhaltigesbauen.de/baustoff-undgebaeudedaten/nutzungsdauern-von-bauteilen.html, last revised: 03.11.2011

#### /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; urn:nbn:de:0221-201210099810 Federal Office for Radiation Protection, Salzgitter, November 2012 http://doris.bfs.de/jspui/bitstream/urn:nbn:de:0221-201210099810/3/BfS\_2012\_SW\_14\_12.pdf

/DIN 18202/ DIN 18202:2013-04 Title (German): Tolerances in building construction -Buildings

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

/DIN EN ISO 9001/ DIN EN ISO 9001:2008-12 (D/E/F) Quality management systems - Requirements (ISO 9001:2008); trilingual version EN ISO 9001:200

/DIN EN 13279-1/ DIN EN 13279-1:2008-11 Title (German): Gypsum binders and gypsum plasters -Part 1: Definitions and requirements; German version EN 13279-1:2008

/DIN EN 13501-1/ DIN EN 13501-1:2010-01

Title (German): Classification of building products and types by fire performance - Part 1: Classification with the results of tests on Reaction to Fire by construction products; German version EN 13501-1:2007 + A1:2009

/DIN EN 13963/ DIN EN 13963:2011-11



Title (German): Jointing materials for gypsum boards – Definitions, requirements and test methods; German version prEN 3963:2011

#### /DIN EN 15804/

DIN EN 15804/A1:2013-05 Title (German): Sustainability of construction works – Environmental product declarations – Core rules for the construction products product category; German version EN 15804:2012/FprA1:2013

/DIN EN ISO 50001/ DIN EN ISO 50001:2011-12 Environmental management systems – Requirements with guidance for use (ISO 50001:2011)

#### /ECHA 2013/

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: 20 June 2013

GaBi 5 2012 GaBi 5: Software and data base for comprehensive analysis, LBP, University of Stuttgart and PE International GaBi 5 documentation http://documentation.gabi-software.com/, (2012) /Gypsum Data Book/ Gypsum Data Book Pub.: Bundesverband der Gipsindustrie e. V. Kochstrasse 6–7, 10969 Berlin Published on: www.gips.de (section: Publications / Books), last revised: May 2013

#### /IGB/

IGB Handbuch Gipsputze Zukunftsaufgabe Bauen im Bestand Pub.: Bundesverband der Gipsindustrie e. V. Kochstrasse 6–7, 10969 Berlin Published on: www.gips.de (section: Publications / Books), last revised: 1st print run, September 2009

#### /Flooding Leaflet/

Removing damage caused by flooding to components made of gypsum or gypsum plaster BVG Information Service No. 01 Published on: 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 (section: Research association, Projects, 2010)

Institut Bauen und Umwelt e.V.	Institut Bauen und Umwelt e.V. Panoramastr.1 10178 Berlin Germany	Tel. +49 (0)30 308 7748-0 Fax +49 (0)30 308 7748-29 E-mail info@ibu-epd.com Web <b>www.ibu-epdcom</b>
Institut Bauen und Umwelt e.V.	Institut Bauen und Umwelt e.V. Panoramastr.1 10178 Berlin Germany	Tel. +49 (0)30 308 7748-0 Fax +49 (0)30 308 7748-29 E-mail <u>i</u> nfo@ibu-epd.com Web <b>www.ibu-epd.com</b>
	PE INTERNATIONAL AG 70771 Leinfelden-Echterdingen Germany	Tel. +49 (0)711 341 817-0 Fax +49 (0)711 341 817-25 E-mail info@pe-international.com Web <b>www.pe-international.com</b>
GIPS Bundesverband der Gipsindustrie e.V.	Holder of the Declaration Bundesverband der Gipsindustrie e.V. Kochstrasse 6-7 D-10969 Berlin Germany	Tel. +49 (0)30 3116 9822-0 Fax +49 (0)30 3116 9822-9 E-mail info@gips.de Web <b>www.gips.de</b>

9.

### Saint-Gobain Rigips GmbH

Headquarters Schanzenstrasse 84 40549 Duesseldorf Germany

Phone +49 (0) 211 5503-0 Fax +49 (0) 211 5503-208

info@rigips.de rigips.de



#### **Export Team**

Saint-Gobain Rigips GmbH Schanzenstrasse 84 40549 Duesseldorf Germany exportde@saint-gobain.com rigips.de rigitone.com Further Information:



rigips.de

